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TAMBI BALCHEN
CERTIFIED REAL-TIME REPORTER

*** UNEDITED REALTIME VERSION ***

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THE VIDEOGRAPHER: October 15, 2015. Z test test test test test test test test test test test. Test.

THE VIDEOGRAPHER: . We're back on the record. Here begins media unit number 1 Volume 2 in the continuing deposition of Tony Sperling on October 15th, 2015. The time is 9:04.

MR. BECK:

Q Good morning, Dr. Sperling. Are you ready to go?

A Yes, sir. Well rested. Good morning to you.
Q Good morning. We were talking at one point yesterday in some detail about the water levels at certain TMPs because the question we were looking at is is it possible for this reaction to actually be below the water table. Do you recall that?
A Yes, sir.
Q That was an important discussion?
A Very important.
Q A lot of the fundamental things you say in your report?
A Absolutely.
Q Now, did you do anything last night to determine water levels at any of these TMPs?
A I reviewed my data set of the monthly reports that were submitted and I did not come across any new information that I could find any water levels within the bridge area.
Q And when you refer to the bridge area you're talking about the neck?

A Sorry I keep talking about the bridge. The neck yes, sir.

Q And what you're calling the bridge area is to look at those maps that actually call out the neck and enlarge it so that you can see better detail so that you can then see which TMPs, which GIWs which gas extraction wells are located there?

A Exactly.

Q And I'll remind you at the start of today, for the benefit to the person on my right, it's very easy for us to be conversational and we have to fight the urge. So if I'm in a middle of a sentence, let me get it out and then you can say something.

A I'll do my best to try and remember.

Q Understood.

So could you just look at your map and give the exhibit number, I think it's 5?

A Got it.

Q And if you look at the blue shaded areas and, again, I can give it to you kind of blown up if you would like?

A M'hmm had.

Q But I'm interested in having you confirm that gas interceptor well 8, GIW 8 is plenty close to temperature monitoring probe 7R. Can you see that?
A Again, it's super-microprinted.
Q There's my iPad so you can see the blowup of it?
A So TMP 5.
Q TMP 7. They're not right adjacent but they're close?
A Yeah, TMP 7. So this is TMP 7R yes, okay.
Q And you'll recall that when we looked at TMP 7 the heart of the reaction was pretty deep?
A Correct.
Q Have you done anything that informs you of the depth to liquid from the top of the casing of gas interceptor well 8?
A No, sir. I have not been able to locate that information.
Q Okay. I'm going to show you something in full, but then when I mark it I'm going to mark an excerpt and the reason is that uniquely among documents in this case, this is one of the few which was submitted

to the Department of Natural Resources under a claim of trade secret protection seeing as how the gas interceptor wells involve intellectual property and first I'll let you see the whole document and then we'll do the whole exhibit so I don't do anything confidential?

A Thank you.

Q And just for the record, what I've handed you is dated August, 2015. It is titled expanded heat removal pilot study initial report prepared by Feezor engineering in association with Peter Carrie and associates and on the front it says the words trade secret confidential but for the purpose of the record we'll just take off the first page and the last page and make that the exhibit.

(EXHIBIT NO. :)

7

MR. BECK:

Q Pause. Test?

A Okay, thank you. I skimmed it. There's a lot of information there.

Q I understand and you haven't read this

before, have you?
A No.
Q Just confirm for me if you would please that the first and last pages are accurately excerpted as Exhibit 7 right there in front of you?
A Yes, sir.
Q Now, if I could ask you to turn to the second page or the last page of Exhibit 7 you can see a small table containing depth to liquid measurements that were taken in the gas interceptor wells or in certain gas interceptor wells on June, 2015?
A Yes.
Q Those are expressed as depth to liquid from top of casing?
A Yes.
Q And if the top of casing elevation of GIW 8 is in fact 499?
A Okay.
Q Then to find out what is the liquid level in that gas interceptor well, you simply subtract the 27.4 from the 499 is that the correct method?
A Yes, sir.

Q And that would give you a calculation of 471.6 feet above sea level?
A Sounds about right without doing the math, but --
Q And that is way above?
A Yes, sir.
Q The heart of the reaction?
A It would appear so. Without, you know, having a full understanding of how these measurements were actually taken and being able to see them for myself, I'm a little skeptical about the water level readings that are collected and piezometers a highly reactive environment.
Q I hear you. Did you, by virtue of your concern about that issue, make a comprehensive effort to go through all of the data that have been collected from time to time with water level measurements not only in gas interceptor wells but in gas extraction wells in order to see if they ever change much?
A I was looking for water level data in the information that I reviewed and like I say, the water level data that I came

across was basically the Aquaterra information and water level information from perimeter TMPs and other locations but I was not able to locate any water level information within the landfill within the data sets that I reviewed.

Q And particularly within that neck area?

A Yes, sir.

Q In the neck area you did see water level information from Aquaterra. We went through that in your expert report and it was in the 420's remember that?

A Yes, sir.

Q And the TMP 7 it was in the 420's?

A Yeah, on that very preliminary estimate of the of the position, you know, in order to be very comfortable with that estimate of the water level I would like a much more detailed review of where that monitor actually was and, you know, not just be picking up a point off your iPad. I feel very uncomfortable doing.

Q We're not talking about a monitoring. What Aquaterra did and you relied it on your own report and described it fairly

accurate is they sounded all the wells?
A Yes.
Q And they used all of those water level measurements to interpret top of water level groundwater contours or leachate contours in the landfill, right?
A Correct, and I have no problem with that.
Q And that's the one I'm talking about first. So on that map you looked at the approximate location where TMP 7 would go and said that as of 2010 the water level there was about 424. Do you recall that from yesterday?
A And that's where I had a problem in that I was quite uncomfortable in transferring the location of the TMP 7 from your iPad, you know, on to that map because there was like no scales or any reference. I just kind of approximately picked it.
Q I understand?
A With the steep cone it could be quite different.
Q And TMPs don't have a water level but they have adjacent wells. What I guess I'm asking you to assume is this: I guess I'm

asking you to assume that beyond what we discussed yesterday all of which is already recorded in the transcript?
A M'hmm.
Q -- that consistently the water levels in the gas intercept wells and the gas extraction wells throughout the neck is all always well above tense of feet above 400?
A M'hmm.
Q That would be substantially above the heart of the reaction as measured at the temperature monitoring probes, correct?
A Yes.
Q If my assumption is is correct?
A Yes. I'm thinking at this point I would really like to have access to sort of a readable map where I can see the spatial relationship of the TMPs and the GIWs.
Q Sure. I'm going to give you back my iPad that?
A If I could request, sir, I was given a nice map by Brenda Audrey of the site.
Q Let me hand this?
A Pretty well essentially the same as this.

They just blew it up and.
Q If you brought it with you, you're welcome to use it.
A Would that be okay to provide that to you instead of handing the iPad back and forth all the time.
THE VIDEOGRAPHER: Going off the record. The time 19:18 test test test test. So let's see if this is working.

THE VIDEOGRAPHER: We're back on the record. The time is 9:32.
MR. BECK:
Q Dr. Sperling, just before the break you were asking to utilize a couple of blowups that you had brought with you.
A Yes, sir.
Q May I put stickers on for you?
A Please. That would be great.
Q I'm going to put the stickers on the back. We'll start with Exhibit 8 can you tell me where you got it?
A Exhibit 8 is a blowup of a map of two times the original scale of a map a well location map provided during our site tour

by Ms. Brenda Audrey when we visited the site and it shows all of the wells as of that time that were available and all I've done is to highlight different like the TMPs would be one color and the GW orange color.

Q Do you happen to know which technical report that map comes from?

A There was a title block that says it, but I don't have a recollection of what report it actually was.

Q The title block doesn't appear on here?

A No. I made a 11 by 17 copy on my color copier didn't copy the title block. I can provide that later for you if it it's important.

Q Exhibit 9 just explains what that one is?

A Exhibit 9 it's the same map at original scale. So it's just a smaller scale.

Q At least if we want to place those maps in time if we look at the original scale Exhibit 9 one of the things that it shows is 41 million gallon storage tanks above grounds?

A Yes.

Q That's that leachate system they built?
A Yes. I believe it's a very current map.
Q Okay. Now, has that given you the ability to on or not yourself TMP 7 and gas intercept well 8?
A Yes, sir. Present time I can clearly see both here TMP 7 and 7R which is the new one and gas interceptor well 8, let me just locate it. I believe it's this one here because it's 8, 9. The yeah, I'm fairly confident.
Q Does it appear to you that they may be 100 feet apart as the crow flies?
A That would appear reasonable.
Q And even if a drawdown cone of depression from leachate wells were uniquely one direction because only one of them is functioning and it's all going one direction down, what's the steepest top of leachate gradient you could imagine seeing out here, not 10 percent?
A In groundwater wells it's purely a function of hydraulic conductivity (phonetic). It's very tight and I would expect a very steep gradient. Spelling

Q There's some contour lines on that map and if so what do you understand they represent?
A My map?
Q Yes. You can work with 8?
A I don't believe there are any contour lines on here. There's just a bunch of straight lines.
Q There's no lines on that that indicate the top of leachate in the waste, the water table?
A Not on this map, no, sir.
Q And so by looking at that map are you able to add anything to the answer to my question which is if I ask you to assume that I can show you measurements that demonstrate that the water levels in the neck during the entire period of operation of the TMPs have been in the 400s say in the 420 and up?
A Yes.
Q That would be substantially above the heart of the reaction as it appears in the TMPs?
A Yes, sir. And on that point I want to

make sure that I tie everything together in terms of having a very good understanding of the GIW screen elevations and also the processes used to collect the water level data because I've had lots of experience in trying to sound water levels in landfills that are not reacting and it's problem act at the best of times with gas escaping and foam and bubbling and all sorts of technical challenges and so I just really would want to feel very comfortable that those are actually static accurate water level measurements.

Q Right. And I think you're actually in your mind thinking a few questions back?

A Yes.

Q Because a few questions back I was asking specifically about some gas interceptor wells. Now my question goes a lot broader than that. You looked for information about water levels because that was fundamental to your report?

A Yes, sir.

Q One of the places you looked was the sounding that was done by Aquaterra and

you found that to be very helpful because it was comprehensive it was done all at one time and it was mapped in a way that showed the water table contours so they could be compared to things, correct?

A Yes, direct.

Q And based on the water level contours on that map in had 2010 if they had not later changed those water levels would be above the heart of the reaction above the TMPs, correct?

A At that time.

Q At that time?

A Yes, sir.

Q And so now what I'm saying is here's what I would like you to assume. I would like you to assume that I'm not just limiting myself to a single set of data or a single data.

A M'hmm.

Q What I'm doing is going through all of the sources in which water levels are measured around these TMPs in the neck and that would include every time a gas intercept well is measured for water level. Every

time a gas extraction well is measured for water. Every time a boring is taken and the boring column tells us when the saturation begins, then I'm looking at all of those sources together and considering what all of them tell me. That's the kind of comprehensive thing you would like to see?

A That would be decree.

Q

A Constructive, yes.

Q And if that look said to you the water table is above the heart of the reaction, if you came to that conclusion yourself, then that would cause you to essentially start rethinking your whole report?

A I would definitely think that's an important consideration to take into account without a doubt and I would look at trying to understand the three-dimensionality of what's going on in the wells, etc.

Q It's a little more than that though isn't it? Is didn't you tell me yesterday that finding out the reaction was below the

water table would in your mind contradict fundamental laws of thermal dynamics?

A Basically what I was saying at the time yesterday was that if the temperatures observed in the temperature monitoring probes were such that they exceeded the boiling point of water such that the liquid phase could not exist, then.

Q You're reminding me.

A Then it would be a violation of whatever thermal dynamic principles.

Q And let me go to that one. Do you recall I discussed with you the effect of depth on boiling point?

A Yes, sir.

Q And the question of whether standard temperature and pressure changes at this landfill?

A Yes, sir.

Q Did you do anything subsequent to our discussion yesterday to try to bring that home a little closer to an understanding?

A Yes, sir. I looked into that to some degree to look at the curve of basically the boiling point versus pressure curve to

familiarize myself. I was fully aware of it and I think it's mentioned in my report that that boiling point was a temperature, but I have not looked into it in detail because I thought it was a relatively minor effect and so I refreshed my memory and actually I had it basically in front of me that the pressure varies or the boiling point will vary as a function of depth to some degree possibly I would say within the zone of influence possibly up to maximum of 300 degrees Fahrenheit I would guesstimate just looking closely.

Q What you're saying is is with the depths and pressure here, that the further down you go, the higher temperature it takes for water to boil?

A Yes, sir.

Q And the change is so significant that whereas the normal atmospheric boiling point of water is 212 degrees on your stove Fahrenheit --

A Yes.

Q -- that down deep in this landfill water doesn't boil until you get it all the way

up to 300 degrees?
A Possibly, yes, sir.
Q Now, I want to go back to close off one loose end that I left yesterday. It is pretty fundamental to your five step description which is a theory of kind of of what happened here.
A M'hmm.
Q It is pretty fundamental to appreciate something called the water-gas shift reaction, correct?
A Yes, sir. One of the reactions that I believe is involved, yes, sir.
Q Did you know with the water-gas shift reaction before you spoke with Dr. Grace and Mr. Foss-Smith?
A Yes, sir.
Q You had heard of it before?
A Yeah, I came across it, like I said, back in 2014 when I was working on the Winnipeg project and trying to explain the hydrogen levels that we were seeing there.
Q And was it provided to you there or did you just run across it doing some research?

A I ran across it basically doing research.
Q You didn't remember it from your college chemistry course, did you?
A I don't think I ever encountered it in my college chemistry.
Q You only took one college chemistry?
A It would have been one or two in engineering school.
Q An introductory level?
A Yes.
Q And so you certainly don't call yourself a chemist or don't claim to have expertise?
A By no means and that's why I recommend in the report somebody knowledgeable be retained to look at this.
Q And then your company yourself how large a company?
A We have a staff of 16 or so.
Q That includes clerical people and billing people, too?
A Correct.
Q But among the professionals and I don't mean to suggest anyone among the people who do environmental work in your company there's not one among then who is regarded

as a chemical engineer or a chemist by background?

A No, sir.

Q Now, the extent to which you have examined the water-gas shift reaction is you did some research in the context of trying to understand the Winnipeg landfill?

A M'hmm.

Q You did some work and conversations in trying to understand the Bridgeton Landfill. You had conversations with Dr. Grace and received written information from him and you had conversations with Mr. Foss-Smith and received written information from him. Is that kind of the sum total of your activities?

A Pretty much, yes, sir.

Q And is there a particular reference that you relied upon as the correct description of what the water-gas shift reaction is and how it works and what it requires?

A I reviewed a couple sort of technical papers on the reaction itself.

Q Okay.

A And I off the top of my head could not

cite exactly which ones. I would have to look through my files.

Q I was just going to ask you if you could just look at the references at the back of your report and point them for us. They're on pages 117 through 119 and if you could just identify which ones I need to go read.

A Oh, I would say the key one would be by Mr. Smith a review of the water-gas shift reaction schematics starting point and then I believe the correspondence with Mr. Patrick Foss-Smith that discussed it in I believe it was one of the the e-mail would be the 2nd.

Q So go ahead.

A And then the third would be the report by Dr. Grace.

Q So the Foss-Smith e-mail and the grace report are specific appendices to your expert report and the Smith article is titled Smith Loganthan and and /SHA*PBT a review of the water-gas shift reaction kinetics from the international journal of chemical engineering in 2010?

A Yes, sir /(.
Q So I would just like to ask you a series of questions that relate to the water-gas shift reaction to see if we can identify some things that are fundamental.
Here's the first one in the water-gas shift reaction, as hydrogen is generated would that increase or decrease the reaction rate?
A If you wouldn't mind I would just like to turn to just so I have the reaction in front of me written down.
Q Sure. What page are you on the report, Exhibit 1?
A I've just got to find it. It's basically the correspondence with Mr. Grace.
Q Oh, do you need to see his letter? It's a separate exhibit?
A I extracted it. I'm looking at page 41.
Q Thank you. All right. So we're in Exhibit 1 your report page 41 and that is where you extracted some information from Dr. Grace's letter in order to set out in your report a description of the reaction?
A Yes, sir.

Q -- itself. Is this a verbatim excerpt from his report that you just imported into your own?
A Yes, sir.
Q So my question is going to be in the water-gas shift reaction, as hydrogen is generated, would the reaction rate increase or decrease?
A My understanding is that it would basically not be affected by because there's basically two molecules or either side of the reaction, so the change would not be affected.

If additional hydrogen gas was being generated and not removed I would think based on the principles of then the reaction would eventually slow /(.
Q So was your answer increase, decrease or stay the same?
A It would depend on what was actually going on within the reaction vesselle.
Q And I'm doing nothing except causing the generation of hydrogen and the question is what is the effect of hydrogen generation? Does it cause the reaction to increase,

reaction rate to increase decrease or stay the same?

A And what I'm saying is that if you have a, you know, a fixed amount of carbon monoxide and water and the reaction starts to proceed and you start generating hydrogen, that the concentration of that will continue to increase until you reach an equilibrium -- as dictated by that equilibrium constant and then the reaction is going to stop, so I'm unclear what you're trying to get at.

Q So specifically, though, if the question exactly is in the water-gas shift reaction as hydrogen is generated would this increase the reaction rate or decrease the rate, your answer is I can't say either increase or decrease or stay the same. I have to give you that explanation?

A Yeah, I would say it would sort of depend on if you're removing the hydrogen, you know, if there's a continuous source of carbon monoxide and hydrogen what are the concentrations of the reactions in the products as a reaction is proceeding as

they changing or are they steady.
Q Let me ask you my second question and that is very simply: Does pressure impact the water-gas shift reaction?
A I would say that again my background in chemistry is insufficient to really say that other than what was provided by Dr. Grace and I'll just quickly scan here yeah, and so the last sentence there because there's no change in the total number of moles in this after the accident that the reaction is independent of the total pressure.
Q So to be fair about what just happened you didn't know the answer in what Dr. Grace had written?
A Correct. I'm not an expert in chemistry. I rely on Dr. Grace's expertise.
Q So you would get a better grade if it's an open book text than a closed book?
A I would say that's true.
Q The question is: Does the conversion of carbon monoxide plus water to hydrogen always decrease with temperature?
A Conversion ... constant increases...

(witness reading to himself) yeah, and so, again, from what I'm interpreting Dr. Grace's input here is that it's highly dependent on two things: Basically the equilibrium constant and kinetic rate constant and what the two are sort of offsetting and so it's not a straightforward thing I would say that if you say it always happens one way or another I sort of draw the conclusion that that's probably not correct.

Q Let me ask you to do this if you don't mind, please. And let's take the remainder of the test closed book.

A Yes, sir. I would be happy to do that.

Q Here's my next question because I'm just trying to understand you're how much of this you're able to provide on your own without Dr. Grace's help. How does the landfill gas affect the water-gas shift reaction?

A So basically landfill gas is predominantly made up of, you know, a good level of carbon dioxide which is one of the reactants and water which landfill gas is

saturated with moisture, so the two reactant products are there, so there would certainly or, sorry, I should say carbon monoxide with water reacts.

So essentially landfill gas on its own is typically devoid of carbon monoxide, right, so the water-gas shift reaction would tend not to occur and let me just -- I would like to write something down for myself.

Q Sure.

A Yes, so one two, one two. So I just wrote the water-gas shift reaction myself to answer that clearly.

So basically in typical landfill gas that's not involved in the subsurface exothermic reaction is generally devoid of carbon monoxide and so one of the reactions to occur is not there in the water-gas shift reaction to occur would not take place.

However, if you get into a situation where you have a pyrolysis such as I'm suggesting is the case that's producing elevated levels of carbon monoxide like

the up to 3 or 4,000 ppm that we see in laboratory analysis, then that carbon monoxide all of a sudden becomes available and then there's the ability for that carbon monoxide to react with water to essentially produce the carbon dioxide and the hydrogen gas as one of the -- I believe is is one of the sources of the hydrogen that seems to be a signature of what's going on at this facility and others that appeared to be in this SSSER state that hydrogen is a key indicator of that chemical reaction.

Q And so that's the answer to the question how does the landfill gas affect the water-gas shift reaction?

A Yes, that's basically.

Q What about the CO present I'm sorry the CO2 present in the landfill gas does that have any effect?

A Yes, and so on the equilibrium constant as you increase the carbon dioxide concentrations, for example, that would tend to sort of have a reverse effect that if you were to increase the CO2

concentrations it's basically an equilibrium constant and it will dictate, you know, how much of that reaction is going to occur.

Q What's the result then if the CO2 is it present in the landfill gas? Is what is the result from the reaction?

A Well, it will really depend on the concentrations of all four parameters together. So if, you know, like typically landfill gas will have maybe 40 percent carbon monoxide or carbon dioxide and what we're seeing at Bridgeton I think in the highest levels is possibly some levels of up to 60 percent carbon dioxide and very aerobic levels so there's maybe a 50 percent increase.

On the other hand the carbon monoxide concentrations climbed from zero to 4,000, so I would say that that, you know, CO levels dramatically override the equitable balances towards the water-gas shift reaction that the increase in the CO concentrations is dramatically higher than the CO2.

Q As you wrote down the water-gas shift reaction reaction from the notes that you're, did you make it reversible?
A I did not but it is a reversible reaction, so that would be basically both ways.
Q Let's make sure we made a good record of what you just did. You had on a closed book basis written down the reaction and you only have the arrow going one way. In response to the question I just asked, you now added an arrow going the other way to make it reversible?
A That's because I was depicting the water-gas shift reaction which in the way it's described is in that direction. The direction that you asked me to draw subsequently is called the reverse water-gas shift reaction that would have the reverse arrow.
Q And it's --
[Indiscernible - simultaneous speaking]
A Anyway, it's recognized as a reversible reaction that can go in any direction depending on the concentrations.
Q And that's the predicate for my next

question and that is since the reaction is reversible, how can you determine in which direction the reaction will proceed based on gas measurements at the landfill?

A Basically, I think it's a combination of looking at the concentrations of the various products and whether they're increasing or decreasing to some degree and also on the temperatures that typically I was looking to find reactions and Dr. Grace provided some potentially other reactions that could be playing a role to actually explain why temperatures in the subsurface are increasing because, as I mentioned yesterday that the pyrolysis processes or the torrefaction processes are considered endothermic and I'm trying to find an explanation of what was actually causing the increase in heat so looking for any reactions that were exothermic in nature and basically as shown in the forward direction of the water-gas shift reactions is one reaction that's known to be exothermic whole range of oxidative reactions that are known to

be exothermic and subsequently have some question whether some of those reactions are also contributing and I believe I may have mentioned that in the report.

Q So before I move on to the water-gas shift reaction to the next, I want to ask about Mr. Foss-Smith for a moment. Is Mr. Foss-Smith a chemical engineer?

A I reviewed his resume at one point and I unfortunately do not have an exact recollection of his educational background. He definitely appeared knowledgeable to me in the chemical processes of the reaction.

Q And let me just draw a parallel, if I might, and see if we can figure out where Mr. Foss-Smith falls.

Mr. Foss-Smith specializes in addressing landfill fires?

A Yes, sir.

Q And that's similar to the orientation of one of your companies, landfill fire control Inc.?

A Yes, sir.

Q You do not have a chemical engineering or

chemistry capability in your company so when you need that capability to understand these reactions you go outside?
A Yes, sir.
Q Do you know whether he's in that same position where if he needs to understand these reactions he ends up consulting with someone at least initially until he's got a full ingestion of the reaction and then, you know, in other words is he more more like Dr. Grace?
A I would say without reviewing his resume and talking to him in more detail I cannot comment and that's why I relied predominantly on Dr. Grace's letter and extracted his information because I felt he had the qualifications and credentials to help me.
Q And so if Mr. Foss-Smith said I looked at bridge too and it looks like a water-gas shift reaction as far as I'm concerned you took that with a grain of salt because you didn't know how much chemical engineering experience he had?
A Basically I did not take that into account

at all. In fact when you point out in the memo when I received the memo I was really interested in his British experience and whether anybody else had experienced or recognized that this water-gas shift reaction may be occurring in landfills and that's basically the confirmation I was looking at from him that he felt it was also occurring. As to how he was concluding that I did not get into that.

