

CONSOLIDATED HEARINGS BOARD

IN THE MATTER OF Sections 2 and 3 and 6 (3) of the Consolidated Hearings Act, 1981, S.O. 1981, c.20;

— and —

IN THE MATTER OF Section 12(2) of the Environmental Assessment Act, R.S.O. 1980, c.140;

— and —

IN THE MATTER OF Sections 30, 35 and 38 of the Environmental Protection Act, R.S.O. 1980, c.141, as amended;

— and —

IN THE MATTER OF Sections 24 and 61 (2) of the Ontario Water Resources Act, R.S.O. 1980, c.361, as amended;

— and —

IN THE MATTER OF Section 28 (3) of, and Regulation 164 under, the Conservation Authorities Act, R.S.O. 1980, c.85, as amended;

— and —

IN THE MATTER OF Section 40(12) of the Planning Act, S.O. 1983, c.1, as amended; In connection with site plan control of the sanitary landfill site;

— and —

IN THE MATTER OF Section 22(1) of the Planning Act, 1983 in connection with a referral to this Board by the Honourable Bernard Grandmaitre, Minister of Municipal Affairs, on a request by the Regional Municipality of Halton to amend the Official Plan for the Town of Milton to redesignate a parcel of land comprising Part Lots 3 and 4, Concession 2 N.S. in the Town of Milton from "Agriculture" and "Conservation and Hazard Lands" to permit the construction, operation and maintenance of a landfill site, Minister's File No. 24-OP-0208-A01;

— and —

IN THE MATTER OF Section 34(11) of the Planning Act, 1983 in connection with an appeal to this Board by the Regional Municipality of Halton for an order directing an amendment to By-law 61-85 of the Town of Milton to rezone the lands situated at Lot 3 and part of Lot 4, Concession 2 N.S., in the Town of Milton from "Agriculture" to permit a regional sanitary landfill site and ancillary uses;

— and —

IN THE MATTER OF Section 15(1) of the Planning Act, R.S.O. 1980 ch.379 in connection with a referral by the Honourable Claude F. Bennett, Minister of Housing on a request by Tremaine Britannia Citizen's Group for consideration of part of the Official Plan for the Halton Planning Area with respect to Sections 1 to 5 inclusive, 7, 9 and 10 of Part III D3 Solid Waste Management, Minister's File No. OPC-0026;

— and —

IN THE MATTER OF Section 64 of the Ontario Municipal Board Act, R.S.O. 1980, c.347 as amended in connection with an application by the Regional Municipality of Halton for an order approving:

a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton and to do so by one of two alternative methods as follows:

- (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
- (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton

at an estimated cost of \$12,775,000.00, and the borrowing of money by way of temporary advances not exceeding in the aggregate such estimated cost pending the sale of debentures, and

(b) the issuance of necessary debentures to a maximum of \$12,775,000.00 for a term not to exceed fifteen years;

— and —

IN THE MATTER OF Section 193(5) and Paragraph 84 of Section 210 of the Municipal Act, R.S.O. 1980, c.302, as amended;

— and —

IN THE MATTER OF Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1980, c.148;

— and —

IN THE MATTER OF an undertaking of the Regional Municipality of Halton to provide facilities for the purpose of receiving, dumping and disposing of waste as required by section 137 of the REGIONAL MUNICIPALITY OF HALTON ACT, R.S.O. 1980, c.436, as amended, by acquiring the land for, constructing, operating and maintaining a landfill to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton.

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Nethercut & Co. Ltd.

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BEFORE: Dr. D.J. Kingham - Acting Chairman

H.H. Lancaster, Q.C. - Member

S. Tanner - Member



Nethercut & Co. Ltd.

Toronto, Ontario

Hearing conducted at The Oakville  
Granary Commercial Centre, 105 Robinson  
Street, Oakville, Ontario, on  
Monday, September 21st, 1987.

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VOLUME 30  
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APPEARANCES:

|                                                 |                                                                                             |
|-------------------------------------------------|---------------------------------------------------------------------------------------------|
| T.R. Lederer and<br>H.D. Hodgson                | for the Regional<br>Municipality of Halton<br>(Proponent)                                   |
| J.R. Tidball                                    | for the Ministry of the<br>Environment                                                      |
| T. Vigod<br>J.F. Castrilli                      | for the West Burlington<br>Citizens Group                                                   |
| D. Estrin,<br>F.E. Leitch and<br>H. Dahme       | for the Corporation of the<br>Town of Milton                                                |
| S.R. Garrod and<br>A. Nurvo                     | for the Milton Area Citizens<br>Coalition and several<br>affected Milton area<br>landowners |
| R.B. Tuer, Q.C.<br>E.A. Cronk and<br>F. Perrier | for National Sewer Pipe<br>Limited                                                          |
| L.F. Longo                                      | for Azova Investments<br>Limited                                                            |
| M.J. McQuaid, Q.C.<br>and C.J. Tzekas           | for the City of Burlington                                                                  |
| C. Mansfield                                    | for the Ministry of Natural<br>Resources                                                    |
| P. Renaud                                       | for Cumis Limited                                                                           |



*Nethercut & Co. Ltd.*

*Toronto, Ontario*

APPEARANCES (Cont'd):

|    |              |                         |
|----|--------------|-------------------------|
| 1  | C. Stevenson | for Framgard Holdings,  |
| 2  | P. Hancock   | Fosseri Investments     |
| 3  |              | Limited, Seriphos       |
| 4  |              | Investments Limited and |
| 5  |              | Topic Investments       |
| 6  |              |                         |
| 7  | J.H. Olah    | for the Halton Region   |
| 8  |              | Conservation Authority  |
| 9  |              |                         |
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Per: C.F. Nethercut, C.V.R.



Oakville, Ontario.  
September 21, 1987.

--- Upon commencing at 9:50 a.m.

DR.KINGHAM: Thank you. Please be seated. I apologise for the late start, but I expect some of you may have had difficulty getting here on time as we did. The traffic in Toronto was pretty awful. I think Mr. Estrin was cross-examining. Is he here?

MS. CRONK: He is here. I'll go let him know.

ALFRED A. SOBANSKI, resumed:  
JAMES BEECHINOR, resumed:

DR.KINGHAM: Mr. Estrin

MR. ESTRIN: Good morning.

CROSS-EXAMINATION BY MR. ESTRIN (continued):

Q. I was handed this morning three pieces of paper and now I am getting a fourth that you produced and let's identify them, as I take it there are copies for other people? First of all, you have one sheet called Vertical Gradients in Upper Till, Tritium Piezometer Nest, Water Levels for June 25, 1986. I don't know if Mr. Lederer wants that marked as an exhibit, and I am not sure until I have had a chance to look at it further if I do, but it is certainly information I wanted.



1 MR. LEDERER: I am in the difficult  
2 position of not being able to speak to the witnesses  
3 to what it is and I do have some qualifications on  
4 what it is.

5 DR. KINGHAM: Well, we can wait.

6 MR. ESTRIN: Secondly is two pieces  
7 of paper dated September 21, 1987 and the heading is  
8 Source of  $2.8 \times 10^{-2}$ , Data Sheet and it attaches the  
9 grain size analysis. I take it, gentlemen,  
10 this is what you say is the source of the number  
11  $2.8 \times 10^{-2}$  that was used in Exhibit 172, your other  
12 handwritten sheet put in the other day, page 17,  
13 where there is hydraulic conductivities used and  
14 one of those is  $2.8 \times 10^{-2}$ , first major sand unit?

15 MR. BEECHINOR: A. That is correct.

16 DR. KINGHAM: We won't mark that  
17 either until we get into some discussion on it.

18 MR. ESTRIN: Q. The next document  
19 you have handed out is several pages headed Raw  
20 Pumping Test Data, Site D, and do I take it that  
21 this represents field notes made of times and  
22 depths when the pumping tests on Site D were  
23 carried out?

24 MR. BEECHINOR: A. That is right.  
25 That is the pumping tests conducted at PW-1 and PW-2.



1 MR. ESTRIN: I would like to mark  
2 this because we will be referring to it at some  
3 time.

4 DR.KINGHAM: Shall we mark this as  
5 a Milton exhibit?

6 MR. ESTRIN: Sure.

7 DR. KINGHAM: That will make it  
8 M-174.

9 MR. LEDERER: I'm not sure it's a  
10 big point, but since the source of the data is  
11 Halton, it would seem to be more appropriate...

12 DR. KINGHAM: I'm easy if you  
13 gentlemen are in agreement. We will call it H-174,  
14 if you are happy with the information in it.

15 MR. ESTRIN: I am.

16 --- EXHIBIT No. H-174: Document entitled Raw  
17 Pumping Test Data -  
Site D.

18 MR. ESTRIN: Q. While we are on that  
19 document, were you present during these pumping  
20 tests on Site D and, if not, do you know who was,  
21 who made these observations on these documents?

22 MR. BEECHINOR: A. I was present  
23 over parts of the pumping tests, both of them.  
24 The names of the individuals -- there were a number  
25 of individuals who conducted the tests, and so I would



1 have to research that to see who was actually there  
2 at that time.

3 Q. Who was responsible for  
4 supervising the tests in the field?

5 A. I was.

6 Q. You were not there all the  
7 time, is that right?

8 A. I was there during critical  
9 periods of the pumping tests, the initiation of them,  
10 monitoring to see how the pumping tests were  
11 performing and at the end of the pumping test to  
12 decide whether or not it was an appropriate time  
13 to cease the tests.

14 Q. Who was responsible for  
15 plotting the information -- let me start that  
16 again. The information or data contained in Exhibit  
17 H-174 was plotted, I take it, on some curves that  
18 we find in the interrogatory response to Weir &  
19 Foulds and you will remember the Theis Curve and  
20 the Jacob Curve?

21 A. They are actually in the  
22 reports.

23 Q. The actual curves?

24 A. That is right.

25 Q. I think that's right. Who was



1 responsible for doing that?

2 A. Again there was a number of  
3 our staff who work for Mr. Sobanski and myself  
4 responsible for plotting that information.

5 Q. Give me the qualifications of  
6 the most senior person who would have plotted the  
7 data?

8 A. A geologist, hydrogeologist.

9 Q. A hydrogeologist and someone  
10 who has a degree in earth sciences?

11 A. That's right.

12 Q. At Waterloo, and how long has  
13 that person been working there?

14 A. One individual I am thinking  
15 of has been working in the area about five years.

16 Q. So several people plotted the  
17 data at Site D?

18 A. Yes.

19 Q. Why would that be?

20 A. Because we were dealing with a  
21 lot of information.

22 Q. We are only trying to fit  
23 two curves; right?

24 A. Are you talking about the  
25 plotting of the raw data....



1 Q. ... on the curve. How many  
2 people were involved in plotting the information on  
3 the curves?

4 A. For any one given curve it  
5 would be one individual.

6 Q. Would you be able to check and  
7 find out who plotted the two curves, and if it would  
8 be one individual in each case?

9 A. It may be the same individual  
10 or a different individual, I am not sure.

11 Q. Can you check it?

12 MR. LEDERER: Surely the question is  
13 the data and what the data tells us and surely  
14 we are going far afield, going back and seeking out  
15 who plotted the curves. It must be clear that these  
16 are large organizations and Mr. Beechinor is a  
17 supervisor and Mr. Sobanski is the senior person  
18 with the firm, and unless there is some reason other  
19 than Mr. Estrin's curiosity, I think we are now  
20 being pressed a bit too far.

21 MR. ESTRIN: It does go further than  
22 curiosity.

23 Q. Perhaps I could clarify it.  
24 Mr. Beechinor, did you plot the information on either  
25 of the curves contained in the report?



1 MR. BEECHINOR: A. This was a year  
2 and a half ago. I would have likely plotted some  
3 of the field data to see how the test was performing  
4 so, as I said, we could monitor how well the test  
5 was performing, and it then went back to the office  
6 where one of our hydrogeologists would have plotted  
7 the information up.

8 Q. To the best of your recollection,  
9 you did not do the curves?

10 A. To the best of my recollection,  
11 I did not actually plot the data you see in the  
12 reports, no.

13 Q. Someone else was responsible  
14 for actually drawing lines and interpreting those  
15 curves or the data once plotted, because you must  
16 do that?

17 A. With the Theis analysis, yes,  
18 and someone would have initiated that and either  
19 Mr. Sobanski or myself would have reviewed that.

20 Q. Do you recall which of you  
21 gentlemen reviewed it?

22 A. Not at the moment.

23 Q. Mr. Sobanski, have you any  
24 recollection?

25 MR. SOBANSKI: A. I did not personally.



1 Q. After we have had a chance to  
2 review this there may be a few more technical  
3 questions arising out of Exhibit H-174, but that's  
4 it for the moment.

5 Mr. Lederer gave me one other sheet.  
6 This is called Site D Purge Well Considerations,  
7 Lower Granular Unit, dated September 20, 1987, with  
8 Mr. Sobanski's name on it and it's four pages and  
9 I take it, Mr. Sobanski, this then is your response  
10 to the question how did you calculate the drawdown  
11 in wells around Site D?

12 A. We were talking about the lower  
13 granular unit and, Mr. Chairman, I could not find  
14 my calculations. We have file cabinets of information  
15 on this study and I could not find the original,  
16 so I recalculated it over the weekend.

17 DR. KINGHAM: It looks like you have  
18 all had a busy weekend.

19 MR. SOBANSKI: Very.

20 DR. KINGHAM: Do you want to refer to  
21 this document now?

22 MR. ESTRIN: I just want to make sure  
23 I know what it is.

24 Q. Mr. Sobanski, does this get  
25 us to the number of 1.7 metres of drawdown at the



1 nearest well and if so, where?

2 MR. SOBANSKI: A. I am sorry. This  
3 gets us to about a metre of drawdown in the nearest  
4 well at a distance of about ten feet, and it also  
5 shows us the drawdown in the pumping well and what  
6 assumptions I have made in my calculations are given  
7 in the text.

8 Q. Let's go back to page 133 of  
9 your report, Volume 1 and you will see at the  
10 bottom of page 133 you say, and you are discussing  
11 the pumping of the upper granular unit, and you  
12 say:

13 "Continuously pumping the UGU  
14 with two wells, as described  
15 above, at a combined rate of 12.6  
16 L/m for 10,000 days, would lower the  
17 water level in the domestic wells  
18 to the west by about 1.7m."

19 You can't locate at the moment the  
20 calculations of how you got 1.7 metres in the nearest  
21 well?

22 A. I didn't say that. We had  
23 been talking about the lower granular unit and  
24 that is what I provided you with and I couldn't  
25 find the information on the lower granular unit and  
so I had to regenerate something, and I don't know



1 if it's exactly the same as I had in here or not.

2 Q. I don't want to confuse you or  
3 anyone else, but my interest was first of all related  
4 to the figure of 1.7 metres and how you arrived at  
5 that and did you come across in the calculations...

6 A. I can find that and I don't  
7 have copies of it but I can make one at the break.

8 Q. That would be great.

9 The document you did produce is  
10 related to any pumping you think you might have to  
11 do in the lower granular unit?

12 A. That is correct.

13 Q. You hadn't provided a specific  
14 estimate of the drawdown as a result of pumping that  
15 unit, I don't think, on page 134 or 135, but  
16 you say it would have less impact?

17 A. Yes.

18 Q. Than calculated for the upper  
19 granular unit and now this document arrives at a  
20 figure of approximately 1 metre drawdown?

21 A. No. It doesn't tell you how  
22 much drawdown there is and there wouldn't be very  
23 much drawdown with the system because the cone  
24 doesn't extend too far, and I haven't calculated  
25 exactly what it would be at the wells, so I would have



1 to look at that. It can come off those curves and  
2 it is possible to get it from the curves.

3 MR. ESTRIN: I think we should mark  
4 this document and I will have some other questions  
5 arising out of it.

6 DR. KINGHAM: This being the Site  
7 D Purge Well Considerations document, which was  
8 again generated by the Halton witnesses, so perhaps  
9 we can call it H-175.

10 --- EXHIBIT No. H-175: Document entitled Purge  
11 Well Considerations -  
Lower Granular Unit.

12 MR. ESTRIN: Q. Then there was a  
13 conversion number on transmissivity which I suggested  
14 you might want to check, and this was found in  
15 Appendix 16 of Volume 2, page 2, and I don't know  
16 if you have had a chance to do that or not?

17 MR. SOBANSKI: A. Yes, I did.

18 Q. It was right at the back of  
19 Volume 2 at page 2, where you are predicting the  
20 quantitative impact of the hydraulic trap?

21 A. Yes, I checked the value.

22 Q. And it is correctly stated  
23 as 8.05 square metres per day?

24 A. Yes. I should point out there  
25 seems to have been a question there, but the 540



1 gallons per day per foot, there is something wrong with  
2 it and it is Imperial gallons and some of the conversions  
3 coming out of the textbooks are in U.S. gallons and  
4 you have to make the appropriate 20 per cent changes.

5 Q. Mr. Beechinor, you will recall  
6 that I invited you to check the gradient calculations  
7 associated with Exhibit M-169 and I wondered if you  
8 had had a chance to do that?

9 MR. BEECHINOR: A. Well, I had a  
10 quick look at it on Thursday. The only thing I would  
11 question with respect to this interpretation of  
12 the lateral gradients in the upper till is that a  
13 number of the gradients that have been calculated are  
14 not beneath the actual disposal area or the buffer  
15 area surrounding the disposal area and in fact, for  
16 instance, the calculation of gradients along your  
17 pathway D and E, give some of the most steep  
18 gradients in your calculation, and using those in  
19 your calculation of geometric mean, that would tend  
20 to generate a steeper slope than I have.

21 Q. Let's start with basics. If  
22 you have checked the gradients at those locations,  
23 we put in a sheet which summarized them and arrived  
24 at a geometric mean?

25 A. Yes.



1 Q. Did we arrive at the data and  
2 if you take the head drop and you take the distance,  
3 are those the numbers you would get?

