UNITED STATES DISTRICT COURT

DISTRICT OF MASSACHUSETTS

Civil Action
No. 82-1672-S

SKINNER, D. J.

ANNE ANDERSON, ET AL

V.

W. R. GRACE & CO., ET AL

Thirty-Ninth Day of Trial

APPEARANCES:

Schlichtmann, Conway & Crowley (by Jan Richard Schlichtmann, Esq., Kevin P. Conway, Esq., and William J. Crowley, III, Esq.) on behalf of the Plaintiffs.

Charles R. Nesson, Esquire, on behalf of the Plaintiffs.

Herlihy & O'Brien (by Thomas M. Kiley, Esq.) on behalf of the Plaintiffs.

Hale & Dorr (by Jerome P. Facher, Esq., Neil Jacobs, Esq., Donald R. Frederico, Esq., and Deborah P. Fawcett, Esq.) on behalf of Beatrice Foods.

Foley, Hoag & Eliot (by Michael B. Keating, Esq., Sandra Lynch, Esq., William Cheeseman, Esq., and Marc K. Temin, Esq.) on behalf of W. R. Grace & Co.

Courtroom No. 6
Federal Building
Boston, MA 02109
9:30 a.m., Wednesday
May 7, 1986

Marie L. Cloonan
Court Reporter
1690 U.S.P.O. & Courthouse
Boston, MA 02109

GEORGE PINDER, SWORN

DIRECT EXAMINATION BY MR. SCHLICHTMANN

Q Would you please state your name for the record?

A George Pinder.

Q Dr. Pinder, what is your profession?

A I'm a Professor at a university.

Q Which university is that?

A Princeton.

Q And do you live in Princeton?

A Yes, sir.

Q And what is your position at Princeton University?

A I'm Chairman of the Department of Civil Engineering.

Q And could you briefly review for the jury your educational background?

A I have a Bachelor of Science in geology from the University of Western Ontario, from Canada, and I have a Ph.D. from the Department of Geology at the University of Illinois.

THE COURT: University of what?

THE WITNESS: Illinois.

A With a minor in civil engineering and statistics.

Q And did you -- could you review your professional experience since attaining your educational degrees?

A Upon receiving my Bachelor's degree, I worked for several years in the summertime for the Nova Scotia Department of Mines as a field hydrologist. That continued into the time when I

began to work on my doctorate.

Subsequent to my doctorate I worked for the U. S. Geological Survey as a research hydrologist in Washington, D.C.

In 1972 I left that position and came to Princeton as an Associate Professor of civil engineering and geological engineering.

Q. And did you make use of this information?

A. Yes, I did.

Q. Is it customary in your profession to make use of this type of information?

A. Yes, sir.

Q. And is it customary in your profession to receive this type of information from consultants like Weston Geophysical?

A. Yes, sir, that is the typical way it is done.

Q. In using this information, did you, in fact, make determinations of the groundwater flow in the East Woburn aquifer?

A. Yes, sir, I did.

Q. What are the methods that you used to determine the groundwater flow in the East Woburn aquifer?

A. Well, the method that I used was basically the same concept that I've been describing to you today, the idea of taking well locations, connecting them with triangles, and then for each triangle determining the direction of groundwater flow for that particular triangle. I have a figure that will illunstrate that if it will be helpful.

Q. Yes.

Will you bring that figure over to the jury box.

A. (Witness complies.)

Q. Let me show it to counsel.

(Whereupon, Mr. Facher and Mr. Keating look

at the chalk.)

Q. Would you please tell the jury what is indicated on this chalk?

A. What I have done here is located those wells where we had water level elevations prior to the initiation of the pump tests at the Woburn site. This represents the undisturbed picture of the groundwater flow at that time.

You see a series of triangles, and those triangles play the same role as the red triangle that I showed you here in the Courtroom.

The vertice of each triangle is a water level. So every three vertices, every three wells, can be connected to form a triangle, and then I determine the slope of that triangle, and I know from that slope the direction of the groundwater flow and how fast -- The steepness of the groundwater table and the direction of the flow of the groundwater. I can establish those both for each triangle. Just like the cream rolled down the red triangle, the water is going to roll down the purple triangle in the direction indicated by the arrows. So you can see that, for example, you just look at the Grace site, we have very large arrows, very wide arrows. The thicker the arrow, the steeper the grading, the steeper the water table.

So you can see clearly there are large arrows up in the Grace site indicating steep gradient moving basically

F-3

to the west and as they get to the neighborhood of the river they tend to move to the south in the direction of the river.

The gradients tend to get shallower. That is, these are very thin arrows in this area, because in the area along the river the water table is fairly flat, but the material is very permeable. In other words, it will allow water to move through it very fast. So the fact that these arrows are small does not mean there is not very much water flowing through, it just means it does not take very much energy to push it along.