Q So as between the two you would say you relied on Dr. Grace as opposed to Mr. Foss-Smith?

A Yes, sir.

Q And from for Mr. Foss-Smith did he ever indicate that he ever worked on one like Bridgeton whose geometry it is built into a deep quarry and which contains a very high liquid level inside the quarry?

A We didn't get into the details of the areas where the reaction was occurring.

Q Okay. Now, with respect to stepping away from the test for a moment?

A Yes.

Q With respect to Winnipeg site that you

worked on, is that one located in a deep quarry?

A No, sir.

Q And is that one in a very wet context sort of like Bridgeton Landfill is?

A There is definitely leachate present within the landfill. I do not believe the levels are as high as what Bridgeton. It has a fairly thick waste column because it's more of a mountain.

Q It's above ground?

A It's an above ground landfill.

Q And with respect to that difference, is it fair to say that the interpreted location of the reaction at the Winnipeg landfill is certainly above the water table within the waste?

A Correct, yes.

Q And was there at the Winnipeg landfill a simply identifiable special waste stream such as aluminum process waste or an aluminum oxide waste that you were able to identify as being potentially related to the reactions sort of like County wide?

A No, sir. From my understanding that the

Winnipeg landfill is predominantly a municipal solid waste facility that receives predominantly residential and commercial waste streams and to my knowledge it has not been pointed out that it has received any sort of aluminum draws-type industrial waste or, but I have not done an exhaustive review of the materials that were received at that facility yet.

Q Did Winnipeg actually install thermistors or temperature monitoring probes in the landfill?

A Not at this point. We had installed a number of wells to collect gas samples and we lowered temporary thermistor strings (phonetic) into those wells to profile the temperatures at a depth.

Q And were you involved in that activity?

A At points. Most of the field work was conducted by Dr. Abedini.

Q But your company was?

A Yes, sir, initially and then technicians for the city of Winnipeg kind of carried on the program subsequently.

Q So you left the equipment with them to operate?
A They rented their own.
Q Okay. Is that the first time that you and Dr. Abedini had used thermistors or temperature monitoring probes in a landfill?
A No, we've used them on numerous projects.
Q Okay. And when you smoke with Mr. Thalhamer one of the things that he told you about was other landfills which were public has come to be associated with and one of them was County wide, one of them was congress?
A Yes, in had passing he's mentioned County wide and high pressures that are developed. I've never sort of spent a lot of time talking to him about the details of either of those facilities.
Q Did he talk to you about Middle Point in Tennessee?
A I have no recollection of him talking about that facility.
Q Did he talk to you about any landfills in California?

A I have a vague recollection of one point we may have talked about the hunter shipyard project possibly and certainly have talked a lot about the landfill fire in Fresno California and one substantial tire fire in California.
Q What I intended to ask you was did Mr. Thalhamer talk to you about any landfills that are operated by subsidiaries of Republic Services that are in California?
A Not that I'm aware of.
Q Okay. All right. Let me go back to just finish my set of questions and I'm actually going to let you turn to page 41 of your report so that you can see the steam gasification reaction?
Q In your Dr. Grace's letter that you have imported into your report you described or Dr. Grace describes the steam gasification as "sometimes referred to as the water-gas reaction is that right?
A Yes, sir.
Q Now, my question for you is as you look at the reaction description, why is the

reaction, the steam gas reaction not written reversibly?

A Because it is an irreversible reaction that for whatever reason, you know, only proceeds in one direction and again I suspect it's because one of the input parameters is solid carbon and it's possibly the chemistry is such that generated enough solid carbon going the other direction is not possible, but I would again defer to Dr. Grace to explain why it's an irreversible reaction.

Q You assume it's irreversible because he says so?

A Yes, sir.

Q Aren't all -- don't all reactions have equilibrium constants?

A I again would assume -- yeah, I would hate to guess on this and I don't know.

Q And do you know what equilibrium constant is I added that to my list of questions?

A Yes, in principle it's a constant that when you basically take the ratio of the concentrations of the products and reactants the yield essentially as you

adjust the concentration of one the other ones will have to adjust to maintain that constant steady.

Q If it's a constant how does it change?

A Well, the equilibrium constant does not change.

Q So you would say that the equilibrium constant is actually a constant and not a co-efficient?

A That's what I believe, but again I'm not an expert in chemistry and would not want to say I'm exact 100 percent sure of that.

Q I thought I had added a question of my own but what I did was asked a question that turned out to be Question 11 on my list, so I've gotten that one out of the way.

Let me go back to where I was and ask you Question 7 which is in the steam gasification reaction, since the carbon is solid --

A Yes, sir.

Q -- is the water a liquid or a gas?

A I would say that probably depends on -- on the temperatures at which the reaction is going but given that it's called steam,

probably would be in the gaseous form because steam is generally considered in the gaseous form.

Q So let's move on past the -- by the way, did you say that the steam gasification reaction is occurring at Bridgeton Landfill or has?

A No, I said it's one of the potential reactions that I believe could be occurring, although because it's an endothermic reaction I felt it would not be one that's particularly important because what I'm very concerned about is understanding what's actually generating the elevated temperatures.

Q And then for the Boudouard Reaction which is Boudouard, that's also not something you're saying is occurring in the Bridgeton Landfill or has?

A That one I definitely felt there may be an opportunity for this reaction to be occurring, in fact is the reverse Boudouard Reaction going in the other direction and the reason I say this is, again, that in the direction shown

Dr. Grace pointed out, it's an endothermic reaction when we have a lot of carbon monoxide being generated by the pyrolysis process, that, you know, I feel that indeed this may be one of the reasons or pathways for -- for the generation of heat and the increase in carbon dioxide that we're seeing so I would not discount that and I would say that's a very real possibility that that reaction may be occurring, the reverse Boudouard Reaction.

Q But, to be fair about it, what you're doing is taking a description of the reaction provided to you by Dr. Grace, applying that to the information that you're aware of concerning the landfill and making the judgment you've just expressed?

A Well, I'm relying on what Dr. Grace again passed to me that the reverse reaction could be relevant if the landfill is more favoured at lower temperatures (phonetic), so --

Q So would it be fair to express it this way that given his broader, deeper more

extensive knowledge of each of these reactions you would be more comfortable with Dr. Grace answering questions about which, if any, is occurring at Bridgeton Landfill than yourself?

A Absolutely.

Q And at any point did you suggest to the Attorney General's office that they simply add Dr. Grace to their other 12 experts so that they would actually have someone who could appear before the jury and testify as an expert in chemical engineering?

A Basically I explained to the Attorney General my or, sorry, to the representatives for the Attorney General's office that, you know, my background in chemistry was weak and that I would want to seek other experts to provide input and I was advised I should proceed to meet with them, get a letter of opinion and then I incorporate that into my report and that's basically what I did. I'm new to this deposition and legal process, so in terms of how to engage these people is something that I felt that I don't know,

you know, who should give advice to who. I believe it's very clear I made it clear that I don't have a strong understanding of chemistry and that I need additional support in that area to try and help me explain the, you know, the repeated trends that I was seeing in this every one of my figures and that's what I was trying to basically come up with a somewhat rational explanations of the patterns I was seeing time after time in the gas wells.

Q And recognizing I don't for a moment suggest that you're in charge of the litigation strategy for the Attorney General?

A M'hmm.

Q But do you know of any reason why Dr. Grace wasn't simply added to the team as another expert witness?

A No, sir, I don't.

Q And so I now want to move on in your list of reactions provided by Dr. --

A Just a -- one thought I have a vague recollection and again this was happening very close to submission of my report and

it may be purely a time constraint, but you would have to ask the representatives at the Attorney General's office that.

Q And then the next reaction on your list there on page 41 that you imported from Dr. Grace's letter is the methanation reaction?

A Yes, sir.

Q Methanation?

A Yes, sir.

Q And is that simply the reaction that produces methane?

A It's one of the reactions that produces methane. Definitely the most common process in landfills for methane production is a bacterial process that is not the methanation reaction. This is basically purely a chemical reaction or actually two chemical reactions that are listed here that again involve, you know, some of the reactant products that I believe are present as a result of the pyrolysis process and these other things that are going on and again exothermic and so I felt that and what I was seeing in

the trends that the rapid climb in hydrogen leading up to step 4, from step 3, this seems to be a very in my mind a reasonable explanation of, you know, where heat is coming from and initially starting to drive that reaction.

Q Well, the normal method of methanogenesis in a landfill is that organisms produce methane?

A Yes.

Q Whereas what's written here is the methanation reaction has nothing to do with any living creature like an organism, but it's actually a chemical reaction?

A Yes, sir.

Q And are you saying -- well, let me just ask a few questions about the methanation reaction. The first I would like to observe that the methanation reactions written are very different from the other ones because the methanation reactions have five reactants. Do you see that? CO2 plus 4 hydrogen?

A Yes, sir.

Q So for those five reactants does that mean

that five molecules must come together at once for the reaction to occur?

A Basically that would be correct that you would require or let me correct myself here, that the way it's written is in a balanced form, but the product is CO2 reacts with hydrogen to produce hydrogen and water or, sorry, methane and water and so basically what would have to happen is that there will be a collision with the carbon dioxide and two hydrogen molecules. The oxygen would then get stripped off and a collision with another two hydrogen molecules, so you would get basically a methane molecule and two hydrogen or sorry two hydrogen molecules as the end product.

Q All right. My ninth question is again for the methanation reactions, since the biological reactions are producing far more methane compared to hydrogen, shouldn't the reactions occur in the endothermic direction?

A Well, the way I see it, that the conditions in the landfill at the time of the stage 3 are such that the temperatures

are generally elevated above the temperatures where methanogenic bacteria can survive which is typically about 131 degrees Fahrenheit and also the oxygen levels in some instances are elevated to a point where the dominant gas being produced is carbon dioxide and so I believe that all of the methanogens have basically died off and been replaced by bacteria-producing CO2 in many of the instances.

That's kind of what we're seeing in chemical charts that we're seeing basically normal landfill gas composition transitioning first to an aerobic conditions where carbon dioxide dominates which is typical of basically aerobic landfills and that's basically conditions that are not supportive of methanogenic bacteria.

And then in my charts what I saw is once those conditions are established that there's a very sudden ramp up in methane concentrations which some people suggested it's the recovery of these methanogenic

bacteria. I was skeptical of that conclusion. I believe that this methanation process actually provides a much better explanation of that because then in step 4, the methane seems to crash to zero and I believe that's simply because at that point the methanation reaction stops and the other chemical reactions take over.

Q And I want to make sure that I've put this in the transcript in an appropriate location. A couple of times during this sort of testing that we're doing you referred to a step, step 3 or step 4?

A Yes, sir.

Q When you've made those references, what you're referring to is what your report describes as the suspected five reaction steps?

A Correct.

Q Now, my last question on this group is: Can you explain the difference between kinetics and equilibrium and are they related?

A I would again on that one I would defer to

Dr. Grace because it's going way back to chemistry 100 and I understood it at that time, but I no longer have a good recollection of what those -- those processes.

Q And if you just turn the page to page 42, at the end of your quotation from Dr. Grace, you have a final paragraph of Section 5 of your expert report and can you just read the first sentence that you wrote there?

A This is all these reactions are strongly exothermic.

Q I'm sorry, after the quotation which is italicized. Go down to the last paragraph and read the first sentence?

A So what I said Dr. Sperling and Abedini, that's the sentence you're looking for?

Q Yes, sir?

A Sperling and Dr. Abedini are not experts in chemical reactions.

Q That's enough. I just asked for the first sentence?

A Oh, sorry, okay.

Q And so when you said in your report Dr.

Sperling and Dr. Abedini who is your colleague are not experts in chemical reactions that is true?

A Absolutely. I think I demonstrated that by my lack of being able to explain. I never presented myself as an expert in that area.

Q And it was true at the time you wrote the report and it's true today?

A Yes.

Q Could I ask you to turn to page 110 of your report so I can just get through this question of the steps, whether it's five steps or 12, seven, 12. We're in the conclusion section of your report where you essentially tie up everything and Section 12.2 is the conclusions that you expressed as your report in this case about the processes driving the conditions at Bridgeton, correct?

A Yes, sir.

Q And the way you phrased it I want to be very precise about. You said analysis, just read along with me. Analysis of monitoring data indicates that the SSSER

♀

involves a five step reaction process?
A Yes, sir.
Q LFCI suspects that the five reaction steps are step 1 overdraw condition. Step 2 aerobic heating phase. Step 3 methanation reaction. Step 4, torrefaction/water-gas shift reaction. Step 5, recovery.
A Yes.
Q Did I read that accurately?
A Correct.
Q And that was intentional in expressing the degree of professional certainty you felt about that conclusion?
A Yes, by saying that we suspect that based on the patterns that we saw in the graphs and the reaction parameters that that's what we drew our conclusions are.
Q When you inserteded I'm on a totally different topic so you won't find the answer in front of you and Dr. Grace didn't write it.

When you wrote your expert report and used the term Hindenburg?
A Yes, sir.
Q Were you intending to try to terrorize the

people of St. Louis County?
A No, sir.
Q Were you intending to evoke fear?
A No, sir.
Q Were you intending to make people think that they are at risk that Bridgeton Landfill somehow is going to blow up?
A No, sir.
Q We said yesterday at the end of the day although I didn't tie this up, you said yesterday that there's never been a temperature identified in any measurement at Bridgeton Landfill either in the landfill gas extraction well or in the landfill waste mass at a temperature monitoring probe never anything approaching 400 degrees?
A Yes, sir.
Q And when Mr. Foss-Smith wrote you his description of things and I don't want to remember it. I think I want to put it to you you're welcome to look at it because it's in the pile in front of you?
A Does it have an exhibit number?
Q It's exhibit number -- I can't remember

which exhibit it is. It's 6.

A Foss-Smith personal communication, okay.

Q And I would like you to turn to the first page of his e-mail and look at the last numbered paragraph of his e-mail paragraph numbered 6 and simply read the last sentence?

A Hydrogen has a high ignition point around 400 C and is unlikely to spontaneously ignite.

Q That's true, isn't it?

A I would like to basically explain to you. You seem to be very concerned about the example the Hindenburg and I mentioned yesterday I was very concerned about the gas bubble that was present under the liner and basically I expressed to you that I'm very concerned about the health and safety of the employees, you know, in those situations and basically my experience goes back to actually high school chemistry in this case where while experimenting I found this quite exciting we were able to actually produce hydrogen gas from I and I don't recollect now how

it was done in this mixing some kind of acids, whatever, but we actually produced hydrogen gas in baggies and with a very simple spark we detonated that gas and it exploded and we found that extremely amusing and interesting.

And that's my concern, sir, is that when the employees at the site basically deflate that bubble and there happens to be an excavator that hits a rock and generates a spark, that there could be a detonation that could be fatal to the employees at the site, and that's why I said Hindenburg.

Q And I think that's a good question to the one so I'm going to move to strike as non-responsive.

My only question is this: When Mr. Foss-Smith wrote to you the sentence "hydrogen has a high ignition point around 400 degrees Centigrade or Celsius and is unlikely to spontaneously ignite" that's true, isn't it?

A I would expect so. I again hadn't researched the ignition point of hydrogen

gas.
Q Well, let's assume for a minute that he's right and do the Fahrenheit conversion. The Fahrenheit conversion is nine fifths of 400 which is 720 degrees, right?
A
Q Plus 32?
A Yes.
Q So the conversion is 752 degrees Fahrenheit is the ignition point of hydrogen?
A Yes, sir.
Q Does that sound about right?
A Yes.
Q And that's more than twice any value that's ever been detected in any device anywhere in Bridgeton Landfill?
A Basically in the subsurface there's two things I would like to qualify there.
Q You can after you answer my question. First you need to answer my question.
A Okay.
Q My question was: 752 degrees Fahrenheit is more than twice the value of any temperature reading ever taken anywhere at

Bridgeton Landfill, correct?
A Any reading taken anywhere, but not any temperature likely to be anywhere.
Q Can you answer my question first? Is this is what I said true? And then you can explain.
A Well, if we want to get into specifics probably the temperature is measured much hotter than 752 Fahrenheit.
Q You're welcome to claim that. First of all, is it true that with all of the gas extraction wells where temperature is had been periodically and with all of the thermistors or temperature monitoring probe where temperature is measured directly in the waste mass there has never been a temperature reading in the subsurface which is even as much as half of 752 degrees Fahrenheit. Is that much true?
A Yes.
Q And would you like to explain some difference with my point of view?
A Yes, sir.
Q Thank you. Would you do that?

A And so as I mentioned hydrogen gas is a gas when it combines with oxygen can be highly exothermic and explosive as was demonstrated by my reference to the Hindenburg and basically when there's a spark generated by whether it's a flint or machinery or whatever it can instantly generate at that point enough elevated temperature to basically detonate that gas and that was my concern.

Q And what you're referring to when you refer to an ignition source like a spark igniting hydrogen gas is at a time when the hydrogen gas is in a concentration in whatever it's in that is within the igniteable range?

A Yes, sir.

Q And for hydrogen the knittingable range is broad it's like 4 percent to 75 percent, right?

A I don't know the specific explosive range of hydrogen.

Q But in what you referred to as being the source of your concern which is you saw places or at least a place where there was

bill owing, visible billowing of gas trapped by the EVOH cover over the South Quarry?

A Yes.

Q And you said, all right, that billowing contains gases?

A Yes, sir.

Q And some of those gases could easily be hydrogen by virtue of the hydrogen content of the landfill and the potential hazard exists if someone took a piece of heavy equipment and worked in that area and caused a spark to come close to the billowing, fair enough /(?

A And particularly when that billowing is deflated and I wasn't sure how that process is done, but generally that pressure seemed to be during the construction of these concrete removal or concrete what the heck were they called, CRPs I think, the wells that had to be removed from beneath the liner. My impression was that that gas bubble had had to be released because in one photothere's the bubble and then the next one the area is deflated and

so my impression was somebody went in and cut that liner to relieve the pressure and let people get on with the work and that's what I was in my mind very concerned about.

Q You didn't observe that happen, did you?

A No, sir, I just observed it through the photographs where in one there is a bubble and subsequently there wasn't.

Q What you're referring to is the reinforced concrete pipes?

A Yes, the RCP.

Q Didn't you know that the RCP abandonment before the EVOH cover had been laid down and not after?

A I would have to go and look at the chronology and possibly the repair that I saw, I mean I assume it was RCP possibly it was one of the wells being injected. I don't have the recollection of exactly what was happening.

Q Right.

A When those photos were taken.

Q I hear you, but here's the sequence I'll ask you to agree with and see if you do.

Bridgeton Landfill entered into an agreement with the Attorney General's office to do some work. The first step in that work was intrusive into the landfill. It was intrusive in had the landfill they were actually taking the tops off of the reinforced concrete pipes so that a settlement would occur that wouldn't be the stress of that pipe against the EVOH cover once the cover was later laid down?

A Yes, sir.

Q And people got concerned enough about the digging into the waste part with the reaction occurring that during the period of time that the reinforced concrete pipes were being cut off to make a place to the cover, we actually were asked to provide hotel rooms for people who lived within about a mile of the landfill and did.

A M'hmm.

Q And all of that was just a predicate for then having the contractors lay down the EVOH cover. Isn't that how you understand the sequence worked?

A Yes, sir. I also understand that or heard

that the depth of concrete pipe removed was about 15 feet or something and I don't recollect where I heard that. I somehow anecdotally heard.

Q Well, you've answered my next question which is who told you that?

A Again this is during a field visit. I picked it up as an and it may not be correct.

Q Well, so now I want to go back to what gave you some concern about an explosion risk to on-site workers.

A M'hmm.

Q You saw some billowing under the EVOH cover?

A M'hmm.

MS. WHIPPLE: Assumes facts not in evidence. The objection.

MR. BECK: Can I finish the question and then you can object?

MS. WHIPPLE: Sorry. I thought that was the end of your question.

MR. BECK: Not close. Not close.

Q But Dr. Sperling has the courtesy at that acknowledge parts of my question while I

ask them on the way which is good for me but not for the Court reporter, so let me get the question out and the question is simply: You personally observed that some material under the EVOH cover caused it to billo which automatically told you one thing and that is that the EVOH cover is good at preventing the pass through of gases, true?

MS. WHIPPLE: Objection. Assumes facts in evidence regarding EVOH cover.

MR. BECK:

Q Go ahead.

A So what my comments were based on photographs are placed at some point in the report I reviewed a couple of photographs taken of the billowing gas bubbles at a number of different locations.

MR. BECK:

Q Were they under EVOH?

A They were under the geomembrane EVOH cover, yes, sir.

Q And what you could tell first when you saw that that billowing was happening is that

the EVOH liner was therefore capable of preventing gas from moving through it?

A Yes, sir, as long as it doesn't have holes in it it's very effective at that.

Q And that's good from another standpoint which is you're always worried about oxygen or air infiltration into the landfill and the EVOH cover over the South Quarry so long as it remains competent is great for that, right?

A Yes, sir.

Q And you had the concern you expressed to me yesterday that you saw some places when you made your walk-around the landfill accompanied by Jim getting that you saw some places where there were either rips or tears or defects at a well but some imperfectations in the seal of EVOH covers in certain locations?

A Yes, sir.

Q Did you see other areas where there was some billowing occurring?

A I, during that tour that I conducted personally I have no recollection of seeing any billowing on the cover system

whatsoever.
Q And so let's discuss for the moment what we should draw from the fact that you observed places where there were imperfections in the seal of the EVOH cover over the South Quarry which you thought were prominent enough that if they came to your attention they should have come to Mr. Getting's as well, remember that?
A Yes, sir.
Q Here's the question: Let's say for a moment that there's a couple of foot tear in the EVOH cover material and air can get in there.
A M'hmm.
Q What happens to the air?
A Basically in the state of vacuum that the landfill is being operated at, the air gets drawn in underneath the EVOH cover.
Q To where?
A Towards the numerous gas well that are extracting landfill gas.
Q So it goes down into the waste?
A Yes, sir.

Q No, it doesn't.
A It absolutely does.
Q Okay. Isn't what you just said impossible by virtue of the design of the EVOH cover system?
A Not that I'm aware.
Q When you saw the EVOH cover, did you notice that it had channels in the cover that kind of look like, you know, spider legs or something?
A I did not notice that. Basically I saw a green geomembrane that covered the whole site.
Q Have you seen the gas and leachate collection channels that are built into the subsurface of the EVOH cover system?
A No, those were all covered under the geomembrane.
Q You couldn't tell from the surface that they were there?
A No.
Q You haven't seen aerial photos where you saw all lines where the channel exists?
A They weren't distinct on the photos. Thelines I saw on the photographs I

interpreted them as gas wells or sorry gas headers that appeared to be above the geomembrane.

Q Above?

A Yeah, like the black, you know, the lines you could see in their photos. I did not see anything or while I was on the site tour there that would suggest there was anything under that membrane.

Q So if you wanted to find out if what I'm telling you is right or wrong and the predicate for my question that I'm telling you is that there is a complete engineered system set up under the EVOH cover?

A Yes, sir.

Q That provides a preferential route for gas and leachate to go so that neither of them infiltrates the waste mass at all. The way you would check to see if that's right or wrong you would look at the EVOH cover system and you would look at the as-builts showing how it was, in fact, constructed?

A Yes, sir.

Q And you haven't looked at any of those?

A No, sir.