4 A. Yes.

5 Q. We have done that correctly  
6 and we have arrived at the correct geometric mean  
7 of those numbers?

8 A. Yes.

9 Q. And you agree with the data  
10 and you are now taking issue with whether or not  
11 the gradients were taken at the most appropriate  
12 locations?

13 A. That is right.

14 Q. The gradients that we arrived  
15 at, the geometric mean of the gradient we arrived  
16 at then was .008, which contrasted to your .004?

17 A. Mine is .005. We had .005.

18 Q. I am sorry, you are right.

19 We are concerned in looking  
20 at the gradient for this unit of weathered upper  
21 till as to the rate at which leachate would or  
22 could travel through that till in a lateral way  
23 off site?

24 A. That's right. Our calculations  
25 are based on the gradients beneath the landfill and



1 in the buffer area of the landfill.

2 Q. Sure. You want to know  
3 essentially from the edge of the waste and indeed  
4 through the waste?

5 A. Yes, through that 100 metre  
6 buffer.

7 Q. Mr. Sobanski, again arising  
8 out of your Thursday testimony, I think you told us  
9 that assuming the scenario of total failure after  
10 twenty years and final cover in place, you would  
11 for that purpose assume a near maximum rate of  
12 leachate production based on about twelve inches  
13 a year and you assumed a porosity of the waste of  
14 70 per cent?

15 MR. SOBANSKI: A. No.

16 Q. No?

17 A. No, 30 per cent in the waste  
18 or 50 per cent and there were two cases given.

19 Q. The first figure was 30 per  
20 cent. Does that correspond, putting it in decimal  
21 places...

22 A. .3 roughly or .33. I am  
23 sorry, 30 per cent is .3 and 50 per cent is .5.

24 Q. Using an assumed porosity  
25 of that, you calculated a rate of rise of



1 approximately a metre a year?

2 A. Yes, using the 30 per cent  
3 porosity.

4 Q. What hydraulic conductivity  
5 were you assuming for the waste?

6 A. It stays the same, about  
7  $10^{-4}$  centimetres per second.

8 Q. What kind of formula were  
9 you using to arrive at about a metre a year?

10 A. Well, if you are infiltrating  
11 the twelve inches and it is about a 30 per cent  
12 porosity, that means you would fill about 3 feet  
13 of waste a year; so about three times as much waste  
14 as you have infiltration and that gives you roughly  
15 a metre.

16 Q. The other assumption was  
17 assuming a porosity of 50 per cent?

18 A. Yes, and then it would be  
19 somewhat less.

20 Q. One other thing arising out  
21 of Thursday. If my notes are right, you said  
22 assuming certain scenarios that were being  
23 considered, to use your words, there was an argument  
24 for placing monitors around each cell?

25 A. Yes.



1 Q. What scenario were you  
2 assuming when you said that?

3 A. A total failure scenario  
4 of the type we have suggested. It's not something  
5 that has to go in immediately, but I would suggest  
6 that it would, so first of all you can see the trap  
7 form and see water levels decline and then establish  
8 base line conditions and then, knowing how it  
9 responds, at a later date you would have some  
10 indication as to whether or not the trap was  
11 failing or not and along with other information.  
12 It's just another piece of information.

13 Q. So, this plot would accompany  
14 this concept regardless of scenarios?

15 A. Regardless of the scenarios  
16 of how high the mound may go, but if it's a  
17 relatively high mound, which I don't believe would  
18 go undetected, nonetheless I think this would be  
19 formed and it would be advantageous to have this  
20 additional monitoring.

21 Q. What would those monitors  
22 consist of?

23 A. They would be piezometers  
24 established in the upper and lower granular units.

25 Q. Would it be one per cell or



1 have you thought about it?

2 A. I haven't thought about it.

3 There are already some monitors in place and that would  
4 be a detail that would have to be worked out.

5 Q. Now, you will recall I asked  
6 you a few minutes ago whether you had checked the  
7 T value, the transmissivity value in the conversion  
8 in Appendix 16, page 2, which was a calculation of  
9 the quantitative impact of the hydraulic trap?

10 A. Yes.

11 Q. The value given there on page  
12 2 of Appendix 16 was 8.05 metres squared per day;  
13 right?

14 A. Right.

15 Q. Can you turn back to Volume 1,  
16 page 46 and there I believe, if you look under  
17 geometric mean in Table 6, there is a T and there  
18 is a transmissivity given in a slightly different  
19 unit of  $2.5 \times 10^{-4}$  square metres per second.  
20 Do you see that?

21 A. Yes.

22 Q. If you convert that to square  
23 metres per day, or metres squared per day, I believe  
24 that would come to about 21.6 metres squared per  
25 day. Do you want to take that, Mr. Beechinor, and



1 to give you a chance to convert that to metres  
2 per second to per day?

3 A. Bear with me, please. I can  
4 certainly see there is a difference, but I am not  
5 sure why.

6 Q. The first question is if you  
7 could confirm that if you convert  $2.5 \times 10^{-4}$   
8 square metres per second into the same unit, it would  
9 come to about 21.6 metres squared per day and if  
10 you can do that, to confirm it, that we have done  
11 our conversion correctly?

12 A. It would be about 21.6.

13 Q. The number on page 46, Table 6  
14 of geometric mean, T,  $2.5 \times 10^{-4}$  equals 21.6  
15 metres squared per day. If you compare that value  
16 for transmissivity versus the value used back in  
17 Volume 2, Appendix 16, the value was 8.05?

18 A. Yes.

19 Q. That is over a two times  
20 difference. In Table 6 -- first of all, have you  
21 any explanation as to why you used two different  
22 T values?

23 A. No, I don't know why it's  
24 different and not without checking back.

25 Q. In both units you are discussing



1 the upper granular unit?

2 A. Yes, that is correct. It isn't  
3 particularly critical, but it just means you cut back  
4 on your pumping rate so as not to create additional  
5 interference; that is something that must be worked  
6 out in the final in any event. It is not a number  
7 that negates the purge wells in any way and it would  
8 just mean that the cone, if we used the higher value  
9 here, and I can't explain why we have used different  
10 values offhand, but if we used the higher value,  
11 the cone would be broader and it would spread some-  
12 what faster and we would not have to draw the cone  
13 down as much and we could still maintain the same  
14 amount of drawdown in the other wells, but at this  
15 stage to me it's not that critical because ultimately  
16 the purge wells -- you would have to put in purge  
17 wells on that side to find out the exact hydraulic  
18 characteristics of the formations on the west side  
19 of the site in any event.

20 Q. You see, Mr. Sobanski, the  
21 concern I had is where in Volume 2, Appendix 16  
22 you were trying to predict and indeed did give a  
23 number to predict the impact of the hydraulic trap,  
24 you used a number for transmissivity which was  
25 lower, more than two times lower than the number you



1 used back in the other volume when you tried to  
2 calculate the effect of the purge wells?

3 A. I can see the difference and  
4 there is no problem seeing the difference. There  
5 is a difference between the two numbers and I am  
6 not sure why it's there.

7 Q. If the higher value used in  
8 predicting the impact of the hydraulic trap in  
9 Appendix 16 of 21.6 metres squared per day was  
10 used in the calculation of the drawdown effect of  
11 the purge wells, you would agree that the purge  
12 wells would have more drawdown than you predicted?

13 A. Not if I cut back on the  
14 pumping rate. I would cut back on the pumping rate.

15 Q. By how much? Is there a  
16 straight relationship? You have increased the  
17 transmissivity by a factor of more than two, so would  
18 you cut down the pumping rate by a factor of more  
19 than two?

20 A. It isn't quite linear because  
21 there is a log term that carries the transmissivity  
22 as well and one would have to look at it, but by cutting  
23 back on the pumping rate you could maintain this  
24 interference, but its adjustable. You want to form  
25 a cone and with the higher transmissivity, you



1 would get a cone that is longer and forms easier  
2 than you do with the low transmissivity material and  
3 so the cone therefore would be easier to form if  
4 the transmissivity is higher.

5 Q. You haven't done the actual  
6 calculation plugging in the figures?

7 A. No, I haven't.

8 Q. It seems incredulous at this  
9 point you have two completely different values and  
10 the values are out by more than a factor of two  
11 in two impact predictions about the same unit. You  
12 have no ready explanation at this point?

13 A. I don't, but I find it  
14 incredulous, given what is in these volumes at all.

15 Q. Now, just turning to another  
16 topic for a moment, on questions of modelling  
17 generally, I understand that Mr. Feenstra will be  
18 coming later on and that he has some important  
19 input into your modelling, is that fair?

20 A. That is correct.

21 Q. But you had to yourself  
22 assume responsibility for the adequacy of that  
23 before you could put it in your report?

24 A. I didn't work with Mr.  
25 Feenstra on the model; Mr. Beechinor worked mainly



1 with Mr. Feenstra on the model.

2 Q. I take it that you were  
3 satisfied -- this is a report from your firm and  
4 I take it -- it has your name on it and I am not  
5 sure if there is a significant page, but it is a  
6 report you stand behind, I take it?

7 A. We stand behind it, but  
8 Mr. Feenstra will talk to the model.

9 Q. I just wanted to ask you a  
10 couple of general questions about modelling and  
11 not in specific terms and if you can't answer say so,  
12 but if you can clarify these I would like to know.

13 If we turn to page 92 of Volume 1,  
14 and 91 starts to refer to your calculations and it  
15 goes on from there, but my question is simply that  
16 you used the Ogata-Banks equation in your modelling,  
17 I take it?

18 A. Yes.

19 Q. This is what has been called  
20 a one-dimensional modelling?

21 A. Yes. It is referred to here  
22 as a one-dimensional model.

23 Q. Does that model not assume  
24 that the unit under consideration and through which  
25 the waste is flowing, is infinitely deep?



1 A. I am not sure.

2 Q. Assuming infinity is part of  
3 that model, would you agree that to assume infinity  
4 would be an oversimplification of the real situation  
5 where your units are three or four metres thick  
6 behind the model? It is an oversimplification?

7 A. It may be, but Mr. Feenstra  
8 could speak better to the model than I can.

9 Q. A couple of other questions  
10 arising out of the Ogata-Banks equation used on  
11 page 92. My understanding is that this does not  
12 consider continuity of flux at the layer boundaries.  
13 If you don't understand what I mean, you can say  
14 that, but if you do know what I mean but don't  
15 know the answer, you can say that too.

16 A. A little of both. I think  
17 Mr. Feenstra would be better to answer that.

18 Q. Let me ask you, does this  
19 model satisfy the requirements for the conservation  
20 of mass?

21 A. Mr. Feenstra would be better  
22 able to analyze that, but this equation in itself  
23 is not a mass equation, but we have velocity within  
24 the equation and diffusion, dispersion, et cetera,  
25 retardation factors, and it isn't really referring to



1 mass as much as it is concentration.

2 Q. Let me ask you this. Is it  
3 not necessary to take into account mass transport  
4 when calculating arrival times and concentrations  
5 of contaminants?

6 A. It takes into account  
7 concentrations, which is what the Ministry requires  
8 for boundary criteria. They look at it from the  
9 point of view of concentration and not from the point  
10 of view of masses that are in the flux.

11 Q. I understand what you are saying  
12 what the Ministry is interested in, but I am asking  
13 you if it is not necessary to take into account  
14 mass transport when calculating arrival times and  
15 concentrations?

16 A. Not using this equation.  
17 This equation gives it in terms of a concentration  
18 gradient.

19 Q. This has to assume a  
20 concentration input and it does that?

21 A. Yes.

22 Q. It doesn't further deal  
23 with mass in the formula?

24 A. Not in this equation, no.  
25 On the other hand though, you know, what it does



1 tell you is that in the event of a failure, corrective  
2 action would have to be taken.

3 Q. Would you agree, Mr. Sobanski,  
4 there are alternative ways to model the system  
5 which is considered at Site D?

6 A. I must be sure there are some  
7 other ways to do it and there are a lot of models  
8 available.

9 Q. You yourself used a finite  
10 elements modelling method at Site F?

11 A. Yes, but it was a different  
12 type of model.

13 Q. There is something called a  
14 finite layer concept?

15 A. I am sure there are many  
16 and again Mr. Feenstra is far more familiar with  
17 some of the models than I am.

18 Q. You are not saying Ogata-  
19 Banks is the only appropriate way of modelling  
20 Site D?

21 A. I would have to defer on that.  
22 I believe this is an accepted way of doing it to  
23 find concentration changes.

24 Q. Another question, and this  
25 goes back to page 89 in Volume 1. At the bottom



1 of the page it says certain dispersivity values  
2 were assumed, and my question is on what basis,  
3 especially for the till and especially for this till?

4 A. Mr. Feenstra can answer that  
5 question, I am sure.

6 Q. You didn't ask him about that?

7 A. No, I did not.

8 Q. Have you any experience in  
9 giving an opinion about that?

10 A. I said I would defer that  
11 question to Mr. Feenstra.

12 Q. Mr. Sobanski, isn't  
13 dispersivity a factor of soil make-up?

14 A. Yes, it would be.

15 Q. Wouldn't any mathematician  
16 or someone applying mathematical principles have  
17 to rely on a geologist or hydrogeologist in order  
18 to plug in the right assumptions if it is going to  
19 be a valid assumption?

20 A. Not necessarily. Mr. Feenstra  
21 is a hydrogeologist of course and he can speak  
22 for these numbers.

23 Q. Can you make measurements of  
24 dispersivity in till?

25 A. I suppose if you instrumented



1 for it, you could.

2 Q. But none were made in this  
3 till?

4 A. How could there be, there is  
5 no landfill.

6 Q. I am talking about dispersivity  
7 values?

8 A. In the lab?

9 Q. Assumed here for this  
10 assessment?

11 A. Again talk to Mr. Feenstra,  
12 please.

13 Q. You have no idea whether the  
14 values set out at the bottom of page 89 of  
15 5 per cent, 10 per cent or 30 per cent are valid  
16 in your opinion?

17 A. I believe I have answered  
18 that question about five times.

19 Q. You have no opinion?

20 A. I have no opinion on it, no,  
21 and I have told you Mr. Feenstra did this particular  
22 part of the modelling for us and these are  
23 the numbers he felt were valid and so he can speak  
24 to them.

25 Q. You have no professional



1 ability to offer any further opinion on the numbers?

2 MR.LEDERER: That's not a question...

3 DR. KINGHAM: He did explain his

4 reluctance to deal with the question.

5 MR. ESTRIN: Q. Do you wish to make

6 any comments on the dispersivity values?

7 MR. BEECHINOR: A. That should be

8 deferred to Mr. Feenstra. We have had discussions

9 on the values, but Mr. Feenstra has the background

10 that can explain the rationale for using those

11 numbers.

12 Q. Basically these are his

13 numbers, and is that how I understand it?

14 MR. SOBANSKI: A. Yes, that is right.

15 Q. Have you any opinion as to

16 whether or not the dispersivity value in this till

17 could be as low as zero?

18 A. My response is the same,

19 Mr.Estrin, and as long as you keep talking about

20 it, it is the same, Mr.Feenstra will answer those

21 questions.

22 Q. You have no opinion?

23 A. I have given that response as

24 well.

25 Q. I take it it's the same answer



1 from you, Mr. Beechinor?

2 MR. BEECHINOR: A. That is correct.

3 Q. Okay. I would like to turn to  
4 what I believe is the last topic I want to cover  
5 and that is monitoring. Assuming mounding close  
6 to the top of the waste after a cell is completed  
7 and the site has an average mounding of 15 metres, and  
8 the perforated-- the perforated sub-headers are working  
9 but the collection tiles underneath the fill were  
10 not, would you agree it is possible to have  
11 significant downward velocities in the nature of  
12 those we were discussing in Exhibit 162 over  
13 much of the area of that cell, say, but still have  
14 locally upward gradients to the sub-headers?

15 MR. SOBANSKI: A. First of all, I  
16 think I have said I don't like your scenario too  
17 much. But, if we accept it, it is possible to  
18 have some very small gradients very locally around  
19 the perforated sub-headers if only they are open  
20 and the water table is drawn down fully at that  
21 point, but it would only be over a very small area.

22 Q. Under that scenario, you would  
23 still be collecting some leachate in the sub-headers?

24 A. You might capture some  
25 leachate in the sub-headers, yes.



1 Q. In that scenario, failure of  
2 the collector tiles may not be detected until after  
3 contamination of the groundwater?

4 A. Could you repeat that?

5 Q. In that scenario, which you  
6 have just answered, you could be collecting leachate  
7 in the sub-headers even though you have a failure  
8 of a cell or more than one cell?

9 A. No, you couldn't have that  
10 scenario.

11 Q. Why not, because you told me  
12 you could?

13 A. Because the amount of leachate  
14 you would be getting in your sub-headers would be  
15 very small and you would be getting a trickle and  
16 you are talking about the rest of the site plugged  
17 off and leaking into the lower material, but it  
18 is just not possible that you wouldn't see that  
19 kind of failure.

20 Q. You have agreed that you could  
21 be getting small upward gradients at around those  
22 sub-headers and therefore leaving some leachate...

23 A. Yes, very, very small, and  
24 you are talking tiny trickles of leachate if we  
25 plug the whole system off, other than the edge.



1 Q. Now, under your design plan,  
2 as I understand it, the way in which it was at  
3 least conceived prior to the hearing was that leachate  
4 was going to build up until it reached specified  
5 levels, say 180.0 to 184.4 metres in the manholes?

6 A. I believe there was some  
7 discussion that we could store some leachate initially  
8 within the waste mound, but Mr. Hiraishi would have  
9 to say how much there is and how much he is planning  
10 on.

11 Q. Mr. Sobanski, you agreed before  
12 that trying to predict leachate flows based on,  
13 say, water budget concepts is very problematic. How  
14 much water is coming in and therefore how much should  
15 come out at any point in time; that is pretty  
16 problematic?

17 A. It is problematic to the  
18 extent that you don't know it is exactly twelve  
19 inches and we don't know the exact number, but given  
20 other parameters in hydrogeology, it is less of a  
21 problem than other numbers are. It will not vary  
22 an order of magnitude or anything like that and  
23 we don't know it's exactly twelve inches.