The same is true with the low gradients on the Beatrice property basically moving some areas toward the river and some areas to the south, and what you see here, these arrows are probably in response to the pumping of the Riley well down this section. Mr. Riley has his own well.

So this is the Beatrice side, and you can see the general flow of the groundwater on the Beatrice side, and you can see the general direction of flow of the groundwater on the eastern side, and that is associated with Grace.

Q. And, Dr. Pinder, you explained the method that you used in determining the groundwater flow for the East Woburn aquifer. Are there other methods that can be used in your profession to determine groundwater flow other than what you just demonstrated?

A. This is a direct method. There is an indirect method

where you use a computational method of known parameters and then calculate based on those parameters what the direction of flow has to be in the aquifer system. That is more abstract. It is well-accepted methodology. It then does not rely on the same data that these arrows rely upon. In the sense, it is an independent check of your conception of the system.

Q. Did you undertake that analysis as well?

A. Yes. We also did that.

Q. Do you have an exhibit that can illustrate that?

A. Yes, sir.

(Mr. Schlichtmann sows the chalk to Mr. Keating and Mr. Facher.)

MR. KEATING: May I see you for a moment, your Honor?

THE COURT: Yes.

CONFERENCE AT THE BENCH AS FOLLOWS:

MR. KEATING: This is the beginning of a series of exhibits and testimony, I believe, in which Dr. Pinder will use a three-dimensional computer model to "illustrate" an opinion which rests solely on a one-dimensional computer model. It is a little bit like describing a tricycle but bringing in a Porsche. It is a much more dramatic way of illustrating

a point. It involves much more information and parameters than what he said his testimony relies on, which is a one-dimenstional model.

In our view, your Honor, it is prejudicial to have him use the three-dimensional model to illustrate -- which is terribly complex and sophisticated -- to illustrate what is a simple thing when he is not even relying on the three-dimensional model as the basis for his opinion.

THE COURT: I didn't hear anybody say anything about it.

MR. KEATING: I asked Mr. Schlichtmann if this was part of the three-dimensional model and he indicated it was.

MR. SCHLICHTMANN: This is the basis for groundwater flow.

MR. KEATING: That is part of it. It is somethir that illustrates his opinion but is not the basis of his opinion. I can't describe to you any better than to say it is like taking a high-powered car to illustrate what he is relying on which is the tricycle. Up until---

THE COURT: I don't really know what you are talking about. I think the Princeton students take this 15 minutes at a whack. I think it is about time for the morning recess.

MR. KEATING: Fine.

THE COURT: You can show me what is about to come and why it shouldn't.

MR. KEATING: Fine.

MR. FACHER: While we are here, as long as we are here, I object to the witness if he is illustrating testimony, fine. If he is testifying about specifics, fine. But I object to these casual references, this must be the Riley well and so forth. I watched that go through with Drobinski and---

THE COURT: Have him separate out his illustrative examples from his testimony.

MR. FACHER: The second thing is I am going to object to this and a series of others on the lack of foundation, so I want to alert the Plaintiffs that there is going to have to be a foundation laid for this and a lot of other things.

We have put up with a lot of illunstrations that were really substantive testimony with Drobinski.

MR. SCHLICHTMANN: While we are standing here may the jury look at the exhibit?

THE COURT: Which one?

MR. SCHLICHTMANN: The one that is there.

THE COURT: They saw it, didn't they?

MR. SCHLICHTMANN: We could put it a little closer up so they could examine it.

THE COURT: What is it?

MR. SCHLICHTMANN: It is right here.

THE COURT: Do you want to pass it around?

MR. SCHLICHTMANN: Yes.

THE COURT: All right.

(Whereupon, a chalk was passed to the jury.)

THE COURT: Does that have a number or identification what has just gone to the jury?

MR. SCHLICHTMANN: I will make an identification for it.

MR. KEATING: It has a title but not a label.

THE COURT: What is the title?

MR. KEATING: It is Woburn Gradients prior to Pump.

THE COURT: Woburn Gradients prior to Pump, that is being examined by the jury.

These labels, all you do is take the title and put a "P" in front of it.

MR. JACOBS: "P" with the initials.

THE COURT: When they finish with that we will give them the recess, and then we will go into the three-dimensional model and the two-dimensional model. You can explain to me what the problem is.

MR. SCHLICHTMANN: If there is a problem.

THE COURT: I ran into this in a pattern case

one time when I listened to 12 days of solution without really understanding what the problem was.

MR. SCHLICHTMANN: All right.

Do you want to make your argument now?

MR. KEATING: Whatever your Honor wants.

END OF CONFERENCE AT THE BENCH.

