United States District Court

District of Massachusetts

CIVIL No. 82-1672-S

ANNE ANDERSON, for herself, and as parent and next friend of **CHARLES ANDERSON,** and as Administratrix of the Estate of **JAMES ANDERSON; CHRISTINE ANDERSON; RICHARD AUFIERO,** for himself, and as parent and next friend of **ERIC AUFIERO,** and as Administrator of the Estate of **JARROD AUFIERO; LAUREN AUFIERO; DIANE AUFIERO,** for herself, and as parent and next friend of **JESSICA AUFIERO; ROBERT AUFIERO; KATHRYN GAMACHE,** for herself, and as parent and next friend of **AMY GAMACHE; TODD L. GAMACHE; ROLAND GAMACHE; PATRICIA KANE,** for herself, and as parent and next friend of **MARGARET KANE; KATHLEEN KANE; TIMOTHY KANE;** and **KEVIN KANE, Jr.; KEVIN KANE; DONNA L. ROBBINS,** for herself and as parent and next friend of **KEVIN ROBBINS,** and as Administratrix of the Estate of **CARL L. ROBBINS, III; MARY J. TOOMEY,** for herself and as next friend of **MARY EILEEN TOOMEY,** and as Administratrix of the Estate of **PATRICK TOOMEY; RICHARD J. TOOMEY; JOAN ZONA,** for herself, and as Administratrix of the Estate of **MICHAEL ZONA; RONALD ZONA; ANN ZONA; JOHN ZONA;** and **PAT ZONA,** Plaintiffs

versus

CRYOVAC, Division of **W. R. GRACE & CO.; W. R. GRACE & CO.; JOHN J. RILEY COMPANY,** Division of **BEATRICE FOODS CO.; BEATRICE FOODS CO.;** and **XYZ** Company(ies), Defendants

Deposition of **JOHN H. GUSWA,** taken on behalf of the Plaintiff pursuant to the applicable provisions of the Federal Rules of Civil Procedure, before Nancy L. Eaton, Notary Public in and for the Commonwealth of Massachusetts, at the offices of Foley, Hoag & Eliot, One Post Office Square, Boston, Massachusetts, on Tuesday, January 21, 1986, commencing at 8:50 a.m.

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APPEARANCES

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171 Milk Street, Boston, MA 02109, for the Plaintiffs.

HALE & DORR,
by **DONALD FREDERICO, Esquire,**
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for Beatrice Foods.

FOLEY, HOAG & ELIOT,
by **AMY WOODWARD, Esq.**
One Post Office Square, Boston, MA 02109,
and **MARK STOLER, Esquire,**
for W. R. Grace & Co. & Cryovac, Division of W. R. Grace & Co.

Also Present for part of Deposition: William Crowley, Esq. and Thomas Kiley, Esq. for the Plaintiff.

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Stipulation

It is stipulated and agreed by and between counsel for the parties after the witness has read the deposition, it may be signed before any notary public, and the filing of the deposition may be waived. It is also stipulated and agreed by and between counsel for the parties that all objections except as to the form of the question and all motions to strike are reserved to the time of trial.

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JOHN H. GUSWA,

having been duly sworn, testified as follows in answer to direct interrogatories:

(Resume was marked Exhibit 1).

Q. (BY MR. SCHLICHTMANN) I show you Guswa 1 and ask you examine that. Is that an updated curriculum vitae?

A. There's just one minor addition and that would be now a Technical Editor for Groundwater Magazine, reviewer of articles. That is the only minor change.

Q. Doctor, Guswa, when were you retained in

this case?

A. I became involved in the case in June of this year, June of 1985.

Q. And who retained you?

A. Foley, Hoag & Eliot.

Q. Were you retained on behalf of W. R. Grace corporation?

A. I believe so.

Q. And you're not retained on behalf of the Beatrice Foods corporation?

A. No.

Q. What was your understanding of your responsibilities when you were retained?

A. We were asked to look at the site, hydrogeologic conditions at the Cryovac plant and within the Aberjona River valley and to evaluate whether or not there is currently -- whether chemicals are currently flowing off site in the groundwater beneath the Cryovac plant, and if so, could they have flowed off site prior to 1979; and if they did that, could they have reached wells G and H prior to 1979; and if they did that, I guess what volumes and what quantities are likely to have reached those wells, and also to look at the

possibility of other potential sources upstream of wells G and H.

Q. And how did you undertake those responsibilities?

A. Well, initially we reviewed a lot -- we reviewed as many of the reports as we could get access to and I believe, I don't know of any reports that we have not had access to, work done by Ecology & Environment, the EPA, the N U S, I guess N U S was involved later, the EPA reports. W. R. Grace hired Geoenvironmental Consultants to do some on-site work for them, reviewed some DEQE memos and letters and sort of historical reports regarding the Aberjona River valley, looked at some -- reviewed some reports describing the entire geology, the hydrogeology of the Aberjona River valley. There is the geologic report that describes the glacial geology of the Mystic Lakes which includes the Aberjona River valley. Reviewed the fundamental geologic reports, a regional scale, and then as it pertained to the information available on the Cryovac plant.

Q. And after your reviewing of this information, did you form any opinions?

A. I formed an opinion that there currently is -- there are chemicals flowing off the Cryovac plant at present. I have formed the opinion that there is potential for numerous upstream other sources of contamination or numerous sources of contamination to wells G and H upstream of wells G and H. I have not formed an opinion yet as to whether or not material is likely to have flowed off site prior to 1979, and consequently have not formed an opinion about whether it got to wells G and H or not.

Q. In your opinion the Grace site is a source of contamination of the groundwater of the East Woburn aquifer; is that right?

MS. WOODWARD: Objection. You can answer.

A. In my opinion there are chemicals that are flowing off site at present.

Q. And what are the chemicals that are flowing off site from the Grace site in your opinion?

A. The ones that I have looked at are trichloroethylene, tetrachloroethylene and 1,2-transdichloroethylene.

Q. Doctor Guswa, what is your understanding of the site activities at the W. R. Grace plant in Woburn, the history of the site activities?

MS. WOODWARD: Objection. You can answer if you can.

A. I am not quite sure what you mean.

Q. What is your understanding as to what took place historically at the site?

A. My understanding is that the plant either manufactures or prepares machinery for packaging of frozen foods or something like that.

Q. Is it important for your opinion as to when contamination got to wells G and H as to when the site became contaminated?

MS. WOODWARD: Objection. You can answer if you understand the question.

A. In order to evaluate whether or not contaminants flowed off site prior to 1979, I would have to do calculations regarding time of travel through the materials that are found on site. I would have to have information about where the source areas were, where they are with respect to the groundwater flow system and I would need that information to form an opinion.

Q. Would you also have to know when the contaminants were actually disposed of on the site to determine the period of time when in all probability they got to wells G and H?

MS. WOODWARD: Objection to the form. Answer if you understand the question.

A. Well, if nothing got on the ground until after 1980, that would answer my question very simply.

Q. And if something got on the ground prior to 1979, you'd want to know when that was so that you could determine your travel times to see when the contaminants got to wells G and H?

MS. WOODWARD: Objection. Go ahead and answer if you can.

A. In terms of determining the travel times, you can do that independent of knowing when the material got into the ground. You can do the analysis without knowing when the materials actually deposited. If, for instance, the analysis says it was one hundred years, then it is not important to know when the material was put on the ground. If the analysis indicates that it is five years, it may be important to know that.

Q. And have you done that analysis?

A. No.

Q. What do you have to do to do that analysis as to travel time?

A. To do the analysis of the travel time is to incorporate hydrogeologic conditions that exist on the site of course, namely, the water transmitting properties and the hydraulic gradient and the distance of travel to make an estimate of the travel time.

Q. What do you mean by the water transmissivity?

A. The transmissivity or hydraulic conductivity of the aquifer is an indirect measure of its water transmitting properties and of water to transfer through that. That's a function of several different things, but basically it is a drain size of the material through which it is going, of the degree of interconnectedness within the material, and that's also related to the degree of sorting of the material that's on site.