24 Q. That is one variable and the  
25 other variable is the storativity or the amount of



1 leachate that can build up within the garbage before  
2 it starts to mound?

3 A. But that can be monitored and  
4 you can monitor it. It builds up within the  
5 leachate regardless of what the porosity is.

6 Q. But you agree to try and  
7 predict it in advance of the system actually working  
8 and say this is the mound of leachate you should  
9 expect at point X in year one, or in month six  
10 of year one or month six or year five or ten, that  
11 is not possible?

12 A. That's not possible, no, not  
13 entirely possible, and we can only give our best  
14 estimates.

15 Q. And in fact it does take some  
16 landfills a long time to begin to produce leachate.  
17 It starts flowing out?

18 A. No, not in my experience, not  
19 in my experience. We have had leachate form fairly  
20 quickly at landfills and it may be that all the  
21 waste mound is not saturated and it may be that  
22 the whole system is not producing leachate, but I  
23 believe experiences generally, being that there is  
24 some channeling within the waste and that leachate  
25 is produced in a fairly short period of time. In



1 other words, you don't have to saturate the garbage  
2 entirely to produce some leachate. There are  
3 preferred channels in which it can flow and show up  
4 at the bottom of the site.

5 Q. But at a certain point in time  
6 you might start to expect more than you have gotten  
7 in the past?

8 A. Yes, that is correct.

9 Q. For example, I was reading this  
10 Brock Road report you were referring to and this  
11 is a landfill site your firm has been monitoring  
12 for the city of Metropolitan Toronto?

13 A. Just recently we started to  
14 monitor it.

15 Q. I understand from reading  
16 those reports that it really wasn't until 1986 or  
17 1987 that the site began to produce significant  
18 amounts of leachate?

19 A. The site was producing leachate  
20 after about six months of operation and they have  
21 been handling it by sweeping it up in a vacuum  
22 truck and taking it back and putting it back into  
23 the waste, but there has been leachate produced at  
24 that site, not quite since day one, but very close  
25 to it.



1 Now, I say some leachate.

2 Q. Do you have a copy of the  
3 1987 monitoring report there? I believe you did  
4 the other day and there were a pile of them on your  
5 desk the other day. This is the 1987 -- sorry, it's  
6 called Hydrogeologic and Monitoring Report, Volume 1.

7 DR. KINGHAM: Is that an exhibit?

8 MR. ESTRIN: No, but I am about to  
9 hand this out and Mr. Lederer has copies, but it's  
10 excerpts.

11 MR. LEDERER: I don't have it.

12 MR. ESTRIN: I gave it to you.

13 MR. SOBANSKI: I should say that my  
14 knowledge of this report pretty well goes to  
15 discussions with one of its authors while he was  
16 preparing it. I have not read this report.

17 MR. ESTRIN: Q. Only a couple of  
18 generalized questions. You referred to Brock West  
19 as an example in a generalized way?

20 MR. SOBANSKI: A. I hope what I was  
21 saying was that we were starting to talk about  
22 attenuation here and during the preparation of  
23 this report, given that I had had some experience  
24 in the installation of the liner at the site as well  
25 as some general monitoring in the area, the author



1 from time to time discussed this report -- not the  
2 report, but his findings with me and my knowledge  
3 at that time was that he had said that the liner  
4 in his opinion was behaving as expected in terms of  
5 its design criteria and also that they were finding  
6 a significant reduction in chemical concentration  
7 as the leachate passed through the liner and into  
8 the subdrain that underlies the liner. This was  
9 pretty well my knowledge of the results of that  
10 study. The liner, Mr. Chairman, is made out of the  
11 native sand and it has 9 per cent by weight  
12 bentonite mixed in and compacted to about a 4 inch  
13 layer, so it is on sand, the site is on sand, and  
14 the liner is very thin, about 4 inches.

15 Q. I have a few questions arising  
16 out of anything to do with Brock Road. First of all,  
17 would you turn to that report and it's my understanding  
18 that this site went into operation about 1975-76;  
19 would that be generally your understanding as well?

20 A. According to this they say it  
21 was operational since June of 1975.

22 Q. If you turn to the top of  
23 page 30 of that report, and the pages might be out  
24 of order...

25 MS. TANNER: The last page?



1 MR. ESTRIN: They should be numbered  
2 and hopefully it's page No. 30.

3 MS. TANNER: It's the last page.

4 MR. ESTRIN: It could be. I don't  
5 have copies of what I handed out. Yes, page 30 is  
6 the last of the excerpts.

7 Q. If you turn back to page 28  
8 for a moment, you will see this is under the  
9 general heading of Leachate Collection.

10 MR. SOBANSKI: A. That's correct.

11 Q. If you turn to page 30, it  
12 does discuss the leachate flow measurements during  
13 1985 and 1986, is that right, and it's summarized  
14 in a certain table; do you see that?

15 A. Yes.

16 Q. "The daily average flow for  
17 1985 was determined to be...."

18 Using Imperial units, 3760 gallons per day:

19 ".... ranging from ...(5940 gallons  
20 per day) during the peak recharge  
21 months of March and April to about  
22 ....(2860 gallons per day) during the  
23 summer months."

24 Stopping right there, we have  
25 a doubling factor it would seem, approximately, in



1 that one year. Is that fair enough, in volume between  
2 the peak and the lowest month?

3 A. I would appear that way.

4 Q. "In 1986, the average leachate  
5 flow was slightly larger than in 1985,  
6 averaging about .... (6700 gallons  
7 per day), and ranged from .... (1560  
8 gallons per day) to .... (26,000  
9 gallons per day) in August."

9B. 10 Now, there is a significant swing  
11 there in the year and there is even a more  
12 significant swing, I would like to suggest, if you  
13 compare the 1986 values to 1985; fair enough?

14 A. That's correct.

15 Q. And in fact the lowest flow  
16 or the lowest range given of 1560 gallons per day  
17 in July of 1986 was lower than 2860 gallons per  
18 day in the summer months of 1985?

19 A. Could you repeat that?

20 Q. The number of 1560 gallons  
21 per day in July of 1986, which was the lowest  
22 collected in that period, is a lower number than  
23 2860 gallons per day during the summer of 1985  
24 by a factor of about 1000 gallons?

25 A. Yes.



1 Q. And yet the highest flow in  
2 '86 was several times the highest flow in 1985?

3 A. Yes.

4 Q. You have no reason to quarrel  
5 with these numbers?

6 A. I don't know enough about the  
7 numbers or how they are generated to tell you  
8 whether I quarrel with them or not.

9 Q. That's your firm's report and  
10 there is no reason to think that those numbers are  
11 not accurate?

12 A. But I don't know how they are  
13 collected and I'm not sure how it's pumped, whether  
14 it is intermittent pumping or continuous pumping  
15 and things like that. These are the numbers that are  
16 reported.

17 Q. And they are reported to the  
18 Ministry of the Environment?

19 A. Yes, of course.

20 Q. Now, let's talk a minute in  
21 g eneral terms about monitoring. What are the  
22 components that go into a comprehensive monitoring  
23 regime for a large site, and you would categorize  
24 Site D as a large site?

25 A. Yes.



1 Q. In a sensitive location and you  
2 would characterize Site D as being in a sensitive  
3 location. It's not as isolated as others?

4 A. Yes. It depends upon what  
5 you mean by sensitive. It has wells around it and  
6 to that extent there is a sensitivity one has to  
7 be concerned about.

8 Q. I want to take you through  
9 this, but what in your view are the appropriate  
10 components to go into a comprehensive monitoring  
11 regime for a large site as D in a sensitive location  
12 such as D is proposed to be. More specifically,  
13 how many holes, monitoring holes, should go into  
14 such a comprehensive monitoring regime?

15 A. We have not specified a number  
16 and that can be modified from time to time as things  
17 go on. We have a program outlined in the report and  
18 it's there for discussion purposes.

19 Q. Just to clarify, where in your  
20 report specifically is that program? Is that  
21 beginning on page 136 under monitoring?

22 A. Yes, that is correct.

23 Q. Do you agree with me that  
24 the discussion contained on these pages is in general  
25 terms?



1 A. Yes, it is.

2 Q. It won't answer any questions  
3 like how many holes you would put in?

4 A. We have suggested a monitoring  
5 program on Drawing 24.

6 Q. That is Drawing 24 found in  
7 Volume 1?

8 A. Volume 1, yes.

9 Q. It might be appropriate to  
10 bring out Drawing 24. Are you saying that Drawing  
11 24 represents the details such as you have conceived  
12 of them at the point in time the report was written?

13 A. Yes, that is correct.

14 Q. Since the writing of the  
15 report and the production of Drawing 24, we have  
16 heard you say in the witness stand that there may  
17 be some other ideas about monitoring you would like  
18 to see implemented, but I take it you have not  
19 put that in any written form or prepared a revised  
20 Drawing 24 at this point?

21 A. No, that is correct. I would  
22 have to look at this in the context of the cell  
23 locations to see whether the wells already in place  
24 would meet those requirements.

25 Q. So, I gather then you have not



1 determined the locations that monitoring wells would  
2 go in because you don't know the number either at  
3 this point?

4 A. We are showing what we are  
5 suggesting for the monitoring program here and  
6 they comprise new sets of wells and also existing  
7 wells, both ones we have constructed and also  
8 domestic wells in the area which would be monitored.

9 Q. The wells you propose are shown  
10 with the circle and a line across in the middle?

11 A. Yes, that is correct.  
12 Those are nests of wells.

13 Q. What do you mean by nests?

14 A. All important zones would be  
15 monitored within those units and it wouldn't be a  
16 single well. You would monitor the weathered  
17 zone and would monitor for gas in the weathered  
18 zone and would monitor the upper granular unit, the  
19 lower granular unit and the bedrock at each of  
20 those locations if the zones existed.

21 Q. For example, looking along  
22 the First Line and coming up from the south, I see  
23 about three or four inches up from the bottom of  
24 the site three circles with squares in them or with  
25 crosses?



1 A. That's right.

2 Q. Those three points joined  
3 together or touching each other are meant to  
4 represent in effect a nest of piezometers?

5 A. Yes, each one of those three  
6 would be nests and there would be three nests in that  
7 general area.

8 Q. So I have difficulty under-  
9 standing this concept and if you have three nests  
10 of piezometers at that location, they would actually  
11 be in the ground over an area that would be what,  
12 half the size of this room or the size of the room.  
13 Physically speaking, between the furthest and the  
14 closest....

15 A. Physically speaking twice the  
16 size of that table perhaps.

17 Q. Referring to the Board table  
18 up at the front?

19 A. About twice that size.

20 Q. Did you say twice?

21 A. About twice that size and  
22 enough to move around so you don't damage the well  
23 when you are moving your rig around and perhaps even  
24 as small as that table.

25 Some of our wells are in areas half



1 the size of that table.

2 Q. For the record, that table  
3 being approximately fifteen feet long, or somewhere  
4 between twelve and fifteen feet long?

5 A. I would say less than fifteen  
6 feet.

7 Q. And about four feet wide, three  
8 to four feet wide?

9 A. About three and a half.

10 Q. So you propose some monitors  
11 at the location we have just been discussing, and  
12 looking at Drawing 24, there is another one coming  
13 down to the south that would be -- how is the location  
14 south of HC3-85 -- is that intended to represent  
15 something significant at that location?

16 A. It's another set of monitors  
17 because there are domestic wells to the south --  
18 in this case I guess it's to the south of that  
19 location.

20 Q. What about -- moving to the  
21 east, there are two along the southern boundary and  
22 just to the west of what looks like a pond?

23 A. Yes.

24 Q. And again were there any  
25 particular reasons for those locations or that



1 location?

2 A. We are monitoring all along  
3 the property boundary to see if there are boundary  
4 impacts.

5 Q. Then another one to the east,  
6 to the northeast of HC6-85?

7 A. Yes, as well as HC6-85 as  
8 well; that nest would be used.

9 Q. Then you have one more in the  
10 southeast corner of the site along Highway 25?

11 A. There is one set there as  
12 well as the existing wells again.

13 Q. Moving back up to the northern  
14 half of the site, you have three proposed on the  
15 eastern side of the northern leg?

16 A. Yes.

17 Q. And then one more over near  
18 the First Line, the northern portion?

19 A. Again keeping in mind that  
20 wells like Morrison Beatty OW-3 and HC1-85 can  
21 be used and various wells already in place can be  
22 used for monitoring.

23 Q. I take it you are not prepared  
24 to say to the Board today that the monitoring  
25 wells delineated on site, on Drawing 24, are the



1 number that this Board ought to approve as part of  
2 plans for the site?

3 A. These wells are not cast in  
4 stone. They are for discussion purposes and in  
5 my experience with hearings, the Board usually allows  
6 the Ministry of the Environment some latitude in  
7 establishing a proper monitoring program around the  
8 site, something that would meet their needs and  
9 satisfy public concerns.

10 Q. Have you had a specific  
11 discussion with the Ministry of the Environment about  
12 your monitoring program?

13 A. No, I have not.

14 Q. What about the depth of the  
15 holes, have you determined that in any conclusive  
16 way or again is that a detail that would have to be  
17 worked out?

18 A. The depth of holes is based  
19 on the hydrostratigraphy and the deepest well in  
20 all cases would be a pilot hole which would be  
21 constructed in the top of the rock at the overburden/  
22 bedrock contact as being one potential contaminant  
23 migration path and if nothing else were found in  
24 the hole and it was solid glacial till, one would  
25 probably put a standpipe in the weathered zone.



1 If we find the upper granular unit, then the upper  
2 granular unit, that would be instrumented as well,  
3 so you would be looking at in some cases for  
4 sure, four monitors at each of these locations.

5 Q. And then in order to have  
6 some idea -- after the instruments go in and just  
7 as a general concept, the water sample would be  
8 taken from each of the holes at each of the instrument  
9 depths within those holes and subjected to analysis  
10 and a report prepared on a periodic basis?

11 A. That is correct.

12 Q. Have you determined how often  
13 such testing should be done; that is sampling  
14 conducted and analyses made, or again is that a  
15 detail you would want to leave for later?

16 A. We have suggested quarterly  
17 or semi-annually for the wells.

18 Q. When you say for the wells,  
19 which wells? Are you talking about off-site  
20 wells?

21 A. We are talking about page 138  
22 and this is the bottom paragraph:

23 "Following well installation,  
24 samples would be collected for de-  
25 tailed background quality analysis



1 and subsequent analysis would be  
2 monitored quarterly or semi-annually  
3 for the landfill  
4 contaminant indicated."

5 For the offsite wells, we would suggest an annual  
6 monitoring for them in that you expect to see the  
7 changes right up against the site, but however, for that  
8 too we should always remember that no monitoring  
9 program, even the one that is finally approved is  
10 cast in stone. It's not uncommon to have to change  
11 frequency and sometimes you monitor more frequently  
12 and sometimes less frequently once you establish a  
13 backlog of information on how things are changing.

14 Q. Indeed, one of the things  
15 you would need to know, which is rather fundamental  
16 to having any reliability in a monitoring program,  
17 are background levels?

18 A. Yes, that is correct.

19 Q. You would need to establish  
20 background parameters for the things you would be  
21 monitoring for?

22 A. Yes, you would.

23 Q. What would a background program  
24 consist of here at Site D?

25 A. Normally we look at taking two



1 sets of samples on site to establish the background  
2 quality and to run -- actually not just the  
3 contaminant indicators, but a full suite of  
4 parameters such as the heavy metals so that we  
5 can have something to fall back on later on for  
6 comparative purposes.

7 Q. When you say two sets, do you  
8 mean two sets at the same time?

9 A. No, two sets about two months  
10 apart.

11 DR. KINGHAM: I hate to break the flow,  
12 but I wonder when might be a reasonable time....

13 MR. ESTRIN: Oh yes, that is fine.

14 DR. KINGHAM: Let's just take fifteen  
15 minutes.

16 --- Recess

17  
18 DR. KINGHAM: Thank you. Please be  
19 seated.

20 MR. ESTRIN: Mr. Chairman, just before  
21 the break I put an excerpt of a document to the  
22 witness and perhaps we could mark that as an  
23 exhibit, an excerpt from Volume 1 of 3, Hydrogeologic  
24 and Monitoring Report on Brock West Sanitary  
25 Landfill Site.



1 DR. KINGHAM: You would like that  
2 marked as an exhibit. That will be M-176.

3 --- EXHIBIT No. M-176: Excerpt from Volume 1  
4 Hydrogeologic and  
5 Monitoring Report on Brock  
6 West Sanitary Landfill  
7 Site.

8 MR. ESTRIN: Q. Mr. Sobanski, we have  
9 looked at Drawing 24 and seen where you have  
10 conceived of on-site monitoring being done and it  
11 also seems to be apparent that you would wish to  
12 monitor off-site, and, in particular, as I read  
13 Drawing 24, you would monitor some of the private  
14 wells on the west side of First Line?

15 MR. SOBANSKI: A. Yes, that is correct.

16 Q. Has your firm been asked to  
17 provide the Region of Halton the cost of  
18 installation of the monitoring that would be  
19 required?

20 A. No, we have not.

21 Q. Have you asked by the Region  
22 to tell them what the annual costs would be, for  
23 example, in taking samples and having them analyzed  
24 and preparing a report?

25 A. No.

Q. I take it --

A. I should point out that I have



1 not been asked specifically myself. I am not sure  
2 whether Mr. Hiraishi may have some numbers or there  
3 may be numbers from some source and they may for  
4 example have used existing sites, I'm not sure, but  
5 we were not asked as hydrogeologists to provide that  
6 cost.

7 Q. I take it your firm hasn't  
8 been retained at this point to design that monitoring  
9 program?

10 A. No, that is right.

11 Q. In addition to what we have  
12 discussed, there would be a cost for maintaining the  
13 monitoring equipment and replacing it periodically,  
14 depending on how many years it is expected to provide  
15 data. These wells get run over, they get stuff  
16 thrown down them and what other things can happen?