Q And do you know whether or not they are part of the information that was shared with you by the Attorney General's office?
A I did not see them, but I cannot -- I suspect that they would have been shared with me. I do have recollections of -- I'm trying to think if I do actually. Yeah, I did not. I reviewed the gas collection design of the bridge, but I did not review the design of the EVOH cover. I did not encounter that information.
Q So either they weren't given to you or they were given to you Bud you didn't get to them?
A Yes, sir, as I said I had megabytes of una number of files and I did my best to go through as much as I could, but I didn't get to those ones.
Q But you understand that what we're doing here is serious business?
A Absolutely.
Q And that it requires a detailed understanding of all the facts, true?
A Absolutely.
Q Now, if you assume that under the EVOH

cover there is an engineered system of preferential extraction of landfill gas or air that could come in through an opening that collects it, keeps it out of the waste mass, sends it to the flare and destructs it, then that would obviate your worry that a defect in the EVOH cover could cause air infiltration into the waste mass?

A Yes, sir as long as that system is maintained fully at all times. Otherwise then it serves as a pathway for oxygen to get into some of the wells.

Q And one of the things that some day I hope in this case will get to is what do people want us to do that we're not doing because my client for better or worse is is doing a lot and you agree with that much, don't you?

A Yes, sir. I definitely agree with that.

Q And so if we asked you help us look at our plants and make sure that we have provisions procedures, checkoffs, cross-checks that enable us to solve the worries that you've identified and one of

the worries that you've identified is that it's important that any engineered collection system under the EVOH liner be kept in it good repair, be kept under proper vacuum, be inspected and printed periodically and that EVOH cover defects be repaired with reasonable dispatch?

A Yes, sir.

Q Is that sort of the set of conditions you would like to see in our operations and maintenance plan?

A And they may well be there already.

Q Understand. Understood?

A Yes, sir.

Q Understood but what I want to make sure I understand because there's always the possibility that at a trial a judge would hear your testimony and say okay I think that's an important thing I want to make sure it's included.

A Yes.

Q And I want to make sure I understand what it is because quite frankly if it you've got good ideas that haven't occurred to the 150 consultants I'm already employing,

I would like to involve them. I would like to include them.

So is there anything else you want me to say in that portion of my operation and maintenance plan directed to that specific issue than what I just captured?

A In terms of just what we discussed, that when I was on site I basically saw, you know, some very aggressive vacuum underneath the cover and the liner was just sucking right into depression so it showed me good vacuum which would potentially suggest that that subsurface is working in those areas whereas when we see those big bubbles developing under the liner that would suggest to me that that system in that area is not working effectively because there should be negative pressures, so flag that.

Q I hear you. And so let me ask how you as a person who does a person who describes landfill operational procedures that you consider to be safe would say that, would it be appropriate for there to be a requirement of a walk-around I'm going to

let that siren pass.
A Yeah.
Q Would it be appropriate to say that there must be a walk-around visual inspection of the entire EVOH cover system to identify tears and billowing that those would then be required to produce an exception report, not only internally for the landfill operating record but also reported to the Department of Natural Resources as our regulator and that there would be a requirement to expeditiously seek repair of those exceptions. Is that a reasonable way to write it up?
A Absolutely and in terms of the frequency, I would defer to the on site staff because my impression was that the landfill especially in the reacting area is very dynamic, you know, rapid settlement and the guys are basically adjusting boots almost daily. There's six people making those adjustments so it's a very challenging job and how frequent that inspection needs to be undertaken is something I'm not sure what the right, you

know, frequency is.
Q Is it fair to say that the typical staffing for a closed landfill for the size of Bridgeton which isn't having a Bridgeton event occurring is less than one full-time equivalent?
MS. WHIPPLE: Objection to form. Assumes facts not in evidence. Closed?
MR. BECK: What?
MS. WHIPPLE: I'm objecting to the word "closed".
MR. BECK: Okay. Well, let me repair the objection.
Q Do you understand that Bridgeton hasn't taken waste for the last ten years?
A Yes, sir. I believe the last date was December 31st 2004 the last waste came in.
Q And as a term of art among professionals, isn't that what's referred to as being closed?
MS. WHIPPLE: Objection. And contrary to the law. Closed is a legal term.
MR. BECK: You don't get to tell the witness what to say.
[indiscernible - simultaneous speaking]
MR. BECK: Now, we're going to get on the phone

with the special master if you continue to make speaking objections that tell the witness what to say.

MS. WHIPPLE: My objection is what it is.

MR. BECK: Make it and then stop.

Q Dr. Sperling, isn't what I said true?

A I'll just clarify just a mediator on these things from what I understand there's two different types of closures and what we're talking about the landfill did not receive waste and yes, after landfill stop receiving waste that generally the number of people on them is significantly downsized. I would say that in our experience in British Columbia as I mentioned where I do most of my work there are only a limited number of large landfills and all of those landfills are still in operation certainly the smaller sites have less than one people allocated to oversee them.

Q And 52 acres that would be a smaller site?

A No, no, in this our mind that would be a medium to larger site like I say. British Columbia only has three landfills that

receives the same sort of tonnage, but for sure landfills that are not operating anymore would have a much smaller consignment of staff and the number of staff at Bridgeton is definitely much larger than the norm.

Q It is orders of magnitude larger than the normal, isn't it?

A Yes, sir.

Q And for the typical post-closure care of a landfill which involves monitoring different media like groundwater, operating big gas system if you have one making sure the cover remains in decent repair, inspection, reporting, for whatever is the regulatory period, that's a relatively inexpensive proposition for a closed municipal solid waste sanitary landfill in the absence of some extraordinary event, isn't that true?

A Yes, I would estimate it in the range of 50 to $100,000 a year, something in that ballpark probably would be reasonable.

Q And spending hundreds of millions on a landfill with no revenue is an

extraordinary resource commitment, isn't that true?

A I would say that's a significant financial pressure on the owner of the company, yes.

Q And it's evidence of a company stepping up to do the right thing in response to a problem, isn't that fair?

A On that I'm not sure, from the impressions that I've had is that a lot of the steps that were taken were driven by orders by the Attorney General rather than the company stepping up.

Q And isn't it true that few than one half of one percent of all the steps taken at the landfill came as a result of orders -- by the way the Attorney General can't order things in our system. The Attorney General can ask a Court to.

Do you know that the only thing the Attorney General ever asked the Court to order was an increase in carbon monoxide monitoring?

MS. WHIPPLE: Objection. Form. States facts not in evidence.

MR. BECK:

Q Go ahead. The?
A From my review of some of the orders and I skimmed then there seemed to be multiple steps, but.
Q Maybe you're misunderstanding something. I know what you're saying. You reviewed the preliminary injunction?
A Yes, sir.
Q You didn't think that was something someone had to order, did you?
A I basically interpret it as an agreed order to do something that basically was driven by the regulators requesting that be done.
Q Why? It says agreed. It says the word Agreed "at the top in the heading so why did you assume that it wasn't agreed?
A In the -- to me I'm not a lawyer or anyone very knowledgeable in the legal system. I interpreted the word "order" is usually when one party says you have to do something to another party and that's basically where I interpret it as being something that one party is ordering the other party 20 do and maybe if I

misunderstand that that's what would I interpret it as.

Q Have you ever heard of an administrative order on consent?

A I've heard of an administrative order, but.

Q Not on consent?

A I'm not knowledgeable about these regulatory processes and they're quite different --

Q Perhaps and I realize today I'm in your country Canada for this lawsuit you're in my country, the United States.

A Yes, sir.

Q Did you not know that the vast majority of environmental remedial work in the United States, the vast supermajority of environmental remedial work in the United States is done pursuant to agreements, but in order to give those agreements power, the agreements are expressed as agreed orders, either administratively or judicially?

A I did not know that.

Q And so because, for example, the

preliminary injunction said that it was a Court Order which it is and despite the fact that it said Agreed at the top you assumed that those were requirements that were imposed upon rather than voluntarily assumed by Bridgeton Landfill?

A Yes, sir.

Q Now, did you ask the Attorney General's office if that was true or false?

A No, sir, I just interpreted that. I was more focused on the technical aspects of the work.

Q Well, let me ask you to hypothetically reposition your thinking about it and go back to my question.

I would like you to assume that the Attorney General of Missouri, Mr. Koster announced that he was filing a litigation, that the response of the company to his announcement on the day of his announcement was we welcome the Attorney General's involvement we look forward to working with the Attorney General to set down an agreed set of things to be done and make those two assumptions. Add the

assumption that over the next several weeks the landfills representative one of whom is asking you questions right now very digitally sat down with the Attorney General to work out the terms of that injunction and without any involvement by the judge in saying you must do this or you should do that, that there was a complete agreement reached between the Attorney General's office and representatives of the landfill and that that is embodied in had the preliminary injunction. I would like you to assume all that.

If you assume all of that and that it was purely an agreement and a constructive response to the Attorney General becoming involved, would that cause you to believe that the landfill was trying to do the right thing?

A Yes, sir.

Q In response to an order?

A Yes.

Q Now, one of the things I've got to talk to you about is the question of a barrier in

the neck of the quarry, a physical barrier in the neck of the quarry and let me see if this fairly captures what your report tells us about that in simple terms.

First of all you didn't advocate that someone dig out garbage and construct a barrier in the neck of the quarry now.

Secondly, you believed that it's not possible for the reaction to take place below the water table and, therefore, felt that a barrier keyed into the top of the water table would be sufficient to prevent the reaction from moving to the North Quarry so long as the be water level was maintained?

A Yes, sir.

Q And, third, as a result you suggested that the difficulty cost at risk of putting in that barrier might have been overstated historically. Is that a fair summary?

A Correct and the magnitude of the work that would be required with a shallow barrier, yes, sir.

Q And what you've suggested which is one might have considered a barrier just down

to the water table and a few feet in, keyed in and that could be done with less excavation, a narrower excavation, less exposure of trash, less odor, less bird risk we find out yesterday less all the things that go with it. Your position was that that might have been a way to go?

A Potentially, yes, sir.

Q Okay. Did nobody from the Attorney General's office tell you why that notion was rejected?

MS. WHIPPLE: Objection. Assumes facts not in evidence.

MR. BECK: I'll depose Joe. I'm going to depose Leanne.

THE WITNESS:

A What I heard /(with respect to -- yeah, I had no discussions about putting the barrier down just to the water table. We had no discussion on that.

MR. BECK:

Q Had you seen the initial drafts of the preliminary injunction that were submitted by the Attorney General's office expressing sort of everything they would

like to have for discussion purposes that were given to the landfill as the earliest part of the negotiations for the preliminary injunction?

A I saw a lot of documents that was in the process, but I don't have a recollection.

Q What I'm referring to would be a full draft of the whole preliminary injunction but in an earlier iteration so it contained things that weren't ultimately negotiated?

A Yeah, I don't have a recollection seeing that.

Q Have you ever seen an earlier draft of the preliminary injunction that actually called for the construction of a physical barrier in the neck?

A Not to my knowledge.

Q On the day that the injunction was agreed to in principle, the finish of the oral negotiations leading up to some just some wordsmithing in the document --

A M'hmm.

Q -- has anyone described to you what happened that day?

A No, sir.
Q Did you know that the final negotiation of the terms of the preliminary injunction occurred in a conference room at the Attorney General's office in Jefferson city?
A No, sir.
Q Did you know that the lawyers from the Attorney General's office who were conducting that negotiation were Joe /PWAO*EURPBD spelling phonetic) and Jessica Boyle (phonetic)?
A No, sir.
Q Did you know that the representative of the Missouri Department of Natural Resources who was present for that negotiation was Leanne /T*EUPT Nosely (phonetic)?
A No, sir.
Q Have you met her?
A Not that I'm aware.
Q Have you met Mr. /PWAO*EUPBD? Need spelling
A I met I believe I'm trying to think from MDNR.

Q He's from the AG?
A No, the only people I believe I've interacted with are the people that came on the site visit while I was in this St. Louis.
Q Have you been told by the Attorney General's office or have you otherwise come to know that during those final negotiations the question of whether there should be a physical barrier constructed in the neck was probably the most important lengthy and complex topic negotiated?
A No, sir.
Q Has anyone informed you that after a discussion of the technical merits and disadvantages of constructing a physical barrier in the neck the decision was made by Joe /PW*EPBD of the Attorney General's office and expressed as we agree it would be crazy to build this. Has anyone told you that that's how the negotiation actually came to fruition?
A No, sir.
MS. WHIPPLE: Assumes objection assumes facts not

in evidence.
MR. BECK:
Q Has anyone told you had that in exchange for the Attorney General's office recognizing the problems with trying to construct a physical barrier in the neck the landfill responded in negotiation by them providing a housing program that cost hundreds of thousands of dollars during the RCP abandonment and the voluntary payment of $900,000 in Missouri Department of Natural Resources oversight and testing costs as our response to what it saw as the constructive step of not doing something that was so technically problematic?
MS. WHIPPLE: Objection. Assumes facts not in evidence.
MR. BECK:
A No, sir.
MR. BECK:
Q And so just to be very, very clear about it, even after you've provided the Attorney General's office your report which expressed skepticism about whether

the degree of difficulty of building a previously building an isolation barrier at the neck of a quarry even after you told them that to you it seemed like the difficulty was being overstated, no one from the Attorney General's office told you that it was their decision not to build that barrier?

MS. WHIPPLE: Objection. Assumes facts not in evidence.

THE WITNESS:

A No, sir.

MR. BECK: Let's go ahead and change the tape. And why don't we take a break.

THE VIDEOGRAPHER: Going off the record. This is the end of media unit number one. The time is 11:13 a.m.

(PROCEEDINGS RECESSED AT A.M.)

(PROCEEDINGS RESUMED AT A.M.) test test

THE VIDEOGRAPHER: We're back on the record. Here begins media Unit Number 2 Volume 2 the deposition of Tony Sperling. The time is 11:26.

MR. BECK:

Q Dr. Sperling, after the break are you

ready to proceed?
A Yes, sir. That was a nice de-stressor. I appreciated it.
Q It is an artifact of the video taping that we all get a break now and again.
A Yeah.
Q So we just spoke before the break about the question of the degree of difficulty in constructing a physical barrier at the neck of the quarry. Now I would like to move the other way and talk about the possibility that EPA has under advisement of building either a thermal or a physical barrier closer to the Westlake landfill superfund portion that has low level radiologically impacted material.
If you're right and if all you need to do to stop the reaction from migrating is build a barrier down to the water table and key into it a few feet and keep track of your water levels, then that is a substantially smaller construction job, true?
A Yes, sir and particularly, if I may expand on that.

Q You may.
A On the barrier between the OU-1 and the North Quarry, I feel it's a much more tenable place to construct a barrier as well and that's what I flagged in my report in terms of recommendations to essentially focus in that area.
Q Understood. Did you consider that what you were making was a recommendation to EPA?
A No, sir, I did not consider it as such. I felt, as I mentioned yesterday, that I feel there are two predominant risks of if this reaction were to grow into the North Quarry one would be the environmental issue of the reaction in in the quarry and the other would be the approach of the radiological waste and certainly the second one I feel is much easier to handle at that OU-1 boundary as to whose jurisdiction is is something I have no knowledge of and I'm a technically focused guy. I'm purely on engineering matters.
Q The relative ease of handling some kind of barrier system, whether it's physical or

thermal, next to the low level radiologically impacted waste is driven by the geometry base of the quarry?

A Essentially the depth of the waste that's present.

Q And if you look at exhibit -- what exhibit is this picture?

A 2.

Q The plain view?

A Where is mine hiding.

Q It's Exhibit 5?

A Yes.

Q And if you look at this inset where there's a three-dimensional CAD depiction of the quarry prior to landfill filling you actually picked that up as part of your drawing in your report?

A Yes, and I suggest that the section down who is much more clearer to representation and that's where I saw right at the I guess it would be north end of the of the New York the separation between OU-1 and North Quarry the depth of the waste mass there appears to be in the order of 50, maybe 60 feet which is sort of 20 metres.

To me it's not a very substantive depth comparative to the hundreds of feet in the neck.

Q Right. And so one reason that you saw that as a relatively easier project is it didn't go as deep?

A Yes, purely the volume of material, whether it's concreted or excavated or whatever would just be, you know, again order of magnitude less.

Q By the way have you ever tried to build a concrete wall in garbage in a landfill?

A No, I've constructed numerous fire breaks and in terms of concrete I probably wouldn't go there. The way I saw that if I had to do something like that I would do probably a controlled excavation with lots of dirt.

Q Short of sheet piling and pouring concrete between the sheet piling, there's really not much way to build a solid wall in the sort of Jello that is the landfill contents?

A Yeah, or some other augering method or whatever vertical solid wall would be a

challenge.
Q But what you would say as potentially preferable would be a V-shaped excavation filled in with an inert material like dirt?
A That's been my experience. I've had a project at Vancouver landfill where we had a fire and had to basically try and isolate that down to -- I think it was on order of 17 metres but I may be incorrect on that number.
Q The low ground surface?
A Yes, sir.
Q Okay.
A We actually came up with a very creative solution to that and that initially I designed exactly what you envision kind of a V-shape right down to the bottom of the excavation.
Q Okay.
A And then subsequently came up with the idea of actually cutting out a V only about half depth and then using a long reach excavator to excavate a key which is maybe in the order of 5 or 6 feet wide and

then basically filling that with dirt and that reduced the volumes (phonetic) (check) in half, that's the approach that potentially I would, you know, envision, although, like you said, the liquid sloppy nature of this material, I -- I've never worked with the waste mass at Bridgeton in my experience when you excavate into landfills that typically the wall in shallow excavation end up standing vertical and don't flow in had or cave in so I have no experience as to how the waste at Bridgeton behaves. I would expect there's a good chance it might do the same thing.

Q Sure. Every time we start staring at a picture I have a question coming from the picture so let me ask you a question coming from Exhibit 5 and particularly the portion of it that is salmon colored and contains the profile view of the base of the landfill quarry.

Do you know that no one has ever detected the reaction below a certain depth or very close to the limestone floor

of the South Quarry?
A Yes, sir, from the temperature profiles there seems to be a very abrupt break in the temperature profile and sort of deeper down the waste mass seems to be much cooler and I've always inferred that's the position of the natural water table.
Q As opposed to leachate?
A In terms of the two in my mind are synonymous like the leachate level.
Q Well, if you happen to be completely wrong about the question of whether the reaction can occur under water, have you considered any alternative reasons why the heat generation of the reaction would be retarded when it gets closer to the limestone floor of the quarry?
A I would speculate that basically the limestone is a heat typically is is at a certain temperature and probably has a different thermal mass like we see that in landfills like the surface is cold the bottom is cold and then inside is warmed up and I would anticipate that the cooling elements of that would tend to just keep

the temperature lower and there may be other reasons. From a chemical perspective I don't see anything, but I am again not an expert on chemistry.

Q Right, but you understand the thermal concept of a heat sync (phonetic)?

A Yes.

Q And that's what you're talking about?

A Yes.

Q And likewise, have you noticed there seems to be a certain space maintained between the nearest part of the reaction and any wall of the quarry?

As the reaction has migrated south, it really hasn't come up against a wall, have you noticed that?

A Yes, and I felt that was essentially a three-dimensional aspect that also even though you have the wall you also have the landfill side slope and which results in a more shallower waste mass so I felt that those two things were probably -- again, the surface cooling, you know, from the waste mass at surface.

Q I'm going to cover the surface third, but

for the second part which is near the quarry walls are you saying that the above ground slope of the landfill bears in some way on why the reaction wouldn't come close to a quarry wall as it migrates to the south?

A Yes, in my mind what I was looking at like going back to that temperature profile of well 7R and we could -- let's just take one quick look at it, if I could refresh my --

Q That would be fine. It's in your report as one of the --

[indiscernible - simultaneous speaking]

A Figure 2 something. 2-10 on page.

MS. WHIPPLE: 21.

A Figure 210 so I'm looking at that figure and I see essentially the first 45 feet because I believe ground surface here is at 405 or sorry, 505 and the high temperatures really start at 565 so there's a 40-foot soft zone of cooling which I infer as as surface effects and so I would definitely expect that at the toe or at the quarry wall the ground interface

is at, you know, at the ground level so instead of being at 100 feet up in the air, so I would expect that that reaction would be pushed, you know, another 40 feet down below ground level which would be down somewhere in the 400 foot range elevation and so the zone reaction is much that will shallower and I had not contemplated if there are any sort of benefits from the side wall from the mass.

Q Wouldn't it the same sort of heat sync creating properties exist along the side walls perhaps not as efficiently producing not as much protection but there would be some?

A I would suspect that there would be some, yes.

Q And so what you're looking at here in Figure 2-10 of your report Exhibit 1 which is the graph of TMP 7R over time shows us that essentially the reaction stayed out of the first 40 feet of the waste column. It occurred most importantly in the next 100 feet of the waste column down to a below ground surface of 140 feet and then

it trails off and goes away in the bottom 100 feet of the waste column. Is that right?

A Yes, sir, and the important point that I want to stress here in that is that this continuity between 140 and 160 feet depth and my explanation for it is I believe that at the time that this is essentially the transition between the gaseous and the liquid phase of water and that has the greatest effect on that, you know, cooling process more so than the bottom of the quarry. That's my interpretation.

Q Well, your assumption was that this means that the water table is around 350?

A Correct.

Q Because that's where the temperature break occurred?

A Yes, that's what I was assuming.

Q And if, in fact, the water table is up around well, let's say above 420, so I don't need to pick a number between say 420 and 460 to make the point, if it's above 420 then it's different than you conceived of it?

A In principle, yes, sir. What you presented to me in one of the earlier, one of the exhibits you gave me sort of a measure of the GIW water levels.
Q Yes, sir.
A I believe it was at the time that those things were commissioned that suggested that the water levels were somewhere in the area of 30, 40 feet.
Q It's actually different than that. The exhibit I showed you which is Exhibit 7 reflects water level measurements that were taken on June, 2015, so it was years after the GIWs were commissioned.
A I apologize for that. I misinterpreted that data, having only had a chance to skim it.
Q It's got a collection date column on that table and the collection date for each water level measurement is June 15, 2015, do you see that?
A Yes, I didn't see that at the time.
Q And if you look at the ground surface being around 500, then the effect is that the water level measurement is really more

like it's at the top of the TMP temperature graph, so up in had the say 460 to 500 range, right?

A Yeah, something here isn't making sense to me. May I just ask to clarify?

Q I don't know if I can clarify everything you want to know.

A So basically the way I understand it, the GIWs are very critical components of the overall infrastructure that's operating it and is our primary line of defence gas migration into the North Quarry is the way I'm interpreting it.

Q That may be the Attorney General's characterization.

A And my impression was that those wells were deeper, you know, targeting the entire area of the reaction and are intercepting all this gas that's being by the reaction are being pumped aggressively to intercept it all and I just have a hard time believing that they only go 30 feet below the ground surface.

Q Do you know what's inside the GIWs right now?

A I would expect it's a gas interceptor well that's pumping a lot of gas and that it also has those blackhawk (phonetic) pumps to pump out water and may make it effective at intercepting -- intercepting gas, but that's my assumption but I have not seen or reviewed the design of those GIWs.

Q Do you know under the pilot study where the cooling loop is?

A Yes, sir, I believe it's in some of the more -- it's definitely in the neck and I don't know what exactly in which wells it's been installed.

Q Did you think they had simply converted some gas extraction wells to a cooling loop?

A That was my understanding that they added the cooling loop to some existing wells.

Q But was it your understanding that they were gas extracting wells or gas interceptor wells?

A To me, my understanding was that the G GEW and the GIWs were in essence synonymous except that those were specifically

targeted as extraction wells so intercept gas and specifically set up close to aggressively capture the gas and that's why they were called that, so if I'm not fully understanding it, that was my understanding.

Q Well, let's get away for a moment from theoretical questions we have and just talk about the question I'm trying to get at with --

A Yes.

Q -- your Figure 2-10 in your Exhibit 1 which is the temperature graphs for temperature monitoring probe 7R and I want to go back to the question I had. You know you had kindly pointed out to me the significance to you is of the depth interval between 140 and 160 feet below ground surface, but I want to get to a much simpler proposition than where the water is.

A M'hmm.