In other words interconnectedness is greater in materials that all have the same size and shape. Materials have different sizes and

shapes, the smaller particles tend to fill in the pore spaces between the large spaces, so there is less interconnectedness of material, and that would be reflected in doing some testing of lower values for hydraulic conductivity.

Q. Have you made any determinations as to how transmissive the soils are on the Grace site?

A. There have been slug tests. I have not personally made any determination. There have been slug tests done on site in an attempt to measure hydraulic conductivity.

Q. Are you aware of those results?

A. Yes.

Q. What do those results indicate to you concerning the transmissivity of the soils?

A. Well, that there is an extreme variability in the hydraulic conductivity across the site, that values of, well, extremely low values to I'll say moderate values on the site. I don't remember what those numbers are. I know that some numbers are less than one foot a day. They might be as low as a hundredth of a foot a day, and I think the highest number, and I really would have to check this to verify it, but I think the highest number

is probably around five feet per day.

MS. WOODWARD: I think you ought to make sure when you refer to site in these questions, Jan, I'm not sure.

Q. I know.

A. I am talking about the Cryovac plant.

Q. That's what --

A. East of Washington Street.

Q. We'll get to the Beatrice site later.

MS. WOODWARD: There is obviously a lot of area between the Cryovac site and the wells G and H. For a time travel the distance of the site inside the --

MR. SCHLICHTMANN: After I finish deposing Doctor Guswa, I will depose you.

MS. WOODWARD: That will be be fun, Jan. I'm looking forward to it.

Q. You haven't made any calculation as to the transmissive qualities of the soils on the Grace site; is that right?

MS. WOODWARD: Objection. Go ahead and answer.

A. I think I just said that I have not done that myself, but there are those values that are

reported for hydraulic conductivity.

Q. Have you made any determination of the transmissive qualities of the soils in the vicinity of wells G and H?

A. No, I haven't.

Q. Have you examined the pump test data that was produced during December and January?

A. We have received some of the pump test data and we have not received it all. I have reviewed some of the data but not all of it.

Q. And have you formed any conclusions in reviewing that data?

A. The only conclusion that I have formed at this point is that we don't have all of the data we thought we were going to get.

Q. Did you examine the water levels that were taken on the Grace site during the pump test?

A. Yes.

Q. What did those water levels do during the pump test?

A. During the pump test they rose.

Q. How far did they rise?

A. Well, I'd have to review the data again to be sure, but my recollection is that we're talking

less than a foot, maybe even less than a half a foot water level rise.

Q. And was that unusual in your opinion?

MS. WOODWARD: Objection.

Q. That the water levels rose during a pump test?

A. Well, the Grace site is several thousand feet away from the pumping wells. The material is material that is referred to as ground moraine deposits, generally low permeability material. There were storm events during the pump test. I did not really expect to see any water level change at the Grace site due to pumping wells G and H, due to my conceptual understanding of where it is located geologically with respect to wells G and H. The fact that the water levels rose to me is just a reflection of the rainfall events that took place during the pump test.

Q. So as far as you're concerned in evaluating the water level information generated by Geoenvironmental during the pump test, there was no hydraulic connection between the Grace site and the pumping of wells G and H; is that right?

MS. WOODWARD: Objection.

A. I don't think -- that's not what I said. I said there was no change at the Grace site in response to the pumping.

Q. Do you think there is a hydraulic connection between the Grace site and the pumping of wells G and H?

A. You'll have to explain a little more detail what you mean by hydraulic connection.

Q. Is that a term of art you're familiar with, hydraulic connection?

A. Well, I would say that the Atlantic Ocean and the Pacific Ocean are hydraulically connected, so basing it in that sense, I believe that all geologic materials are hydraulically connected.

Q. So the answer to my question then in some sense the Grace site is hydraulically connected to the aquifer serving wells G and H; is that right?

A. Yes.

Q. And is there another sense in which you use the word hydraulic connection?

A. I only raise the cautionary statement because some people imply or use the word I think inappropriately when they talk about hydraulic connection and assume something greater than I

think I would assume when other people say hydraulic connection.

Q. How do you use the phrase hydraulic connection?

A. I use the phrase hydraulic connection as the water is in the ground. There are different materials in the ground. There is a continuity of water within the ground, so everything is hydraulically connected.

Q. Well, do you consider that the East Woburn aquifer has certain bounds or limits?

A. The aquifer, yes. Aquifer is a man derived term that generally originally was based on the economic feasibility of withdrawing water in sufficient quantities to supply a well, so typically when one looks at aquifers, particularly in the glaciated New England area, the wells are put in close to the rivers because the materials there are more conducive to providing water to wells.

Q. Do you consider that the, well, you do consider that East Woburn aquifer has certain bounds or limits conceptually; is that right?

MS. WOODWARD: Objection.

Q. Or has no bounds?

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

Q. What's troubling you?

MS. WOODWARD: Objection.

A. I don't understand what you mean. I explained to you that my view of the earth is sort of being unbounded. On the other sense the aquifer, the areas which is more productive for water producing and which is going to be the main contributor to the water does not include the whole world or the whole earth.

Q. Doctor Guswa then, you consider that the W. R. Grace site is part of the East Woburn aquifer serving wells G and H, is that right?

MS. WOODWARD: Objection.

A. I wouldn't call it part of the aquifer, no.

Q. Why wouldn't you call it part of the aquifer?

A. Because the aquifer has been defined by other people who have done their analysis and used the commonly accepted definition of aquifer.

Q. Well, how do you define it?

A. The aquifer is -- the only definition of

aquifer that I know, formal definition of aquifer, is materials that produce water in sufficient quantities to be economically feasible for development.

Q. Do you consider that the groundwater underneath the Grace site flows towards wells G & H?

A. I don't know whether it flows -- it flows, let me just say it flows in a general sense towards wells G and H. I don't know whether it gets to wells G and H.

Q. But you do -- in your opinion the groundwater underneath the Grace site does flow towards wells G and H?

A. That's right, at least as it is leaving the property, that's correct.

Q. Do you have an opinion that it stops someplace?

A. I don't know that it would stop but it might be diverted.

Q. Do you have an opinion where it is diverted?

A. I have an opinion where it might be diverted.

Q. Where is your opinion as to where it might be diverted?

A. Can I get out a map to show you?

Q. Certainly. Be my guest. Refreshing. That's not the whole world now, is it?

A. No.

(Mr. Cheeseman joined the deposition).

A. This is a map that was produced by the Geological Survey. It is a hydrologic atlas HA 589. It is called Hydrology and Water Resources of the Coastal Drainage Basins of Northeastern Massachusetts from Castle Neck River, Ipswich, to Mystic River, Boston and it was published in 1980 by the U. S. Geologic Survey; and this area on the western portion of sheet 2 of this atlas has what's defined or drawn to be the Aberjona River valley aquifer and that typically would be this dark blue area which parallels or generally coincides with the course of the Aberjona River.

Now, as water comes off the -- see if I can find where I am here a minute. This is the W. R. Grace property right here, I believe (Indicating).

And this is well H and this is well G. This property is located -- this is what is referred to on this map as till, poorly sorted

glacial material with characteristically low transmissivity.

On another map, from a report entitled Glacial Geology of the Mystic Lakes-Fresh Pond area, Massachusetts which is U. S. Geological Survey Bulletin 1061 F -- find out where I am here again. That area is shown as a pink area on this map and is labeled ground moraine deposits, chiefly till, as one moves from position or the location of the W. R. Grace plant -- where is that again -- here down towards the center of the river valley, there is a color change on the map shown in the Hydrologic Atlas report.