17 A. You try to prevent those  
18 things, but inevitably some damage may occur and  
19 yes, they are replaced if necessary.

20 Q. That is a cost that should be  
21 built into a budget for the Region if they are  
22 going to know the overall picture?

23 A. Yes, but I think it is  
24 relatively small compared to the cost of running  
25 one of these sites.



1 Q. How long you would have to  
2 sample and how long therefore you would have to  
3 maintain your monitoring equipment in monitoring  
4 order would be a function of what the strength of  
5 the materials essentially in the landfill was at  
6 any particular interval in time. In other words,  
7 if you have the strength in the landfill, a  
8 concentration of, let's take chloride for example,  
9 and if it's down in the landfill, leachate on site  
10 to a low number, then is it your view that really  
11 it's at that point in time that off-site monitoring  
12 should cease?

13 A. That's a difficult question  
14 to answer. I would think -- I am not sure how  
15 long the Ministry will require the monitoring of  
16 these large landfills. I can't say for sure.  
17 We know that all sites have the same problem and  
18 it's a common problem and they would be monitored  
19 as long as is required, and certainly one indication  
20 is the overall leachate strength. However, leachate  
21 strengths vary from time to time and place to place  
22 and just how long this system might be monitored,  
23 I really can't say. We haven't had these types of  
24 sites in place for a long time and the Ministry  
25 now has a problem of going in and actually looking



1 at some of the old sites and I think in time we  
2 will get a better idea of how long sites have to  
3 be monitored.

4 For the purposes of this exercise,  
5 we have suggested a monitoring period of forty years  
6 and perhaps it might be longer.

7 Q. Perhaps?

8 A. It's up to the Ministry how  
9 long it will be monitored.

10 Q. It wouldn't be unreasonable  
11 to suggest that monitoring could go on for as long  
12 as -- double that or eighty years?

13 A. Possibly. I just don't know,  
14 but if that is required at this site, it would be  
15 required at any site and it would be a common  
16 problem to sites in Ontario.

17 Q. You see, I took it from your  
18 report, Volume 1, Figure 15, the chloride value  
19 declines in the leachate and after about forty or  
20 forty-five years, the level you were predicting in  
21 the leachate itself would be brought down from its  
22 initial concentration to about one hundred parts  
23 per million?

24 A. For modelling purposes, that  
25 is what we have assumed.



1 Q. And, you are saying now, as I  
2 understand it, that doesn't necessarily mean that  
3 monitoring will have to end at that point, even if  
4 the chloride values do a decline in accordance with  
5 that graph?

6 A. Chloride is one of the  
7 indicators and it is something to give us a feeling  
8 for how sites behave and it's a conservative  
9 contaminant. There could be some other contaminant,  
10 which may be of interest which we would to control  
11 and it may take longer, we don't know for sure, and  
12 monitoring must go on as long as it is required to  
13 make sure there is no problem.

14 Q. So, while chloride is a very  
15 mobile indicator, it isn't necessarily the only one  
16 that may cause a need for modelling and remedial  
17 action?

18 A. That is correct. We have  
19 modelled some of the organics as well, to get some  
20 idea of how they would behave, but this information  
21 I guess will become known in time at all sites, as  
22 we get more experienced with them. Right now I  
23 don't believe there is enough experience to know  
24 exactly how long modelling may have to go on.

25 Q. Could we look at Table 15 for



1 a moment in Volume 1, and this is at page 110.

2 A. Figure 15?

3 Q. On page 110.

4 If we could, let's look at the bottom  
5 of page 107 for a moment. You say:

6 "Based on observations at landfill  
7 sites and in laboratory leaching  
8 experiments, it is inappropriate  
9 to assume that contaminant inputs  
10 from landfills will remain constant  
11 for a period of 200 years. It is  
12 generally regarded that contaminant  
13 concentrations in municipal landfill  
14 leachate will be initially high  
15 during operation and shortly following  
16 closure, but will decline as more  
17 readily leachate compounds are removed."

18 Then you go on to say in the next  
19 paragraph:

20 "The effect of a declining contaminant  
21 input concentration is very significant  
22 with respect to off-site migration of  
23 contaminants...."

24 And you go on to say that:

25 "... contaminant migration through



1 the Unweathered Upper Till - Lower  
2 Till - Granular Unit pathway occur on  
3 a scale of tens of years, similar to  
4 that of the expected declines in input  
5 concentration."

6 Now, stopping right there, I just  
7 want to get this clear. Are you saying -- then you  
8 go on to discuss Figure 15 and you say:

9 "Because of this relatively long  
10 travel time, the high initial  
11 contaminant concentrations in the  
12 leachate may never be reflected at  
13 the site boundaries, even for non-  
14 adsorbed contaminants. This effect  
15 can be illustrated by examining  
16 the Weathered Upper Till component  
17 model and the Unweathered Upper  
18 Till - Lower Till - Granular Unit  
19 coupled with a decreasing input.  
20 Figure 15 shows an example of  
21 decreasing chloride concentration  
22 with time which was used to represent  
23 the input from the landfill in the  
24 following simulations. Chloride is  
25 initially 1500 mg/L, decreases to



1 100 mg/L after 50 years and continues  
2 at 100/L to 200 years. "

3 Now, coming back to the statement on  
4 page 109, you say:

5 "At Site D, contaminant migration  
6 through the Unweathered Upper Till -  
7 Lower Till - Granular Unit pathway occur  
8 on a scale of tens of years, similar  
9 to that of the expected declines in  
10 input concentration."

11 Then you refer to Figure 15. First  
12 of all, where did -- do you think Figure 15 itself  
13 is realistic?

14 A. I think it's realistic  
15 considering the input data that we use to it which  
16 has come from various places such as Dr. George  
17 Hughes, work done by Pohland in leaching columns,  
18 landfill sites we have looked at in Ontario, and  
19 there seems to be a general decline in chloride with  
20 an increase in time and I think it makes sense that  
21 readily leached components are taken out of a  
22 landfill and of course in this case they be taken  
23 to a sewage treatment plant. These are materials  
24 that can be dissolved and consequently as rainfall  
25 hits them, they are taken away. It won't stay in



1 there for ever and there is a declining mass of  
2 contaminants in the landfill over a period of time,  
3 but the model has shown in this case again that we  
4 can have an impact at the property boundary that  
5 would likely exceed Ministry guidelines if we were  
6 to have a major failure of the system and, as I  
7 mentioned before, to me it isn't that critical as  
8 to whether the concentration at the property  
9 boundary is 300 milligrams per litre or 600 milligrams  
10 per litre, because in either case it would have to  
11 be collected and it also isn't critical on whether  
12 it is fifty years or seventy or eighty years,  
13 whatever the collection period is required for it  
14 to be collected, and that is true for all landfill  
15 sites in the province and this is no different to  
16 other sites.

17 Q. But how quickly it declines,  
18 even just taking chloride and how realistic this  
19 table is does have to play a role in determining,  
20 either from the Ministry of the Environment point  
21 of view or your point of view how long monitoring  
22 might have to go on?

23 A. The monitoring, I said, will  
24 go on as long as the Ministry deems it necessary  
25 and I have no problem with providing you the curve



1 I use and providing Mr. Feenstra with the data on  
2 which it was based, but it doesn't mean it is  
3 absolutely reliable, because it's leachate data  
4 collected on several cells in the site and drawing  
5 a curve through it.

6 A declining curve based on that and  
7 there are many points below the curve, below the  
8 concentrations and a few above the curve with  
9 higher concentrations, but the Ministry for a  
10 starting point on chloride for impact calculations  
11 would like us to start at about 1500 and that's what  
12 we do.

13 Q. Are you saying the choice of  
14 1500 as a starting point is really a Ministry  
15 number?

16 A. This is the type of number  
17 they ask us to use, yes.

18 Q. Did you make any assessment  
19 of what the data from Halton regional sites  
20 including Bayview in Burlington, might indeed  
21 indicate?

22 A. We have in our report some  
23 information collected, I believe by Pollutech,  
24 on the types of concentrations they are seeing  
25 in the leachate at this time and that was taken



1 into consideration as well. That's on page 81.

2 Q. Do you have that curve here?

3 A. Yes, I do.

4 Q. Perhaps you wouldn't mind  
5 getting it out. Don't throw it at me. I just  
6 wanted to see the curve.

7 While Mr. Lederer is looking at that  
8 and to divert for one second to another topic,  
9 going back to your calculation of purge wells in  
10 the lower granular unit, and I am diverting while  
11 Mr. Lederer locates that, but at Site D, you  
12 prepared this calculation of purge well considerations  
13 which was made Exhibit H-175, and I won't take you  
14 through it, but in the bottom line on the third  
15 page of that you have calculated that approximately  
16 seven purge wells would be required in the lower  
17 granular unit, if I have got this right, on the  
18 west side of the site?

19 A. That's around the total  
20 perimeter of the site.

21 Q. The total perimeter. How many  
22 on the west side?

23 A. None. As we explained on the  
24 west side, if I can show you what I did, the number  
25 wouldn't change a great deal. If I can refer to



1 Drawing 18, in fact I can control the lower granular  
2 unit by the upper granular unit in a fairly large  
3 part of the area by pumping pump well No. 2 and as  
4 we have seen in our discussion, we have extended the  
5 cone out to HC2-86 and so a large portion of the  
6 site and what leaks through it to the upper granular  
7 unit can be controlled from there, but for  
8 conceptual purposes, we don't have everything  
9 absolutely defined here. I believe we have agreed  
10 that this is the extent of the upper granular unit  
11 on the west side of the site and in this area we  
12 believe we can capture any leachate moving down  
13 out of the cells in the upper granular unit. So,  
14 where I have said the lower granular unit wells may  
15 have to go is starting at the northerly extent --  
16 we would start probably in the order of HC1-85  
17 and extend it across the north boundary and down the  
18 east boundary, across the south boundary and part  
19 way up the west boundary and then make the assumption  
20 here that we can capture it in the upper granular  
21 unit. If we can't do that, then we would have to  
22 add two extra wells or so into the area presently  
23 shown as the upper granular unit on the west side;  
24 so seven wells approximately is correct. The number  
25 in the figures you will see comes out at six wells and



1 we have another well thrown in. That is how it was  
2 calculated and the western part of the site I am  
3 saying is that since we have agreed the upper granular  
4 unit is there, then we can do any purging we have  
5 to do through the upper granular unit.

6 DR. KINGHAM: In both cases you are  
7 talking contingency programs?

8 MR. SOBANSKI: These are contingency  
9 programs if needed.

10 MR. ESTRIN: Q. At the bottom of the  
11 third page, the numbers, I want to make sure I can  
12 read them, but the drawdown in the pump wells is  
13 equal to 38 feet approximately and one-third into  
14 LGU?

15 MR. SOBANSKI: A. That is right.

16 Q. What do you mean one-third into  
17 the UGU?

18 A. You can see where the drawdown  
19 occurs if we look at page 4 of the figure. If  
20 we pumped a well, we can pump into the unit itself,  
21 we can lower the drawdown into the unit itself  
22 without significantly affecting the transmissivity  
23 of the zone by dewatering it if we leave about  
24 one-third of the zone saturated. In fact here we  
25 have about two-thirds of the zone saturated. If I



1 can come back to perhaps the little drawing, when we  
2 pump a well and we are controlling the lower granular  
3 unit, but if we develop a cone of depression away from  
4 the well, with the pumping level in the well being  
5 at the top of the lower granular unit, the lower  
6 granular unit behaves like an artesian aquifer.  
7 It is receiving its water from leakage through the  
8 zone, through the lateral flow through the zone,  
9 through the compressibility of water and through  
10 the compressibility of the skeleton, the small changes  
11 that occur because the grains move a bit when you  
12 release the pressure on them.

13 So, again  $T$  is equal to  $kh$  and  
14  $h$  is the thickness of the zone. When we enter the  
15 zone, if we now take the curve like so and enter  
16 the zone, then  $h$  starts to decrease and so  
17 apparently the transmissivity would become somewhat  
18 smaller.

19 Now, in pumping in this manner of  
20 drawing this in to this granular unit, without --  
21 because of the way flow lines converge into the  
22 well, usually before  $T$  starts to change  
23 significantly, you can pump down into that unit about  
24 two-thirds of its thickness, leaving about one-  
25 third saturated and that does not affect the



1 transmissivity significantly and the reason this is  
2 happening is because of the convergence of flow  
3 lines and the way flow is taking place and in this  
4 case it's all lateral like so, and if it is totally  
5 saturated and if we start to desaturate it, the flow  
6 lines start to deflect to feed the saturated section  
7 and consequently it starts to change the T.  
8 Normally we can pump to this type of a limit.

9 Now, in the case I have looked at,  
10 I have said we only have to come down about one-  
11 third into the zone to create the cones I am talking  
12 about in this calculation and so I have said that  
13 that's okay.

14 MR. LEDERER: Before Mr. Estrin goes  
15 on, I don't know if he will ask questions and I  
16 don't know the Board's reaction, but Mr. Sobanski has  
17 referred to this drawing as assisting him in making  
18 a point and I wonder if that might be exhibited  
19 in case you want to review this at a later date,  
20 because I doubt the transcript will make much sense  
21 without the drawing.

22 MR. ESTRIN: Certainly.

23 DR. KINGHAM: It will become H-177.

24 --- EXHIBIT No. H-177: Drawing prepared by  
Mr. Sobanski.



1 MR. ESTRIN: Q. While we are looking  
2 at that exhibit, the fourth page, Exhibit H-175,  
3 and that is what I meant to say, the fourth page,  
4 but if you go over those lines on there, those  
5 slanting lines, what are they meant to represent?

6 MR. SOBANSKI: A. Okay.

7 Q. Very simply, do they try and  
8 indicate the extent of the drawdown?

9 A. Yes, they do at any time.  
10 For example, if we look at the first one, we are  
11 plotting a drawdown on the lefthand side, and that is  
12 very poor, but on the Y axis we are plotting drawdown  
13 in feet and then we are plotting radius along the  
14 bottom, along the X axis, so this is also in feet,  
15 0.1, 1.0, 10.0 and 100.0 and finally 1000.0  
16 feet from some point. The first point we put on  
17 is the radius of our pumping well, a six-inch well,  
18 which gives us a radius of three inches, which is  
19 a quarter of a foot, and so that comes in at 0.25  
20 feet and we plot the drawdown in that well, which  
21 was at 21.6 feet. We then plot at 10 feet, which  
22 is about 3 metres, the drawdown we observed in the  
23 observation well, which is just a little over  
24 three feet. So, by joining those two points, we can  
25 measure here our sub zero, which is the radius



1 which the cone was out due to pumping, and that was  
2 equal to 19 feet. So, this is how we draw cones of  
3 depression and the drawdown is shown in a linear  
4 scale and the radius away from the pumping well  
5 or any radius in feet along the X axis. This is  
6 actual field data and the first curve is from field  
7 data.

8 Q. Mr. Sobanski, Mr. Lederer  
9 suggested it might be appropriate to mark the next  
10 page as an exhibit, the one you have just been  
11 referring to.

12 DR. KINGHAM: H-178.

13 --- EXHIBIT No. H-178: Diagram showing  
14 drawdown, being actual  
field data.

15 MR. ESTRIN: Q. Coming back to the  
16 handout, Exhibit H-175 and the fourth page of that,  
17 let's go to the bottom of the third page first of  
18 all. What we have done on the first three pages  
19 is discuss the lower granular unit?

20 A. That's right.

21 Q. And the bottom line on page  
22 3 literally is that the drawdown in pumped wells  
23 is equal to 38 feet approximately or one-third into  
24 the lower granular unit?

25 A. Yes.



1 Q. Then you have put in the word  
2 "acceptable?"

3 A. That's right.

4 Q. Now, let's turn the page.

5 The graph you have there, unless I am misreading it,  
6 seems to look at calculations of drawdown in the  
7 upper granular unit. The calculations there are  
8 relative to the lower granular unit, but if we look  
9 at where you are deriving -- where I understand you  
10 are getting your drawdown for the lower granular  
11 unit, it appears on the left axis to refer to the  
12 top of the upper granular unit, the middle of the  
13 upper granular unit and the bottom of the upper  
14 granular unit?

15 A. You are right. Make that  
16 the lower granular unit.

17 DR. KINGHAM: You are telling us  
18 the initials should be LGU on the lefthand side?

19 MR. SOBANSKI: Yes, I was getting a  
20 bit tired last night when I was finalizing the  
21 graph.

22 On the righthand side it's the same  
23 thing and where it says ground level, GL, and then  
24 top and bottom, that should be the lower granular  
25 unit.



1 MR. ESTRIN: Q. If we can come back  
2 to where were discussing chlorides and the decline  
3 in the concentration of contaminants, you have  
4 provided me with a graph which has your initials  
5 on it, and this is some data you had plotted or  
6 you plotted yourself?

7 MR. SOBANSKI: A. From time to time.

8 Q. You provided this to Mr.  
9 Feenstra, I think you told us, but when? Was it  
10 for the purpose of his doing Figure 15?

11 A. Yes.

12 MR. ESTRIN: Can we mark that as  
13 the next exhibit and I believe it should have a  
14 Milton number.

15 DR. KINGHAM: It will be M-179.

16 MR. LEDERER: Again, a small point,  
17 but by way of establishing some form of rules,  
18 if the source of the data is Halton, clearly that  
19 should be Halton.

20 DR. KINGHAM: I am easy. Do you  
21 want it as H?

22 MR. ESTRIN: I believe H.

23 --- EXHIBIT No. H-179: Chart re. chloride decline.