Q And that is where the temperature is, not why but just where. And what we can see is sort of the bottom 100 feet of the

waste are not affected by the reaction?
A Correct.
Q The top 40 feet or so of the waste are not affected by the reaction?
A Correct.
Q And it is in the depth interval between 360 elevation and 460 elevation that we see the principal effect of the reaction?
A Correct.
Q And the reason I say that is now let's go back to 5 which is the map and let's go back to the same profile view at the bottom along cross-section AA Prime and I just want to talk to the geometry of the bottom of the quarry for a moment and just before I go there we've talked about the heat sync at the bottom the potential heat sync at the sides.

What is the effect at the top that keeps the reaction 40 feet below ground surface? What is the cooling principle or the thermal dynamic principle or just the physical phenomenon that explains why this is a subsurface reaction and not closer to the surface?

A In terms of the mechanisms that are driving the reaction, I believe it's something that is temperature controlled and if temperatures get sufficiently cool, there's just not enough heat to try the pyrolysis process or the subsequent reactions to occur.
Q Sure. And so we all know that it's not 140 degrees in the ambient air. That has an impact that has an effect it has relative to the heat of a reaction it has a cooling effect in the top of the waste column, right?
A Yes, sir.
Q And we all know that limestone can get cold and limestone certainly doesn't get 160 degrees and so just the massive amount of rock around the sides and bottom of the quarry help provide a way to contain the reaction sort of middling in the subsurface and that would occur even if heaven forbid at some time in the future the reaction were to cross through the neck and start proceeding in the North Quarry you would still expect to see those

temperature controlling physical phenomena play, right?

A Yes, sir.

Q And so now that we've established that, so let's say hypothetically the reaction is moving in the North Quarry. It is not a thermal chemical phenomenon. Now it's animate. Now it has intentions how it has a brain. It has a desire to go eat some radioactive material as fast as it possibly can and so it is on a bee line directly for the rads at whatever maximum speed it could travel and it's so single-minded there's nothing else in this life that it wants than to get to the rad /(material.

Do you see the first quarry step which is at approximately elevation 320 over in the North Quarry around where TMP 16 and 17 and 18 are located?

A Yes, I do.

Q And help me appreciate the importance of that step for a moment.

Does the step change the shape of the reaction to essentially a smaller

depth because the heat sync moves up so that you still have the heat sync mechanisms of the quarry side walls and a higher heat sync mechanism of the quarry bottom and a heat reducing mechanism of the top of the waste column and so essentially the reaction still could be quite thick in terms of depth but it's probably thinner than before it reaches that step?

A Yes, I see that there would potentially be some thinning to it. In my mind, though, still I believe that the capacity of water in the face change is the dominant process that controls the -- the cooling effect on the bottom of this reaction. And I'm not sure without doing some additional analysis what that profile would look like, you know, because I think the water table will have a significant effect there which may actually be very favourable because I believe the water table is very high in the North Quarry.

Q In fact you're giving me a gift?

A Yes.

Q And the gift is that because the water table in the North Quarry is on a static basis, on a continuous basis well above 480, the chances of the reaction migrating through the water table in the North Quarry are extraordinarily low full stop and the only thing that could change that is a dramatic decrease in the water level in the North Quarry in your opinion?

A Yes, sir, if you buy my interpretation that the reaction is affected by water table then that would be true and that's why I recommended that, you know, that the team carefully re-evaluate aggressive de-watering of the gas wells to pull down the water table and make the gas wells more effective.

Q And by team in that instance I want to make sure what you're talking about isn't just the team at Bridgeton Landfill. You're talking about the team of all the people who are responsible for the condition of Bridgeton which includes the myriads Department of Natural Resources?

A Yes, I would say see in my mind it I came

across a description of team Bridgeton brought in all experts working together which I think in my mind the most effective way of trying to solve these problems.

Q So let me step back and get that point straight because I think it's a really important point to put in the record.

In your experience based on decades of experience and the interaction between regulated parties and regulators, the best thing to do is to get the people to need to make and force and monitor decisions together in a room, that you can things through, agree on the best course of action, implement it expeditiously and force it rigorously and just do our best collectively to solve the problem?

A That has been my life experience, yes, sir.

Q And isn't it exactly the opposite of that to file lawsuits, parade scores of expert witnesses in front of a judge or jurors and let people who are seeing the problem for the first time and only for a period

of weeks make fundamental decisions that could change the way that thoughtful people have chosen to approach a problem for years. Isn't that the opposite?

A On that, I feel I have insufficient information to render an opinion.

Q Well, it's a very different model, will you give me that much. One model is regulators and regulated parties sit down and talk and try to understand each other and accept the fact that they both want the same thing and share science ideas and come to conclusions and when they can't agree the regularity makes the final decision and that's it. That's one model.

Another model is people who barely speak to each other, throw things at each other in Court and then they take turns calling people to say their point of view in front of someone who then has to make a decision between the competing points of view and nothing is collaborative that is a very different model, right?

A Yes, sir, and I had a very similar conversation with Ms. Whipple and my

impression was she shared exactly that a collaborative approach where everybody worked together to solve the problem is definitely in the best interests of everybody.

Q And if that's true, do you have the slightest idea why the Attorney General of Missouri absolutely refuses to sit down and talk to try to how to resolve this case?

A Again, I'm not able to comment on that at all because I'm not involved in that process.

Q Can you think of any reason not involving headlines that sitting down and trying to work out what is the best answer for Bridgeton Landfill among people of good intention and solid scientific background isn't the right way to go?

MS. WHIPPLE: Objection. Assumes facts not in evidence.

THE WITNESS:

A Yeah, I think I would prefer to not comment.

MR. BECK: I'm going to withdraw the question.

It's not fair to ask you in the appreciate that you're in.
[Indiscernible - simultaneous speaking]
A Yes, I appreciate that.
Q It is fair for me to ask the trier of fact.
In your country, is there some system where the way that we make decisions about how to solve environmental problems associated with landfills is we go to Court and fight?
A I think it's generally a last resort. Just looking at my experience, there are two, you know, on fire projects there are two things that sort of render an approach. One is the financial resources to actually do the work that's necessary and then the willingness of the owner to actually execute it. And so I've only my experience has been involved in one, well, actually two regulatory driven actions where the government actually took over the project because the private owners, you know, weren't stepping up to the plate and I think in that aspect that that's

when the regulatory process is necessary to protect the public and so, you know, I'm not able to judge whether your company is stepping up to the plate or not. But I think that's where the fundamental question is.

Q Well, let me ask you this: Have you ever heard of any private company stepping up to the plate to the tune of 170 million dollars for a landfill remediation project before?

A That's sort of a difficult question to answer.

Q It's not. You either have or haven't heard of that?

A I think it requires qualification because I've never heard of it but I've never encountered the problem of magnitude of environmental impacts that have been sort of occurring on this project.

Q To be fair about it, though, you recognize that to my company which has a my company Republic Services which has a subsidiary called Bridgeton Landfill that's something that happened to us, too. It was a costly

position it was a problem, it was a set of worries. It was a set of litigations. It was a set of all kinds of things that arbitrate really constructive for companies to be involved in that happened to my company.

A Yes, sir.

Q I just parked one question as a trial question.

Let me go back to my exhibit which is Exhibit 5 and this is again the profile view of the landfill. And I'm now taking you to the step where the reaction now requires intellect and crosses the quarry as fast as it can because it wants very much to reach the low level radiologically impacted material and it's gone above the first step of the quarry, the step at, say, 320 feet above sea level and it's still moving to the north and now it encounters the second step which is the greater step in the quarry and goes from approximately elevation say 320 to approximately an elevation like 435, 440, is that what it looks like to you?

A Yes, sir, it's under 450 so somewhere 440ish.
Q It's at least 100 foot step?
A Yes, a significant step.
Q And it happens to be positioned just because of the heat sync effects of the surface cooling and the bottom cooling and it happens to be positioned right in front of the reaction, right?
A M'hmm.
Q Yes?
A Yes.
Q Had you done anything to look at the question of whether the reaction in reaching that more than 100 foot vertical wall directly in its path and as tall as the reaction itself would cause the reaction to jump up over it to get to OU-1 or like every other side wall of the entire quarry would simply provide a heat sync that would tend to repel the movement of the reaction?
A Yes, that's an interesting point and I see what you're saying in that if you're getting sort of sandwiched with cooling

material above and below, the zones overlap and the reaction would be unlikely to continue, there wouldn't be enough heat to sustain it.

And that is certainly true, but what, as a landfill fire expert, you know, basically I bring to bear and I've raised it in my mind and in the report what my greatest concerns are that the way that the situation is currently being controlled at Bridgeton is essentially introducing a very large amount of overdraw to control emotion gases into landfills where we're seeing, you know, significant oxygen within the waste mass and I believe if the reaction were to spread into the North Quarry, that you would be basically looking to implement, you know, a similar or same approach to prevent the re-release of odors in the community and volatile, etc. and that which I believe has been, you know, successful from what I've heard the relative level of impacts before the EVOH cap and all the gas controls that you've

put in was dramatic worse than it is today and when I was on site I basically uncovered the odors only in some areas, although when I got off the site our gear just stank to high heaven, so there is definitely some volatile organic matter above the liner, but so what I'm really concerned about is essentially as all these measures are being undertaken to control the SSSER that we're really, you know, creating conditions that could at any time essentially initiate a classic of subsurface fire, right, and I think that that is something that we flagged and I remain concerned about and let me say for the record only that often in making a motion to strike part of an answer as not being responsive I can draw a verbal point between one point and another and say move to strike. I can't quite do that verbally right now because of the migration of that answer moved so much distance, but I move to strike whatever portion of that answer is not responsive to my question.

/(So let me see if I can break it

down in parts because I'm going to let you talk about your concerns. I am. I promise you.

A Thank you.

Q I am going to let you talk about your concerns, but just help me get some points packaged in a way that they can be read and appreciated and one point that can be read and appreciated it and you hadn't really thought about it before we discussed it in detail, but it could be that this step in the quarry that is greater than 100 feet in depth could have benefit?

A Without a doubt, yes.

Q And the same sort of benefit that the walls of the quarry has -- have as the reaction has migrated around the -- of the South Quarry?

A Yes, sir.

Q Now, separately what you're saying is that's not the end of our concern because, you know, I want to protect against any exposure of the reaction to the surface, if that is -- if it's possible for the

reaction to reach the surface, right?
A Yes, sir, or basically exposure of reacting material to oxygen at depth as well.
Q Two separate points. I'm going to take them sequentially. So for the first point of wanting to make sure the reaction doesn't daylight if you will, one thing that would be very useful would be to have the North Quarry like the South Quarry not only temperature monitored and gas well temperature monitored, but also to finish covering the North Quarry with EVOH. That would be beneficial, wouldn't it?
A Yes, sir, and I flagged in my mind I researched, you know, the melting point of EVOH and I believe it was somewhere around 350 degrees Fahrenheit or something and I kind of flagged that if when we encounter, you know, fire-type situations that we encounter temperatures very much higher than that so that cover could be compromised if there was an uncontrolled situation like that thing that happened in 2014 it got larger and so my

recommendation in the report is to in addition to or prior to placing the EVOH cover, if that's the chosen bit that there would also be an insulating barrier of some additional soil beneath that cap.

Q So I've got to unpack all of that, but I was trying to get there in chunks and I'm going to go back to the chunk I was on.

A Yes.

Q And so did you know whether or not Bridgeton Landfill has already committed to finish covering in the North Quarry with EVOH as soon as the people with the decision making authority make the final decision whether or not there is an isolation barrier required, whether it's a physical barrier or a thermal barrier so that we can key the EVOH cover into whatever is there and not have to tear out something that's been built. Did you know that Bridgeton Landfill has already committed to that?

A No, I did not know that.

Q Okay. So if that's true, if it's true that Bridgeton Landfill has already

committed to that and if Bridgeton Landfill performs its commitment, then that would mean that it is simply a matter of sequence for the North Quarry to be finally covered with the EVOH cover in the same way that the South Quarry is and that whatever EPA chooses as the decision on an isolation barrier which is I which could be one of three things one is there's not a need, the second it could be thermal like cooling systems, the third is it should be physical and aligned this way, but once EPA makes that decision, it is a good thing if then, following implementing their decision, I then button up the North Quarry with EVOH cover right up to that point, fair enough?

A What I would offer to comment on that is, as I mentioned, the travel times the risk case scenario, you know, historically that reaction in my opinion has spread as quickly as, you know, travelling through that North Quarry in three to six months and so I'm saying if there was a concern about, you know, that that reaction is

entering the North Quarry I think that all parties at the table should basically agree to implement that measure on a party basis and not delay it just for the sake of implementing safe guards, you know, if there's a willingness by you guys to put it in, I believe it's logical to just hopefully expedite that as quickly as possible.

Q I hear you, but you're speaking to someone who is not and you're forcing me to go back to the question of this three to six months stuff. So that's where I'm going to go next.

Here's what you're not saying. You're not saying that the settlement front has ever moved at an average rate of 5 to 10 feet per day. You're not saying that?

A No, sir.

Q You're not saying that the CO2 progression in any area has moved as fast as 5 to 10 feet per day. You're not saying that?

A I would say --

Q The CO.

A The CO progression in my interpretation of that Stage 3 Stage 4 transition that that has moved at that rate, that the escalation, the initial spike-up of the carbon monoxide generation has initiated and that's why I believe in the period of 2012 2013 when there was such serious releases when this thing was spreading very, very quickly that the travel from wall to wall is quicker.

Q I just have to keep reminding the listener of the context of what you're saying because I want you to understand that we don't think that your suspicion about a five-step reaction is true. I'm not asking you to agree that I'm right. I'm asking you to agree that we have that view?

A And I have no -- you're entitled to whatever you want to hold.

Q Right. But just to go back to it and just to get the sequence of things that have to be true before any of yours counts, on page 110 you describe the five steps.

A Is that in the conclusion section?

Q Yes.
A I'll quickly return to that.
Q We read this a few minutes ago.
A Yes. I'm ready.
Q It's under 122 it starts with the word analysis in the second paragraph and here's where we are. You list five steps, right?
A Yes, sir.
Q You say LFCI, that's your company?
A Yes, sir.
Q Your company which admittedly has no experience in chemical reactions that makes you an expert in that, right?
A Yes, sir.
Q And you say LFCI suspects that the five reaction steps are and then you list the five steps, right?
A Yes, sir.
Q And then you start graphing things and you make a hand drawn place where you say here is then what I think is the place where there's a transition from step 3 to step 4.
A Yes.

Q And that's the next part of your analysis. The next part of your analysis is you say, I think the speed of transition between my step 3 and my step 4 that I suspect exist is 5 to 10 feet per day, correct?
A Yes, sir.
Q And then built upon all of those claims and suppositions you say and if that were the speed of reaction across a quarry including the reaction through the water in the North Quarry, then the mathematical calculation of the distance from the neck to the rads divided by that rate of speeds is three to six months?
MS. WHIPPLE: Objection. Form, argumentative.
MR. BECK:
Q Isn't that exactly what you're saying?
THE WITNESS:
A That is the complicated explanation of what I'm saying in that it builds in the reaction what I think is critical is the transition between 3 and 4.
MR. BECK:
Q And other than as context all I can tell

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you is I don't care and I say that respectfully.

A Yes, sir.

Q I'm trying to make a point about what moves and how fast it moves and when you keep pulling me back into your steps that you suspect involving chemical reactions in which you're not an expert and inferring from distances on graphs between what you think is one step and what you think is another step and then applying that to distances across geography, I still have to be able to get to a point in order to finish questioning you.

A Yes, sir.

Q And so in order to finish questioning you, the point I need to get to is: I get how you constructed the idea of three to six months. I get it.

A Yes, sir.

Q What I want to talk about now is something totally different from the theory suspicion and construct under which you saw fit to write the phrase three to six months in report.

So before I go there, you didn't intend for that to terrorize in St. Louis County, did you?
A Absolutely not, sir.
Q And you haven't said that the reaction is either in or going into the North Quarry, have you?
A No, sir.
Q And you haven't said that this concern that you have has ever or will ever occur, this concern about the reaction meaning the rads you haven't said that will occur or it is occurring, correct?
A Correct.
Q All you've done is created this theoretical calculation basis, applied that to distance and that produced the phrase three to six months", correct?
A Yes, sir.
Q And if people think you mean it's time to start putting away bottled water because you're going to be in your basement for a long time, you've got to feel bad about them worrying that much, right?
A I do, yes.

Q Okay. Because you didn't mean for them to?
A No, sir.
Q And if people are out there trying to use what you wrote to make people worry like that, that is evil, isn't it?
A I wouldn't --
Q It's terrorism?
MS. WHIPPLE: Objection. Argumentative. Form.
MR. BECK:
Q I'll give you a better word. It's fear mongering?
MS. WHIPPLE: Objection. Argumentative, form.
MR. BECK: It's also cross-examination.
THE WITNESS:
A The way I would answer the question is the when I wrote the report in my mind based on the similarity of the South Quarry and the North Quarry, I felt there was a possible risk of that same scenario playing out and some of the points raised today and I sort of flagged them as well, you know, with the water levels with respect to the ones that you raised about the thermal barriers of the bedrock I did

not consider that may have an effect on the thing, but what I kind of find frustrating is that if we can just take one second to conclude and hopefully simplifyI like, I admit totally that on the chemistry side let's not go on the chemistry and the five steps, right, but if we simply look at the time when the temperature in each well spikes up and something starts happening, that's essentially the trigger that I use to make the determination of when a reaction reaches a well and I think in my life of measuring temperatures in had landfills, I could say I'm a reasonably proficient person in doing that and if we simply strip away everything else with the five step reactions and look at when the temperatures escalate in each well I believe you'll draw exactly the same conclusion that in those wells that I looked at, the elevation and temperature started over that same travel time.

Q I move to strike the entire answer as non-responsive to my question.

A Sorry.
Q Can you point to me a place in your report, Exhibit 1, where you conducted the calculation that you just loaded in your answer to my last question which is a calculation of the time it takes for well A over here to be hot until the time it takes for well B over here to get hot? Can you show us anywhere where you developed that time of heat effect to move and used that to calculate a migration rate for the reaction?
A Yes, sir.
Q Sure.
A It will require probably one of my additional appendices to do that.
Q Just show me the appendix?
A I'm not sure if we have that already. It's basically all of those colored interpretation graphs that I created for each of the wells and then I will also require that contour map that's in one of my figures.
Q I don't require that much of an information. I remember words. I don't

want to look at your color coding or highlighting or maps. I want you to put in your report where in words you said that the speed of travel of temperature between two specific wells occurred at a rate that justifies your use of the number three to six months?

A Let me have a look at exactly what those words were.

Okay, so.

Q Page?

A To answer that question, I'm looking at basically the bottom of page 84 in Section 8.13.

Q Let me turn to that, please.

A And --

Q All right. I'm there?

A And I need to put that in the context of the figure on page 78.

Q Well, before I turn to the figure, show me the words.

A Okay. So basically it's the entire paragraph on the bottom of page 84 where I'm describing the observation of my picks of when the step 3, step 4 thick occurred.

Q I thought thought we were off the step 3, step 4?
A Well, it's the same place where temperatures spike up in the wells, right, and so if you want to instead of saying step 3 and 4 you can basically inject in that word initiation of escalation of temperatures in wells would be exactly the same thing.
Q Are you referring essentially to the last sentence in its antecedent?
A Yes.
Q And so there are two nodes referred to in had that last sentence. What is the first node? I don't need an explanation. I just need it identified.
A Okay. It would be the location which is at on Figure 8-19 which is highlighted as February-11 I can't quite make out the well number. That's one of the nodes.
Q Well, the nodes are spaces, right, they're places?
A Spatial locations, yes, sir.
Q Is it 65? Someone with better eyes than me told me it was 65.

A As far as I can read it looks to me like it's 67A.
Q You think it's 67A?
A That's what I believe my February 11 points to.
Q So node 1 is 67A?
A Yes, sir.
Q And what is node 2?
A It's the node that's dated March 11th and below that is is a well number that I can't make out.
Q Just below the March 11?
A Yes, sir.
Q

(Discussion off the record)

Q There are two March 11. You're talking about the?
A The one that's centralized in the contours.
Q You're talking about the one here?
A Yes.
Q So it's at the top of the diagram about three fifths other the way to the right and it says March 11 in a little circle surrounded by an and the larger circle

says April 11?
A Yes, sir that's the one.
Q Now, whatever the GEW inside that circle that's node 2?
A I believe so, yes.
Q And so what you're saying is and I think you actually answered it here, haven't you look back at the text of 8.13 on page 84 of your report, Exhibit 1 and so here is what you're saying, you're saying that on February 11 it was at GEW, February 2011?
A Yes.
Q And then you're saying shortly afterwards which is March 2011 it was at GEW 35?
A What I'm saying is a second, I believe there were two places that the reaction initiated that independently started in two locations. One was in the centroid of this contour and the second one was in the centroid of the other contour and then the reaction spread from those two locations.
Q So you're saying the three to six months now is not a calculation based on the distance between two nodes, it is not?

A It is.
Q What are the two nodes whose distance results in that calculation?
A Basically my calculation looked at the rate of spread from the initiation points and the one I used was basically GEW 67 in February and then the next location in March 11 down below, that's where I kind of made my calculation.
Q But don't say down below. Give me a place.
A Well, I'm saying it's whatever this well here is.
Q Help me with the record. This well here is what?
A On the daily scale of this drawing I cannot make it out. If you give me a second I'll show you where --
Q Just show me where?
A Basically that location right there.
Q Right there?
A Yes, sir.
Q Let me try to make a record of this. In the center of Figure 8-19 of your report there exists the numeral 2 in a large

printed form?
A Yes, very visible.
Q Immediately above that is the handwritten words March 11, correct?
A Yes, sir.
Q Just below the M in March is a gas extraction well, correct?
A Yes, sir.
Q And so you said if in February the reaction is at 67A?
A Yes.
Q And in March it is at that other well under the M?
A Yes.
Q Then the distance between those two told me how far the reaction moved in one month?
A Exactly.
Q And then if I multiply that by 3 or 6 and it's the width of the North Quarry that's how I came up with this?
A Yes, sir.
Q Is that where you got the three to six months?
A Yes.

Q Wow.

Now, let me ask you something about this iceo contouring that you have done on Figure 8-19 and before I do that let's tell the world that iceo contouring is. People who are trying to interpret data have data points and that's what you actually know. You don't infer it. You measure it, right?

A Yes, sir.

Q And then it's frequently done for environmental professionals to look at the data points they have and to try to draw inferences from them or conclusions based on them including conclusions about how far something might go or conclusions about what direction something might go and for that purpose environmental professionals sometimes draw what are called iceo contours which in this particular instance is this sort of macaroni shaped contour that has the words March 11 written around it just above the 2, right?

A Yes, sir.

Q And the only data that that you had beforehand drawing that iceo contour are the data reflected by the highlighted data points?
A Yes.
Q The rest is inference and conclusion?
A Correct, yeah, and I think I typically engineering geologists will use dash lines when they make an inference like that and that is what I did.
Q And that's the signal?
A Yes.
Q That's the signal you gave us that this is my inference and conclusion?
A Yes, sir.
Q Sometimes isocontours can be drawn by a computer.
A Yes.
Q Using software incorporating an algorithm which interpolates or makes predictions about the space about data point A and data point B using various statistical methods?
A Yes,sir.
Q One is called /KRAO*EG?

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too fast
A Yeah, /KRAO*EG it's called. Spelling
Q Kreegan (phonetic). /KRAOEG, you didn't do that?
A No, sir.
Q You didn't have a computer draw these?
A I did not have a computer to draw that. Spelling. As you can tell from a lot of my markups I'm trying to basically do things quickly and efficiently and in my world also I'm reluctant to rely on computer programs because they generally tend to make totally straight line linear estimates between data points.
Q They have to.
A Yes. Well, no, there's a whole world of this is where I did my Ph.D. and there's all sorts of different algorithms for doing the contouring, but depending on the, you know, the number of data points you can get some pretty skewed out especially if you have very limited data sets.
Q But the difference between having a computer do it and having a human being do

it with dashed lines based on looking is the computer has rules, right?