That map, that color change is done to reflect the change in the water transmitting properties of the materials that exist there. Intermediate between the W. R. Grace plant and wells G and H there is a light blue area which actually I guess really is not light blue but it is white. There is -- it is a light blue area, sorry, which is a zone of low transmissivity. That area was determined for mapping purposes on the basis of one well log. Therefore the exact dimensions of that are really not known on the basis of this map.

There is an indication from this well that there is a zone of low transmissivity, perhaps a barrier to flow or diversion to flow, groundwater which is flowing in this direction.

My understanding is that the EPA has installed additional wells in this area. One of the pieces of information I'd like to get from that is to see whether or not this material exists and if it is as extensive as shown here, more extensive or less extensive, but I guess to summarize your question shortly, there is an area where there might be potential diversion away from wells G & H.

Q. Where would it be diverted to?

A. It would be diverted this way or it could be diverted that way. If it is diverted to the north, it would, could end up in wells G and H. If diverted to the south, it may not.

Q. Now, in making a determination, will you be able to make a determination from examining the well test data as to whether or not it was diverted or not?

MS. WOODWARD: Objection.

A. I could make a determination about the relative --

Q. I'm sorry.

No, I didn't mean to interfere with your answer.

A. I could not make a direct determination about whether it is diverted or not. I'd make an interpretation of whether it was diverted or not after some subsequent analysis.

Q. Let's have these marked as Guswa Exhibit 2 and Guswa Exhibit 3.

(Hydrologic Atlas was marked Exhibit 2).

(Map from US Geological Survey was marked Exhibit 3).

(Off the record discussion).

MR. SCHLICHTMANN: In fact if you just Xerox the titles for me, that will be sufficient for me.

MS. WOODWARD: I'll do my best.

MR. SCHLICHTMANN: If you can't do it today, I'd like to have the originals because there has been a delay in my getting --

MS. WOODWARD: If there has been a delay, tell us now what that is.

MR. SCHLICHTMANN: Doctor Tannenbaum's resume which was marked, although I have asked Marc

several days running.

MS. WOODWARD: You'd make a request that I remind Marc to send it?

MR. SCHLICHTMANN: I don't think it is necessary to make a request. I am telling you my problems and hopefully you'll take care of them.

MS. WOODWARD: We'll do our best.

MR. SCHLICHTMANN: Can you give me a Xerox copy of these titles of these things today?

MS. WOODWARD: I'll do my best.

MR. SCHLICHTMANN: If you can't do it today, then I want the originals before the end of the day.

MS. WOODWARD: The originals will stay here because they are exhibits to this deposition.

MR. SCHLICHTMANN: That's right. They'll go with the stenographer.

MS. WOODWARD: That's right. If I can't give you Xeroxes of the titles today, I'll give you Xeroxes of the entire maps.

Q. Doctor Guswa, what type of data would you have to look at in order to make your interpretation as to whether the contaminants were

diverted from wells G and H on the Grace site?

MS. WOODWARD: Objection.

A. I believe the original question was whether water could be diverted around that. It would be my intention to upon receipt of the EPA information from the pump test including the well logs, the water level data and the elevation of the top of the casing which was used as the measuring point for water level data to take that information and formulate a conceptual model detailed understanding via cross sections, geologic sections of material of the flow system, and then translate that into a mathematical model and then a numerical groundwater flow model.

Q. What kind of information would lead you to believe that groundwater is diverted from the Grace site?

MS. WOODWARD: Objection.

Q. To wells G and H or excuse me, is diverted away from wells G and H from the Grace site?

A. The purpose of the analysis as to till, it is really not to see whether it is diverted away from wells G and H but to see in fact which way the groundwater does flow after it leaves the Cryovac

property and as it flows towards the Aberjona River valley.

Q. What kind of information would tend to indicate that the groundwater moved away from wells G and H from the Grace site?

MS. WOODWARD: Objection. Can you answer the question?

Q. I think he can answer it.

MS. WOODWARD: Can you understand it?

A. I thought I do. I think I do. I'll rephrase the question and answer; and if it is what you're asking, then I will answer the question.

Q. That's very nice of you, thank you.

MS. WOODWARD: Very helpful.

Q. Very nice.

A. You're asking what kind of information should be included in the analysis to evaluate --

Q. No.

A. Flow direction from the Cryovac plant.

Q. No, I want to know what type of information would tend to indicate to you that the groundwater from the Grace site was being diverted away from wells G and H?

MS. WOODWARD: Same objection.

A. Well, I suppose if we had a tracer we could follow the tracer and see if that was diverted away.

Q. A tracer would be something in the groundwater?

A. Something that you would put in the groundwater.

Q. And how would you be able to trace it if you put it in the groundwater?

A. Well, I'm not a specialist in tracer technology, but there are different kinds of tracers. There are dye tracers. There are isotope type tracers, and you inject it at one location and have installed monitoring points where you take samples and see if the tracer occurred at that location, some subsequent location at some subsequent time.

Q. And is the way that you use a tracer is that you put the tracer in one part of the geography of the site and then at various locations from that point you put monitoring wells to see if the tracer shows up in those monitoring wells?

A. That would be one way of doing it, yes.

Q. And if you put your tracer in one spot

geographically and then you would put monitoring wells down gradient from that?

A. In what you thought was a down gradient direction, that's right.

Q. If the tracing kept coming up in the monitoring wells, that would be an indication to you that the tracer was flowing with the -- that the groundwater was indeed flowing in the direction you thought?

A. That would be an indication that some of the water was flowing in that direction. If the tracer showed up in some other location, let's say there were a partial diversion and the tracer showed up in that other location, that would be an indication there was that sort of a diversion.

Q. And if the tracer showed up in several locations, that would indicate that you're mapping out the down gradient portion of the groundwater; is that right?

MS. WOODWARD: Objection.

A. The concept is you follow the tracer and you see where the tracer occurs to see where the groundwater is flowing.

Q. And the way that you trace the tracer is

by putting monitoring wells into the earth, into the groundwater, and seeing if the tracer shows up in the groundwater?

A. That's right.

Q. And if you have a general idea of what the groundwater flow is, the gradient is and the tracer keeps coming up and monitoring wells in the down gradient portion or what you believe to be the down gradient portion, then you conclude as an engineer and as a scientist that in all probability that the groundwater is flowing in the direction that you had thought. Is that right?

MS. WOODWARD: Objection.

A. Well, I think what you're saying is that if the tracer shows up in many different locations, it is showing that the groundwater is spreading out and additional water is being added from precipitation, etc., some of the water is flowing in each of the directions where the tracer has been found.

Q. And that spreading out of the tracer, that's known in your science as a plume; is that right?

MS. WOODWARD: Objection.

A. Well, that's right, yes.

Q. So in trying to find out where the groundwater was flowing, you would follow that plume of the tracer; is that right?

A. That's right and you're assuming that you know exactly when and where the material was introduced and there were no other materials introduced of a similar composition.

Q. Yes.

A. That's right.

Q. Now, Doctor Guswa, one thing you want to do then in determining whether -- when contaminants from the Grace site ended up at the wells G and H over a period of time is that you'd have to understand the travel time of the contaminants?

MS. WOODWARD: Objection.

A. Well, I am not sure the contaminants ever got or chemicals ever got to wells G and H.

Q. Uh-huh.

A. So could you rephrase your question again?

Q. One of the things you want to do in determining whether in fact contaminants from the Grace site ended up at wells G and H is determine if the groundwater flows to wells G and H from the

the Grace site?

A. That's right.

Q. That's the question you have right now, whether in fact the groundwater flows to wells G and H?

A. That's right.

Q. Now, if in fact the groundwater goes flow from the Grace site to wells G and H, is there something else you want to know?

A. Then you'd want to know how fast the water moves from the Grace site to the wells G and H and how fast any chemicals contained in that site would move.

Q. Have you made a determination how fast the groundwater moves off the Grace site?

A. No.

Q. And once you have determined how fast the groundwater moves and the direction of the groundwater, would you then be able to determine how long it took the contaminants from the Grace site to get to wells G and H?