24 MR. ESTRIN: Q. The appropriate  
25 name for this might be plot of chloride decline decay.



1 MR. SOBANSKI: It says chloride  
2 decay data.

3 Q. It's plotted by Hydrology  
4 Consultants.

5 DR. KINGHAM: Chloride decay data.

6 MR. ESTRIN: Yes.

7 MR. GARROD: This is for Site D?

8 MR. SOBANSKI: It's for both sites.

9 MR. ESTRIN: Q. It's a generic  
10 curve?

11 MR. SOBANSKI: A. Yes.

12 MR. LEDERER: I don't think that's fair.

13 MR. ESTRIN: Generic in the sense  
14 that it is for both sites.

15 MR. LEDERER: You have to look at  
16 the source of the data...

17 MR. ESTRIN: Q. It was used by your  
18 firm for both sites?

19 MR. SOBANSKI: A. Yes, that's right.

20 Q. The data that is plotted, some  
21 of it is data that I take it your firm obtained  
22 from time to time?

23 A. Yes.

24 Q. Some of it is from Gartner  
25 Lee, from their investigations of regional sites?



1 A. I don't believe so.

2 Q. For example, the Georgetown  
3 site, that is a closed-out regional site and did your  
4 firm do any work there?

5 A. Yes, we did some Georgetown  
6 work some years back but that number is coming from,  
7 I believe it was from '81.

8 Q. Gartner Lee?

9 A. No, this is an analysis by  
10 Pollutech Limited.

11 Q. They didn't go and sample  
12 themselves, did they?

13 MR. LEDERER: We had better establish  
14 whether Mr. Sobanski knows who sampled, because  
15 our experience with Pollutech is that they do sample  
16 in some circumstances.

17 MR. ESTRIN: Q. Which data on  
18 here is your firm's or do you know that?

19 MR. SOBANSKI: A. I am sorry, what  
20 do you mean?

21 Q. You plotted certain values  
22 on here?

23 A. Yes.

24 Q. I am interested in knowing  
25 which data was the data your firm arrived at



1 yourselves as opposed to taking it from someone  
2 else's report or the literature?

3 A. Mississauga, Brock West,  
4 and I don't know what you mean by literature, but  
5 Burlington, Georgetown and Oakville came from this  
6 report, based on data provided by Pollutech to us,  
7 and Brantford is ours, Waterloo is ours, Preston  
8 I believe was ours, the U.S. data is from information  
9 published by, I believe, Dr. Hughes. There was  
10 some other data that falls within the whole range  
11 done by Pohland, but it is not on here and his were  
12 results from laboratory results and they were all  
13 quite low, relatively low chloride concentrations  
14 so I left them off. He had quite a few points.

15 Q. I don't expect you to answer  
16 this right now, but I would like to know whether  
17 the data -- the Pollutech data -- relative to  
18 the Region of Halton sites was it their own data or  
19 whether it was taken from another report?

20 MR. LEDERER: I thought it was clear  
21 but perhaps it wasn't, but Pollutech is a  
22 consultant with respect to this project and we will  
23 be calling evidence from them and surely it makes  
24 more sense to pose the question directly to them.

25 MR. ESTRIN: I just wondered if it



1 could be clarified before then?

2 MR. LEDERER: If Mr. Estrin will take  
3 it from us, we will contact Pollutech and ask them.

4 MR. ESTRIN: I would be quite happy  
5 with that. I am just asking if it's Pollutech data  
6 or someone else's data and if so, whose?

7 DR. KINGHAM: On this exhibit?

8 MR. ESTRIN: Yes, relative to  
9 Region of Halton landfills.

10 MR. LEDERER: I can say this subject  
11 to checking, but Mr. Hodgson has been meeting people  
12 from Pollutech and I believe this is Pollutech  
13 data directly, but we will check it.

14 DR. KINGHAM: We will hear evidence  
15 on that?

16 MR. LEDERER: You will.

17 MR. ESTRIN: Q. Now....

18 MR. SOBANSKI: A. In reading this,  
19 if I can help, we start off on the lefthand side  
20 with the curve Mr. Feenstra has used and it starts  
21 at about 1500 milligrams per litre and then it  
22 follows through the dashed line that says "Given  
23 to Feenstra for chloride decay model."

10A

24 Q. As far as you are aware,

25 Figure 15 is published in your report, Volume 1, and



1 is derived from the data on Exhibit H-179?

2 A. Yes.

3 Q. Let's come back to the  
4 discussion on page 109 of your report. As I read  
5 it, and I won't repeat it as I have read it a couple  
6 of times, but you say contaminant migration is  
7 similar to that of the expected declines in input  
8 concentrations?

9 A. I am sorry, could you tell me  
10 where you are?

11 Q. The paragraph on 109 beginning  
12 "The effect of a declining contaminant  
13 input concentration is very  
14 significant with respect to off-site  
15 migration...."

16 and then it goes on:

17 "At Site D, contaminant migration  
18 through the Unweathered Upper Till -  
19 Lower Till - Granular Unit pathway  
20 occur on a scale of tens of years,  
21 similar to that of the expected  
22 declines in input concentration."

23 Is that a mere observation or  
24 is something being suggested there to the effect  
25 that contaminant migration is somehow tied in in



1 periods of years to the decline?

2 A. No, not at all. There is  
3 nothing sinister about the statement, just an  
4 observation that we were talking about fifty to  
5 sixty years to the property boundary in the case of  
6 the model and we were also predicting that a lot  
7 of the contaminants will have been leached out of  
8 the fill in about the same period of time, but there  
9 is nothing sinister about it at all. If the  
10 chloride concentration stays higher for a longer  
11 period of time, it will affect the migration curve,  
12 but that is only important if the system fails and  
13 in any event you would need a collection system and  
14 whether it follows this model or some other model  
15 of chloride decay doesn't really matter. If the  
16 system fails and you have a major failure on the  
17 site, and I am not saying a small failure but a  
18 major failure on the site, you will have to collect  
19 leachate regardless of which model we use, but we  
20 are saying this is a reasonable model given some  
21 of the data we have in our data banks.

22 MR. LEDERER: With respect to the  
23 question about Pollutech, Pollutech's report has  
24 been filed and I am not certain of the number and I  
25 am sure it has one and we will get the exhibit number,



1 but if you refer to page 31, you will see there the  
2 statement at the bottom of the page:

3 "All samples of landfill leachate were  
4 collected by Pollutech staff  
5 utilizing sampling procedures  
6 specifically designed for each  
7 particular landfill site,"

8 and the four landfill sites being referred to are  
9 the Georgetown site, the Oakville site, the Burlington  
10 site and the Bayview site and I should say it's  
11 Exhibit H-43. H-43 at page 31 where you will find  
12 that statement of the four landfill sites being  
13 referred to and two immediately contiguous to Site F  
14 and the other two being Georgetown and Oakville.

15 DR. KINGHAM: Thank you.

16 MR. ESTRIN: Q. Mr. Sobanski, using the  
17 assumption or using Figure 15, can you express any  
18 opinion that if you doubled the initial concentration  
19 of chloride and took it from 1500 to 3000 and kept  
20 the same removal rate over a period of years, would  
21 it take approximately twice as long to get the  
22 concentration down to the same value of 100 parts  
23 per million?

24 MR. SOBANSKI: A. Mr. Feenstra could  
25 answer it better, but I believe the peak would be



1 higher and it would be longer, because you would have  
2 to remove more mass, but I will defer to Mr. Feenstra.  
3 However, I believe it would be higher and certainly  
4 the concentration would be higher and I would expect  
5 it would last longer as well.

6 Q. To the extent that anyone  
7 was trying to predict how long leachate collection  
8 systems might have to run, for example the Ministry  
9 based on an assumed decline of concentration of  
10 chloride, and if the number or the initial concentration  
11 was higher than shown on Exhibit 179 or assumed in  
12 your report, the period of years that one would be  
13 concerned about would also vary?

14 A. We have already said that it's  
15 an uncertainty as to how long it would have to be  
16 and so the concentration is just another parameter,  
17 but we have already said that you don't know  
18 exactly how long it would be.

19 Q. When we are talking about  
20 engineering systems, I have a concern and that is  
21 that you have got to -- I take it you are saying  
22 to the Board that you want to make sure that the  
23 monitoring goes on for however long there is  
24 sufficient mass of contaminants in that landfill  
25 to get out and such that you would be properly



1 concerned that they got out?

2 A. Certainly . We said it would  
3 be monitored as long as it has to be and as long as  
4 the Ministry wants it monitored the Region will  
5 have to monitor it and that is true at any landfill  
6 site.

7 Q. We could be talking anywhere  
8 from forty to eighty to even more years?

9 A. I don't know, Mr. Estrin, how  
10 long it would be. .

11 Q. And you agreed earlier this  
12 morning that chlorides isn't necessarily the only  
13 parameters that one would necessarily base a number  
14 of years on. For example, as I understand it, while  
15 chlorides do decline, perhaps as you have described  
16 it and assuming you know the initial concentration,  
17 but heavy metals may behave differently?

18 A. Heavy metals usually to my  
19 knowledge aren't a real problem at landfills. We don't  
20 detect a great many heavy metals on landfill sites.

21 Q. Could that be because monitoring  
22 hasn't gone on long enough and the leaching of them  
23 has not yet occurred and there hasn't been enough  
24 time to cause their leaching out?

25 A. I don't think I would say that.



1 There are a lot of metals that leach pretty readily and  
2 aren't attenuated such as iron, and iron is sort  
3 of the bane of the landfill monitoring program and  
4 it doesn't take much to give you a stain. The metals  
5 come out and they are mobilized, but overall they  
6 don't seem to go very far in our landfill sites.  
7 We have the beauty in Ontario of having limey soils  
8 in Southern Ontario and they tend to neutralize the  
9 acidic solutions that are formed within the landfill  
10 and these keep our leachates fairly neutral and they  
11 tend to plate out, as Mr. Feenstra says in here, as  
12 insoluble compounds.

13 Q. Are you saying that there is  
14 sufficient historical data in Ontario to permit  
15 the formulation of a rate equation and rate coefficient  
16 with respect to the decline of heavy metals in landfills?

17 A. Probably not, but they are  
18 monitored as well and if they are a problem, you have  
19 to purge them.

20 Q. So monitoring is the answer?

21 A. Monitoring is the answer at  
22 all sites and it has to be. We monitor what we  
23 consider to be even the safest sites, if there is  
24 such a thing as a "safe site."

25 Q. Mr. Sobanski, coming to a



1 little more general aspect of this topic, we under-  
2 stand clearly that Site F and Site D require  
3 "engineering?"

4 A. Yes.

5 Q. But at Site F there is no  
6 need to do that form of engineering which you would  
7 be doing at D, create a hydraulic trap?

8 A. We don't believe it is necessary  
9 at Site F.

10 Q. And really at Site F what  
11 you are relying on is in effect, if I can use this  
12 term, simple gravity plus a little bit of mounding  
13 to make the leachate go down to the leachate  
14 collection system; right?

15 A. Yes, yes.

16 Q. There is no need, as at D,  
17 to use engineering to reverse natural gradients  
18 to ensure that most leachate is captured?

19 A. That is correct.

20 Q. In fact through simple  
21 gravity and your leachate collection system, you  
22 expect to get about 95 per cent approximately of  
23 the leachate at Site F into those pipes?

24 A. Yes.

25 Q. And there is historical



1 experience at Site F as to what would happen if a  
2 leachate collector system failed, and I think you  
3 would agree. For example, the Bayview Park site,  
4 the closed-out Burlington site, you understand has  
5 no leachate collection system or it had no leachate  
6 collection system?

7 A. Initially it did not have  
8 a leachate collection system.

9 Q. Today perhaps it has some toe  
10 drain collectors?

11 A. Yes, it has a toe drain collection  
12 system on portions of the site.

13 Q. Could you take a sketch for  
14 a moment and illustrate the difference between toe  
15 drains and leachate collection systems? I am sorry,  
16 toe drains and underdrains.

17 A. I am trying -- pardon me, but  
18 I am trying to think if there is a true definition.  
19 The definition of a toe drain for me, and I would  
20 draw what I would consider to be a toe type drain,  
21 and if we draw it for Site F, for example. Now,  
22 we would have perhaps some type of a hole dug, or  
23 it could be on the original ground, and leachate  
24 springs would occur and somewhere in this area one  
25 would install a toe drain near the toe of the waste.



1 I am not sure whether there is an absolute definition  
2 but then I would consider a drain on the bottom to be  
3 a perimeter drain.

4 Now, if we look at Bayview, we have  
5 a relatively shallow drain installed around a portion  
6 of the property and I haven't seen the final drawings,  
7 but bear with me if it's not exactly right. It would  
8 be that type of a simple system so that leakage can  
9 still occur from a site into the subsurface, for  
10 example, and there is no form really of groundwater  
11 control, but just shallow groundwater in terms of  
12 this relatively shallow interceptor at the toe of  
13 the waste.

14 If you look at the proposed site,  
15 Site F, it has a two-level tile collector system  
16 with one running within the valleys and, on top of  
17 that, there is another set of drains set out in a  
18 herringbone fashion, and I won't draw it exactly  
19 but over the total site so you have two levels of  
20 drains, one within the valley system which would be  
21 partially filled and then on top of that is another  
22 set of tiles so that you have drains set out all  
23 over the property. In addition, down towards the  
24 toe, there is again what we will call here a  
25 perimeter drain that would be installed along the



1 bottom end. That is my understanding of the latest  
2 concept, and so it too is acting to capture shallower  
3 leachate and behaving in some manner like a toe drain but  
4 set deeper. In terms of sophistication, at the  
5 Bayview site what we have is a fairly shallow toe  
6 drain along the west and south sides, and in the site  
7 we are proposing to put in between the two we have  
8 a full set of tile collectors set at two levels  
9 within the landfill, and Mr. Hiraishi can explain  
10 it more than that, but this is a far more sophisticated  
11 system and provides a much higher level of leachate  
12 collection than a simple toe drain.

13 Q. I am wondering if it might  
14 be appropriate to mark that as an exhibit.

15 DR. KINGHAM: H-180.

16 --- EXHIBIT No. H-180: Sketch prepared by  
17 Mr. Sobanski showing  
drainage systems.

18 MR. ESTRIN: Q. Perhaps you could  
19 indicate at the bottom we are looking at the plan  
20 view and in the top we are looking at sections.  
21 Is it your understanding that the site on the west  
22 of proposed F, that is the present Halton regional  
23 site, a good half of it perhaps, the original half,  
24 had no underdrain system?

25 MR. SOBANSKI: A. Yes, that is my



1 understanding and the recent expansion, I understand,  
2 has an underdrain system.

3 Q. The recent expansion being at  
4 the north end?

5 A. That is right.

6 Q. But approximately half of  
7 the site or the southern half of the site has no  
8 underdrain, but there may well be toe drains installed?

9 A. I believe there are toe drains  
10 and I think it's more than half the site which was  
11 equipped just with toe drains.

12 Q. And the Bayview Park site  
13 was closed out, can we agree, approximately 1972?

14 A. I don't really have that  
15 number in my mind, Mr. Estrin, I'm sorry.

16 Q. Let's assume that for the  
17 moment. The point I want to discuss with you is  
18 that if proposed Site F collector system or under-  
19 drain was to fail, we would be back in the same  
20 situation that Bayview Park is in and has always  
21 been in, save for the little toe drain around the  
22 front?

23 A. Yes, other than the contingencies  
24 we have proposed for F and if it failed, it would  
25 be in that situation, yes.



1 Q. So one can, I think, would you  
2 agree, look at whether and to what extent the Bayview  
3 Park site with no leachate collection system has, over  
4 the last decade or two decades or more, created an  
5 off-site environmental problem and to gain some  
6 understanding of what would happen at your proposed  
7 Site F, if worst came to worst and leachate collection  
8 at F failed, and forgetting about your contingencies.

9 A. I think we have to look at  
10 empirical data and use that as a guide. That's  
11 the guide we used in all of our work to indicate  
12 the types of environments we should or should not be  
13 disposing in. Certainly we have had quite a bit  
14 of work done on a research type level at Bayview.  
15 There is a lot of work in progress at Burlington.  
16 Mr. Feenstra, I believe, is going to speak to the  
17 chemistry at those sites in some detail, but  
18 certainly we do look at that when we compare these  
19 sites. It's sort of like a huge field experiment.  
20 You don't have to make as many assumptions in a  
21 case where you have landfills on either side of a  
22 piece of land and they have been in for a reasonable  
23 length of time, and I think any reasonable person  
24 would say that a new site, given the fact that wastes  
25 don't change drastically, would behave the same way.



1 Q. In that context, we really have  
2 a unique experience and experiment here?

3 A. I don't mean to be argumentative,  
4 but it does come up on expansion sites for example  
5 where a site may go to expansion and this always  
6 serves as good empirical data as to how the site  
7 is behaving and whether there is a problem or not.

8 Q. Now, let's just contrast the  
9 role of contingency measures at Site D. If I under-  
10 stood your evidence correctly, if the engineering  
11 system or systems, being the hydraulic trap and the  
12 leachate collection system, if they fail, then a  
13 contingency plan, as I understand your evidence, must  
14 be implemented?

15 A. Yes, that is correct.

16 Q. That contingency plan would  
17 have basic elements such as a finding where the  
18 leachate is going, specifically, and at what rate?

19 A. Yes.

20 Q. It would, secondly, involve  
21 engineering devices -- if the first observations  
22 indicated an inappropriately fast travel time for  
23 leachate, you would then get into your second  
24 level of engineering devices such as purge wells  
25 or other measures?



1 A. Yes, that is correct.

2 Q. Whereas it would seem, and tell  
3 me whether you agree, that down at Site F you have  
4 enough -- there has not seemed to be, when one gets  
5 beyond 200 or 300 metres of the downgradient slope  
6 of say Bayview Park or indeed the Burlington site,  
7 or even within that distance, there does not appear  
8 to be any impact of leachate beyond an insignificant  
9 level at this time?

10 A. I think I'll pass that one to  
11 Mr. Feenstra to some extent. I have looked at the  
12 data, some of the data, and I think Mr. Feenstra has  
13 taken a more careful look at it. I wouldn't want  
14 the advantage -- the advantage of Site F as I see  
15 it is that you don't have wells within quite a  
16 distance of the site, but this site would be treated as  
17 Site D is in terms of contingencies.