A Yes.

Q Now, I at least know for the first time now in your deposition on the 15th day of October that in order to have our experts speak to your time calculation, what they need to do is look at Figure 8-19 and the distance between those two points in space and the time between the two data collection events and see what they think. Is that a fair statement?

A Yes, and they would look at the escalation of temperatures in those wells above.

Q They might think that that's an artifact of a five step suspicion that they don't agree with in which case they don't think?

A People thought the world was flat at one point as well.

Q People thought there was no water on Mars?

A See, science is wonderful. There's always advancements being made.

Q But let's go back to earth for a moment. And just ask you what day in February of 2011 was the data collection at Well 67A?

A Basically.
Q I'm just asking for a count or day.
A I would not without going to the database and figuring out what date it was I could not answer that.
Q Just for calculation purposes you used it could have been February 1st or it could have been February 28th or 29th?
A Yeah, I made basically a pick from the graph and essentially looked at a month basis.
Q Right, I know. I know. But it may not be a month. It may be longer or shorter, right?
A M'hmm.
Q That's my point?
A Yes, sir.
Q And there wasn't a February 29th in 2011 so we can exclude that. But right now the February data point that is the start point for this race that drives all your calculations of time you're not sure what day in February it was?
A No, sir.
Q And the March date for the data point at

the second well to which the race or at which the race ended I assume you can't tell me whether it's March 1st, March 31st or my birthday.

A Yeah, and, again, my picks were basically made from a linear projection on the graphs, not and may not necessarily correlate to a specific date that the measurements were taken. It's essentially an interpolation of the trends of the temperature lines.

Q All of which I don't understand but don't need to.

All I need to understand is: Do you or do you understand what day in March the second temperature well value was taken?

A Basically to fairly answer that question is in my analysis it was immaterial what day the sample was taken because I'm looking at just a trend line on a graph.

Q Having told me that my question doesn't matter, can you now give it a response?

A I'm trying to --

Q Do you know which day in it March?

A That the sample was taken?

Q Yeah.
A It's in the database. I specifically don't know it off the top of my head.
Q Do you know if the time lapse between the February sample at 67A and the March sample at the other well was 30 days, more than 30 days or less than 30 days?
A Yes, I made the assumption it was approximately 30 days.
Q And that's the opposite of what I asked you. I knew you made that assumption.
A Yes, sir.
Q Nobody doubts you made that assumption. My question is: What was the fact, not the assumption. Was the fact that it was 30 days, more than 30 days or less than 30 days?
A In my mind, it's all about trend lines and contouring, not specific -- I don't know how better to answer your question.
Q Well, you can answer my question by answering it which you haven't done so far and I move to strike as non-responsive.
The question was simply from the time period from the collection of the gas

well temperature 67A February 11 to the gas well temperature at the second place on March 11 a time period of 30 days, more than 30 days or less than 30 days?

A Okay. Could I try and --

Q No, you can answer that. And if the answer is I don't know, that's a great answer, too, but I get to ask the question and I'm entitled to an answer.

A The time gap was 30 days.

Q Exactly.

A Exactly.

Q Okay.

A Yeah.

Q And so those two sampling events occurred 30 days apart?

A The travel time analysis that I used 30 days apart?

Q I'm not talking about that. I'm talking about when the data were gathered?

A That I don't know because -- okay.

Q All right. Now, you see where you say in your report on page 84 that the second node started independently?

A Yes, sir.

Q That can happen, right?
A Yes.
Q There's not necessarily movement from point 1 to Point B. Sometimes there's just heat at point A followed by heat at Point B that is not related to point A?
A Sometimes.
Q All right. Let's break for lunch?
THE VIDEOGRAPHER: Going off record. The time is 12:49.
(PROCEEDINGS RECESSED AT P.M.)
(PROCEEDINGS RESUMED AT P.M.) /* test test
THE VIDEOGRAPHER: We're back on the record. Here begins media Unit Number 3, Volume 2 in the deposition of Tony Sperling. The time is 1:42.
MR. BECK:
Q Dr. Sperling, after the lunch break are you ready to proceed?
A Yes, sir. Rock and roll.
Q You had referred to an appendix containing some wealth of monitoring gas well data that was important to your explanation to me of the grounding for your time of travel calculation?

A Yes, sir.
Q That's Appendix G.
A Beautiful. Thank you.
Q And I have very few questions about it.
MS. WHIPPLE: Did we make this number 8?
MR. BECK: 10.
MS. WHIPPLE: Sorry.
MR. BECK: Number 10.
Q And so for Appendix G I see a series of pages each of which has two graphs. The upper graph appears to graph for a particular well and on a series of dates the vacuum pressure measured in inches of water and the temperature measured in had Fahrenheit. Is that what the upper graph shows?
A Correct.
Q And I don't see any handwritten marks on that, so I don't need to worry about that.
The lower graph then shows for the same well the -- it shows three things one is the average of carbon dioxide, the average of methane and the average of temperature for that well based on data points which are across the bottom axis

as points in time?
A Yes, sir.
Q And when you say average of, why does it say average of CO or CH temperature?
A That would be a Dr. Abedini question --
Q Okay.
A -- as to why he --
Q Your view would be these that these would measure not averages but actual data collection moments?
A I believe so, yes.
Q So if it's something other than that, he'll need to explain how he got there?
A Yes, sir.
Q The decision about how to mark these up by hand based on your interpretation of what they meant?
A Yes, sir.
Q So for that I need to ask you when you mark them up by hand your interpretation what they meant was not that these were average values but these were measured values at particular points in had time?
A Yes, I interpret them as spot measurements at particular moments in time.

Q And let's go to the second, well, no, we can see on the second page of graphing of well 12A you've got some highlighting in pink, some highlighting some highlighting in red and highlighting in orange. Can you simply give me a verbal key to what those colors refer to? I don't need a long explanation, just a verbal key.

A Yes, sir. Generally they refer to foremost I'm highlighting different chemicals or temperature in different colors, so I can see, for example, the pink would represent the I believe it's the let me just get it right because the green and the blue, but the pink generally represents CO, CO2 and the orange would be representative of temperature and the green of methane in in the green of methane and then I tried to flag those within these zones that you don't sort of -- seem to like me talking about. So for example the methane drop in step 4 is marked by red and so I always mark the methane drop in step 4 with the red highlight.

Q Right. But both the existence and location of step 4 are things that you came up with?
A Yes, as an interpretation of the trends in the data that I see.
Q Right. The existence of step 4 is an invention of yours as a concept and because the invention of the entire five step process was an invention of a concept, but the highlighting simply reflects what you see in that parameter when you look at the data that you think is important to call out?
A Yes, sir. I see, you know, when it drops dramatically that's wherever I highlighted.
Q Right, and the dotted lines are simply to separate the places you called the steps?
A Yes, and.
Q The vertical dotted lines?
A Yes, where I see break points and changes in trends.
Q And the circled numbers simply represent you labelling the steps that you said you suspect are involved in the reaction based

on looking at a particular data value as it progressed over time?

A Yes, sir.

Q Axis?

Q Back to your map, I want to go back to your report, it's on page 85 which is this map we were trying to interpret to get a well number.

A Yes, sir.

Q And, again --

A My map page 85 disappeared.

Q You probably pulled it out and referred to it earlier.

A Yeah, I must have. It ended up somewhere else in the pile. That's unfortunate.

Q Let's see if it we can find it. I need to use it.

A Okay. Let me just look in the exhibits just in case it got mixed in.

Pause.

MS. WHIPPLE: 85.

THE WITNESS: Page -- I'll put it in the right place. What page number is it?

MS. WHIPPLE: This is 19 through --

MR. BECK: 84.

MR. BECK: Comes right after 84.
A So it belongs right there.
Q I'm interested in the text as well as the picture on 85 for this line of questions. Now, I'm going to show you something I've done with page 85 on my version.
A Mm.
Q I've drawn kind of a big circle to help identify this elbow macaroni-shaped isocontour that contains those two walls we were talking about. Can I ask you to do something similar to that to draw out on the original?
A So basically to highlight the single contour?
Q We want to encircle the isocontour that contains both wells.
A Right (witness indicates) something like that.
Q Other than the difference between lawyers and engineers is I left my pen on the paper and drew a continuous line and you being an engineer took your pen and picked it up and drew a dotted line, right?
A Yes.

Q And if the question is who then is happier, the answer then is someone other than the both of us who is not looking at this map.

Next question is this: The two wells that you gave me as points of interest are 67A which is the one immediately next to the FEB 11 handwriting?

A Yes, sir.

Q Just under that handwriting. And then the other one is just under the March 11 handwriting still within the elbow macaroni isoconcentration line and it's highlighted in orange under the M?

A Correct.

Q And if you could just look at my iPad and see if it looks to you like it's 11A?

A Just to -- it appears to be, but I think I would like to just reference my bigger map to confirm that.

Q That would be great. I would love to have an exact name.

A Because I think it's essentially that, a copy of that map that generated.

So if we look at number 2 here and we have 67A and below that March, it actually looks like it's labelled -- it's number 13A.

Q 13A?

A Yes.

Q Thank you.

And so my first kind of getting back to where I was going question is: Let's assume for the moment that in sequence 67A exhibited whatever characteristic matters to you and later 13A exhibited whatever characteristic matters to you.

A M'hmm.

Q You already told us that there were instances where two wells separately and independently exhibited that characteristic, right?

A Yes.

Q How do you know that's not the case for 67A and 13A?

A Basically I cannot know for certain that there is a chance that the reaction started at one and independently at other. Given the overall cluster of what I saw

in -- I'm not sure if it's a forest fire or whatever occurs if it starts at one place and grows over time from a centroid, then I typically relate that spatially from one event spreading outwards.

Q That's what you would do if you were looking at a forest fire?

A Yeah, or down wind, you know, in one direction.

Q If you were looking at something in the wind?

A Yes.

Q Okay. Now, we're looking at something deep in the subsurface of the ground, right?

A Yes.

Q And I think you've answered my question about whether 67A and 13A could be independent, but let me ask you a different question and that is there's not scale on this drawing that I can see. Can you tell how far apart they are?

A Yes, if I had the major map. There are grid lines in the drawing which was to scale and I made that determines but off

the top of my head I don't remember what that what those what that separation is.

Q And if my penultimate goal today is acquire the information necessary for other of greater intellect than myself to check your work --

A Yes, sir.

Q -- how do I do that?

A Basically I would request from Peggy here, I have essentially this map I believe in the folder with the scale bars and everything. I could provide and that would actually give you the title --

Q Please.

MS. WHIPPLE: Do I have it here?

THE WITNESS: I believe it is, but.

MS. WHIPPLE: In a folder?

THE WITNESS: I'm just not sure if I actually put it in the package. I had it yesterday. It doesn't look like it is there. So unfortunately it seems like I didn't bring it with me today.

MR. BECK:

Q Can you answer from your memory how far apart are they?

A I'm trying to think if there is information to that effect. I would imagine that they're a certain amount of yards apart or I believe it would be a 500 yards or a thousand feet, but off the top of my head -- would it be possible for me to answer to you at the end of day and send you that information or -- I can.

Q I can't leave the record open for answers after the record, but I can do this. I can try and help you. Let me ask you to turn to page 84.

A M'hmm.

Q The preceding page in your text and see if we can draw a reverse inference since we're reversing everything in this deposition.

A Yes, sir.

Q Since you say from these two nodes one of which is 67A "the SSSER spread at a rate of approximately 50 to 100 yards per month to the north and south and somewhat slower to the east and west"?

A Yes.

Q Does reading that text help you

approximate the distance between 67A and 13A as you measured it?

A Yes, sir, it would be basically roughly a one-month increment initially in that distance. I would assume would be.

Q So you think they're about 150 to 300 feet apart?

A Yes, sir.

Q If they turn out to be only 100 feet apart that affects your whole time?

A To some degree.

Q If they turn out to be more than 300 feet apart it affects your whole time calculation?

A Yes, when I made that calculation I used ad scale bar and accurately measured that distance with the scale bar and the conversion, so I --

Q If you accurately measured it with a scale bar why did you have to express the result in a range of, you know, where one end of the range was twice as much as the other?

A Because the distances between node points, for example, going from February to March is one month whereas the next contour has

got two month increment, so the reaction was in that period slower.

Q Are you saying you made two scaled measurements one of which produced 150 feet and the other which produced 300 feet?

A Yes, sir.

Q And so which is the other node? Is it from 35 to something else?

A It would have been from the node dated March 11th to the node dated June 11th.

Q And which node dated March 11th?

A It would have been Well 13A and then June 11th.

Q 14A down below it?

A Correct.

Q Okay. And so what you said is, if I get it right, the time of travel from well 67A to well 13A was one month. I'm sorry, was one month and 150 feet. The time of travel from -- well, no, I don't get it. I'm sorry, you'll have to explain it in words.

A Okay.

Q How far is it from the well 13A to the

well 14A?
A 13, 13A to 14A... assuming that if -- if the distance between the February 11 and March 11 date points is about 150 feet, the next one would be 300, but --
Q Well, no, it's a three-month time frame. Let me turn it around. The distance between February 11 and March 11th from 67A to 13A, as you've mapped it here --
A Yes.
Q -- would be 300 feet in one month?
A Yes.
Q And the distance from 13A to 14A would be 450 feet in three months, so a rate of 150 per month.
A Yes.
Q Is that what it is?
A Something like that, yes, sir.
Q And this is how you got your range. One went a longer distance in one month and the other went a shorter distance per month over a three-month time frame?
A Correct, and I basically looked at the approximate contour spacing and, again, getting so a typically range of, you know,

like this far looking at the sort of representative spread of the -- I guess we could call them isochrones (phonetic), they're points in time.

Q Now, have we now gone through what one needs to know to evaluate your time calculation that led you to use the phrase "three to six months" on several occasions in your expert report?

A Yes, sir.

Q Dr. Sperling, let me go to a different topic and in order for me to do that and feel like we'll be able to find your exhibits later, let me take a moment and ask you to kind of re-arrange them in the order they go in and then we'll come back and talk?

A Excellent.

THE VIDEOGRAPHER: Should we go off record, counsel?

MS. WHIPPLE: Sure, we can.

THE VIDEOGRAPHER: Going off record. The time is 2:03. .

(PROCEEDINGS RECESSED AT P.M.)

(PROCEEDINGS RESUMED AT P.M.) test test

test
THE VIDEOGRAPHER: We're back on the record. The time is 2:07.
MR. BECK:
Q Ready to go?
A Yes, sir.
Q So let's judge this from the following perspective for a moment. Let's assume that one either has to believe Dr. Sperling or not and that if one chooses to believe Dr. Sperling that it requires belief in everything you've said, everything you've said in your report and so here's my question: If I just leave the water level in the North Quarry where it is and where it's been, the reaction can never go in the North Quarry because it can't travel under water according to you, correct?
A Correct that assuming the elevations in the North Quarry were to be very close to ground surface. Again, I had information going back to the Aquaterra 2010 graph that shows approximate water levels depressions and I don't know what the

pumping history has been recently but if if you have good levels that show what the water levels are in the quarry and they're very high, my belief that the temperatures below the water table are cooled by the water will not generate pyrolysis, that yes, I would assume that certainly, yes /(.

Q Well, here's what happened right now. I included an assumption within my question and you said yes, if that assumption is true so let me ask it again just really clearly.

If we don't reduce the water levels in the North Quarry, then it is your belief and testimony that it is physically impossible for the reaction ever to enter the North Quarry, true?

A From my understanding of the process, yes.

Q So if I want an isolation barrier to protect the radiologically impacted materials in operative unit of the superfunds site, all I have to do is maintain the water level in the North Quarry at a sufficient height and I've

accomplished everything that you need from me, right?

A Basically, that is my conclusion, but I would predicate that on, you know, confirming that with the experts in -- in the field of chemistry.

Q Right now I'm only on what you're telling me.

A Yes, yes.

Q And so based on what you're telling me, I'm correct?

A Yes.

Q Okay. And so do you remember that in your report you came up with some ideas to have people talk about, think about, bring in experts to look at, consider and maybe implement and that one of those ideas was well, you could rapidly fill the quarry with water and you were referring to the South Quarry where the reaction was you could rapidly fill it with water and that might help remove some of the heat and eventually bring it to a conclusion sooner.

A That's right.

Q True?
A Yes.
Q That had the potential disadvantage of by introducing so much water into the quarry potentially making it difficult to stop the ex-filtration of leachate to groundwater offsite and it might cause groundwater contamination off site?
A Yes, sir.
Q And that's why before anybody should ever think about implementing an idea like that, you would want groundwater professionals who have really studied groundwater here to do a very thorough evaluation of is that a risk and, if so, how important is it because you would certainly agree that cause offsite groundwater contamination is something you don't want to do?
A Absolutely.
Q And particularly that's true where you have some effects of this reaction in groundwater on site such as some fairly sharply increased benzene. That's something you don't want to go off site?

A Yes, sir.
Q And so before anyone does anything about putting any cold water fast into the South Quarry, you want that to be fully vetted?
A Yes, sir.
Q Okay. Do you know why the Attorney General's office didn't have that idea fully vetted by its groundwater experts who are their expert witnesses in this case?
A I do not know if they had or did not have.
Q Okay. But let's talk about, you know, the different goals that we have. One of the goals is it would be just better than anything in the world for this reaction to stop and that's what that goes to, right?
A Yes.
Q Another of our goals is if it's not going to stop, we certainly want to control its effects as best as we possibly can, right?
A Yes, sir.
Q EVOH cover is is a part of that?
A True.
Q And if it's not going to stop we certainly want to make sure that we keep it out of

the New York if we can for two reasons one, we don't want the North Quarry to go through that and the community to go through that and, two, we don't want the reaction anywhere close to the radiologically impacted materials, right?

A Yes, sir.

Q And I accomplish both of those goals completely if I agree to, receive, monitor and comply with a permit condition setting a minimum liquid elevation in the North Quarry higher than the reaction is in your opinion, correct?

A Yes, sir.

Q And have you identified the specific elevation that gives you the margin of comfort that you feel like it would be a reasonable permit condition to accept?

A Based on what I have seen in the temperature profiles and I would want to study those in more detail, but just going off TMP 7 as a preliminary indication.

Q Sure.

A I would say it appears something like 40 feet.

Q 40 feet below ground surface?
A Based on that one monitor and I want to reserve my opinion on adjusting that depth.
Q And to make it really simple and I know it's not a bowl full of water but if it were a big bowl full of water if we stay no more than 40 feet from the top then we're good then you start to worry if we go lower than that or if you find there's a change in the reaction profile of the TMPs?
A Yes, sir.
Q And that can be done without ever introducing any water into the South Quarry, right?
A Yes, sir.
Q Mostly that is protected by controlling the removal of leachate from the North Quarry so that the balance between what infiltrates from rain, what infiltrates side gradient from groundwater or other flow is at least equal to what gets pulled out as leachate; is that right?
A Sorry?

Q I was on water balance.
A Yes.
Q On water balance, the way that you keep the level of the leachate in the North Quarry at least within 40 feet of the top ground surface is that you make sure that the amount of leachate you pull out is is not greater than the liquid that goes in had?
A Yes.
Q And two ways liquid goes in are it rains or some comes in from the sides?
A Pretty much that's the way I understand it.
Q And if for any reason you pulled out too much liquid and created a situation you didn't like because you didn't know the next time it was going to rain, you didn't see the water level moving up, then you could add liquid into the North Quarry not the South Quarry but the North Quarry and that would accomplish the same effect?
A Yes, sir.
Q But it would be better to do some benchmarking where you say, all right, the

water level is down to -- I'm sorry what was your benchmark level 40 feet from the top?

A Yes.

Q The water level is 40 feet from the top. Another benchmark now it's 25 feet from the top time to take action. If it gets to 30 feet from the top alarming time to take action but some step-wise determinants of when something needs to occur in order to have this perfect liquid barrier stay intact, that would make you happy, right?

A Yes, except for the offsite migration figure you raised.

Q You would still want groundwater professionals evaluating that you weren't exacerbating a problem from the North Quarry?

A Yes.

Q Okay. But -- okay. That's a little easier, though, isn't it, because if you don't a reaction occurring, you don't have that huge mass production of contaminants coming out of the waste thrown out that

you have in the South Quarry. In the North Quarry you've just got static conditions that you can look at trends on.

A Yes. Yes, in principle.

Q In principle.

A I've never examined the leachate characteristics in the North Quarry versus the South Quarry, so I just want to reserve my opinion on that. I don't know how bad the north leachate is.

Q And one thing you would look at the chemistry, another thing is the PH?

A Yes, sir.

Q But assume for a moment that the groundwater monitoring, decks, monitoring and assessment the scheme applicable in Missouri and followed by this landfill requires quarterly groundwater monitoring at perimeter wells around the North Quarry spaced according to the state's requirements and assume that if there is a decks of an increased contaminant or a new contaminant, that requires follow-up testing, reporting and the event of repetition assessment of corrective

measures. That's a pretty good structural scheme, isn't it?

A In principle, yes, although one of the things that, you know, once you detect something especially in the case of Bridgeton I believe the property line seem to be in fairly close proximity to the core perimeter by the time you detect you might be into offsite migration.

Q Who told you that?

A Just from my observation.

Q Isn't the North Quarry right in the middle of the --

A Oh, sorry, I was focused on the south.

Q I'm in the North Quarry. Isn't the North Quarry right in the middle of the property?

A Yes.

Q So you've got a little bit of room?

A Yes.

Q If you -- you've got a little bit of room to catch up?

A Yes.

Q

[Indiscernible - simultaneous speaking]

Q And based on your groundwater experience you could be a valuable member of a team evaluating conditions to make sure tweaks to the monitoring system that already exists that those were considered and inserted into the landfill's permit?
A I would be happy to contribute in any way.
Q Sure.
A I could. If I may expand on something that in the direction that the strategy I outlined and was essentially that my premise that the reaction cannot occur below the water table, right, is essentially the conclusion that pyrolysis does not occur at temperatures sort of below the boiling point of water and that is something that I would like to, you know, have some again an expert in chemistry just verify because when I had discussions with Dr. Grace about the process of pyrolysis and which I believe drives these chemical reactions, he indicated to me that they essentially are reactions are slower and slower at lower temperatures and he felt that -- that

basically the boiling point of water is very close to limiting temperature for those processes and so I'm drawing -- that was my primary conclusion why I felt that the reaction could not occur below the water table and I think, you know, given the significance of going in the direction, that's where I recommended that somebody like a specialist like that be engaged to verify that hypothesis.

Q So is that a long way of saying that's my opinion but I could be wrong?

A What it is is it's a long way of saying that my opinion is based on something I learned during my discussions with Dr. Grace and I just wanted to have one more confirmation of that from him, you know, to --

Q Did you have any discussion with Dr. Grace about the question I went into with you yesterday which is whether the added pressure at depth in this landfill changes the boiling point?

A No.

Q Is that one of the things you want to

follow up on?
A That in terms of the boiling point I believe the science is solid, right. Like I reviewed the graph and I was aware that the boiling point changes as a sense of pressure I reviewed that graph so I think it's more of an understanding of, you know, probably both the pressure and temperature aspects of the pyrolysis reaction, yes, sir.
Q Is it fair to say that after writing your report and doing the few months of work that you've done, the visit to the landfill, the documents you've reviewed and the two days you've spent with me that you're left with perhaps more questions than answers?
A Basically, no, I wouldn't say that. What I would say is that I given within the amount of time that I've had to do the analysis that I tried to document my interpretations as best I can and my report, you know, clearly recommends that to verify the chemical aspects of that, that it would be a value to engage a

specialist in that area and my report stands on that.

Q I hear you. So I want to cover -- you know, we talked about Hiroshima -- or I'm sorry, we talked about the Hindenburg --

A Yes, sir.

Q -- and why you mentioned that.

Now I need to talk about Fukushima and Chernobyl and what you intended people to take from your reference to those two.