MS. WOODWARD: Objection.

A. Once you determined how fast the groundwater moves and -- state the question again.

I just forgot.

Q. Yes, if you determined the groundwater moves from the Grace site to wells G and H and you determined how fast the groundwater moves from the Grace site to wells G and H, would that be sufficient for you to come to an opinion how long it took the contaminants from the Grace site to get to wells G and H?

MS. WOODWARD: Objection.

A. That would give you an opinion as to how fast contaminants or chemicals, if there were chemicals at the boundary of the property, how fast they would have taken to get to wells G and H.

Q. Yes.

A. It doesn't tell you anything about the length of time that would have been required or may have taken from any disposal or any disposal area or location, doesn't tell you anything about the length of time it would take to get from that location to the edge of the property.

Q. Well, to determine that, you'd still have to know how fast the groundwater moved on site; is that right?

A. That's right.

Q. Once you determined how fast groundwater moved on site, would you then have sufficient information for you to come to the opinion as to how long it took those contaminants to get from the Grace site to wells G and H?

MS. WOODWARD: Objection.

A. I think you'd have -- you have to look also at what happens, where the material was disposed or placed, how long it took to get from there down to the zone of saturation of the water table. Then if you were somehow able to quantify each of those individual subsets, you'd have information on which to form an opinion as well as an estimate of the uncertainty in that opinion.

Q. All right. But once you have determined where the sources of contamination were, once you have determined that those sources of contamination have reached the groundwater and once you have determined how fast groundwater moves in the site and from the site to wells G and H, you then have sufficient information for you to determine how long it took the contaminants to get to wells G and H; is that right?

MS. WOODWARD: Objection.

A. Those are the general categories of information you have to have to determine, to calculate travel time.

Q. You wouldn't have to calculate anything else other than those things; is that right?

A. Excuse me, there is one other thing. You would need to know some information about the quantity of chemicals that may have been disposed.

Q. Okay. And after you determined the quantity of the chemicals that were disposed, would you then have sufficient information how long it took contaminants to get from the site to wells G and H?

MS. WOODWARD: Objection.

A. You'd have to have additional information to determine whether or not they got to wells G and H and if there were sufficient quantity disposed of that it could have gotten to wells G and H, then you could make, form an opinion about the travel time, yes.

Q. So the travel time then, assuming contaminants are in the groundwater at the Grace site, assumming that the contaminants are at the edge of the Grace property in the groundwater, once

you know that, once you know that there is groundwater contamination at the edge of the Grace property, all you need to know then, is how long the contaminants got from the Grace site to wells G and H, is to know how fast the groundwater moves; is that right?

MS. WOODWARD: Objection.

A. It would be how fast the contaminants or the chemicals in the groundwater would move.

Q. What would you have to have to know that?

A. Well, you would have to know what the chemical is that you're looking at and how it behaves physically, chemically and biologically or what the physical, chemical and biological processes that act on it as it moves through the ground.

Q. And do you have an opinion as to how trichloroethylene moves in the groundwater?

MS. WOODWARD: Objection.

A. My general opinion is that there are processes that act on it, but the magnitude of those processes I don't know. I am talking about processes such as chemical, biological and physical such as dispersion that would all affect it.

Q. Do you have any opinion as to how those things affect trichloroethylene in the groundwater?

A. Well, the physical dispersion would tend to reduce concentration. And the other processes that caused trichloroethylene to react would tend to reduce the concentration. That's the limit of my understanding of those things.

Q. Well, do you have an opinion as to how trichloroethylene was affected in the groundwater in this case?

MS. WOODWARD: Objection.

A. No.

Q. You haven't done the work. Do you intend to do the work? To determine that?

A. Specific details of measuring those particular properties, no.

Q. Why don't you intend to do that? It is not necessary in answering the question as to how long the contaminants got from the Grace site to wells G and H?

A. It is not that it is not necessary, it is that the values that you measure at one location may not be appropriate for another location, and so I don't know, how many points do you measure? I

don't know how many points to measure, would be necessary to make those determinations.

Q. If you don't measure those points or don't intend to, would you still be able to come to an opinion how long it took trichloroethylene from the Grace site to get to wells G and H?

A. I think you can still form an opinion, yes.

Q. Why can you still form an opinion even if you don't have that information?

A. Well, you can use some simplifying assumptions, standard practice. One assumption might be let's assume nothing happens to trichloroethylene as it moves through the ground. Look at travel times for the conditions when nothing happens to it. Look at the conditions -- I'm not familiar with the information, but there are, I believe, reports available that talk about those kinds of factors that affect TCE, so there are reaction rates that could be incorporated into the analysis; and so you might say: Well, let's say there is an effect of a ten percent reduction in the travel time because of adsorption.

Let's suppose there is a certain amount of biodegradation that might go on. I don't

know what those numbers are. Those numbers can be incorporated and those are typically done either with what might be called a sensitivity analysis or a bracketing type analysis when there is information that affects the transport but which is not readily measurable or interpretable, you bracket the range of conditions likely to expect, calculate travel time for each of the alternate areas, and on the basis of that form an opinion which one thinks -- I would think would be the most likely condition to exist.

Q. Do you intend to make simplifying equations?

MS. WOODWARD: Objection.

A. I intend to do bracketing type analysis, yes.

Q. And what are the values you intend to use when you do your bracketing analysis?

A. I haven't made that determination yet.

Q. How would you obtain the information to make those bracketing analyses?

A. I would talk to people who do column experiments or laboratory experiments on TCE and the other chemicals that we're looking at to see

what their best knowledge is in terms of D K rates, D K rates and adsorption coefficients.

Q. And would you rely on that information in making your calculations?

A. I wouldn't replace it with my own independent analysis if that's what you mean.

Q. Well, you would have received that information, you would independently analyze it yourself to satisfy yourself that it was valid and then you would use it in your calculation?

A. Yes.

Q. That's an appropriate scientific methodology in solving this problem as to how long it took contaminants from the Grace site to get to wells G and H; is that right?

A. Well, the way you said it, it seems like it is, yes.

Q. Good, all right. Tell me if I don't say it the right way.

Doctor Guswa, do you have -- so it is important to you in figuring out whether in fact contaminants got from the Grace site to wells G and H as to when contaminants were first put on the property in the Grace site; is that right?

A. Yes, that would be important, yes.

Q. Well, do you have any understanding as to when the site first became contaminated?

A. No, I don't.

Q. Has that information been provided to you?

A. No, it hasn't.

Q. Have you asked for that information?

A. I have asked is there any information such as that and there is no factual information.

Q. Have you been told that there is no factual information as to when contamination was first introduced onto the Grace site?

A. I believe that there is no factual information. The answer is yes, I don't think anybody knows when it was first introduced on the Grace site.

Q. What kind of information would that be? What form would that information be?

A. Well, that would be some record of someone doing something to put contamination or put the chemicals on the Grace site.

Q. And how would, what would be the mechanism by putting contamination on the Grace site?

MS. WOODWARD: Objection.

Q. What would be the method that you would use?

A. I don't know what are the different methods of introducing contamination onto the Grace site.

MS. WOODWARD: Objection.

A. Well, I think that's something that people that work for W. R. Grace are still trying to figure out.

Q. And have they figured it out yet?

MS. WOODWARD: Objection.

A. If they have, they haven't told me.

Q. They haven't told me either. We all pray that they figure it out. Doctor Guswa, what would be the methods that would introduce contamination onto the Grace site? What are the different ways it could happen based on your experience?

MS. WOODWARD: Objection. Are you asking hypothetically what are the different possible ways or are you talking specifically about the site?

Q. May I have the question read to the witness, please?

(Question reread).