18 For instance, if a tile plugs and  
19 some leachate comes out in a toe discharge, it will  
20 be remedied and we would never let -- despite the  
21 fact there are no groundwater users or surface water  
22 users, if there is a failure at Site F, we will  
23 also correct it at Site F. If for some reason  
24 the boundary criteria is set and in spite of the  
25 bad quality water for some parameter that might



1 be in the leachate, then we would use purge wells  
2 with the site, so we are not saying forget the site  
3 and let it go, we want this to be -- this site to be  
4 environmentally safe as well. The beauty of it can  
5 be said is that your impact -- you don't have as much  
6 uncertainty and you don't have the uncertainties of  
7 the impacts on nearby users. Certainly we would run  
8 this in an environmentally safe manner like we would  
9 any site.

10 Q. I understand why you would  
11 want to do that, but I am just asking you to just  
12 think about the scenario where we have some idea,  
13 subject to further evidence, that at Site F, based  
14 on the Bayview site and on the Burlington site, that  
15 if in fact for one reason or another it was let go,  
16 then aside from surficial problems like leachate  
17 flowing along the surface, because obviously  
18 something would have to be done about that, but  
19 contamination moving down and out at deeper levels  
20 and based on present experience, I am suggesting  
21 to you that this in-field experiment seems to indicate  
22 that you have a large reason to think that Site F  
23 won't -- will be quite a contrast?

24 A. I would say the empirical  
25 data is indicating that. That is not a great ground-



1 water problem at either site, despite the fact they  
2 have no underdrain system to protect them from  
3 downward leachate migration into the lower zones.

4 Q. When you are saying either  
5 site, you are saying Bayview?

6 A. Bayview or Burlington, but I  
7 must point out that even in our modelling, there is a  
8 possibility of some break through at a future time  
9 as well and, you know, we are using the same type  
10 of criteria for assessing this site as we did at  
11 Site D, but certainly there doesn't seem to be any  
12 indication so far of any large effects on groundwater  
13 quality.

14 MR. ESTRIN: Would this be an  
15 appropriate place to break for lunch?

16 DR. KINGHAM: We could do so, yes.  
17 You will be continuing this afternoon?

18 MR. ESTRIN: I probably have three-  
19 quarters of an hour, I would say.

20 DR. KINGHAM: We will allow an hour  
21 and a half and will begin at 2:00 sharp.

22 --- Luncheon Adjournment (12:23 p.m.)

23 --- Upon resuming at 2:00 p.m.

24 DR. KINGHAM: Thank you. Please  
25 be seated. Mr. Estrin.



1 MR. ESTRIN: Thank you, Mr. Chairman.

2 Just at the break Mr. Lederer handed out something  
3 called -- something in handwriting about two pages  
4 and then a graph and another page.

5 MR. LEDERER: To be clear, I didn't  
6 hand it out.

7 MR. ESTRIN: He gave me a document  
8 entitled No. 5 Well Interference, Effect on Domestic  
9 Wells.

10 Q. I chatted briefly with you at  
11 the break and you confirmed that that document really  
12 is the detailed calculation for the drawdown effect  
13 of the hydraulic trap?

14 MR. SOBANSKI: A. I believe so,  
15 Mr.Estrin.

16 Q. So we are still looking for  
17 a somewhat equivalent calculation as to the drawdown  
18 effect on the domestic wells caused by the purge  
19 wells?

20 A. Yes, I'll get that for you.

21 MR. McQUAID: I'm always suspicious  
22 of things Mr.Estrin doesn't use. I'll have a look  
23 at it. It's my insatiable desire to read about  
24 hydrology -- hydrogeology.

25 MR. ESTRIN: Q. Also, and I can't



1 seem to find my copy -- Mr. Sobanski, given out  
2 earlier this morning there were two documents which  
3 are not yet marked as an exhibit and, just to keep  
4 this complete, one was headed Vertical Gradients  
5 in Upper Till - Tritium Piezometer Nest, Site D?

6 A. I would rather refer these to  
7 Mr. Beechinor; he prepared them.

8 MR. ESTRIN: I am just attempting to  
9 clean up the paperwork, Mr. Chairman.

10 Q. Have you got that, Mr. Beechinor?

11 MR. BEECHINOR: A. Yes.

12 Q. That represents the  
13 information you said you might have about water levels  
14 and gradients in the boreholes where the tritium  
15 piezometer -- where the tritium tests were done?

16 A. That's right.

17 Q. Let me ask you -- I think  
18 I asked you this?

19 MR. McQUAID: Have these been  
20 marked?

21 DR. KINGHAM: The Board is waiting  
22 to see if they are going to be referred to in any  
23 substantive way.

24 MR. ESTRIN: I take it, and I don't  
25 know, but I just want to clarify what the data is



1 and I have no questions directly arising from this.

2 MR. LEDERER: I have had an  
3 opportunity to review them and if you want a  
4 complete record, they should be entered and if  
5 Mr. Estrin has no questions, that is fine.

6 DR. KINGHAM: The two documents, the  
7 source of the  $2.8 \times 10^{-2}$  as well as vertical gradients  
8 in the upper till?

9 MR. LEDERER: Yes.

10 DR. KINGHAM: We will call them  
11 H-181 and H-182.

12 MR. LEDERER: Which is which?

13 DR. KINGHAM: We will call the  
14 Vertical Gradients in the Upper Till - Tritium  
15 Piezometer Nests as H-181 and the other is H-182,  
16 the source of  $2.8 \times 10^{-2}$  data sheet.

17 --- EXHIBIT No. H-181: Document entitled Vertical  
18 Gradients in the Upper  
Till - Tritium Piezometer  
Nests.

19 --- EXHIBIT No. H-182: Data Sheet re source of  
20  $2.8 \times 10^{-2}$ .

21 MR. ESTRIN: Q. Mr. Beechinor, I take  
22 it piezometers were installed in these wells  
23 referred to in Exhibit H-181?

24 MR. BEECHINOR: A. That is correct.

25 Q. Does that mean you have a log



1 of these wells?

2 A. Yes, we do.

3 Q. Is that yet in the materials?

4 A. It's in the interrogatories,  
5 one of the interrogatories.

6 Q. The logs?

7 A. Yes.

8 Q. The other document, which was  
9 H-182....

10 DR. KINGHAM: H-182.

11 MR. ESTRIN: Q. The source of  $2.8$   
12  $\times 10^{-2}$  in data sheet; do I infer from this that  
13 the number we saw on Exhibit 172, page 17, that  
14 H-182 gives us the source of that?

15 MR. BEECHINOR: A. That is right.

16 Q. Had you done any pumping  
17 tests at the time the number found on page 17  
18 of Exhibit 172 was put down?

19 A. It's an estimate of that forma-  
20 tion from the grain size curve at HC2-85 in order to  
21 help us design the pumping test for that upper  
22 granular unit and help us define the yields we  
23 might expect and what sort of pumping rates we  
24 should conduct the test at.

25 Q. Mr. Sobanski, I would like to



1 return to the topic of monitoring. In order to  
2 make some use out of a monitoring system, as I under-  
3 stand your evidence, and you tell me if I have got  
4 it right, sometimes in the course of sampling and  
5 analysis, you might get an odd number which on first  
6 appearance might be put down to a number -- any number  
7 of errors, such as an error in sampling or mislabelled  
8 bottle or error in the lab or whatever?

9 MR. SOBANSKI: A. Yes.

10 Q. If you get one bad result, as  
11 I understand your evidence, you don't get that  
12 concerned but really look at the next one to see  
13 if there is a trend?

14 A. Yes, that is correct.

15 Q. In other words, in order to  
16 expect that monitoring will lead to remedial action,  
17 you want to find something consistent happening over  
18 a period of time?

19 A. Yes. You would be looking for  
20 increases over a period of time.

21 Q. I think you put it that  
22 monitoring is a study of trends?

23 A. Yes, it is.

24 Q. You want to have something  
25 that will allow you -- you need a trigger, and I think



1 that is the word you used, you need something to  
2 know when to implement contingencies because  
3 contingencies may be expensive and you want to make  
4 sure the contingency is required?

5 A. Yes.

6 Q. Not just a change in background?

7 A. That is correct.

8 Q. At Site D, I think you have  
9 already said and agreed that there is considerable  
10 variation in the chemistry of the waters at the site?

11 A. Yes, there is.

12 Q. And accordingly you are going  
13 to need, or those people who will be responsible  
14 for monitoring, and you have indicated to date that  
15 you have not been asked to look at that in specific  
16 detail, but will have to determine that any reading  
17 or series of readings is leachate and not just  
18 natural background variation?

19 A. Yes.

20 Q. Sometimes I suggest there  
21 is a tendency by those who are looking at monitoring  
22 data to disregard data even though it may be  
23 recording something on the assumption that even over  
24 a period of years it is somehow not accurately  
25 recording itself. Have you ever experienced that?



1 Not just one year, let's say, but over several years  
2 where you get readings?

3 MR. LEDERER: there are really two  
4 questions in what Mr. Estrin has asked, one of which  
5 I can't object to and the other I think I can.  
6 He said as a general rule, people allow things to  
7 shift in this way and said have you ever experienced  
8 that and the question have you ever experienced that  
9 is a fair question, but the question generally does  
10 the profession do that, I don't think it is fair to  
11 ask anyone to speak for other people in that way.

12 MR. ESTRIN: Thanks.

13 Q. Let's take the last aspect of  
14 that. I am always glad to have my questions clarified.  
15 Can you think of any situations where data has been  
16 reported in a monitoring situation which indicated  
17 something was happening by way of seepage or  
18 leakage or whatever, but it was tended to be  
19 disregarded?

20 MR. SOBANSKI: I really don't know.  
21 Now if you have something you can refer me to because  
22 a response sometimes is recognising that something  
23 is happening and I have seen a case where the  
24 Ministry has been monitoring a certain well and  
25 has seen some chloride increase and a great deal of



1 investigation went into it and later on it was  
2 found it was road salt. Action was taken, but it  
3 was a very slow gradual rise and it wasn't ignored.  
4 If you see changes that indicate trends that are  
5 rising and you are serious about your monitoring  
6 program, which I think everybody is, then you  
7 investigate it and find out if it's a real trend or  
8 not. I don't know if I know of cases where things  
9 are ignored.

10 Q. Not necessarily ignored, but  
11 downplayed and the conclusion reached that notwith-  
12 standing that measurements have been made by  
13 instruments, that really these instruments couldn't  
14 be reporting accurately or there is no significance  
15 to what they are reporting?

16 MR. LEDERER: I presume the question  
17 means is Mr. Sobanski aware?

18 MR. ESTRIN: Q. Mr. Sobanski.

19 MR. SOBANKI: A. Not really, no.  
20 I can't say that I am. That's not to say it hasn't  
21 happened.

22 Q. How long has your firm been  
23 involved in monitoring the Brock Road site?

24 A. Brock West monitoring?

25 Two years.

Q. That's fine. I wonder ....



1                   A.       You see that site, Metro has  
2       been monitoring on their own and they turn the  
3       results over to the Ministry of the Environment.  
4       They just hired us a couple of years ago to look  
5       into or to reassess or assess how the liner is  
6       working at the request of the Ministry of the  
7       Environment. Full-blown monitoring and investigation  
8       has only gone on now for two years.

9                   Q.       Who is doing the monitoring?

10                  A.       Metro Toronto has been doing  
11       their own monitoring and they are still doing a  
12       lot of their own monitoring. They have their own  
13       chemical lab and they have a group of trained people  
14       with their own truck and own samplers, the whole  
15       paraphenalia for sampling wells, and they sample all  
16       of their sites and they turn the results over to  
17       the Ministry. It's just in the last two years that  
18       Brock West has been formally turned over to a  
19       consultant to monitor it.

20                  Q.       There is something which bears  
21       on this topic in the 1986 Brock Road report which I  
22       believe -- that has not yet been made an exhibit,  
23       and you have the 1986 monitoring report, the original,  
24       and it should be in the same pile as the other  
25       document.



1 Were you able to find your copy?

2 A. Is this revised, 1986?

3 Q. Yes. This is a report your  
4 firm did in its first year, I take it, of acting  
5 for Metro with regard to this site; is that correct?

6 A. According to the introduction  
7 it says this report initiates the annual reporting on  
8 the environmental monitoring.

9 Q. Excuse me, but I seem to have  
10 misplaced it here. If you turn to page 20 of the  
11 excerpt that has been handed out, and possibly we  
12 could mark it?

13 DR. KINGHAM: This we will mark as  
14 a Milton exhibit. It will be M-183.

15 --- EXHIBIT No. M-183: Excerpts from Annual  
16 Monitoring Report,  
17 Brock West site by  
Trow/Hydrology  
Consultants revised  
to December, 1986.

18 MR. ESTRIN: Excerpts from annual  
19 monitoring report, Brock West Sanitary Landfill  
20 Site by Trow/Hydrology Consultants, revised to  
21 December, 1986.

22 DR. KINGHAM: You referred us to  
23 a specific page?

24 MR. ESTRIN: I was starting at page 20.  
25 They are talking about liner efficiency, and I think



1 you in passing referred to liners, Mr. Sobanski.  
2 The last half of the page is talking about seepage  
3 occurring through the bentonite sand liner above  
4 the lysimeters and it says:

5 "Seepage was measured in the re-  
6 constructed lysimeter No. 2"

7 and can you help us with what is a lysimeter?

8 MR. SOBANSKI: A. In this case it's  
9 a sheet of plastic about one thousand square feet,  
10 I believe, that is laid underneath the liner and it  
11 then goes from there by a tube to a manhole where  
12 they can measure any influx of materials that would  
13 leak through the liner. So, this is a plastic sheet  
14 laid under the liner.

15 DR. KINGHAM: Like a large funnel?

16 MR. SOBANSKI: Like a large funnel  
17 that funnels to one area and from there you have a  
18 collection pipe in which they can measure whether  
19 anything is coming through or not.

20 MR. ESTRIN: Q. Reading the second  
21 full paragraph under liner efficiency:

22 "In May, 1982, seepage was measured  
23 in the reconstructed lysimeter No.2  
24 at a rate of about 4.5 L/day"

25 and it equates that to something,



1 "No flow was reported during the  
2 following four year period.  
3 Monitoring data has indicated  
4 no leakage through the bentonite  
5 liner at lysimeter No.1 since its  
6 installation in July of 1976.  
7 However, visual observations made  
8 in August, 1986 indicated  
9 the occurrence of a distinct wet  
10 area below the outlet pipe in  
11 lysimeter No. 1. Since the seepage  
12 is small and discharges onto  
13 permeable sand, no fluid build up  
14 could be expected giving rise to  
15 the earlier reports of no flow."  
16 Then it goes on:  
17 "Leakage in lysimeter No. 2 could  
18 not be verified in August, 1986 as  
19 the water level within the lysimeter,  
20 believed to be the ground water  
21 stage, was immediately below the  
22 outlet pipe and some sump water  
23 brought to surface with a pail was  
24 observed to be greyish coloured  
25 but without odour. These recent



1 observations suggest that previous  
2 lysimeter reports may not be  
3 strictly accurate."

4 Now, stopping right there, it would  
5 suggest, or this report done by your firm, and you  
6 were not directly involved in this project, but it  
7 does give us an example of where instruments were  
8 measuring some seepage from May, 1982 until some  
9 time in 1986 and then the reports had been made to  
10 the effect that the lysimeters were not measuring  
11 any leakage, or negligible leakage, but then, as a  
12 result of visual observation made in 1986, it would  
13 seem that your firm chose to differ from what the  
14 previous people had concluded and your firm has  
15 said at the top of page 21,

16 "These recent observations suggest  
17 that previous lysimeter reports may  
18 not be strictly accurate, i.e. no  
19 leaking."

20 Am I reading that fairly?

21 A. Yes and no. The previous  
22 firm is our own firm as well. In terms of  
23 monitoring, about the only thing we ever did monitor  
24 at the site was the leakage through this liner  
25 and it was reported to us by Metro Toronto. Whether



1 or not anything was found in these lysimeters, that  
2 is. Our job with Metro was to supervise the installation  
3 of the liner. At the same time, while we did not  
4 comment on chemistry, we did comment on what the  
5 results of the lysimeters were. This is a new  
6 finding to me and I am not aware of it. In May of 1982,  
7 and this was on one reading from my collection,  
8 we did have some leakage which equated to a  
9 permeability of less than  $10^{-8}$  centimetres per second.  
10 However, at this site, in spite of the fact that  
11 the lysimeters may or may not be accurate, and they  
12 suggest it may not be strictly accurate, and it doesn't  
13 mean that it isn't, what they are saying is they are  
14 throwing some doubt on it, but this site also has  
15 an underdrain system wherein you can measure the  
16 quality of the water below the liner.

17 Q. Oh yes, no doubt and no doubt  
18 you are proposing contingencies and not just one  
19 item?

20 A. This site was never designed  
21 with contingencies. This was before contingencies  
22 were required at landfills. At this one you have  
23 a problem of possibly having to retrofit it if  
24 something goes wrong, which is much more difficult  
25 than providing for it initially.



1 Q. I suggest that what we see  
2 here in this report on page 21 is an example of  
3 where there was some measurement intended to be  
4 viewed as not indicating seepage or leakage when  
5 in fact it is now concluded four years after the  
6 initial measurement that previous reports which  
7 indicated that conclusion may not be strictly accurate?

8 A. That is what it says here.  
9 Things are changing all the time and that is why  
10 you are looking at all these parameters and assessing  
11 whether your previous interpretations are correct  
12 or not. It's a fluxy sort of an undertaking. You  
13 may be adding wells or taking wells out of operation  
14 or you may be adding parameters or subtracting  
15 parameters and doing it more frequently. You must  
16 have flexibility in your monitoring programs to  
17 respond to what you actually observe in the field.

18 Q. Turning away from that  
19 document to more specific questions coming back to  
20 Site D, you have assumed in all of your opinion with  
21 regard to Site D that the thin bed of silt had no  
22 hydrogeological significance and I think we went  
23 through that before?

24 A. Yes.

25 Q. Therefore it hasn't been really



1 considered in your calculations or in the design?