First of all, did you mean that you foresee that there will be a Fukushima or Chernobyl incident here?

A No, sir.

Q And if people who see it as their role in life to make people fear the Bridgeton and Westlake landfills are playing your report that way because your report is right there on the web for them to read, is that something that you wish they would stop doing?

A I would agree with that statement that the parallel that I drew in illustrating the migration of radioactive materials through steam was what I was trying to make the

point on.
Q You were describing a potential mechanism that one ought to be concerned about, not a magnitude?
A Yes, sir, a process of basically migration of radioactive material if water gets heated to steam and then potentially carries radioactive material or --
Q You remember we had a pretty long discussion yesterday about what I referred to as the SSE report in which professionals provided to EPA their evaluation on a what if basis, what if the reaction actually hit the low level radiologically impacted materials and then EPA's research stepped in and gave their comment.
A Yes. I'm sorry.
Q Are you saying that you would like to see that evaluation take account of the potential mechanism of distribution that you have identified which is superheated converts to steam, comes into contact with radioactive particles and through the process of steam just moving causes them

to be carried?
A If that had not been done already, then I would say that would be a prudent thing to consider.
Q Okay, and all you intended to do with your references to Fukushima and Chernobyl is to explain that process in a way you hoped the reader would be able to comprehend so that they could take into account making sure that we protect against that, the risk of steam transport?
A Yes, sir.
Q Who picked the words Fukushima and Chernobyl? Who termed that phrase?
A Totally myself, based on perception of, you know, nuclear events that where steam is involved, those were the ones that came to mind for me.
Q Was there any advanced discussion with anyone from the Attorney General's office about the particular selection of either of those words or the word "Hindenburg" prior to delivering your report to them?
A No, sir. The only time they would have seen that when I submitted my report.

Q Did you submit it in draft prior to the due date?
A No, sir. I basically finalized it.
Q September 2nd?
A Yeah, I was on an airplane to Iceland while I was e-mailing the conclusions and recommendations.
Q Did you not provide any summary, analysis, interpretation or anything so that the Attorney General's office could be aware of what's in it without reading the whole thing?
A No, sir. I was asked generally that the Attorney General's office wanted my opinion of the matter and I had essentially carte blanche to interpret the information as technically as accurately as possible with them basically, you know, I submitted my outline initially and the Attorney General's office when is Whipple says that makes sense, write your report.
Q Were you aware in advance that your report would be served on the press at approximately at the same time as it would be served on me?

A No, sir I wasn't aware of that at all.
Q Did you have any idea your report would be publicized?
A No.
Q Did you ever consent to your report being publicized?
A I believe that my report was written for the Attorney General's office and that they essentially took ownership of the report and it was then essentially their report to use it as -- as necessary.
Q Okay. So if you look at page 116 of your report, Exhibit 1, please.
A M'hmm.
Q I want to refer you to the section of your report titled limitations which appears just above your name and seal?
A Yes.
Q And particularly the third paragraph of that discussion and I would just ask you to read the third paragraph outloud for us?
A This is the report that that says the report is intended solely for the use of the Missouri Attorney General's office.

Any use of any use which a third party makes of this report or any reliance on or decisions to be made based on it are the responsibility of such third parties. Landfill fire control Inc. does not accept any responsibility for the materials nor for damages suffered because of decisions made or action. Copying of this of for other purposes is not permitted check document [missing text - check audio].

Q Is that a common limitation that you put in all of your reports?

A Pretty much, yes.

Q But just to describe it in execution, if, for example, the Attorney General had seen fit to place this on the internet and call it out to the press and place phone calls to the press saying I'm not getting enough coverage for my expert reports and if as a result somebody printed something that you said that causeded some people to say I think I'm going to close my business, it's too close to this place and they suffered a loss from that, you would say that you would not be responsible for that loss

under this paragraph?
A Correct.
Q Did you know that after the Attorney General elected to publicize this report that there is a business that claims to have closed on the basis of your report?
A I saw an article on the web that mentioned it. I was trying to remember if it was a dog lease (phonetic) or something --
Q Yes.
A That was quite concerned about it and was going to relocate.
Q Jazzy's?
A Yes.
Q Have you ever met the owner of that business?
A Definitely not.
Q Do you think you said something that should cause her to close her business or move?
A I believe that it's possible that somebody, if they weren't reading it the way it was intended, may have interpreted for a layperson that's not fully, you know, cognizant of some of the wording,

that possibly I could see there was a concern.

Q And that takes us to an issue that's pretty important and that is you work with government agencies.

A Yes, sir.

Q Those government agencies sometimes have to communicate with the public about scary things, right?

A Yes.

Q The landfill fires that you go put out sometimes can be scary things?

A Yes, sir.

Q And it's vitally important that the government agencies that provide information to the public do so in a mature, responsible, measured way that is not fear mongering because otherwise they cause themselves cause fear that should not exist?

MS. WHIPPLE: Objection. Form. Argumentative.

THE WITNESS:

A Yeah, I would say that -- that the public or government officials, you know, have a responsibility to protect the public

from -- from risks and should present risks in a balanced, you know, approach and certainly I feel that my report, you know, presented that migration thing as a worst case scenario and my impression is that a lot of the media commentary, whatever like you said it's almost like it was going to happen in three months and that I feel is unfortunate.

Q I join you in that.

So let's kind of take the time that we have left together and I would like to just kind of go through some notes that I made in the report where you had follow-up questions or things I wanted to make sure we're -- and maybe just to tie something up before I go, let's see if a few things fairly summarize what's occurred in the last two days. ***

The first thing is this: What is happening at the Bridgeton Landfill today as we talked is not a fire, right?

A Correct.

Q It is a subsurface reaction that happens to be both self-sustaining and exothermic,

meaning it gives off heat?
A Yes, sir.
Q Today, that reaction is confined to the South Quarry of Bridgeton Landfill, correct?
A Yes, correct.
Q It's not in the North Quarry, correct?
A Correct.
Q And it's not close to the radiologic material at OU-1?
A Correct.
Q It is not moving in that direction in any way that you can discern?
A On that one, I would say I have not examined the information at the neck in the level of detail to determine if there is movement.
Q Okay.
A If there is movement, it's relatively much slower than it has been in the past.
Q And if there is movement, you don't know it as you sit here today?
A Correct.
Q And from the standpoint of the reaction front as that term is technically used,

it is in the opposite direction from the neck?

A Correct.

Q All right. Now, let's go into your report in page 1. I've got my markings on an abbreviated word copy, so I'll try to stay up with the copy you're looking at and keep you there.

All right. On page 1 in the paragraph under the seven numbered items in sequence, you describe a full-day inspection of Bridgeton Landfill, a full day of landfill sampling, landfill gas sampling of ten operating extraction wells and a half-day orientation tour of Champ Landfill, correct?

A Yes.

Q When you went to Champ, did it smell?

A I did not notice any significant odor.

Q Did you notice whether or not they're still taking or were taking when you were there, loads of sludge, sanitary sewage treatment sludge from the Missouri -- from MSD?

A I believe it was mentioned. I do not

recollect seeing any being disposed of at the time.

Q Who brought up the idea of going over to see the Champ Landfill?

A I'm trying to recollect on the details of it. It was a discussion about understanding the geology and it was either Brenda or Todd and I can't remember --

Q Okay. Brenda is Brenda Audrey (phonetic)?

A Yes.

Q From the Missouri Department of Natural Resources?

A Yes.

Q Todd is Todd Thalhamer?

A Yes.

Q And somebody said, Let's go over and see Champ?

A That's correct. I have a gut reaction but I can't be 100 percent percent.

Q Give me your impression.

A That it was Brenda.

Q And who made the arrangements with Champ for your entourage to go see the place?

A That I don't know.

Q Those arrangements were made before you got there?
A Yes.
Q They were expecting you?
A Yes.
Q Who met you and gave you the site tour at Champ?
A I would not -- without looking in had my notebook find the gentleman's name, but I believe he was a senior manager of the facility.
Q Okay. Did you meet during the time you were at Champ an employee there whose name is Lina Klein? Spelling
A No, my recollection is we only were driven around with one gentleman, a fairly I would say mid-age of maybe 55, 60.
Q Sure.
A And that he toured us around and that's the only person we met.
Q And what operations were occurring within Champ just in very broad --
[indiscernible - simultaneous speaking]
A Well, basically first we saw the operation of the as we entered the production of

crushing of rock and we essentially drove into the pit, observed the drills that were drilling, you know, on the quarry base and then some of the soil material being placed with dozers. And then --

Q I'm sorry, why were they drilling?

A I believe to produce, essentially take the material down and possibly to make some of the siltier covered material, I'm not 100 percent sure, but they were basically blasting the quarry rock.

Q At the quarry operation?

A At the bottom, yes.

Q Okay.

A And then we drove into the landfill portion of the operation.

Q Okay.

A And saw the active face of the facility, had a quick look at some of the vertical leachate extraction towers they were constructing and the clay barrier side wall they were building and then we headed out and had had a tour of their large landfill gas extraction facility and I believe it's also some form of methane

conversion facility, I don't recollect the details.

Q By that you mean gas to energy?

A Yes, sir. It's a very -- it seemed like a big building and I didn't quite catch the technology they were using to I believe recover the energy in that building.

And that was basically our tour.

Q Did you have the opportunity to kind of get up close and personal to the side walls of the quarry and see where there would be seeps and see what the strata looked like?

A Yes, sir. Within the proximity, you know, not having a rock fall on your head, but certainly right close to the rock face.

Q And just to prove what you went to some extent, you and I both are, you found that fascinating to see the side wall of this quarry, right?

A Yes, sir. It was interesting, very much so.

Q Now, with respect to Champ one of the things you've pointed out in your report and you said today is that they installed

a liner at the base of the quarry before they put garbage in?

A Yes, sir.

Q What was that liner configured like?

A My recollection is that it was compacted soil and I can't remember if they described the -- I have a vague recollection description of it as a cherry or not a cherry tree or a Christmas tree that basically those series of triangular, you know, going up the side walls was elevated.

Q So in addition to being a bottom liner there was also a side wall liner on the quarry wall?

A Yes, correct.

Q And this is a landfill being constructed in 2015 under the subchapter D regulation -- subtitle D regulations, right?

A Yes, sir.

Q You can tell that the people who actually know things are to my left.

A Just like what I didn't know what an SPS was, but that's because I was Canadian.

Q So talk about with me for a minute. One of the things you say in your report is in the nature of that it was unfortunate that in the case of Bridgeton Landfill that at some point in time a decision was made to develop the landfill without putting in a bottom liner, right?
A Yes.
Q And that's because the regulations at that time didn't require something like that, right?
A And I would say it's probably because of the environmental awareness at that time wasn't at the same level as it is today.
Q Of course. But let me ask you this: When the Archdiocese of St. Louis and the Catholic charities who collectively own the landfill, the South Quarry and got it permitted, when they did that between 1985 and '87 and when they operated the landfill during that time period, are you saying that they, the church and the charities were negligent for operating in compliance with regulations but without a liner in the quarry?

A No, sir.
Q Okay. And when their environmental consultant who helped them with permitting, this is before anybody I know was involved, when their environmental consultant helped them with permitting in that time frame, Burns and McDonnell and created designs that were prepared to govern the eventually operation, construction of this landfill, are you saying that Burns and McDonnell were negligent?
A No, sir, I wouldn't.
Q And then finally the third party in that triangle when the Missouri Department of Natural Resources which had a choice elected to permit that landfill to operate there in the South Quarry without requiring as a permit condition any clay liner in the bottom of the quarry or along the side walls of the quarry, are you saying that the state was negligent?
A No, sir.
Q And it was simply a reflection of the practices, environmental awareness,

conditions, even analytical chemistry of the day that caused that to proceed and caused it not to be negligent at all?

A Yes, sir, I would agree with that that basically I believe at the time there was not the understanding of the, you know, potential challenges with operating these very deep and gradient landfills that we know today, so I would say that it's important to look at it from that perspective.

Q Okay. And then when the State of Missouri permitted the ownership of the entity which held the landfill permit to be transferred from the ownership of the Archdiocese of St. Louis and these Catholic charities to a private company whose name in 1987 was Laidlaw?

A Yes.

Q Are you saying that in some way that the state was negligent in not conditioning that transfer of ownership on some change in operational practices like putting in a new liner above the waste or putting in a liner from then on along the side walls of

the quarry?
A Yeah, I would say that process I'm not sure where, you know, subtitle D timing kicked in probably.
Q It's pre-87?
A Pre-subtitle D?
Q Yes?
A Yeah, then definitely not.
Q And for laid how which now owns the subsidiary that had had a permit already for this landfill and had had no conditions attached to its permit when the ownership of the company was transferred from the church, for Laidlaw it was not negligent either to operate in accordance with their permit?
A I would say that's reasonable, yes.
Q And when the state had the opportunity to consider whether or not to attach new conditions to the permit at the time Laidlaw as a company was acquired by another company called Allied Waste, do you say that the state was in some way negligent in not conditioning that ultimate transfer of ownership on changing

existing permit conditions?
A I think that at some point that there is a need to sort of recognize the advances of science and look at the long-term, you know, management, liabilities of these ingradient facilities especially if they rely on pumping and, two, make sure that one way or another that the public is protected from assuming those liabilities in the post-closure period and as to when that should happen I, you know, I'm not sure -- I wouldn't call it negligent, but I think there's a social need to recognize that.
Q Because that's the state's job?
A Yes.
Q And so among the parties you might fault is you might fault the state for not conditioning that ultimate transfer of ownership on some additional permit conditions?
A Yes, I would say it's important to always keep conditions up to date and, you know, I'm involved with the government in British Columbia, for example, rewriting

our guidelines and regulations to make them current.

Q Now, I understand I'm trying to verify what you're saying. I'm not incorporating, adopting or agreeing with what you just said. I just want to make sure it's clear. So I understand what you've said, now, here's my next question: Do you know of any involvement by the company called Republic Services with Bridgeton Landfill at all at a time when the landfill was owned by a subsidiary of one of its competitors.

Allied was a competitor of Republic up until December of 2008. Do you know if anything Republic had to do with that landfill at all prior to 2008, prior to December of 2008?

A I'm not aware of anything, but I don't know the history.

Q It would surprise you if they were involved --

A Yes.

Q -- in a competitor's landfill, wouldn't it?

A I would think so.
Q And I don't know how much information has been shared with you, but do you have any reason to say that there was some information at the time Republic acquired Allied Waste in December of 2008 that actually said to Republic there is some reason to expect extraordinary costs at this closed landfill called Bridgeton?
A I would say that this would have been 2008?
Q December of 2008.
A Yes.
Q December 5, 2008.
A So fairly current in terms of the transaction I would have assumed that Republic would have evaluated the long-term maintenance risks on such a facility. I expect they did but probably would not have foreseen SSSER-type calamity.
Q And when you say you would expect them to acquire some information about sort of the long-term financial position, what you're talking about is sort of odor

transactional due diligence if you acquire a company which has as its business a portfolio of operating and closed landfills?

A Yes, basically in our industry, especially closed landfills I would say are considered as liabilities rather than assets.

Q Of course.

A And acquiring a portfolio a number of these Republic would have done its due diligence and assessed the likely post-closure care costs on each of those facilities and factored that in their purchase price for Allied.

Q And you know that in today's world private companies of size that are involved in landfills try to predict what their forward costs will be so that they can make appropriate provision and disclosure and reserve and that sort of information is exactly the kind of information you would expect Republic to look at?

A Yes, sir.

Q And so I want to pick up on something you

just said and that is that closed landfills really aren't assets, they're liabilities. That's because they have no revenue nor any anticipation of any, right?

A Yes.

Q And because they have care obligations that will condition for lengthy periods of time and could change?

A Yes.

Q Now, one of the questions I've always had in this case is how it is anyone's claims that Republic has been bestowed a financial benefit from any of this. Do you know of any way of how Republic has been bestowed a financial benefit from anything connected in any way, shape or form to Bridgeton Landfill?

A I'm not aware of anything in -- I think my, you know, expertise is way outside that sort of information.

Q We talked yesterday about some statements you made in your expert report concerning the level of experience of Dave Vasbinder when he was the environmental manager of

Bridgeton Landfill during this important time frame between say December of 2008 and December of 2010.

Was there anyone else whose experience you were commenting on in actually the Republic Services family of companies other than Mr. Vasbinder's in making that comment?

A No.

Q Okay. So, for example, you weren't judging the level of experience, knowledge or expertise of, say, Dave /P*EPB at Republic corporate who became sort of a manager of landfill gas operations with an oversight role? Spelling?

A No, sir, my expression there was strictly limited to the information I read in the deposition of Mr. Vasbinder.

Q Okay. Did you actually watch any of the video of that deposition?

A No, sir.

Q So you don't feel like you've met him face to face?

A No.

Q You read what he said?

A Yes, sir.
Q Could I ask to turn, please, to page 2?
A 2?
Q Of Exhibit 1, your report. I'm interested in the paragraph that says LFCI's report is based on personal knowledge and experience gained on the above assignments as well as a detailed but not all encompassing review of available information supplied by the Attorney General's office and the three day site visit. Did I read that accurately?
A Yes, sir.
Q Is that where you got your information, all of your written information about Bridgeton Landfill itself came from the Attorney General's office?
A Correct, except for a few searches on, you know, on stuff available on the internet.
Q Okay. And then you weren't able to get it all reviewed. Is that -- you did tell me that yesterday, right, you weren't able to get all the information they gave you reviewed?
A Oh, I would say nowhere near. The amount

was just overwhelming. That's one of the challenges I had balance reviewing data versus try to write a report.

Q Does that refer to just you or does that refer to Dr. Abedini and whomever else helped you?

A I would say predominantly myself in the -- I believe Dr. Abedini's tasks of sort of providing the analysis of the gas data was manageable, yes.

Q He had less to do than you?

A Yes, sir, I would say that's correct.

Q Because for the most part what he needed to do could be handled with the SCS database and a map?

A And I think I relied on his experience in essentially assessment of operations and, you know, balance gas concentrations oxygen levels and the like.

Q Was there anything that Dr. Abedini helped you with on this project other than the landfill gas information?

A And certainly I relied on him for all the field sampling that I didn't really have any significant knowledge of at all.

Q Of course. So when you went to the landfill and somebody had had to go and collect some gas samples in SUMMA canisters and using some field devices halves Dr. Abedini and not you?
A Yes.
Q If I could ask you to turn to page 7 of Exhibit 1.
A Yes.
Q On page 7 you at the top in the first paragraph you contrast the design of Champ with its liners and leachate collection system on the one hand and Bridgeton on the other.

Have we fairly and fully discussed that comparison now as you intended to describe it?
A Yes, sir.
Q Okay. This always happens to me. I make all these grand plans for how a deposition is going to go and when I go back and look at my note I've acted entirely so forgive me if I go through this page by page and find things I've already asked.
A No problem.

Q I would like you to ask you about Section 2.4 of your report, though. It's on page 15 and I mention in the first paragraph under the heading groundwater hydrogeology. You start out by saying the massive landfill formation I'm sorry the massive limestone landfill you say the massive limestone landfill formation is relatively impervious have I read that correctly?
A Yes, sir.
Q When you're saying about the massive limestone you're talking about the side walls?
A The lower side walls, yes.
Q And when you say is relatively impervious what you were referring to is that being rock it is so dense that unless there is some special route it's kind of hard for water to get through it at all?
A Permeability is a very essentially a relative thing that varies over I believe something like 12 hours of magnitude in the natural geologic from the limestone down to unfractured bedrock, right, and so

certainly my understanding is that the massive limestone formation and I believe it's called the St. Louis is relatively limited fracture (phonetic).

What I saw at the Champ Landfill kind of confirmed that that there's only the odd rusty area where there were some fractures that are sort of leaking water into the formation. I'm aware of those fractures and where the amount of water seepage is tiny.

Q Sure. And if the people that are making the factual decisions about this case want to appreciate what you're saying, a good way to drive in Missouri during the winter when it's really cold outside and if there's been some rain nearby recently you'll see -- you'll see ice actually forming out of the side wall of limestone where there's been a road --

A Yes, that would probably be an excellent visual.

Q And when you say groundwater seepage does occur through fractures, that's exactly what you're talking about?

A Correct.
Q Another thing you say is but the bulk of groundwater flow occurs in the overlying overburden and possibly in the near surface weathered and fractured bedrock. Let me cover the last part first. Weathering is simply the erosion of rock over time generally as water has passed next to it so it basically creates separation between two rock layers?
A I kind of describe that slightly differently. Weathering is essentially the permeation of water and organic acids and other physical freeze/thaw processes to kind of break up the rock mass and make it less intact.
Q Fair enough. I did have one question about these two formations the St. Louis formation and the Salem formation. Do they consist of essentially interbedded layers sequentially of limestone, shale, limestone shale?
A From what I understood, there's a sort of more -- I'm trying to remember the correct word to use, but sort of more shaley or

maybe even a shale at the base of the Champ quarry, but the upper formation predominantly are fairly massive limestone units.

Q And that's usefulle because the shale is very dense and provides a liner?

A I would say that for my understanding it was more that the shale is a lower value material that's not useful for, you know, road building and limestone cement or whatever they use the limestone for and so the excavation terminated at that level.

Q Do you know what elevation it is?

A In Champ quarry I do not. I would sort of speculate it sort of seemed, you know, several hundred feet deep, so I would assume it's fairly close to what Bridgeton is.

My understanding is that the geology here is pretty much pancake with relatively low gradient.

Q I did have that question.

You talk about how sometimes there can be things that will change geology across a fairly small area, but that

doesn't seem to be between Bridgeton and Champ. I wondered how you knew.

A I recollect reading somewhere that the area here the geology is relatively flat lying and there aren't in the immediate area sort of folds or faults. I don't recollect exactly I've reviewed a lot of geological reports in there somewhere I grasped that information.

Q One of the questions we've asked groundwater experts in this case who were hired for groundwater purposes is whether there are any water wells between the landfill and the Bridgeton landfill and the Missouri River. I didn't see a report on that topic. You haven't researched that topic?

A I have to some degree.

Q Okay.

A And I came across a description I understood that the city of St. Louis and most of the communities gain their water from the river, but I came across information that there is a district called I believe it's St. Charles District

No. 2 that draws their water from deep groundwater wells, but the location of where those wells are located I don't know. I just remember hearing that St. Charles I think was either the area around Bridgeton or somewhere close.

Q Is it across the river?

A It could well be. I don't know. I just know it's sort of near the vicinity.

Q And are the deep -- you're not saying the deep wells are physically located between Bridgeton Landfill and the Missouri River?

A I don't know.

Q And so since you don't know that do you know of any wells that are in fact situated between Bridgeton Landfill and the Missouri River?

A I'm not -- I don't know.

Q And groundwater flow isn't always continuous and simple, but there are regional flow directions across areas and the regional flow direction from Bridgeton is gently towards the Missouri River?

A Westward, yes, sir, that's my understanding.

Q Is it somewhat northerly as well as westerly?
A That level of detail I am not able to -- because most of the information I've seen is sort of cross-section or word descriptions in a report and I just have the recollection it was towards the river, but specifically I don't recollect. And there may be something in my words that I copied it from the report at the time that provides more specifics, but...
Q Give me a second, please. Okay. If I could keep you on page 15. In the fifth full paragraph on the page which begins "the water level in Bridgeton" do you see that?
A Yes.
Q You say was controlled by four vertical pumping towers LCS 1 through 4. Is that the number of leachate collection devices that you're aware of?
A I understand that there are also a number of these gas sort of two phase gas extraction wells that provide some of the de-watering.

Q The dual extraction wells?
A Yes.
Q Okay. So up until say December of 2010, you're aware, are you not, that Bridgeton Landfill, in fact even for some years after, that Bridgeton Landfill was permitted to dispose of collected leachate by simply discharging it untreated into an inlet to the sewer system?
A I understood that yes, that it was -- I am aware of that.
Q Okay. And then in the next paragraph in the middle of the paragraph, you say that you refer to "the regional water table level which was historically about 400 feet above sea level in the surficial aquifer. Do you see that line?
A Yes, it actually says 430 feet.
Q If I didn't say it right I meant to.
Let me read it again that the regional water table level which was historically about 430 feet above sea level in the surficial aquifer. That's your words?
A Yes.