A. Well, if we're just talking about wonder if type ways of which contaminants can be introduced into the ground or on the ground regardless of whether it is the Grace site or not, there may be a spill, there might be a leak. There might be dumping of wastes on the ground. There may be midnight dumpers, meaning people who just find a convenient spot to dump their material. There could be leaky sewers, there could be surface runoff that flows onto the site. I'm sure there are an infinite number more that I don't know about, that I couldn't name.

Q. Would dumping on the site including digging pits on the property and pouring waste solvents into a pit?

A. Well, that could be a way, yes.

Q. Could another method of contaminating the site be pouring waste solvents down a storm drain which flowed into a drainage trench onto the property?

A. That could be a way.

Q. Could another way be just pouring waste solvents on the ground?

A. That could be a way.

Q. Now, all of those ways are capable of contaminating the groundwater in your opinion?

MS. WOODWARD: Objection.

A. They are capable of putting the chemicals on the ground. Whether or not they contaminate the groundwater would be a function of what happens to them once they reach the ground.

Q. Well, what happens to them once they reach the ground?

MS. WOODWARD: Objection.

Q. In your opinion?

A. Well, there can be a lot of things that happen to them and particularly at a site like the W. R. Grace site which is ground moraine deposits which have extreme variability in their lithologic materials, once material is put on the land surface the initial -- I guess there are two initial reactions if we're talking about TCE.

One is for volatilization to occur and the other -- so there is an upward component, some of it is going off into the air somehow. There would be a downward component or a tendency to move downward into the soil because of the effects of the gravity. How far it moves down into

the soil will depend on the volume of material that was put on the ground or released at any particular time.

In cases where there is only a minor amount disposed, it is likely that material would not move very far into the ground before it is basically adsorbed or sucked into the soil due to capillary pressure similar, you know, water retention phenomenon that sort of maintains the plants and the trees that grow on the soil. So depending on the volume, it may not go very far.

If there is a sufficiently large volume you were put on, and I don't know how to quantify sufficiently large, then it may actually penetrate down completely to the water table. The length of time it would take to get to the water table would be dependent upon the kinds of material it encounters along the way, meaning what kinds of geologic materials, what the grain size, what the level of saturation in that material is. If the material is very dry, for instance, such as it probably was during the drought of the mid sixties, it is very unlikely anything would have gotten very deep into the soil because the soil was very

extremely dry and had a greater capacity for retaining fluids, whether it was rainfall or whether they were chemicals.

Q. Doctor Guswa, when it rains, does the rain, when it hits the ground, where does it go?

A. Some will go into the ground, some will run off. Some will evaporate. Some will move on through the ground depending on how much rain we have, some will make it down to the water table and some may not.

Q. When rain hits the ground and on ground which has been contaminated with trichloroethylene, is it your opinion that rain is going to carry with it some of that trichloroethylene into the groundwater?

MS. WOODWARD: Objection.

A. It is my opinion that it could, yes.

Well, excuse me, could but the fundamental principles are the same and that depending on the amount of rainfall, if it flows past the trichloroethylene, if it becomes dissolved in, if the trichloroethylene or the chemical becomes dissolved in the rainfall, and if the rainfall makes it to the water table, then it would

be carried down to the water table.

Q. And Doctor Guswa, would, is a better method of getting trichloroethylene or not a better method but a faster method of getting trichloroethylene into the groundwater if you had a pit in the ground several feet deep in which the waste solvents which contained trichloroethylene were poured into the pit?

MS. WOODWARD: Objection.

A. It would cause a release to be closer to the water table. It may or may not be faster depending on what kind of material is under the particular pit.

Q. Suppose it is rocky and gravely?

MS. WOODWARD: Objection.

A. Well, that's not kind of good enough description because rocky or gravely could be a very big rock or it could be ground moraine or it could be glacial outwash which is rocky also. What I was saying was that if all conditions were equal, meaning the same lithologic materials were encountered, the closer you release it to the water table, the greater the probability that it would get to the water table; but that's not universely

true because there are geologic -- there is geologic variability, so I can also conceive of situations where material excavated, would be excavated on top of a clay layer or a till layer with a very low permeability such that there would be no significant penetration or no rapid penetration of that material.

Q. Now, you have examined the test well results of the Grace property?

A. Yes. Well, I'm sorry. I have looked at the lithologic logs for the property and I have seen the slug test results.

Q. Have you seen the chemical analysis of the water on the grade size?

A. I have seen chemical analysis. I have probably seen all of it, most of it. I'm not sure.

Q. Do you have an opinion whether the chemical analysis shows the groundwater on the Grace site or any part of it is contaminated with chemicals?

A. There is contamination of the groundwater, the chemicals in the groundwater on the Grace site.

Q. How would you characterize it?

MS. WOODWARD: Objection.

A. Well, relative to what?

Q. Do you have any characterization?

MS. WOODWARD: Objection.

A. No, I don't.

Q. Would you call it a small amount, moderate amount, high amount?

MS. WOODWARD: Objection.

A. I would characterize it as from what I've seen ranging from none detected to several thousand parts per billion.

Q. Do you consider several thousand parts per billion to be a high amount of contamination?

MS. WOODWARD: Objection.

A. I really don't know.

Q. Do you have an opinion based on your experience as a hydrogeologist as to whether that is a high amount of contamination?

A. I have been in sites where contamination levels of five hundred thousand parts per billion have been recorded.

Q. You consider five hundred thousand a lot?

A. Well, I don't know. I guess it depends on what the chemical is.

Q. And are you familiar with how high the

chemical data, what some of the highest values of the chemical data are for the Grace site?

MS. WOODWARD: Objection.

A. I don't know if I'm familiar with what the highest is. I believe I have seen four thousand. I think four thousand parts per billion TCE.

Q. Have you seen anything higher?

A. I think I have seen 6 thousand TCE but I am not sure.

Q. Well, you consider those high?

MS. WOODWARD: Objection.

A. With respect to what or relative to what or for what purpose? I don't know.

Q. Would you consider them high for purposes of contamination of the aquifer in East Woburn?

MS. WOODWARD: Objection.

A. That's not an area that I have been asked to analyze. I am not a toxicologist. I am not an environmental fate and risk person. I will look at how groundwater moves from land surface down to the water table and through the ground and offer opinions about travel times and directions of movement, but it is not my area of expertise to talk about what is acceptable and not acceptable in

terms of levels of concentration.

Q. Well, do you consider trichloroethylene to be a hazardous material?

MS. WOODWARD: Objection.

A. I have not -- there are people that say that it is. There are people that say coffee is hazardous or people who say too much coffee is hazardous. I don't know.

Q. I want to know what your opinion is.

MR. WOODWARD: Jan, he told you he does not have an opinion. He is not a toxicologist.

Q. You can make your objection.

A. I have no opinion.

Q. You have no opinion whether trichloroethylene is hazardous; is that right?

A. That's right.

Q. Now, you work as a hydrogeologist?

A. Yes.

Q. And you have investigated several sites?

A. Yes.

Q. Sites where manufacturing plants have contaminated the groundwater?

MS. WOODWARD: Objection.

A. The sites I have worked at generally have

included abandoned landfills, active landfills, waste processing facilities I believe is the euphemism that was used for the operation, barrel cleaning type operations.

I have never worked -- to my knowledge I have never worked then on a site that was either a manufacturing or processing facility.

Q. Doctor Guswa, I want you to assume that the groundwater in fact moves from the Grace site to wells G and H. I want you to assume you have done your investigation, your analysis and you have determined that the groundwater does move from the Grace site to wells G and H.

A. Uh-huh.

Q. Now based on the levels of contamination at the Grace site that you saw and with the assumption that the groundwater in fact moves to wells G and H, in your opinion at some -- over some period of time those contaminants from the Grace site will arrive at wells G and H; is that right?

MS. WOODWARD: Objection.

A. Let me just go over the assumption again. The assumption that the chemicals or the water does move from the Grace site to wells G and H?

Q. Yes.

A. And there are chemicals in the groundwater?

Q. Yes.

A. And so then the only thing I guess that I would need to know is the persistence of the chemicals, meaning what happens to them physically, biologically and chemically as they move from the Grace plant to wells G and H. Am I to make an assumption about that also?