THE COURT: Will you please look at it without discussion, members of the jury. Discuss it later on when you deliberate, but just look at it and remember it without discussing it among yourselves at this point.

CONFERENCE AT THE BENCH AS FOLLOWS:

THE COURT: We are getting some explanatory lectures.

MR. SCHLICHTMANN: It is a lot of information for one morning.

THE COURT: We will give them a rest after this.

MR. SCHLICHTMANN: Yes, your Honor.

THE COURT: There were a couple of words that were used that I didn't get, was he saying force media?

MR. SCHLICHTMANN: Porous media.

the moment.

Establish the foundation, what went on.

Q. Tell the jury, please, Dr. Pinder, how you used the information that you have described in making this independent calculation about groundwater flow in East Woburn.

A. What we do is take all the information that we have regarding the physical system as we understand it, and then we use a computational method to take that information and try and predict what the water levels will be in the system, given all the other information that is put in, and that generates a set of gradients very much, that look very much like the kinds of gradients that I have shown you before, in the sense that they are -- The arrows are the same shape and things like that. And that basically constitutes a separate and distinct calculation not depending directly on water levels themselves, but rather creating water levels computational based on everything else we know about the physical system.

Q. And is this a methodology which is used in your profession?

A. It is very commonly used, yes.

Q. And what are the tools that you use to make these calculations?

A. Well, the mathematical tools are basically those of algebra, and to some degree an area of mathematics called numerical analysis. The equations that we are working with are the fundamental equations of physics, the same equations

that describe every other physical phenomenon in the surface of the earth. We use a large computer to do the calculations because there are so many of them. Each calculation is very simple in and of itself. Then the results that the computer presents comes out as either a tremendous number of numbers, such as we've provided in this case,or you can ask the computer to present the information graphically, directly. And that, normally, is the best way to do it so you can understand what is going on rather than have to thumb through and look at thousands of individual numbers. So I basically look at the graphical output and make my interpretations from that.

Q. And in this case did you, in fact, form opinions based on the calculations that you have described about groundwater flow in East Woburn?

A. Yes.

Q. And what is your opinion as to groundwater flow based on these calculations?

MR. KEATING: I object, your Honor.

MR. FACHER: Objection.

THE COURT: I am going to have to get some further information.

CONFERENCE AT THE BENCH AS FOLLOWS:

THE COURT: Is this the February 14th problem?

MR. KEATING: Yes, it is.

MR. FACHER: Among others.

MR. KEATING: I have the deposition references here. I don't know how much time you want to take, but it is clear in his depositions, he always said he was relying on that one-dimensional thing that he first described. When he referred at all to the three-dimensional, he said it was "To illustrate his opinion." I can quote you page after page, "My opinion is not predicated on the mathematical model."

I relied on Mr. Schlichtmann's representation that he would not, "he" meaning Dr. Pinder, would not add anything to what he had testified to on his last day of deposition. That could not have been more explicit.

Mr. Schlichtmann said, "I don't like surprises, counsel. I don't like to be surprised, I don't like anyone else being surprised."

I will tell you now, I am genuinely surprised. This was not any basis for his opinion. I thought the worst I would have to fight on this that somehow he was going to use it to illustrate it and I was going to try to persuade you that it was not fair because it was the Porsche and the tricycle.

He is now advancing a new independent basis for his opinion, and it is a clear contradiction to the representation Mr. Schlichtmann made, which I have right here

in front of me. He said---

THE COURT: What do you need this for?

MR. SCHLICHTMANN: Yes, I do.

MR. KEATING: Read the bottom, the last paragraph and over to the next page.

(Whereupon, the Court is looking at a transcript from a deposition of Dr. Pinder.)

THE COURT: Well, he will not be allowed to talk about anything he did add.

MR. SCHLICHTMANN: He did all this before. He created his mathematical model, he has given them his program, every data bit, every point of information, he has given them the graphic pictures. They have absolutely everything. Their experts have recreated his model. They know everything there is to know about Dr. Pinder's model. That is all we did during the deposition is talk about the model, the work he did, and it has been fully available.

MR. KEATING: Judge, what he added to his six volumes of deposition is that he now relies on this calculation as an independent basis to establish groundwater flow, not to illustrate his opinion, but as an independent basis.

I represent to the Court that is a totally new thing for him to get into, and it has happened since his last day of deposition. I can show you page after page where---

THE COURT: Let me see.

MR. SCHLICHTMANN: The point here is he is not depending upon the computer model.

MR. KEATING: "My opinion is not predicated on the mathematical"---

MR. SCHLICHTMANN: Not dependent on it.

MR. KEATING: "The purpose of the model is to illustrate my opinion. It lets people not familiar"---

THE COURT: Well, is the opinion that he comes to from this the same?