Q And unless it were affected by pumping, that regional water table level would exist across Bridgeton Landfill?
A Yes. My sort of understanding is that on the east side of landfill there's some Foothills and the level is slightly higher maybe 460 and then it slopes towards the river and then in the west side it would be at that 430 foot level.
Q So that surface feature that you described could actually result in higher levels like the North Quarry?
A Yes, and to the east of the landfill.
Q Sure. I'm interested in this: If I could turn you to page 18.
A Yes.
Q At the top it says the most recent sampling conducted by MDNR's consultants indicate that water levels in bedrock on the east side of the landfill are found in elevation of 460 to 470 feet above sea level while water levels on the west side to be at 330 to 430 above sea level. First of all did I read that accurately?
A I believe so yes.

Q Who are you talking about?
A So I believe that the Attorney General's office has a team of specialists that have been looking at the perimeter wells and doing sampling and interpretation and again I'm very poor at remembering the names of the people that I've actually talked to, but the person leading that program is the person I'm talking about.
Q Okay.
Now, give me a moment, please. I want to refer to page 23, first full paragraph. Do you see in the first full paragraph you refer to specific chemical constituents which are contained in a leachate sample recently collected for the Attorney General's office?
A Yes, sir.
Q Have you seen other leachate chemistry information from all the leachate sampling the landfill has been doing for a long time?
A I'm trying to recollect if -- I have a vague recollection of scanning through some in the data set, but I was not very

focused on it because at the time I was more focused on landfill fire and --

Q Was there some reason that you thought this sample that the Attorney General's office had taken was more representative of the leachate than all the sampling the landfill has been doing for a long time?

A No, it's just convenient and available, so I looked at it as a typical representation of leachate.

Q It was handy?

A Yes.

Q And you drew some comparison between leachate chemical values and EPA drinking water standards, didn't you?

A Yes, sir.

Q Did you know that those drinking water standards are typically based on judging risk posed by a lifetime of consumption of water by an individual for a very long, a very long life?

A I know there are certain risk base processes that the regulators use to determine their levels and they're designed to be safe to protect the public

long term. Exactly what those criteria are I do not know.

Q So you don't know anything about what EPA uses to be conservative as the weight of the person or the amount they drink or the number of years they drink it or the fact that they never use bottle water ever ever and they always drink from the faucet and they've never gone from their house, none of that?

A Just very peripherally, in my company we basically as probably most consultants we just look at the numbers that the regulators provide and try and stay within those boxes.

Q They give you numbers from their lab --

A If they're over, we're in trouble and if we're under, we're good.

Q Without getting into how EPA comes up with its values in my experience people who drink leachate do it once and never again. Has that been your experience as well?

A I would say that -- I would try never to drink leachate.

Q I would, too. There is no regulatory

basis for comparing leachate chemistry levels to drinking water standards, is there?

A Except if that leachate gets into the environment.

Q Right, but then you test groundwater and not leachate?

A Yes.

Q So I get it. I get taking a pail and dropping it into the groundwater, taking a sample, sending it to the lab and holding it up to the drinking water standard. I understand that.

I don't understand doing it for leachate and I wondered if you had some reference material you were relying on in treating that as if it were relevant.

A Basically the point that and particularly in a situation like where you have a very large, you know, mass like this South Quarry that if there's an egress of leachate into a fractured bedrock mass, I would imagine that the amount of dilution that occurs along the flow path certainly within the fractured rock mass

portion of that flow path would probably be fairly limited and so that the difference between groundwater and leachate would be not very significant. And that's, I believe, you know, why I'm flagging that because particularly again for the South Quarry I feel that there's a compliance point, you know, in very close proximity to the quarry walls and that in my mind that the concentration of the water at that compliance point, if there was an outward gradient occurred we would probably be very similar to the leachate chemistry that we see here.

Q All right. And one thing you referred to that I would like you to clarify for me. You refer to chromium at 1.4 times the drinking water limit. Are you talking about total (phonetic) /KRO*EPL spelling /(?

A That part, I had my hydrogeologist David crick (phonetic) actually do that assessment (spelling) and provide me with the comparison to the data, so that one I would have to ask him exactly what he did.

I do understand there's two of chromium and one is much more toxic than the other and I don't know how that assessment was done.

Q So you don't know whether this is hexavalent, trivalent or total?

A I do not.

Q You realize that if the sample is either trivalent or total and the drinking water standard is hexavalent, then the comparison is not apt (phonetic)?

A Correct.

Q And you don't know if it's right or wrong?

A That would be an appropriate comment.

Q So tell me what -- let me ask you how much of this information you have. How much have you done to come to an understanding of how the people who used to own Westlake landfill I'm not talking about a company or a church, the people back in 1973 who owned it came to be in possession of some low level radiologically impacted material?

A I was interested in that and researched again and I learned that there was

basically evolved from a Manhattan project and there was different levels of radiological material and I believe ended up and some property on the airport lands here and there was a move different cleanups and that material was relocateded to much more secure facilities I believe in Colorado and then the leached was it barium sulphate or whatever that material that contained I believe it was barium sulphate contained some low level radiologic and in order to clean that up it was determined that it would be mixed together with a bunch of top soil and then brought into the Westlake landfill, as I understood it and used as operational cover in the landfill to barium as operational cover is used for sort of daily intermediary cover. That's basically my limited knowledge of that cover.

Q Let me start from your historical perspective and try to distinguish the conduct of two parties neither of which is my client.

On the one hand there is Cotter Corporation which is a corporation in the uranium processing business in Colorado that happens to have purchased some rare earth metals, has some left over, needs to get rid of it and /(mixes it with top soil with a place called Laddy Avenue (phonetic) and has a contractor take it to a landfill owned by a couple of families of people spelling and gives it to them for free as a kindness to be utilized as cover dirt which to a landfill in a quarry is gold. That's one party on the one hand. The.

And assume no small company. This suspect is a subsidiary at the time of the petroleum company that was then called arco and is now part of BP. M'hmm?

Q That's one party. The other parties are a couple of families who together own a quarry and have been operating a landfill in the quarry and are happy to receive clean dirt because that's nice and don't know anything about low level radiologic material and are tricked into accepting

this radiologic material about which they know nothing.

A M'hmm.

Q Would you consider either of those parties to be culpable?

A I would say that certainly if not legally, then morally, yes. I don't know the laws of your states other than I believe there's some like in terms of I know in the States it's called superfund that if waste is deposited in a facility and, you know, causes grief that the waste generators themselves are ultimately responsible for that material.

Q So you're refer to Cotter?

A That's how I would track the waste, yes, but I would like to sort of qualify that really. I probably shouldn't even offer an opinion because I know nothing about this stuff.

Q I think you're permitted to offer that moral opinion.

A Yes.

Q And so my question is going to be Cotter was then owned by arco, changed hands, got

sold. Became a subsidiary of a company called Commonwealth Edison that is now part of a nuclear company called Excelon (phonetic) and they had it for a while and then Cotter was sold to another company called general atomics. Don't you think the Attorney General, if he's mad about the radiologic material ought to be going after Cotter in some way?

MS. WHIPPLE: Objection. Form. Argumentative.

THE WITNESS:

A Again, I believe that's beyond the scope of what my report was that it would be all just sort of ethical and questions that I feel that I shouldn't be asked to really comment on.

MR. BECK:

Q And I credit you with saying you feel like you shouldn't be asked, but you have been and I know that it's outside your report and I may even be asking you to be make a normative judgment, but I am. So what's your normative judgment?

MS. WHIPPLE: Same objection.

THE WITNESS: Try the question again.

MR. BECK:

Q If the Attorney General is mad about the radiologic material, shouldn't he be doing something with Cotter?

A Well, I would say that if a party illegally deposited material on a property that that party should be to some degree responsible, if not all, for trying to clean that material up. But again as a layperson and just basic ethical principles and that's where I'm going to limit my comments to.

Q And I'm going to stop talking about Cotter except to ask a single question and that is: By any chance have you been retained by the Attorney General of Missouri to provide expert assistance to them in going after Cotter?

A No, sir.

Q

(Discussion off the record)

Q So if you could turn to Section 2.7 of your report and, in particular, the top of page 24. Look at the first full paragraph on the top of 24 and don't describe it for

me, just see if I'm capturing your point.
Water moves from higher elevation to a lower elevation. It would be a really good idea to look at the water elevation under the Westlake superfund site with the radiologic material as compared to the groundwater elevation in the North Quarry to see if there is a migration pathway from Westlake to the North Quarry?

A That's what I'm sort of outlining there, yes, sir.

Q Have you acquainted yourself with the groundwater monitoring that has been conducted by EPA across the entire site, not just OU-1, not just the Westlake portions but Bridgeton Landfill, South Quarry, North Quarry, all of it, on many occasions in the last few years, at least four different realms of groundwater sampling in the last couple of years to determine whether or not there has been any leaching and subsequent migration of radionuclides from material at Westlake?

A No, sir.

Q And so if they have had done quarterly

samples of that, that would be a good thing in response to the concerns you have raised?

A In terms of the both the water levels and chemistry?

Q Yes, sir.

A Yes, I would say that would be reasonable.

Q If the water actually moves from Westlake to the North Quarry, that would be the opposite of the regional direction of groundwater flow, wouldn't it?

A My impression is it would be at 90 degrees, but if I could just have a --

Q No, that's okay. I'll stay with that.

A Okay.

Q Even if it's 90 degrees, water doesn't move that way, right?

A Well, just if I may sort of draw a mental picture that basically my understanding of typical regional groundwater flow is from east to west towards the Missouri River and then you've got basically here are the quarries and then you've got Westlake landfill here which I believe is somewhat topographically at the water table

elevation higher than the water level although I'm not 100 percent sure because all the data I saw was limited to the North Quarry water levels and so that was my question is, you know, is that water level is there a mound within the Westlake landfill that would be driving groundwater flow towards the North Quarry or not? And I would imagine there's probably information on that.

Q Well, there's two questions and maybe regional health doesn't help us with. The first one question is do radio leech from the barium sulphate, right?

A That would be an important consideration, yes.

Q Because if it has already been leached so much that they don't, then you shouldn't have migration of groundwater contaminants via leachate to groundwater?

A Yes. If they are static, you wouldn't expect that they would stay there.

Q But if there has been some leaching of groundwater contaminants since back in 1973 when this material was given to those

families who owned the landfill then, then you would look at from time to time what have been the directions of groundwater flow which you would determine entirely by comparing water level measurements taken at the same time as close in time as possible between the two locations because the water will flow from the higher elevation to the lower elevation?

A Yes, sir, and that may be somewhat of a dynamic because whenever you do that water level measurement at a snapshot in time and there may be things like pumping or, you know, infiltration of runoff that might radically change that flow pattern historically.

Q Right. The conditions are potentially dynamic enough that, for example, it would be a mistake to compare the groundwater levels at two sampling points that were taken even two weeks apart because you wouldn't get the contemporary matchup that allows you for the flow?

A I'm thinking that there's typically small fluctuations seasonally that's the biggest

thing and then there's much larger fluctuation whenever man disturbs a natural and puts in a sedimentation pond and adds a lot of water.

Q But, for example, and you are you consider yourself a groundwater professional?

A Yes, I would.

Q And you wouldn't take a water level measurement in one place on day one and try to compare that to a water level measurement taken two weeks later at another point and treat them as a basis for inferring direction of flow in a dynamic environment like this?

A In my mind, two weeks unless there's a radical change in the ground conditions I feel is probably not huge a difference. My experience is that water levels in the groundwater flow system basically oscillate, you know, seasonally over months and so ideally it would be closer, but I wouldn't want to offer a huge opinion or be extremely concerned over a two-week gap.

Q But to look at the factors that would be

most important, what you would want to look at is is during those two weeks was there precipitation and during those two weeks was there pumping, right?

A Those would be potentially things that could affect if it there was a big change in pumping for example if a well pumped 600 gallons a minute and then gets cranked up to 5,000 gallons a minute yeah, something like that could change the --

Q Sure. In 2.8, still on page 24, you express the understanding that Bridgeton Landfill received and we talked about this a little bit yesterday, petroleum or hydrocarbon contaminated soils?

A Yes. Could you please.

Q Still placement 2.8 it is our understanding that Bridgeton Landfill received hydrocarbon contaminated soil. Do you see that?

A Yes, I do.

Q I'm just wondering where you got that. There's no reference cited here and I'm not sure where you -- I'm not saying it's true. I just want to know --

A Yes. It would have been in reviews specifically I don't recollect where I read that information, but typically everything in the report I read somewhere, and predominantly from the, you know, material provided by the Attorney General. I would have to spend a lot of hunting to figure out exactly where that came from.

Q And the rest of that sentence says "and we anticipate that this it material was used for intermediate cover purposes as this is a common practice in landfills". Is that based on just an assumption or is that based on some regulatory document that you were given to look at that you just don't remember to?

A No, it's just my experience in landfills in British Columbia that will accept treated hydrocarbon cleanup waste as a cover material. It's sort of a low essentially that same sort of free cover material that you mentioned that was unfortunate, low level radiological waste.

Q And if you look at Section 2.9 just below, you do say "last sentence "in 1994 Laidlaw

requested authorization to use contaminated soil for daily and intermediate cover."

A Yes, sir.

Q Now, do you remember there was in fact a regulatory reference to that then?

A I would have read that in the correspondence, you know, went through the history and I encountered that authorization. At the time I was trying to track down the fire history and read all the documents and I sort of flagged that as I came across it.

Q One of the obligations I have here in this deposition is to figure out what things you survey are based on. Can you point me to a document that's based on?

A I would have to basically dig through my files and find that document for you, unless it's -- there is a possibility that in that table that table that listed all the historical stuff I'm not sure in which case it would have a Bates number.

Q Okay. Well, what's the importance of anything in 2.9?

A Basically.
Q It just seems like old news. I'm trying to figure out why you say it.
A I think it's to relate to the basis that on my hypothesis that condition of the SSSER was initiated by overdraw of -- of the gas system that would assisted by lack of soil cover and historically relating to the earlier fires that were experienced at the landfill dating back a long time. So that's where I felt it was kind of --
Q First of all you put an S on fire when you said earlier. You're talking about the fire that occurred at the side wall of the quarry in 1992 and some some time to extinguish?
A Yes, sir, that I'm sort of reading the history of that incident. It wasn't clear to me whether there were two fires or one. There was an event in 1992 and a breakout in had 1994 and I'm not sure. In my mind I almost felt like they were two different things, but I recollect somebody concluding at some point that the other one wasn't and I wasn't essentially sure

if that's -- you know, if I was going to buy that comment or not.

Q Do you know do you know if that's one or two events?

A I do not know. I just flagged what I read and it was kind of interesting that people debated whether it was one or two.

Q If one of our experts was somebody who fought that fire, would that be useful information to you?

A It would be interesting, yes.

Q And so with respect to that, do you know how that fire related to the installation of the active landfill gas system then around 1992?

A My understanding of the installation of the gas system was predominantly driven by trying to control odors from the facility. It was sort of what I.

Q Who told you that --

A I interpreted.

Q Where did you find that?

A Maybe that was a -- I'm not sure if I'm mixing up my dates or whether there was such additional future gas extraction

systems that were for that purpose.
Q We're here and I can only ask questions. Do you know of any basis for that statement?
A That the initial gas extraction system was driven by overcontrol?
Q Yes, sir.
A Specifically, not without going back to all my notes.
Q Okay. And to the extent this discussion of stuff up to and in July of 2004 in that section of your report relates to cover, it wouldn't really help us know much about overdraw in the 2008 to 2010 and later time period if in between after 2004 and after the landfill stopped receiving waste a final cover was placed over the landfill, right?
A In had general, yes, with the exception that in my experience that, you know, having significant fire breaks within the phases of a landfill can prevent migration of lateral spread of situations. From that context I think it's important to understand if there are, you know,

significant barriers, for example if there was a big burn between the North Quarry and the South Quarry if there was inert material that would be very significant and could prevent migration.

Q Well, I see three things in this paragraph about cover. One is is that there was an inspection report in December of 1992 where there was inadequate cover?

A Yes.

Q Needed to be dealt with. Do you have any reason to think that wasn't dealt with?

A No.

Q And the next is a 1994 inspection by the Department of Health noting that settlement had occurred, had opened up fissures along the quarry wells and that a leachate collection wells was exposed and venting and that there was a hole with fissures in whatever is called pit 1 that was venting gas. Do you have any reason to think that those inspection items weren't brought to the attention of the landfill and prepared?

A Not at all. The reason I basically

incorporated that information to me I find that if a problem historically develops that it provides us with some learning opportunities and also what could happen in the future and so basically just to emphasize that there's, you know, when you get settlement and active combustion that these soil covers come under stress and open up contraction and fissures and open up oxygen into the landfill.

Q Okay. And what does that help?

A Well, I was thinking in terms of the situation that started in 2010, 2011 with the reaction and prior to the EVOH cover being placed on it that you're in sort of the same situation where you have a subsurface reaction possibly, some air being drawn in with the operation of the gas extraction system to control odors and so that's where I was drawing the parallel. I felt it was important.

Q I have to change the tape, but why don't we just keep track of where we are. But when we come back I'll just ask you to read where we are so I don't lose it?

THE VIDEOGRAPHER: Going off record. This is the end of media Unit Number 3. The time is 3:45.
(PROCEEDINGS RECESSED AT P.M.)
(PROCEEDINGS RESUMED AT P.M.) test test test test test test test test
THE VIDEOGRAPHER: We're back on the record. Here begins media unit Volume 2 number 4 Volume 2 and if I could hear back the last question and answer to be where I was.
THE COURT REPORTER: (By reading):

MR. BECK:
Q Let me make sure I understand, Dr. Sperling. Are you claiming that what happened in 1992 to 1994 was not a fire, it was a subsurface reaction?
A No, sir. What I'm suggesting that the '92, '94 that I believe was a subsurface fire however, that in experience that all fires to some degree are driven by oxygen intrusion and I feel that the effect of oxygen should not be overlooked at Bridgeton because I feel that that is to some degree an unrecognized or to my mind

I shouldn't say unrecognized. What I should probably say is concerning thing that the data I'm seeing is that the oxygen levels within the landfill are forever increasing and that people are losing the focus that oxygen intrusion, you know, initiates fire situations in landfills and I'm very concerned about that.

Q Do you think the 1992 to '94 event was subsurface?

A From what I read that yes, that there was material burning, you know, deep within the interface of the rock quarry wall and -- and then re-appeared and the vent holes developed so I interpreted that what I read about was a subsurface fire.

Q Couldn't you just stand there and look at the flames?

A That there was a subsurface expression of it, but certainly in my experience, any surface fire is typically very simple to contain in a period of typically in a period of weeks and it's only if you have a situation where you have something deep

underground that, you know, the gas may blow out or the exhaust gases cause surface fires, but the bulk of it would be underground.

Q One of the problems I have with getting through this report is it doesn't refer to much of anything. It says a lot of facts but it doesn't say where they come from.

A M'hmm.

Q What reference do you rely on in claiming that what happened in in the early 1990s was subsurface?

A Basically in the timeline that I -- and let me just turn to it if there is some actually reference to those historical events as to where they may have been originated. So if someone could help me out. I believe it's Table 6.2. I don't remember where that timeline table is.

Q When you find it, just let me know.

A Thank you. Hang on. I'll try and go to the table of contents first.

There's a lot of different history chapters so I may have to go flipping again. Peggy is trying to help me.

MS. WHIPPLE: Look at page 44. Is that the one you're looking for?
THE WITNESS: That is the one, Peggy.
MS. WHIPPLE: Okay.
THE WITNESS:
A Okay, and so we're looking at event, okay, I'm looking at basically on the left there's a reference date and it's the fire history event is sort of those two red areas in the table and so I reference these things were not Bates numbered. I believe I would have got them off the MDNR website and I referenced them like Missouri and DNR web County health inspection letter, SCS fire proposal and I believe all of that information was pulled off the MDNR website.
Q You didn't include those as appendices in your report?
A No, sir.
Q But that is a list of the documents from which you acquired your information as to what happened in 1992, '94 is this list of documents on that page in that sequence?
A Yes, sir and the dates are on that page so

we would certainly be able to track down the date of each one the reference.

Q And so the first date is September 25, 1992, bless you.

And the last page is June 22, 1994?

A For the 1992 event and then I had some follow-up information that goes back as far as March 29th, 1995 with respect to the North Quarry 1994.

Q That refers to the time frame then from --

A From --

Q 7 27 94, no, just give me the date range?

A What I'm seeing here second subsurface fire reported on 1994, 10 31 and then North Quarry fire extinguished and that was 1994 03 29.

Q Well, do you see in your own table that you're referring to now on October 31, 1994 Laidlaw letter to DNR, your description of the event is initial 1992 fire re-ignited?

A Yes, sir.

Q So your understanding it's the initiation of the same fire at the same location?

A That's what I was extracting the words in

the letter and I assumed that's what it says, yes.

Q Okay. And do you know how that fire started?

A Not specifically.

Q How many fires occur at U.S. landfills per year?

A That is a statistic I'm trying to remember specifically it's actually one of my papers. It is definitely a large number off the top of my head I don't remember exactly. I probably quote it in it my report.

Q Isn't it true that it's on average more than one per landfill per year?

A That would sound approximately correct.

Q Now, let me refer to the last sentence of Paragraph 2.9. What you're saying there that you looked at an old photograph that goes back to 2004?

A Sorry, can you refer me to the page number again?

Q 2.9, I think it's on page 24, Section 2.9, I think it's on page 24?

A I'm getting there. Yeah, I got it on 24.

Q And then the last sentence of 2.9 it refers to something totally unrelated to everything else in the paragraph, right?
A This is sort of the last sentence in Paragraph 2.9 that you're referring to?
Q Yes, it is.
A Yes, I was looking to assess whether there's any indication that operationally there was a history of ongoing exposed waste with lack of operational cover because from the context of fire initiation and lack of fire breaks, that was I felt an important consideration.
Q Move to strike.
Does that sentence simply say LFCI noted a mottled texture in the July, 2004 photothat is typical of exposed MSW?
A That's what it says, yes, sir.
Q And that picture, can you give me the Bates number or a better identification of it?
A The photograph that's provided is presented in had photo 2-2 of my report.
Q It doesn't say that in the text. That's why I didn't get that.

A Sorry.
Q And where is the mottled text yes or no that is typical of exposed MSW?
A May I sort of point it out to you directly.
Q Sure. Yeah, just tell me where the picture?
A Basically just above this brown.
Q At the open face?
A Correct.
Q So there's a daytime picture of a landfill in 2004 that has a mottled texture that that looks like trash on the working face?
A I would say to me it seemed an excessive area to be a simple operational act of/active face /(.
Q You're just saying that working face looks pretty big to you?
A Yes.
Q Because it's a couple of acres?
A Correct, if that's -- I'm just looking at the scale here.
Q I'll give you the scale. The South Quarry is 30 acres, right?
A Yes.

Q So it's a couple of acres?
A On the order of 100 by 50 metres, yeah, so half a hectare. Yeah, that would be about right.
Q So on one occasion in 2004, according to a photograph, it appeared to you that the working face that we're using was that size?
A Correct.
Q During the working day before they put on daily cover?
A Yeah, based on this one photograph I cannot conclude any more than there's just a very large area of exposed waste that seems sort of abnormal for a normal landfill.
Q It's exposed because the tracks brought it off and they haven't put on daily cover yet, right?
A I understand that, but general best practice for landfill operations is to keep, you know, construct landfills and keep a very small active face and in my experience is this seems rather large.
Q Do you know of any condition of Bridgeton

Landfill's permit or provision of Missouri's regulations in force in had July of 2004 that contained any constraint at all on the size of the working face other than cover it at the end of the day?