Q. Yes.

A. Which is what?

Q. That they remain in the groundwater.

A. So there is no chemical transformation, physical transformation?

Q. That's correct.

A. Well, I think you asked me to assume they got there and I have concluded that they get there.

Q. Now, it wouldn't make any difference to you the levels of contamination in the groundwater; is that right?

A. As to whether they got to wells G and H?

Q. Yes.

A. No.

Q. Why is that?

A. Because you told me to assume that they got to wells, that the water goes to wells G and H, that there is nothing that happens to the chemicals as they flow from the plant to wells G and H.

Q. Yes.

A. So if nothing happens to them and the water is going to wells G and H, then regardless of the level of concentration, they would get to wells G and H.

Q. Now, in your examining the chemical data concerning the Grace site, it is clear to you, is it not, that past site activities contaminated the groundwater at some time?

MS. WOODWARD: Objection.

A. It is my opinion that there is, there are chemicals in the groundwater beneath the Grace site and they appear to be originating from somewhere on the Grace property, yes.

Q. And in your analysis of the data, is it also clear to you the locations where those sources of contamination are?

A. No.

Q. Is it --

A. Well, no, it is not. The exact location

is not clear.

Q. Is it clear or have you in examining the data, does the data indicate to you that one of the sources of contamination is underneath the present building?

MS. WOODWARD: Objection.

A. No, I don't know that as a source.

Q. You don't know that as a source?

A. No.

Q. Have you been shown any data indicating that the source of contamination, one of the sources of contamination at the site is underneath the building?

A. No.

Q. Have you seen any chemical data of wells around the building?

A. I have seen chemical data for -- I believe it is wells 13 and 14 along a trench that goes along the south side of the building.

Q. Are you aware that 13 and 14 go along the south wall of the building?

A. Yes.

Q. And did the levels of contamination in wells 13 and 14 that you have seen indicate to you

that there is a source of contamination underneath the building in that location?

A. Well, it indicates to me that the trench might be the source of contamination, source of the chemicals.

Q. Are you aware that the trench existed where there is now the second addition to the building?

A. That's right, yes.

Q. So?

A. You're talking about the additions to the building that went over the trench?

Q. Yes. So you're looking at the chemical data, it is an indication to you that the trench that is now built over by the second addition is one of the sources of contamination?

MS. WOODWARD: Objection.

A. The chemical data I look at in the wells on the southwest portion of the property, that data is consistent with that trench being a possible source of the chemicals, yes.

Q. Have you seen chemical data concerning the north side of the building?

A. I have seen something for well W 19.

Q. And what have you seen?

A. I have seen four analyses and I remember some puzzlement over the TCE concentrations in well W 19 as one value that is in the sixty thousand parts per billion and then others that are I think the replicate or duplicate for that, I am not sure what it was or what term it is, was in six thousand parts per billion; and then subsequent samples at two different dates were in that same range maybe up to eight thousand parts per billion.

Q. What does that indicate to you as to the area near well 19? Is that also another source of contamination?

MS. WOODWARD: Objection.

A. Well, it indicates that there are chemicals in the groundwater at that location, yes.

Q. And that would be a local source right at that well?

MS. WOODWARD: Objection.

A. It may be.

Q. And have you seen the well, chemical well data for the wells in the field in back of the property?

MS. WOODWARD: Objection. If you

know what wells he is talk about?

A. No, I don't.

Q. Wells 6 A and 6 B and 6 C.

A. I think, yeah, I think I have seen well data.

Q. Have you noted any levels of contamination in those wells?

A. I think, as I recall, there is an indication of some chemicals there. Generally in the -- my recollection is like ten parts per billion or less.

Q. Are you aware in that area that there are wells in the 6, 7, 8, 10 thousand parts per billion range?

MS. WOODWARD: Objection.

A. No, I'm not.

Q. Have you been informed that concerning the results of the site investigation this past July on the Grace site?

A. Site investigation by whom?

Q. Geoenvironmental, the Environmental Protection Agency and Weston Geophysical?

A. Is that Geoenvironmental report phase one through three or something like that?

Q. No that was previous to that. I am talking about this.

A. Is this the trenching over the fourth of July weekend?

Q. Yes.

A. I know that something happened, yes.

Q. Based on your analysis of the information produced during that site investigation, do you have any opinions as to whether there are any sources, major sources of contamination at the site in that field?

MS. WOODWARD: Objection.

What field are you talking about?

Q. The field on the Grace site.

A. I know there was some concern or I believe there was some concern about a pit and that there was, has been, is, has been sort of an interest; and there were a lot of geophysical or magnetometer, seismometer services out there and then some trenching done to investigate whether or not that was a source of chemicals; and my understanding now is that there were barrels found in the pit but that the concentration levels are indicative that it is not a source of chemicals.

Q. That would be the area where wells 10 are now?

A. I guess. I am not that familiar with where that trenching took place.

Q. Are you aware that there was an excavation this past July which indicated another pit that had been dug on the property?

MS. WOODWARD: Objection.

A. I don't know. I know that there was an analysis to see whether or not there was another pit. My understanding was that the results indicated that there was no second pit, but I'm not sure about that.

Q. Well, if wells on the property to the rear of the property in the vicinity of 6 A, B and C were showing levels of contamination of 6, 7, 8, ten thousand parts per billion of various contaminants, would that be an indication to you that there was another source of contamination?

MS. WOODWARD: Objection. Do you know exactly where these wells are?

A. I have an idea where the wells are. The chemical information is confusing to me because my understanding or what I have seen are that those

values are not appropriate for those wells.

Q. Well, if they are in that area, there is well data indicating contamination of wells in that area, what would that indicate to you?

A. It would indicate the water that was pumped out of those wells had that level of chemicals in it.

Q. What would those levels indicate to you? Would that indicate that was another source of contamination?

MS. WOODWARD: What levels are you talking about, Jan?

MR. SCHLICHTMANN: You want to make an objection?

MS. WOODWARD: Your questions have lost all content over the last five minutes. Yes, I'll make an objection.

MR. SCHLICHTMANN: Good. Continue to do that and make your objection. Everything will be fine.

A. Well, if the contamination levels were six or seven thousand parts per billion at those locations, I would suggest there was a source of chemicals to those wells nearby I guess. I am not

really sure to be honest.

Q. Have you been informed that the -- since the plant's existence in June of 1960 as to the methods that the plant used for disposal of their waste solvents?

MS. WOODWARD: Objection.

A. I don't think there is. I mean I have asked for whatever detailed information would be provided on, you know, what was done, and basically there is no detailed information. My general understanding of the practices would be that there is sort of a chronic or episodic release somehow of small volumes, but I don't know exactly when and exactly where and exactly how. Storm drains may be involved, people going to the back and spreading it on the land surface may be involved.

Q. How about the pouring of waste solvents into pits?

A. I have not -- I know that there is a concern about that, but I don't know that that actually happened. I have not been told that that actually happened.

Q. Have you been informed or have you received any information indicating that since the

plant began its existence in June of 1960, that the method of disposing of waste solvents at the plant was by pouring the waste solvents on the ground into, down the storm drains and into pits?

MS. WOODWARD: Objection.

Q. Or trenches on the property?

A. I am sorry. My mind wanders.

(Question was reread).

A. I have not been informed that that's actually what happened. There are chemicals in the groundwater and they got there somehow and I guess that's maybe something that I have put together or the basis of other discussions during our meetings that seems to be the most likely method of which this stuff could have gotten in the ground.

Q. The one I have described?

A. Yes.

(Brief interruption).

(Recessed from 10:00 AM until 10:04 AM).

Q. Doctor Guswa, have you done any analysis or any investigation concerning the Beatrice site?

A. No, I haven't.

Q. Do you have any opinions as to whether the Beatrice site contributed to the pollution of wells

G and H?