2 A. No, that is correct. We have  
3 considered it in the design and I discussed that  
4 with Mr. Hiraishi and he doesn't see it's any kind of  
5 construction problem even if you were to encounter it.

6 Q. Would you look at Table 10 of  
7 the Site D report, page 88. I am asking you to  
8 address the column on the right, Linear Groundwater  
9 Velocity. Do I have this right that looking at  
10 those numbers, the flow from the upper till into  
11 the lower unit, there is about a 10 per cent  
12 difference in velocity? I am taking the difference  
13 between .09 metres per year in the righthand column.  
14 for the velocity downward from the landfill through  
15 the unweathered upper till and then a change in the  
16 velocity from that point downward into the sand unit  
17 of .08?

18 A. Yes.

19 Q. So there is about a 10 per  
20 cent difference in the flow between the -- across,  
21 if you like, the thin bed of silt?

22 A. Well, it's more than that.  
23 You see, when you get into the lower units and get  
24 into the sandy silt till, we can look at the hydraulic  
25 gradients and there is a great change in that area



1 in general. This reflects that they are more  
2 permeable than the unweathered upper till and they  
3 are acting to underdrain that unweathered upper till.  
4 The unweathered upper till which sits on top has a  
5 hydraulic gradient in this case of about .85. Now,  
6 it's lower than that because I believe that was  
7 an imposed system, but it is still around .35 or .4,  
8 somewhere in that order, and so it's a full order  
9 of magnitude or more higher gradient, which means  
10 this whole lower unit, the lower till and the granular  
11 units, the lower till and the shale bedrock are more  
12 permeable than the upper weathered till and it is seen  
13 reflected in the hydraulic gradients for the entire  
14 section down below, and not any one particular  
15 unit. Suddenly the gradients have dropped a great  
16 deal, reflecting a greater permeability.

17 Q. Mr. Sobanski, my point was  
18 a very, very narrow one. You have a linear velocity  
19 in Table 10 downward from the landfill to the top  
20 of the lower till of .09 metres per year?

21 A. Yes.

22 Q. Once it hits that point,  
23 from the top of the lower till downward into the sand  
24 unit, you have a change, a slight change of .08;  
25 right?



1 A. Yes.

2 Q. You have used the same effective  
3 porosity in both cases?

4 A. Yes.

5 Q. Therefore any difference in  
6 velocity is equal to -- would equal a similar  
7 difference in quantity?

8 A. Yes, there is an effect on  
9 quantity as well.

10 Q. We are losing 10 per cent of  
11 the downward flow at the point of the thin bed of  
12 silt, according to these numbers?

13 A. Those numbers aren't that  
14 precise that you could say .09 and .08 are a  
15 difference of .01. That is how the number shows up,  
16 but you can't derive that that quickly from these  
17 kind of numbers.

18 Q. But these are your numbers  
19 and, just sticking with your numbers, what we are  
20 finding is that we are in effect losing over 10 per  
21 cent between the two tills. Assuming your numbers  
22 are right, the question is where is that flow going  
23 and at what speed?

24 A. As I say, you can't take  
25 that number and use it in that way.



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Q. They are your numbers?

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A. That's neither here nor there.

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We have talked about the differences between these numbers and how one could have changes in hydraulic conductivity, et cetera, and one wouldn't have to change the hydraulic conductivity very much to bring that to the same number unit, and we can't measure these values that accurately.

Q. That applies to all --

A. Ten per cent, to take 10 per cent based on hydraulic conductivity values is just too tight a number.

Q. Shall we change or apply that greater margin of error to all your numbers in Table 10? I thought you had agreed to other ones, so I don't want to delimit my question. Are you saying there is at least a 10 per cent margin of error in your velocities?

A. I would think so.

Q. Let's stick with your numbers. You don't want to say that the difference represents 10 per cent of the flow going out through the thin bed of silt?

A. The point we are making is that this is a silt till and in that silt till or on that



1 silt till we have a silt layer on top of it and it  
2 is silt on silt and we feel that this would behave  
3 as a single unit as opposed to independent units.

10B

4 Q. But you have no further basis  
5 for disagreeing with what I put to you than your  
6 opinion?

7 A. Even if you are losing that  
8 water, the permeability of this material is far,  
9 far lower than what we are assuming for the granular  
10 units. It's the granular units which will carry  
11 the bulk of the material laterally to the site  
12 boundary and not some low permeability layer of  
13  $10^{-4}$  or  $10^{-5}$  centimetres per second. It will take  
14 hundreds or more years to move through a layer that  
15 is that fine grained, as opposed to this granular  
16 unit that lies below, which will take the bulk of  
17 the material. It is  $10^{-2}$ , which will carry the  
18 bulk of your fluid.

19 Q. But your figures indicate  
20 10 per cent could go laterally in that unit, in  
21 the thin bed of silt?

22 A. I don't believe that and I  
23 don't believe the numbers can be used that way.

24 Q. And you disregarded that?

25 A. It's too easy to make that



1 kind of change.  $2.2 \times 10^{-3}$  and  $2.2 \times 10^{-3}$  is  
2 10 per cent and that is not measurable in terms of  
3 hydraulic conductivity. It can't be measured that  
4 accurately; it's impossible.

5 Q. Mr. Sobanski, I wonder if  
6 you would put up Drawing 18 for us. I picked it  
7 because it happens to be mounted on the front of that  
8 board. If you find a loose Drawing No. 18, it belongs  
9 to us.

10 Could you also bring out Drawing 2  
11 from Volume 3, unless you have something else.  
12 Have you something that would indicate the actual  
13 boundaries of the landfill cells we can overlaid on  
14 something like Drawing 18?

15 A. I don't.

16 Q. What we have done, and you  
17 may want to check it, but this is an overlay we  
18 have prepared indicating the approximate boundaries  
19 of the landfill cells taken from Drawing 2 of Volume 3  
20 to fit over Drawing 18. Let me put this over there  
21 for a moment and you can look at that.

22 Does that look -- do you want to  
23 check that drawing to make sure it seems to be  
24 reasonably accurate? I am essentially concerned  
25 with the west boundary of the cells. That is all I



1 really need to get you to verify.

2 A. I would say the west boundary,  
3 if we are using a 100 metre setback, I would say your  
4 boundary is off by 15 to 20 metres. It should be  
5 further to the east.

6 Q. The boundary of the cells?

7 A. I am reading your boundaries  
8 somewhere from the property boundary of around 80  
9 metres, maybe 85 metres, and it should be 100 metres.

10 On the bottom one you are reading  
11 somewhere in the order of 90 metres and it should be  
12 100. The south end is off by nearly 20 metres on  
13 one side, the east side, and the west side seems to  
14 be okay. The east boundary seems to be good and the  
15 north boundary isn't too bad.

16 Q. As I understand the design  
17 then, the waste would be buried no closer to the  
18 First Line than approximately 100 metres; right?

19 A. Yes, I believe so.

20 Q. That is the intent. So, let's  
21 go across First Line and are you assuming that is  
22 a 66 foot road allowance?

23 A. I am not sure, but those are  
24 normal road allowances or in that order.

25 Q. What is the location of the



1 closest well across First Line, approximately? Do you  
2 know exactly based on any information or are you  
3 making assumptions?

4 I want to suggest, and you can look  
5 at this if you want to, but would 150 metres be an  
6 approximate separation between a well on the west  
7 side of First Line and the edge of the garbage?

8 A. How much?

9 Q. About 150 metres. 150 from  
10 the edge of the cell or the waste, i.e. the waste  
11 to the well on the west, or in that area?

12 A. Something in that order.

13 I don't have an exact fix.

14 Q. 150 metres is a fair number  
15 to discuss, I take it. So, really what we have at  
16 Site D is a situation where if you are concerned  
17 about leachate getting out of the landfill site and  
18 hitting the nearest well, you have about 150 metres  
19 in which to find the leachate and to do something  
20 about it before it hits one of the nearest wells  
21 on the First Line?

22 A. Yes.

23 Q. Now, at Brock Road, to go  
24 back to that for a moment, you have found, as I  
25 understand it, that on-site monitoring is not



1 sufficient at Brock Road West. You have recommended  
2 and monitors have been installed off-site, off  
3 property?

4 A. Yes, they have been, I believe.

5 Q. In your calculations of  
6 velocity back at Site D, you have assumed lateral  
7 continuity and off-site extent of the upper granular  
8 unit in trying to assess the worst case; right?

9 A. Yes, and the lower granular  
10 as well.

11 Q. I guess what I would like to  
12 suggest to you is that your assumption of continuity  
13 for that purpose if not correct, if not correct,  
14 provides potential problems, and I would say  
15 severe potential problems, both for monitoring and  
16 a purge well system. You will recall we got into  
17 that a bit the other day. Your worst case for  
18 velocity calculations is to assume it's there and  
19 assume it's continuous and then we looked at the  
20 testing of the lower granular unit and found you  
21 couldn't even get an effect 12 metres away from the  
22 observation well. I am suggesting to you that having  
23 discontinuities such as you yourself have shown in  
24 the lower granular unit, for example, provides a  
25 potentially severe problem, both for monitoring and



1 | purge wells?

2 |                   A.       I don't believe I said there  
3 | were discontinuities in the lower granular unit.  
4 | I thought that when we went through our discussions  
5 | on this thing, that we were agreed that the zone  
6 | is extensive in the area outlined, after having  
7 | gone through the sections, but now we have gone the  
8 | other way. I normally don't have to fight it both  
9 | ways, but of course this is the purpose for  
10 | monitoring the ultimate recipients of any  
11 | contaminants themselves, the off-site wells.  
12 | These are the ultimate monitoring wells in any  
13 | program and if there were to be any bypass of the  
14 | monitoring wells that are on-site, then changes  
15 | would be seen off-site if there were to be a  
16 | problem. However, I believe in my opinion we have  
17 | shown that there is continuity to this upper  
18 | zone and we can monitor it on-site. If we were  
19 | to find areas where we had no sand unit, I would  
20 | suggest that we would have to install some additional  
21 | wells to find it, because after all we know these  
22 | wells on the other side are constructed in that  
23 | unit. We wouldn't have to worry about monitoring  
24 | a place that is solid till, the contaminants wouldn't  
25 | move in the general area, and if there was a bypass



1 area they would follow more permeable zones and  
2 I admit that freely. If we were to drill an  
3 observation well and find it was till to the top  
4 of the rock, then it would be incumbent on us to  
5 find out what was feeding the wells across the road,  
6 and I believe we will find it just by drilling that  
7 there would be a sand unit in that area which they  
8 derived their supplies from. It must have some  
9 continuity as several homes are drawing their  
10 supplies from that zone and I would think there is  
11 some continuity and our pumping tests indicate there  
12 is a fairly large lateral continuity.

13 Q. The lower granular unit  
14 pumping test didn't tell us that?

15 A. The lower granular unit  
16 pumping test said it was a lower granular unit  
17 that was a silty material that had a low permeability  
18 and the cone spread as far as the cone spread.

19 Q. Twelve metres. You have it  
20 as 12 metres?

21 A. That's right, but the cone  
22 would spread much farther given time, just as I  
23 have shown in the report I presented to the Board  
24 and in time the cone continues to spread as the  
25 well draws down.



1 Q. Assuming continuity?

2 A. Assuming continuity, but

3 the continuity shows up in many of the cross-sections  
4 we had up here. The lower granular unit is showing  
5 up in well after well and if there was any lack of  
6 continuity it was in the upper granular unit in  
7 this cross-section which we discussed, running from  
8 HC1-85 down to HC6-85 and we found zones of  
9 discontinuity, but those are reflected as well in  
10 the outline of the upper granular unit. When we  
11 went through the individual wells and checked the  
12 depth upon the First Line, they indicate the upper  
13 granular unit is there as well as Morrison Beatty  
14 well (IN)OW-2, as well as HC2-85, which responded  
15 to pumping from over 500 metres away, so there is  
16 continuity to that zone.

17 Q. Well, you are assuming there  
18 is continuity and it could be, as you said a  
19 moment ago, you put some holes down west of where  
20 you have drilled in the middle of the site and  
21 you may hit till where you would expect the upper  
22 granular unit and in fact some of your cross-  
23 sections show you don't hit till everything?

24 A. We hit till everywhere.

25 Q. But you don't hit the upper



1 granular unit everywhere?

2 A. There were places we did not  
3 hit the upper granular unit, correct.

4 Q. Could you now turn to the  
5 excerpt I gave you in June -- I gave you last week  
6 from Dr. Cherry's book. Everyone has had copies for  
7 several days.

8 Now, you recognise these excerpts  
9 as coming from the book Groundwater by Dr. Cherry  
10 and Dr. Freeze and that's a reference you yourself  
11 have cited in your report?

12 A. That is correct.

13 Q. It's a standard textbook  
14 on groundwater used in hydrogeology courses in  
15 North America?

16 A. I don't know. I understand,  
17 according to Dr. Cherry, he was very successful  
18 with it, which is unusual for a textbook, and I  
19 believe they are planning a second publication of  
20 it and I believe at the Owen Sound hearing he said  
21 it was a primer he would give his first year students.

22 Q. As I recall, you have taken  
23 diagrams out of this book and put them in your  
24 report, such as diffusion into the matrix?

25 A. I believe so.



1 Q. You think it's a pretty reliable  
2 text?

3 A. It's a good textbook, no  
4 question about it.

5 Q. I would like to take you to  
6 page 397 and we start a specific topic at this page  
7 under the heading Nonreactive Constituents in a  
8 Hetrogeneous Media and let's take this slowly. I  
9 want to ask you about the first sentence. Can you  
10 read it?

11 A. "If it were not for the  
12 effects of hetrogeneities in  
13 natural geological materials, the  
14 problem of prediction and detection  
15 of contaminant behaviour in ground-  
16 water flow systems would be easily  
17 solved."

18 Q. Stopping there, I take it  
19 that is a general statement and you can agree with  
20 that?

21 A. Yes, it's unusual to find  
22 anything that's homogeneous.

23 Q. Then he addresses the  
24 topic of advection being a process which transports  
25 solutes by the bulk mass of flowing fluid and you



1 certainly addressed advective flow in your report?

2 A. Yes.

3 Q. He goes on in the last

4 sentence to say:

5 "Our purpose here is to consider  
6 in more detail the effects on flow  
7 lines and velocities exerted by  
8 various types of heterogeneities."

9 And then we see this diagram, Figure 9.8, and I don't  
10 want to go to it, but let's go to the text:

11 "To illustrate the effect of simple  
12 layered heterogeneities on transport  
13 patterns, the cross-section flow-  
14 domain illustrated in Figure 9.8(a)  
15 is used. It is assumed that steady-  
16 state groundwater flow occurs  
17 through the cross-section and that  
18 the flow domain is isotropic with  
19 respect to hydraulic conductivity."

20 Stopping right there, when he says  
21 it is assumed steady-state groundwater flow occurs,  
22 could you help us with what your understanding of  
23 that term means?

24 A. It's a steady-state system  
25 and you are not changing the water table at all --



1 you are not changing the water table at all and you  
2 are essentially leaving the same amount of water in  
3 the unit.

4 Q. As I understand it in your  
5 modelling, you have assumed sort of a steady state  
6 of contaminants, at least in some of your modelling,  
7 coming out of the landfill, for example? You haven't  
8 tried to reduce it?

9 A. Steady state in terms of the  
10 amount of liquids being generated in the landfill  
11 and with the changing concentration of course.

12 Q. The other assumption he says  
13 is the flow domain is isotropic. Could you explain  
14 that briefly?

15 It is assumed the steady-  
16 state groundwater flow occurs throughout the cross-  
17 section and that the flow domain is isotropic?

18 A. He is saying it has equal  
19 hydraulic conductivity in all directions.

20 Q. Is that an assumption you  
21 have used essentially in your report?

22 A. No.

23 Q. What is your assumption?

24 A. We have a layered case which  
25 will be similar to the ones he has further down.



1 Q. But in terms of flow being  
2 equal in all directions, are you saying that once  
3 something gets down to the upper granular unit, are  
4 you not assuming it goes out throughout the upper  
5 granular unit and not just going in one direction?  
6 I just wanted to clarify isotropic and you haven't  
7 assumed that?

8 A. We have assumed essentially  
9 radial flow from that zone. In other words, it is a  
10 100 metre boundary in all directions around the site.

11 Q. Is that different from the  
12 flow domain being isotropic?

13 A. It isn't any different than  
14 what is being said here.

15 Q. That is what I thought.

16 A. This is one dimensional, a one-  
17 dimensional model.

18 Q. Then going on:

19 "To illustrate the effect of  
20 stratigraphic variations on the  
21 transport pattern of contaminants  
22 netering the system in a recharge  
23 area, a contaminant input zone is  
24 located on the cross-section."

25 Stopping there, first of all you



1 have told us this is a recharge area?

2 A. Yes.

3 Q. In other words, something --  
4 precipitation is being recharged to the groundwater?

5 A. Yes.

6 Q. He says:

7 "In field situations this could  
8 represent seepage from a waste lagoon,  
9 sanitary landfill, or some other  
10 surface or near-surface source.  
11 Figure 9.8(b), (c), (d) and (e)  
12 shows the patterns of contaminant  
13 transport that would occur with  
14 various hypothetical stratigraphic  
15 configurations. The contaminant is  
16 assumed to be non-reactive and the  
17 effect of dispersion is neglected."  
18 Non-reactive would be something like  
19 chloride for example?

20 A. That is right.

21 Q. You yourself have used  
22 chloride as a good indicator of travel time?

23 A. Yes.

24 Q. "The flow lines that depict  
25 the limits of the contaminant



1 migration patterns were obtained by  
2 solution of the two-dimensional  
3 form of the steady-state groundwater  
4 flow equation using the finite-  
5 element method in the manner  
6 described by Pickens and Lennox."