A I'm not aware of any. What I basically write reports in terms of assessing risks and potential for fires and whatnot and contemplate things as best practices, not necessarily as regulations and my focus here is to try and identify not things that are necessarily best practices in my opinion such a large active face is not best practice.

Q Why didn't you highlight the things that they did that were best practices ? I'll withdraw that. I'll withdraw that.

So I guess my question about this picture of the landfill during the middle of the operating day that you said had had a working face that was legal, but not what you would love to see, I guess my question is: What made that worthy of inclusion in your report?

A Basically what I was trying to understand

was the potential for essentially air intrusion into the landfill and as a that typically almost every, you know, landfill fire project that I do is somehow related to lack of operational cover and so maybe I'm overfocused on that issue, but I don't believe so and so I look for it religiously.

Q Let me ask you to turn to page 26, still in Exhibit 1 of your report. Sorry, page 26, there it is.

Do you see the statement on page 26 in the third paragraph from the bottom, second sentence that says: Elevated concentrations of CO are considered indicative of subsurface landfill fire. Have I read that accurately?

A Yes, you have.

Q Do you know of anyone other than Tony Sperling who has ever said in writing that concentrations of CO between 500 and 1,000 parts per million are indicative of fire?

A I believe, I have a vague recollection of seeing documented information from a site visit by Mr. Ed Walsh to Bridgeton during

the initial evaluation of that incident on December 23rd or thereabouts were exactly the same number 500 ppm was quoted to the landfill staff so yes, I say.

Q Ed Walsh?

A I believe that was the document that I came across.

Q You're not talking about Jim Walsh, the president of SCS?

A Or it may have been I suspect it may have been Jim Walsh.

Q So you think there is a document prepared by Jim Walsh that says CO concentrations in the subsurface above 500 ppm show a fire?

A I have again a recollection of and this was the handwritten notes taken by one of the staff that was present in -- at that meeting and I definitely recollect seeing 500 parts CO as a warning of whether it was subsurface oxidation or fire, I can't recollect exactly, but definitely it was that 500 ppm number was of significance.

Q I'm afraid I'm having trouble keeping up with you.

My question was did you say you had seen some place that Jim Walsh of SCS had said in writing that 500 ppm of CO is indicative of a fire?

A No, what I have seen is a verbal instruction to landfill staff that was noted in a field book and was then somehow included in the documentary of this case that indicates that that was the case.

Q And what is the title of that document or its Bates number or some other way to find out what the heck you're basing your statements on?

A I would have to ask Peggy something I actually just came across just by fluke this morning in reviewing some of the information.

MS. WHIPPLE: Do I have it.

MR. BECK:

THE WITNESS: It should be somewhere. I'll try and dig it up.

MR. BECK:

Q Was it given to you by Ms. Whipple?

A No, it was basically information, a disk that I received probably about a week or

two ago from, additional information.
Q From the Attorney General's office?
A From the Attorney General's office.
Q So they sent it to you to read and now you're telling me about it?
A Yes, sir:
MS. WHIPPLE: I don't have anything else.
A Oh, okay. Yeah, because I was reviewing it this morning in my office. I'm not sure if I felt it was important to put it in a package, but yeah, I have a very clear recollection of it, a scanned handwritten field notes and on sort of a yellow piece of paper and just just some summary observations.
MR. BECK:
Q So you can't describe the document better or give me a Bates number?
A Not immediately, no.
Q Unfortunately this is my one and only deposition we're on day 2 and it's 4:24 p.m. so I'm running out of opportunity to discover this from you.
A Okay. Well, what I would say is if I could take a little break and just make

sure that I do not have that information. I would be pleased to try and maybe have a quick office -- call to my office and see if it's lying on my desk and see if I can get a Bates number off of it.

MR. BECK: I don't want to because I've got too many other topics to cover, I'm just going to go on and and if there's something you want to do, feel free.

Turn to page 27 if you would, please, in your report.

THE WITNESS:

A Could I just would it be possible to just take one second for a question with Ms. Whipple?

MR. BECK: Yes, as long as there's not a question pending, you can.

THE VIDEOGRAPHER: Going off record, the time is 4:27.

(PROCEEDINGS RECESSED AT A.M..)

(PROCEEDINGS RESUMED AT A.M.)

THE VIDEOGRAPHER: Back on the record. The time is 4:29.

MR. BECK:

Q Dr. Sperling, are you ready?

A Yes, sir.
Q On page 27 of Exhibit 1, your expert report, Section 4.1?
A Yes.
Q The paragraph that starts with the word "notably" do you see that it refers to the Republic Services standard operating procedure?
A Yes, sir.
Q Have you read that document?
A I read the basically the summary of it in Mr. Thalhamer's report.
Q And so if I take issue with Mr. Thalhamer's description that you have now recited, I need to take it up with him because you just relied on what he said?
A And I'm not 100 percent sure now if I also -- I believe I also had the document and reviewed it but I'm not 100 percent sure. I've read so many documents that I don't recollect exactly if I looked at that or not.
Q Well, you actually incorporated if thank you turn to the next page you actually incorporated his table into your report.

A Oh, that I definitely did. I'm just saying I don't recollect if I specifically read the actual SOP document. I have a vague recollection if I did but I cannot 100 percent guarantee.
Q So that language just describes information from the table on page 28?
A That would be a certain assumption and, yeah.
Q And the information that says Republic on the table on 28 is not information you wrote, but information that Todd Thalhamer wrote and you copied into your report?
A Yes, that's noteded and I had it on the table.
Q And if I think there's about four different ways that this misstates the Republic SOP I'm?
A Yes, sir.
Q I'm going to have to take it up with him?
A Yes, sir.
Q Because you can't answer it?
A Yes, sir.
Q When you talked to Mr. Thalhamer, did he tell you at any point that I was actually

in attendance at a deposition of him?
A No, we had never discussed depositions at all.
Q I just wanted to find out what he said about me.
A Oh, yeah.
Q If I could ask you to look now at -- just a moment -- Section 4.2 on page 31.
A M'hmm.
Q The second paragraph begins at Bridgeton the final closure cap was constructed in 2005 and 2006, correct?
A Yes, sir.
Q And so far as you know, that is true and accurate?
A Yes, sir.
Q Now, the next sentence says, however, significant cracking and slumping of that cap has been reported in the 2010 annual financial report.
A Yes, sir.
Q I don't know what the 2010 annual financial report is. Can you tell me? There's not a Bates number reference to it.

A Again, it was a report that I reviewed at the time, I believe that's what it was called. I believe it was a general overview report to the board or to I'm not sure if it was the source seemed like a fairly high level report that discussed all issues at Bridgeton Landfill.
Q To the board?
A I'm not sure -- like it seemed like it like it wasn't intended maybe it was it just seemed to me like it wasn't a technical report. It was more a financial overview report of possible liabilities and stuff like that.
Q You don't think in 2010 at that time of fire anyone reported anything about Bridgeton Landfill to either the board or the shareholders, do you?
A I'm just saying that the wording in this the report was such it wasn't your typical engineering report. It seemed to be aimed at a different audience.
Q Audience concerned with budgetary issues?
A Yes, or it might have been management, I don't know.

Q Whoever it was written to, what's the Bates number of that document?
A I'll have a quick look again at table under that date I must have something. Can you help me out with that date.
MS. WHIPPLE: 44.
THE WITNESS: 44, thank you.
A So the date is -- where are we? So we're basically looking at 2010 information.
Okay just when I scanned all of the information here, I don't seem to have that noted in the time log.
Q I understand. Of I don't know what it is, so help me with enough information to find that document.
A Okay. I'm just trying to think how to track that document down.
Q Were you never given instructions to make a list of the documents you relied on for the statements in your report?
A Not specific to my recollection.
Q And what I'm referring to is in all of the interactions you've had with the Attorney General's office which retained you, is there no time that anyone ever said part

of your report has to be a description of the documents that you relied upon for the statements in your report sufficient to enable opposing counsel to find those documents and test your statements?

A Not specifically, no.

Q Now, page 31 of your report, bottom of the page.

A M'hmm.

Q Still Exhibit 1, says from the landfill gas extraction record presented in Figure 4-1 it is evident that Bridgeton commenced aggressive extraction of the landfill gas around November, 2009 with landfill gas flows increasing from about 1200 CCFM to about 1700 SCFM an increase of 42 percent?

A Yes.

Q And I want to start there.

A Yes.

Q Is that based on flare flow?

A Sorry, is that based on.

Q Flare flow?

A Basically it's methane flow to flare 2005 to -- yes.

Q Is that methane flow or is it landfill gas

flow?
A Basically it's titled methane flow to flare, 2005 to 2009.
Q Right. I know that's what the person who drew this chart called it, but does the chart actually depict the total landfill gas flow or does it depict just the methane fraction of the landfill gas?
A Yeah, I would suspect it's probably total gas flow but in this instance there's actually a Bates number so we can confirm that.
Q But you reviewed this and approved the chart, right?
A Yes, sir.
Q And so as the person who reviewed this and approved the chart, do you know whether it's mislabeled by calling it methane flow when, in fact, it's total flow?
A Without looking at the exact document, I have a suspicion that typically it's total flow that's logged so it would probably make sense that it would be total gas flow, but I would check that.
Q Isn't it true that there's no way to

measure just the methane in SCFM within a given line of landfill gas? You can measure concentration, but you can't measure flow of methane in landfill gas, right?

A Yes basically you can estimate the methane flow by knowing the total flow and concentration of methane.

Q So you don't know whether this is some working of the of the data to come down to a methane fraction by applying some percentage or whether this is just listing the total flow?

A No, sir, and in this my mind was relatively immaterial whether it was one or the other. What I was just looking at is the relative increase over that period of time.

Q And what is the period of time that shows the increase as depicted on figure 4.1?

A Basically I'm looking from roughly 11 30 2007 through to 7 30 or 9302009 where it appeared to me that the average trend line was a flow of approximately 20 SCFM and then there's a significant, you know,

uptick.
Q Well, that's not what you said in your report. What you said in your report, it's on the preceding page, is that that the upticks started in November 2009, not in 2007, right?
A And that's what I was trying to say, sir, is starting in roughly November, 2007, it appeared to me that if you average all those data points within the noise, it appeared in a relatively straight line at approximately 1200, 1250 SCFM and from there if you were to average the points from 9 30 2009 that you would see an average diagonal increase of gas flow.
Q So what you're doing is looking at the graph and drawing a mental trend line?
A And that's the same sort of thing as the issue you were sort of disagreeing me on the exact date. I kind of analyze data on long-term trend line more so than specific points.
Q And so what you're interested in is that for the period of time from September of 2009 to February of 2010, there was a flow

increase?
A That was my conclusion.
Q That two-month period?
A Yes.
Q How about after that? Why isn't that on there?
A In terms of -- I believe this was a graph extracted from some data set that was available within this reference.
Q Are you saying the data set didn't go past February of 2010?
A I believe this was a graph basically extracted from that document and that's all that was available.
Q Was Dr. Abedini involved in this effort?
A I do not believe so. This is indicated that the graph was drawn by Nicholas one of my draft people and probably just extracted a figure, so.
Q And so if a graph in here shows those initials as the drafter it's a drafter and not Dr. Abedini?
A Yes, sir.
Q And if you checked it and Dr. Abedini initials appears nowhere that's not his

graph?
A I would conclude that happened.
Q And can you just tell me from this graph or otherwise what happened to the flare flow between February of 2010 when the graph stops and December of 2010 when the detections occurred that led to the contact to DNR?
A I have not plotted that information.
Q And could the change from 1200 SCFM to 1700 SCFM just reflect the addition of flare capacity?
A Basically in my understanding that it's certainly poor practice to vent landfill gas into the out atmosphere without going through a flare and so if there was an increase in flare capacity, I concluded there was also equivalent increase in landfill gas extraction. So yes, that adding flares would have increased flare capacity, but in had general would also result in this more gas being pulled out of the system and that's what I was concerned about.
Q Okay. You're saying that if you get more

gas out of the landfill and destruct it that's a bad thing?

A No, sir. What I'm saying is that if it you're operating a gas system and then assuming that the well is reasonably balanced and you're extracting, you know, all of the gas that's sort of reasonably available without causing overdraw and then you increase the gas extraction by 40 percent that there's a strong likelihood that you are going to induce overdraw.

Q So how do you know that the well was reaonably balanced and they were getting out all the gas they could between 07 and 09?

A My assumption that the data set indicates that there was surplus capacity for beyond that up to about 2500 SCFM as far as the earlier data indicates and that I would imagine that the reason that the gas production was throttled back was because there was less gas basically available to service those flares.

Q So you're saying that there was no

decrease in this flare capacity at any time between May 3rd 2005 the high point and November 30, 2009, correct?

A Yes, and basically from the trend lines that I see which are sort of typical of decaying landfill production overtime so that curve is sort of consistent with what I typically see in landfill gas production at facilities.

Q I lost you halfway through.

A Yes, so basically in landfills there's typically an exponential the amount of gas production goes up and then when you close the landfill which is kind of consistent to December, 2004, it's very similar to the date here, only a month later, basically at that point in time the gas is shut off the waste flow and gas production gradually starts to drop down. It's typically an exponential decay. I'm seeing an exponential trend line here.

Q And you're talking about 05 when the landfill was closed and 09?

A Correct.

Q My question was: Do you know there was

not a decrease in flare capacity during that period?

A And I do not know that, sir.

Q And do you know what company was involved in maintaining the well field and determining the amount of flow to capture, if you will, between 05 and 08?

A The only company that I'm sort of aware that was doing that was mike lamb's company, the monitoring.

Q Control and compliance?

A Yes, whether they were doing it prior to that I don't know.

Q Has anybody told you anything about a Bridgeton Landfill in the 2005 to 2008 that put the control of the in somebody'ss hands?

A No, sir, I'm not aware of that.

Q If that happened, you're not aware of it?

A No.

Q I don't want to make any statements for assumptions. I'm just wondering if you know anything about that subject?

A No.

Q Have you ever heard of the name forta star

in connection with Bridgeton Landfill?
A No.
Q Page 33 of your report, top of the page, in table 4-2?
A Yes, sir.
Q The O 2 percent exceedance, if I understand correctly what you're intending to say is that the number of landfill gas well total readings for the year summing up all 12 events and summing up all of the wells, that the portion in which oxygen at the well was measured to exceed 5 percent was the percentage of the total number expressed in the O 2 percentage exceedance column?
A Correct.
Q And who extracted and did that calculation to come up with that?
A That was one of my junior engineers by the name of -- and I apologize. My brain. I think I did this before I sometimes draw blanks even though I well people very, very well that's the way my brain works. His first name is Ken and -- it will come to me in a second. When I'm under stress

I have a hard time recollecting names.
Q I would call to your attention the fact that there are two years 2005 in that table. Why? They have different data.
A I suspected maybe that there are two separate sort of chronological data sets in that year.
Q So what are the data sets behind this table?
A They were basically submissions, I believe, to St. Louis County of monitoring data that were compiled and I reviewed basically their data tables of the annual compliance monitoring that was submitted.
Q Is there some place here you cite those documents that you got this information from?
A Basically it was, again, information that was my data package. I'm sure it had Bates numbers, but I did not realize it was that important and for that I sincerely apologize I didn't know that was what I needed to do.
Q Well, I don't mean to do that. I do need to have a full understanding of the basis

for statements that are in your report and I do need this.

Do you know for certain that this came from something that originated at St. Louis County as opposed to the landfill?

A Basically, this information was provided to me by the Attorney General's original data set package and it was part of sort of the annual monitoring report submission that I believe is submitted to the County, but I'm not 100 percent sure of that.

Q If you had the SCS database information why not just use it?

A I believe that the information here predates the SCS database that we have on file.

Q You see that for 2006 the comment is no data for first half?

A Yes, and that probably explains why there's, you know, seems like a semi-annual report.

Q So why, what would the data have looked like if you had included the data for the first half?

A I don't understand your question.
Q Sure. If it were a full year's data, would the percentage of O 2 exceedances with be higher or lower?
A I would anticipate that they would probably be in that same for oxygen for example in the same range but without having the data available, I can't confirm that.
Q Why would you anticipate anything without having the data available?
A Looking at, again, trends in data I sort of automatically do that.
Q But wouldn't you be a lot more comfortable making predictions about what it showed if you actually read it?
A Absolutely.
Q So why are there two years 2007 in had this statement?
A Basically, my impression of this is that it's a semi-annual report that is presented and basically in the year or in the time there are two data sets, then there's 2005 and 2007 there are two data sets and in 2008 there's basically only

one.
Q Have you done any sort of modelling calculations to compare in order to determine the significance of this old information, from 2005 to 2008 any information to compare the volume of methane -- excuse me the volume of landfill gas generated in the landfill between 2008 and 2010 and the maximum volume of oxygen this could possibly represent in 2005 to 2008?
A No, sir, I have not.
Q Bridgeton Landfill in 2009, 2010 was producing a lot of landfill gas?
A Yes.
Q And the effect of that production of landfill gas by the nature of gas expansion is that it would tend to push out everything in its way in all directions as much as it could?
A This is you're talking pre-dating the SSSER.
Q I'm pre-dating December 22nd, 2010.
A Yes, right.
Q The fundamental nature of the way

landfills produce gas is that as the gas is produced in this very large quantities?
A M'hmm.
Q -- it tries to expand its reach in all directions pushing out gases in this its path as much as it can to fill up the landfill with itself. Is that true?
A Yes, basically gas is produced and it will build pressure and eventually escape from the landfill into the atmospheric laterally because there's just continually more being produced, yes.
Q Just to conceptualize it's like filling a balloon with air, it just gets bigger and bigger and bigger, right?
A Yeah, generally there's a gas flow is driven by pressure so if there's more gas being road typically what happens there's a pressure buildup that allows more gas to escape unless you put a gas extraction system in to de-pressurize.
Q Right. That's what you would call positive pressure?
A If it's leaking out under its own pressure, yes, positive pressure.

Q And the reason that we have to have we're required to have by law -- well, strike that I'm not so sure. The reason that a landfill has an active landfill gas system is so that that gas doesn't escape the landfill and go into the atmosphere, right?
A Correct.
Q And the reason we don't want the gas to escape the landfill and go into the atmosphere is that that can carry odor and green house gases?
A Those are the two predominant reasons, yes.
Q And so one of the things the landfill is supposed to do is to capture as much of that gas as they reasonably can before it gets out into the atmosphere?
A Correct.
Q And for the gas that's in the subsurface of the landfill to capture as much of the gas as they reasonably can before you have methane in the subsurface which is also something not wanted?
A Yes.

Q And so pulling the amount of gas that collects the most methane with the least oxygen intrusion is the sweet spot of landfill extraction well flow control?
A Correct.
Q And by sweet spot, we mean we as a landfill operator here, a regulator across the table and an interested member of the public at your end should all want that?
A I would say I would agree with that statement, yes.
Q How long did it take for any amount of oxygen which may have been overpulled into the landfill by 2008 to be pushed out by the continued generation of this mass of new landfill gas being formed?
A Basically, from the information that I've reviewed, that most of the oxygen would get actually consumed within the landfill by bacteria, so initially at a point and my impression was that there was an active gas collection system operating that would prevent that oxygen from being pushed out. It was rather being drawn in.
Q In other words, it would be pulled to the

flare?
A It would be pulled into the wells and toward the flare. And typically, the oxygen would be -- a lot of it would be consumed by aerobic microbes on its pathway through the waste before it got to the wells.
Q Okay so let's assume that there was overpull between 2005 and 2008 and that you had just proven it.
A M'hmm.
Q In 2009 and 2010, any effects of that oxygen that came in because of overpull years earlier is gone because of the microbial activity and the pumping to the flare and you would have to have new oxygen in 2009 and 2010 to make any difference?
A Yeah, generally my understanding is that the oxygen that is within the waste mass would get consumed relatively quickly and if it's sort of continuous overdraw that causes the problems on a much more short-term basis.
Q If there is an effect of overdraw first of

all there can be overdraw with absolutely no effect, right in fact that's probably most of the time?

A Correct I would say so, yes.

Q If there's going to be an effect from overdraw that is in some way negative, you find out about it pretty quickly?

A If you're monitoring your wells routinely yeah, you would detect it in your monitoring program.

Q Okay. And so all of this history from 2005 to 2008 and whomever was in charge of the well field from 2005 to 2008 may be academically interesting, but it's unrelated to the events from November, 2009 to December, 2010 that you and I have been debating for the last couple of days?

A I would not go that far in that one of the things or the reason that I always preach that any oxygen intrusion into landfill is bad is basically that it converts the subsurface microbial population from anaerobic or methanogenic bacteria which generally likes to thrive at temperatures below 131 degrees Fahrenheit to aerobic

microbes which generally produce significantly more heat to the point of, again, I'll have to quote Celsius because it's like 75 to 80 degrees Celsius, somewhere up around 176 Fahrenheit, but I have a table that explains that. /(And generally my experience has been is that when heat is allowed to build up in a landfill it's dissipated very, very slowly like we're talking months to years and any time you basically allow heat to increase within a landfill, you run the risk of increased risk of some form of chemical reaction to trigger spontaneous combustion and so what was done in the past, even though it may not have an influence on the oxygen regime, it may well have had an influence on thermal regimes that would have been much longer lasting /(.

Q Two assumptions. One is for it to have an effect on the thermal regime that could inhibit methanogenesis which was one of your things, it would have to be above the level at which methane generation stops?

A Yes, sir.

Q The second thing is in order to have any effect in a particular area of the landfill, it would have to be unaffected by the flow is being created by the gas wells and the header pipes because otherwise the heat dissipates by function of flow; isn't that right?

A The dissipation of heat through flow is certainly something that I believe does occur in terms of the magnitude of heat that's extracted through that system. I do not know whether it's hugely significant or not.

Q Okay. So do you know of any particular area you have identified at Bridgeton Landfill that was unprotected by the flow operation of the landfill gas well collection system, the wells and the pipes and that therefore didn't have the resulting heat dissipation that results from flow -- I'm sorry, let's go off record.

Going off record. The time is 5:06. Test test test.

(PROCEEDINGS RECESSED AT A.M..)

(PROCEEDINGS RESUMED AT A.M.) test test
THE VIDEOGRAPHER: We're back on the record. The time is 5:14.
MR. BECK: Dr. Sperling, we've got child care needs that a person who runs this conference center that I'm going to respect and stop the deposition. I need to cover one quick question for you now and that is one of your recommendations was that there will be an examination of drill cuttings on a forward going basis for the presence of char?
A Yes, sir.
Q You haven't been able to make any determination from any sample or photograph that you've seen and the result that any char is present at Bridgeton Landfill?
A No, sir.
Q And that's why you suggest doing that testing?
A Yes, just based on the understanding that typically pyrolysis is a key process in this I think your professionals concur that as well is typically a process that

generates tars and chars and I'm concerned about the presence of unreacted carbon in the landfill and I think/see that's worthy of investigation.

Q I know you are and I know from your report why you say that you are.

A Yes.

Q And, you know, it's really hard visually to look at a drill cutting and know the difference between old very wet waste stuff and tars and chars if you don't actually test it, right?

A Yes. I believe there's basically like continuous core samples, like sonic drill rigs that will a continuous core and then there's basically opportunities to do carbon analysis to determine the carbon content of that material which will provide you a very good, you know, indication of whether the material left is inert non-carbonaceous material which would be the case of ash or whether there's still a lot of carbon left.

MR. BECK: I guess I am reluctantly willing to close the deposition, even though I've got

a lot of stuff I would like to cover because I've had two full days and I recognize that as being the longest length of time we've allowed anyone for anything in this case, so --

MS. WHIPPLE: Would you hold for a minute and let me talk to Andrew right outside?

MR. BECK: Yes.

THE VIDEOGRAPHER: Going off record. The time is 5:16.

(Discussion off the record)/

(Brief break)

THE VIDEOGRAPHER: Back on the record. The time is 5:17. Okay, this concludes today's deposition. It's the end of media unit number 4, Volume 2. Going off the record at 5:17.