A. No, I don't.

Q. Do you in your knowing what you know about the aquifer and the information that you do have, do you have any understanding as to how the Beatrice site could under some circumstances contribute to the pollution of wells G and H?

MS. WOODWARD: Objection.

A. The answer to that question is no.

Q. You have no understanding?

A. I have an understanding of how water could flow from, under what conditions it may be possible for water to flow from under the Beatrice site towards wells G and H. Whether or not I guess if I made some assumptions about the presence of contamination at the time I guess then you could make the final analysis, yes.

Q. Well, do you know anything about the levels of contamination on the Beatrice site?

A. I have seen levels of contamination for 1984 and 1985 data, yes.

Q. Would you consider those to be high levels of contamination?

MS. WOODWARD: Objection.

A. I think I have seen numbers as high as a hundred thousand parts per billion.

Q. Do you consider that to be a high level of contamination?

A. I think we went through this. I'm not -- I don't make determinations of high or low.

Q. Do you have any opinions as to based on the data that you have seen whether the Beatrice site is a potential source of contamination of wells G and H?

A. Do you mean if the wells were to be put on line now?

Q. Yes.

A. Well, I hope the EPA pump test will help answer that question but I have not looked at the data for the Beatrice site to make that determination.

(Mr. Frederico joined the deposition).

Q. And how would the pump test data indicate that the Beatrice site is a source of contamination of wells G and H?

MS. WOODWARD: Objection.

MR. FREDERICO: Objection.

A. The question you asked which I was trying

to answer is under what conditions could contaminants or chemicals at Beatrice reach wells G and H?

A. Yes.

Q. Now, if the wells are turned on now and if the water level change is such that there is a hydraulic gradient from the Beatrice property toward wells G and H and if there is nothing to prevent the chemicals that are in the groundwater beneath the Beatrice property to get to wells G and H, then under those conditions, it could be a source of contamination. I don't know, I have not seen and we hope to see that very soon what the actual cone of depression looked like as a result of the pumping for the EPA pump test. I don't know whether or not there is a groundwater divide between Beatrice or not or whether there is a gradient for Beatrice towards the wells. That was the purpose of doing the test.

A. Under those conditions I described, there are flow direction from Beatrice towards wells G and H.

Q. If there --

A. There could be --

Q. If there was no groundwater divide between the Beatrice site and wells G and H and the gradient?

A. Was towards?

Q. Towards wells G and H from the Beatrice site, then in your opinion if there was drawdown when wells G and H were pumping during the pump test, drawdown on the Beatrice site, in your opinion then the Beatrice site was a source of contamination of wells G and H?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. That's not actually what I said. There can be drawdown without a gradient back towards. That's one of the reasons for asking, you know, for the long term pumping, in my understanding of why EPA wanted to do the long term pumping test, was that there can be drawdown without actual flow toward the pumping wells, so the important thing is to put that all in the perspective of what are the potential gradients or the heads out from the aquifer and is there a potential to flow towards well G and H.

Q. And the potential would be based on the

gradient?

A. The gradient is a measure of the change of potential between two different locations.

Q. So if there is a gradient --

A. If there is a gradient towards wells G & H.

MR. FREDERICO: Objection.

A. If there was a gradient towards wells G and H then and was defined sufficiently well to make sure that there were no changes in that gradient between there and wells G and H?

Q. Yes.

A. Then water would flow in that direction.

Q. When the wells were pumping?

A. When the wells were pumping, that's right.

Q. So the answer to my question then, Doctor Guswa, is that if there were no groundwater divide between the Beatrice site and wells G and H, if the gradient from the Beatrice site to wells G and H and during the pump test there was drawdown on the Beatrice property in your opinion then, the Beatrice site was a source of contamination of wells G and H?

MS. WOODWARD: Objection.

MR. FREDERICO: Objection.

A. It is only my opinion that water would flow from the Beatrice property to wells G and H. Whether or not there were chemicals on site, when G and H were in fact pumping, I have no information about that at all.

Q. If there were contamination in the groundwater during the period of time that the wells G and H were pumping and with those other assumptions that I gave you, then in your opinion the Beatrice site was a source of contamination of wells G and H; is that right?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. You have to do the same sort of travel time calculation; but if they were there early enough in the groundwater beneath the Beatrice property and sort of like the same question as before. If they were in the groundwater beneath the property prior to -- sufficiently prior to the wells going on such was enough time for them to reach the wells and there was nothing to divert them from flowing to the wells and there was nothing to happen to them chemically, biologically or physically as they were going to the wells, then

they would get to the wells.

Q. Now, Dr. Guswa, in any of the information you have seen, do you have any other indication that there is another source of contamination of wells G and H?

A. I'm still --

MR. FREDERICO: Objection.

A. I am still reviewing a lot of reports and letters and memorandums that come back, so I would say 1950s, as an example, there is a 1958 Whitman and Howard report published prior to the installation of wells G and H that refers to the contamination that exists in the Aberjona River at the location of wells G and H and recommends that wells not in fact be installed.

There is another report that's actually -- I don't know how this is actually published. It is two different reports. One is a Massachusetts DEQE report entitled Surface Waste Impoundments in Massachusetts, a survey report, November 17, 1980; and there is a companion report labeled Water Resources Investigations, Open File Report 80-431 entitled --

MR. SCHLICHTMANN: Going to have

trouble making copies of these exhibits.

A. Distribution of Aquifers, Liquid Waste Impoundments and Municipal Water Supply Sources, Massachusetts and that's a 1980 publication and I gave you the citation to that. This was a result of a joint study by EPA, the US Geological Survey and the Massachusetts Water Resources Commission to sort of, it went under the euphemism, or not euphemism but the acronym: Pits, ponds and lagoons, to do a survey across the state of impoundments in those kinds of areas.

And there is a map actually in the Massachusetts DEQE report -- trying to find it, which is on page 9-3 and put it in context. This report describes an analysis of the whole state to summarize and to make I think clear to people who are reading this report how this investigation worked and what the results were, they gave us sort of a little case study of one of the state quadrangles.

In this case they used the Wilmington, Massachusetts topographic quad in which they identified areas where there were known municipal wells, impoundments, landfills and which had been

field checked and verified that they existed and then listed a description of those chemical sources; and so just looking at this map, looking at the fact the other map that we had, the one that showed the hydrogeologic setting of the Aberjona River valley, there are numerous, in my opinion, numerous potential sources of contamination to the Aberjona River valley aquifer that exist upstream from wells G and H, and these would include any and all abandoned waste impoundments, lagoons, etc., that exist upgradient.

They would include culverts, drainage ditches that drain parking lots, that drain Route 128, might drain Route 93. They would include the piggeries that were located up there, the Woburn town landfill. They would include the Mishawum Lake dredging operation and filling operation.

I have not looked at any of these in any particular detail, but it seems to me that there are a significant number of potential sources of contamination.

Q. Doctor Guswa, have you identified any plumes of contamination polluting wells G and H?

MS. WOODWARD: Objection.

A. No.

Q. You haven't identified any?

(Witness shook head).

Q. Is it necessary for contaminations to follow a plume to get to wells G and H?

MS. WOODWARD: Objection.

MR. FREDERICO: Objection.

A. It is the mechanism conceptually. Let's look at water flow within the Aberjona River valley and I will use this as sort of an illustration (Referring to Exhibit 2).

The purpose that wells G and H were installed where they were located was to take advantage of the fact that it is a marshy area, it is generally over the deepest part of the aquifer and there is a stream nearby and wells are typically installed in glacial deposits like this near the streams in order to intercept one river flow that is flowing down the river, or two, the groundwater flow which is accumulating in the center of the valley.

So it is not necessarily -- it is a combination of induced recharge from the river plus diverted groundwater discharge that normally would

flow to the river but now doesn't because as the wells are pumping, a cone of depression would extend up the valley and intercept water which normally would flow to the stream but now keeps it in the ground and carries it to the well.