MR. SCHLICHTMANN: Same. Exactly the same.

MR. KEATING: I have been relying on the fact of my presentation of my cross-examination of my own experts that I'm dealing with a man who did not use a much more sophisticated, actually much more persuasive, method to do his opinion because he said he hadn't. I walk in here today and he says --

MR. SCHLICHTMANN: The issue is what is the minimum that he needs to form his opinion, being fully aware of the work he did, the conclusions, the graphics he produced from the computer, the opinions about the meaning of the computer and where the contamination was flowing and ground-water, they have all of that stuff.

THE COURT: It seems to me that it can be simply put in without raising the question. I hesitate to outline your questions for you any more.

MR. SCHLICHTMANN: I won't ask you to do that.

THE COURT: It's so easy; I don't understand why you keep banging your head against these stone walls.

MR. KEATING: There is another place there, Judge.

THE COURT: You have a great affinity for stone walls.

MR. KEATING: He says here, Judge, he says,

"Question: I take it the use of the calculations in the comprehensive model simply illustrates the opinions you had? Answer: Correct."

Now he is saying it is the basis for the opinion.

THE COURT: What you want to do is get the picture before the jury.

MR. SCHLICHTMANN: Exactly.

MS. LYNCH: Your Honor, on the question of the picture before the jury, Mr. Schlichtmann told you before that we had been given it before the end of the deposition. We were not. This is what we were given, which is not the same thing.

MR. KEATING: Not the same thing.

MS. LYNCH: What he is doing now is something different.

MR. SCHLICHTMANN: It's the same arrows and the same --

THE COURT: Except the arrows aren't as pretty.

MR. SCHLICHTMANN: Smaller.

THE COURT: Let me see the thing and see if it is different.

MR. FACHER: It is different. But I'd rather save it for cross-examination. I mean, the same way with the second opinion. It was supposed to be illustrative. If he wants to give it, fine.

THE COURT: No, he will not give it that way.

MR. SCHLICHTMANN: I'll give a demonstration.

MR. KEATING: I don't want it.

THE COURT: He has already given an opinion and that is the opinion.

MR. FACHER: If he wants to contradict his deposition, that's fine.

MR. SCHLICHTMANN: Okay. You can talk to him.

THE COURT: I suspect you may have tumbled into the secret somehow along here. I will give you a chance.

MR. SCHLICHTMANN: Fine. Thank you.

END OF CONFERENCE AT THE BENCH.

MR. FACHER: Is the question withdrawn?

THE COURT: I think the question has been withdrawn and we will start on a slightly different tack.

Q (By Mr. Schlichtmann) Dr. Pinder, do these calculations that you have described to the jury illustrate the opinions which you have previously given concerning groundwater flow in the East Woburn aquifer?

MR. FACHER: At what point in time? If I may use that hackneyed expression.

THE COURT: Yes. As of what period?

A Well, there are two different time periods represented, and they correspond one for one with the preceding figures. In other words, one is prior to the pump tests and the other

information one question can produce.

MR. FACHER: But there is also a limit as to how broad a question can be without actually asking anything.

THE COURT: Okay.

END OF CONFERENCE AT THE BENCH.

Q. (By Mr. Schlichtmann) Dr. Pinder, do you have an opinion as to the time it would take for contamination from the Beatrice site of these chemicals to reach the well field of G and H?

A. Under what conditions are you asking the question?

Q. Under conditions of pumping.

A. Under conditions of pumping---

MR. FACHER: Just a second, sir. Let's do it one stage at a time.

Is the answer going to be yes?

THE COURT: Do you have an opinion as to the rate of travel under conditions of pumping?

THE WITNESS: Yes, sir.

THE COURT: Next question.

What is that opinion?

Objection.

Overruled.

All right, go on.

(Laughter)

MR. FACHER: I knew we would get it right.

Q. What is that opinion?

A. It is my opinion that contamination from Beatrice would reach the well field under pumping conditions in less than a year's time.

Q. Now, Dr. Pinder, have you made various calculations concerning contaminant transport in the East Woburn aquifer?

A. Yes.

Q. What types of calculations did you make?

A. Well, I made basically two kinds of calculations.

One set of calculations are based on very simple engineering formula. Those calculations serve to sustain my opinion on the behavior of the system. And then I went to the same type of computational methods as we used for the flow field for illustrative purposes to, basically, have more insight into the overall problem.

Q. Now, Dr. Pinder, you talked about chemical analysis of wells in the aquifer. Do those chemical analyses of wells in the aquifer bear on your opinions that you just expressed about source of contamination to the well field of Wells G and H?

A. Yes, it did.

MR. FACHER: Objection, leading.

THE COURT: I will let it stand.

In what respect did it contribute?