Now, as these wells cycle off and on and as the stream flows, ebbs and flows as it normally does, I don't think in this kind of a context with so many numerous potential sources coming on either side of the rivers that you could say there would be a well defined or even reasonably, or even moderately well defined contaminant plume.

Q. Have you identified one?

A. No.

MR. SCHLICHTMANN: Talk to you for a minute.

Why don't we have this one and that one marked.

(DEQE Map was marked Exhibit 4 and Water Resources Investigations book was marked Exhibit 5).

MR. SCHLICHTMANN: We'll reserve our right to depose Doctor Guswa when he forms his

opinion after he has seen the information.

MS. WOODWARD: Assuming we'll have the same right to depose your experts after they have formed their opinions and conclude their analysis.

MR. SCHLICHTMANN: Since they already have and you have deposed them --

MS. WOODWARD: The testimony on that speaks for itself, Jan, but you can say whatever you want to say on the record.

MR. SCHLICHTMANN: All right. Let's have this marked.

THE REPORTER: It was.

Q. Have you identified any sources, any sources of contamination of wells G and H?

A. No.

Q. Do you intend to?

MR. FREDERICO: Objection.

A. I don't believe so.

Q. You don't believe so. And Doctor Guswa, do you know who George Pinder is?

A. Yes, I do.

Q. Are you aware of the fact he has been retained by the plaintiffs in this case?

A. Yes, I am.

Q. And he has conducted a hydrogeological investigation of the area?

A. Yes, I know he has spent some time in the same way that I have, yes.

Q. Have you read his deposition?

A. Yes, I have.

Q. And in reading his deposition is there anything in there which you disagree with?

MR. FREDERICO: Objection.

A. I'm not quite sure what you mean by disagree with.

Q. When you read his deposition, was there any statements that Doctor Pinder made which you disagreed with?

MR. FREDERICO: Objection.

A. I don't recall very many definite statements in his deposition.

Q. Well, do you remember he gave his opinion about who the sources of contamination were for wells G and H?

A. My understanding is he gave his opinion based on the assumption that those were the sources.

Q. Well, are you aware in his testimony he

did testify that those were, that W. R. Grace and Beatrice Foods were the sources of contamination of wells G and H?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. My understanding is that's what he said in his deposition.

Q, Well, do you agree with that --

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

Q. Opinion?

A. No, I haven't completed my analysis yet.

Q. But you don't disagree with Doctor Pinder?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. I have no basis on which to agree or disagree.

Q. Because you haven't completed your investigation?

MR. FREDERICO: Objection.

A. That's right.

Q. So you haven't formed your opinion?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

Q. On that point?

A. That's correct.

Q. And are you aware of Doctor Pinder's reputation in the community?

MS. WOODWARD: Objection.

A. Yes.

Q. And how would you characterize Doctor Pinder's reputation in the community?

MR. FREDERICO: Objection.

A. I'm sure that would depend on who you talk to, but George is a well known groundwater hydrologist.

Q. How do you consider him?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. I worked with George in the Geological Survey. I have had dinner with him. We have worked against each other and I respect him as a person and as a professional.

Q. Now, is there any statements, any scientific statements of fact, and I don't mean his opinion now, but I mean were there any statements that he made based on science and which you read in the deposition to which you disagreed with?

MS. WOODWARD: Objection.

MR. FREDERICO: Objection.

A. I don't think I can answer that because I haven't read his entire deposition and so I can't answer it.

Q. Did you read his first day's deposition?

MS. WOODWARD: Objection.

A. Maybe you can summarize it for me so I can tell you. I haven't read every deposition in its entirety.

Q. He's had two depositions.

MS. WOODWARD: Objection, Jan.

Q. Have you read two volumes?

MS. WOODWARD: He has had three.

Q. That's right.

A. I have three volumes. I have not read each in its entirety.

Q. That's right, Amy. I wasn't at the other one. Three volumes. You haven't read all three?

A. No.

Q. Are you curious as to how it ends?

MS. WOODWARD: It hasn't ended, Jan.

A. Can you tell me?

Q. How many volumes have you read?

A. I have read parts of all three volumes. I have not read each volume in its entirety.

Q. Of the parts you remembered, did Doctor Pinder in his deposition make any statements of science to which you disagreed?

MR. FREDERICO: Objection.

MS. WOODWARD: Objection.

A. I am not -- I don't know any statements of science that he made actually. Could you refresh me?

Q. Do you recall that he made any statements?

A. I'm sure he did. I'm sure he did. I don't recall an outright statement saying that is an inappropriate scientific interpretation. That's not to say that there aren't some in there I haven't read yet, nor is it to say that I wouldn't approach the same problem differently than he would.

Q. But nothing that you read which you disagree with as a statement of science?

MS. WOODWARD: Objection.

MR. FREDERICO: Objection.

A. No.

Q. And Doctor Guswa, in your opinion are water level measurements taken during the pump test

more, give you more insight or more -- are they more revealing concerning the transmissivity of soil than individual slug tests at a well?

MR. FREDERICO: Objection.

A. I think those two actually are -- rephrase the question or restate the question.

Q. Read it back.

(Question was reread).

A. They are designed to do different things. A slug test is a short term hydraulic test with respect to near proximity of the screened interval of a well. A long term test, pumping test, can be used to calculate the same coefficients, but it represents a different volume of the aquifer than the slug test does, so that let's say transmissivity calculated from, if you did it from a large pump test would represent the transmissivity of the area contained totally within the cone of depression of that pumping well, and it is an average value that integrates the whole volume of that cone.

Similarly, a slug test does the same thing except a slug test is limited in the size in which it is evaluating, so particularly in

contaminant transport studies, people rely on the slug test to look at local variability in water transmitting properties whereas in a large scale pump test, that's generally not as useful in evaluating transport phenomena because it doesn't look at the individual heterogeneity or lithologic variation.

Q. It gives the whole picture?

A. It gives us an average value over the whole area.

MR. SCHLICHTMANN: Thank you very much. I appreciate it, Doctor.

(Deposition adjourned at 10:27 AM).

Excerpt from Rule 30 (e):

Submission to Witness; Changes; Signing. When the testimony is fully transcribed the deposition shall be submitted to the witness for examination and shall be read to or by him, unless such examination and reading are waived by the witness and by the parties. Any changes in form or substance which the witness desires to make shall be entered upon the deposition by the officer with a statement of the reasons given by the witness for making them.

* *

I, JOHN H. GUSWA, have read the foregoing transcript of my testimony and it is true and correct to the best of my knowledge, information and belief.

_____
Deponent's Signature

That on_____, 1986, the foregoing deposition was submitted to JOHN H. GUSWA, the witness, for examination and was read by the witness, at which time any changes desired were entered upon the deposition, and that thereafter the deposition was signed by the witness before me.

Notary Public in and for the Commonwealth of Massachusetts.

My Commission expires

COMMONWEALTH OF MASSACHUSETTS)
) ss.
COUNTY OF SUFFOLK)

I, Nancy L. Eaton, a Notary Public within and for the Commonwealth of Massachusetts, duly commissioned, qualified and authorized to administer oaths and to take and certify depositions, do hereby certify that heretofore, on the date cited above, the witness personally appeared before me at the above location and testified in the above captioned case; that the said witness was by me duly sworn to testify to the truth, the whole truth and nothing but the truth, that thereupon and while said witness was under oath, the deposition was taken down by me in machine shorthand at the time and place therein named and was reduced to typewriting thereafter.

I further certify that the said deposition constitutes a true record of the testimony given by the said witness.

I further certify that I am not interested in the event of this action.

IN WITNESS WHEREOF, I have hereunto subscribed my hand and affixed my seal of office this 26th day of January, 1986.

Nancy L. Eaton

Notary Public in and for the Commonwealth of Massachusetts.

My Commission expires January 6, 1989.