7 Stopping there, Trow, your firm,  
8 used a method similar to that at Site F?

9 A. Yes.

10 Q. "The conditions for the flow  
11 system shown in Figure 9.8(c)  
12 are similar.... "

13 I think I missed something:

14 "Figure 9.8(b) indicates that in  
15 situations where the flow domain is  
16 homogeneous, the contaminant  
17 migration pattern would be simple  
18 and relatively easy to monitor."

19 You would agree with that, I take it,  
20 everything being relative, but he is saying if you  
21 have a homogeneous medium, the migration patterns  
22 would be simple and relatively easy to monitor?

23 A. I think that's an over-  
24 simplification.

25 Q. On a relative scale though,



1 wouldn't you agree?

2 A. Not entirely. Dr. Cherry  
3 has done a great deal of work at Camp Borden and  
4 has found the plume sinks at Camp Borden and it  
5 isn't something you pick up off the top, and he has  
6 found that had to be instrumented fairly carefully  
7 too and it's a fairly uniform type of situation  
8 as you can get in the province of a thick surficial  
9 sand, but even there he has had to use his good  
10 judgment on how to monitor.

11 Q. Let's go on:

12 "The conditions for the flow system  
13 shown in Figure 9.8(c) are similar  
14 to the previous case, with the  
15 exception of the inclusion of a  
16 thin, higher-conductivity horizontal  
17 layer that extends across the flow  
18 domain. This would cause the  
19 contaminants to move through the flow  
20 system almost entirely in this thin  
21 layer. The total travel time would  
22 be one-fifth of the nonstratified  
23 case illustrated in Figure 9.8(b).  
24 The thin higher conductivity bed has  
25 a conductivity 100 times larger than



1 the rest of the system and exerts a  
2 very strong influence on the migration  
3 patterns and velocity distribution."

4 Stopping right there, at Site D.  
5 you have identified the upper granular unit and  
6 have indicated -- well, for the purposes of your  
7 modelling, at Table 8 ---- going back rather to page  
8 88, Table 10, and looking at the hydraulic  
9 conductivities you have used, you have assigned for  
10 the purposes of this exercise a hydraulic  
11 conductivity for the granular units of  $10^{-3}$ ?

12 A. Nearly  $10^{-2}$  actually.

13 Q. Nearly  $10^{-2}$ ?

14 A. Yes.

15 Q. Whereas for the lower till  
16 you have  $10^{-6}$  and for the upper till,  $10^{-8}$ ?

17 A. Roughly  $10^{-7}$ .

18 Q. In any event, we are talking  
19 about difference in hydraulic conductivities now  
20 between the thin higher conductivity bed, i.e.  
21 the granular units, and the till above that of not  
22 one hundred times larger, but one thousand times  
23 larger or greater?

24 A. That's right, and all the  
25 more reason why anything that leaks from this



1 zone would end up in this layer.

2 Q. Right.

3 A. It gets even more amplified  
4 than what Dr. Cherry is showing and it becomes the  
5 major path as we have identified.

6 Q. Exactly. And accordingly  
7 the total travel time within that kind of zone would  
8 be much less and he has one-fifth in his one hundred  
9 times difference situation, but whatever the number  
10 is, it will be faster substantially?

11 A. That's what these numbers show.

12 Q. He goes on, picking up where  
13 I left off:

14 "If the lower-k...

15 And k is standing for hydraulic  
16 conductivity; the short form?

17 A. Yes.

18 Q. "If the lower-k medium  
19 ( $K_1$ ) represents a very fine-grained  
20 sand, the higher-K...."

21 and that is the faster bed in layman's terms....

22 " $K_2$ ) could represent a medium or  
23 coarse-grained sand. In stratigraphic  
24 studies of waste disposal sites, a  
25 thin medium-grained sand bed in an



1 otherwise fine-grained sand deposit  
2 could easily be unnoticed unless  
3 careful drilling and sampling  
4 techniques are used."

5 Now, let's come....

6 A. This is why I was saying the  
7 other day that you screen the entire zone to make  
8 sure that you are picking up whatever is moving in  
9 it and it is relatively thin in any event, about  
10 a metre thick, so it's not too difficult to screen  
11 it all.

12 Q. Now, let's look, -- he says:

13 "In Figure 9.8(d) a discontinuous  
14 layer of low-conductivity material  
15 exists in the cross-section. The  
16 contaminant migration zone...."

17 and we can refer back to the chart to see what we  
18 are talking about here on the previous page, but  
19 the contaminant migration zone moves over the first  
20 lens and under the second one to reach the discharge  
21 area and passes through the second lens near the end  
22 of its flow path. In other words, tell me if you  
23 agree? If one was to monitor the case described  
24 in Figure 9.8(b) and put a monitor down about an  
25 inch from the righthand margin of that and it didn't



1 quite hit that thin bed of silt or whatever it is,  
2 you might not pick up anything because it would be  
3 going underneath it.

4 A. There are a couple of things.  
5 First of all, you put a stream in here which is not  
6 on this site at depth.

7 Q. A stream?

8 A. He says there is a discharge  
9 point, a stream on the righthand side and that is  
10 why the water is coming up. That isn't the case  
11 at Site D. We are in the deep zones and the deep  
12 zones near the site do not intercept streams.

13 Q. What about wells which happen  
14 to be in the upper granular unit?

15 A. That is another possibility  
16 and we talked about that and they are monitored  
17 to see if anything is bypassing any of our system.

18 Q. That is what we are talking  
19 about?

20 A. They are the ultimate monitor  
21 of what is happening off-site. They are the things  
22 that take into account heterogeneities such as  
23 these that Dr. Cherry is describing, but strictly  
24 speaking, 9.8(d) is not very similar to anything we  
25 have found on this particular site. It is more



1 analagous to (c) where the coarse-gained layer carries  
2 the bulk of the contaminant.

3 Q. Let's go to 9.8(e). It shows,  
4 the text says:

5 ".... the contaminant migration  
6 pattern that would exist if a thin  
7 higher-conductivity bed is discontin-  
8 uous through the central part of the  
9 cross-section. The discontinuity causes  
10 a large distortion in the  
11 contaminant migration pattern in  
12 the middle of the cross-section."

13 Would you agree that what he is  
14 referring to, looking at 9.8(e), is that bulge  
15 effect shown at the bottom of the page?

16 A. Yes.

17 Q. "The contaminated zone spreads  
18 out in the central part of the flow  
19 system and extends to the water-table  
20 zone. In situations where  
21 contaminants can be transferred  
22 through the unsaturated zone by  
23 advection, diffusion, or vegetative  
24 uptake, this condition could lead to  
25 spread of the contaminants in the



1 biosphere. Figure 9.8(e) also  
2 illustrates some of the difficulties  
3 that can arise in monitoring  
4 contaminated flow systems. If little  
5 information were available on the  
6 stratigraphy of the system, there  
7 would be no reason to suspect that the  
8 type of distortions shown in Figure  
9 9.8(e) would occur. Lack of this  
10 information could result in inadequate  
11 monitoring of the system. In nature,  
12 geologic cross-sections typically  
13 include many stratigraphic units  
14 with different hydraulic conductivities.  
15 Large conductivity contrasts across  
16 sharp discontinuities are common.  
17 Relative to real situations, the  
18 effects of stratification illustrated  
19 in Figure 9.8 are very simple."  
20 Let's start with the last sentence:  
21 "Relative to real situations, the  
22 effects of stratification illustrated  
23 in Figure 9.8 are very simple."

24 A. We have certainly recognised  
25 that here. We have a multi-layer system and we have dealt



1 with a weathered zone on top of the clay till. We  
2 have a massive clay till. We have an upper till and  
3 we then have embedded in that two granular units  
4 of varying permeability and below that we have a  
5 continuation of the glacial till and finally -- the silt  
6 till and finally below that we have a weathered  
7 bedrock zone and we certainly have not assumed  
8 anything simple at this site.

9 Q. Going back to the diagram,  
10 Figure 9.8(e), what that diagram I suggest to you --  
11 how it is important in this case, Mr. Sobanski,  
12 is that if in fact there are discontinuities in your  
13 upper granular unit, for example between the waste  
14 and somebody's well, you very well could get what  
15 Dr. Cherry is saying in 9.8, i.e., that kind of  
16 bulge effect where you have the leachate going up  
17 or going down or both and out and you may not at  
18 all be monitoring at that location because that's  
19 just the kind of thing you wouldn't expect to  
20 happen?

21 A. First of all, I don't know  
22 we have everything on here we need in terms of  
23 hydraulic conductivity and in terms of gradients  
24 to know how this was calculated, but we are  
25 monitoring the weathered zone at this site, we are



1 monitoring surface water at this site and these  
2 will indicate whether we have so-called bulges within  
3 it. I think it is important to notice, however, that  
4 in terms of contaminant movement, what he is showing  
5 is that the flow line going into the bulge goes  
6 up and then it comes back down and  $K_2$  is still carrying  
7 the bulk of the fluid on the site. What he is  
8 suggesting is that in this very special case he has  
9 put down for illustrative purposes on complexities  
10 and in hydrostratigraphy, that you can get this  
11 bulge, but indeed those types of things are being  
12 monitored at this site.

13 Q. That brings us back to where  
14 we started on this discussion, and that is how do  
15 you know where to monitor if in fact these  
16 discontinuities lead to these kinds of uncertainties;  
17 until you see the leachate turn up in someone's  
18 well?

19 A. If the leachate turns up  
20 in someone's well, then again it will be gradual  
21 and won't happen overnight. If changes occur,  
22 as I have discussed, the recipient of any leachate  
23 -- the ultimate monitoring point is the domestic  
24 wells, and if changes occur there, then we have to  
25 take appropriate action to fix them and that is



1 the final sort of monitoring that takes care of  
2 these various -- let's call them scenarios that  
3 one show with these types of diagrams. You must  
4 remember that he is saying that you don't know much  
5 about it, but in fact there has been a lot of  
6 drilling done on this site and we have domestic  
7 wells in the area from which we know supplies are  
8 drawn and we can see on our sites the same zones,  
9 so I would suggest we have better than just an  
10 indication of what the geology is. While  
11 geology is interpretive, you have to somewhere along  
12 the line say that you have enough hold and you can  
13 make your predictions.

14 These types of scenarios being  
15 shown -- they are pretty unusual in some ways.  
16 They are fabricated to show you the type of an  
17 effect you can get, but, at this site the zones  
18 are being monited in any event and streams, the  
19 weathered zone and also the wells and this till  
20 is fairly thick through the area. We don't have  
21 indications of this type of a system.

22 MR. ESTRIN: Mr. Chairman, I don't  
23 know if it would be inappropriate to turn on the  
24 airconditioning, because it does feel it is getting  
25 rather warm.



1 DR.KINGHAM: The thermometer agrees  
2 with you, it's well above twenty.

3 MR. ESTRIN: I wonder if I could  
4 turn the page to 399 of Dr. Cherry and it says:

5 "In the discussion above, layered  
6 heterogeneities on the scale that  
7 could, if necessary, be identified  
8 and mapped by careful drilling,  
9 sampling and geophysical logging  
10 were considered. Heterogeneities in  
11 another category also exist in  
12 most geologic settings. These are  
13 known as small-scale heterogeneities.  
14 They cannot be identified  
15 individually by conventional methods  
16 of field testing. Even if identifi-  
17 cation is possible using special  
18 coring technuques, these hetero-  
19 geneities usually cannot be  
20 correlated from borehole to borehole."  
21 He goes on and says in the last

22 sentence:

23 "For example, a change of silt or  
24 clay content of only a few percent  
25 in a sand zone can have a large



effect on the hydraulic conductivity."

Generally speaking, would you agree with that paragraph?

A. I would.

Q. I wonder if you would just get out your borehole records for a couple of holes on Site D, borehole 2-85 and borehole 4-85 and I believe both of those are in the upper granular unit.

First of all confirm that 2-85 is in the upper granular unit and then I will be taking you to the grain size analysis and the other one is borehole 4-85 and that is also in the upper granular unit?

A. Yes, I agree.

Q. Those two are into the upper granular unit.

Now, turn to Appendix 3 in the same volume and I believe you will find the grain size analyses for samples taken in the upper granular unit and those are charts with a curvy line on them. If you would look up the results for the grain size analysis for, first of all, borehole 2-85 and before we get into the results perhaps you could explain what results this kind of an analysis provides, and without telling us what the numbers are?



1 A. It provides you with a break-  
2 down of various components of a soil, breaking it  
3 into clay, silt, sand and gravel.

4 Q. Looking at the analysis done  
5 for 2-85 in the upper granular unit, am I correct  
6 that this chart indicates that 7 per cent of the  
7 stuff was silt and with the possibility there is  
8 no clay in it, 40 per cent was sand and gravel was  
9 53 per cent?

10 A. First of all with the silt  
11 part, I am not sure about the clay, but it indicates  
12 7 per cent is fine and 7 per cent is in the silt-  
13 size range.

14 Q. Seven per cent silt, 40 per  
15 cent sand and 53 per cent gravel?

16 A. Slow down a minute because  
17 we must do them one at a time.

18 MR. McQUAID: What depth chart?

19 MR. ESTRIN: At a depth of 10.36  
20 to 10.67 metres.

21 DR. KINGHAM: Thank you. It is  
22 important to know. That is the second chart.

23 MR. ESTRIN: Q. Would that be....

24 MR. SOBANSKI: A. It would be 7 per  
25 cent silt, 50 per cent sand and 43 per cent gravel.



1 Q. You are over 100 per cent;  
2 7 per cent silt and 40 per cent sand?

3 A. Fifty per cent sand.

4 Q. And?

5 A. Forty-three per cent gravel.

6 Q. Could you show us where you  
7 are putting your marker to determine the amount of  
8 sand?

9 A. I am reading this on its side.  
10 You are right, it's 40 per cent sand and 53 gravel.

11 Q. Do you mind getting a chart,  
12 something we can write on. Would you mind writing  
13 down borehole 2-85 - UGU for upper granular unit  
14 and then under that 7 per cent silt, 40 per cent  
15 sand and 53 per cent gravel. Those are numbers  
16 which you could now agree with; right?

17 A. Yes.

18 Q. Can you do the same for one  
19 other borehole, borehole 4-85, at a depth of 14.17  
20 to 14.48 metres?

21 A. 4-85?

22 Q. 4-85, about five or six  
23 pages over.

24 A. What was the depth?

25 Q. 14.17 to 14.48 metres and



1 let me suggest the numbers and you can check them,  
2 but 22 per cent silt. You would also need a  
3 category for clay in this one?

4 MR. BEECHINOR: A. I have one.

5 MR. SOBANSKI: A. The numbers I  
6 get are 4 per cent clay, 23 per cent silt, 22 per  
7 cent sand and 51 per cent gravel.

8 Q. You would agree then that  
9 these two analyses both from the upper granular  
10 unit do indicate a change of silt or clay content  
11 of a few per cent or greater?

12 A. Yes, yes indeed.

13 Q. Dr. Cherry is saying a change  
14 of only a few per cent in a sandy zone could have  
15 a large effect on hydraulic conductivity. Let's  
16 look at the bottom of that page, just a couple more  
17 paragraphs and we will be finished with this.

18 "Figure 9.9 illustrates the effect of  
19 two types of small-scale hetero-  
20 geneities on the pattern of migration  
21 of a tracer or contaminant in  
22 granular porous media."

23 Of course we are dealing with  
24 something called the granular units; right?

25 A. Yes.



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Q. "In Figure 9.9(a) the pattern of dispersion is regular and predictable using the methods described above. "

That means, I take it, the usual techniques of advective flow or plug flow and that is what he describes it as being on the lefthand side of the top diagram, plug flow?

A. Yes.

Q. "In Figure 9.9(b) the lense-type heterogeneities cause the tracer front to advance in a pattern commonly referred to as fingering. In this case the contaminant is transported more rapidly in the lenses or beds of higher hydraulic conductivity. Figure 9.9 (c) illustrates results obtained by Skibitzke and Robertson using dye tracers in a box model packed with fine sand and long sinuous lenses of coarser sand. There authors observed that a large angle of refraction at the boundary between sand of contrasting permeability



1 caused accelerated spreading of  
2 the tracer zone."

3 I suggest to you that we can apply  
4 that to the upper granular unit variations between  
5 sands and fines and whatever. There is a variation  
6 in the UGU itself as you have determined?

7 A. There is variation in the  
8 upper granular unit indeed, and I said that, and we  
9 didn't have to go through that because I know there  
10 are these kind of heterogeneities and we talked  
11 about them with respect to pumping tests I ran in  
12 the past, and so this isn't unusual to find these  
13 sort of things but, nonetheless, the type of analysis  
14 that we have done for this is in the higher units  
15 where we are modelling relatively rapid impacts.  
16 When we get into these lower permeability types  
17 of materials, the movement through the zones is  
18 not as rapid and what we are looking at is for  
19 the major fingering to create the problem. If we were  
20 to miss these, it is always recognised I think by  
21 hydrogeologists that we have these problems and  
22 we don't try and put this together as a perfectly  
23 uniform set of beds, but again we come back to  
24 the recipients of waste --- that's not the word I am  
25 looking for -- but the point of interest or point of



1       impingement you are concerned about are the houses  
2       along First Line and they are part of the monitoring  
3       program. If you were to see changes in lows, even  
4       though you weren't getting changes in your  
5       observation wells on site, then you would have to  
6       respond in some way and do some additional drilling  
7       to confirm whether or not it was leachate or some  
8       other source, but ultimately whether or not these  
9       wells are impacted, and again we are talking a  
10      failed system, but would be dependent on what we  
11      would find in the individual wells. They themselves  
12      may be in a less permeable unit and in fact may be  
13      one thousand years travel time from the site.

14                   Q.       I take it from what you have  
15      just said that you agree that a plausible or  
16      possible scenario here is because in the upper  
17      granular unit itself there could be the fingering  
18      effect, you could end up with leachate being  
19      observed in say a well to the west of First Line  
20      without it necessarily being detected in a monitor  
21      on the other side of the road?

22                   A.       I don't think it would happen.  
23      I think if you use this scenario it could happen.

24                   Q.       Are you saying this  
25      scenario is incredible?



1 A. No, it's not incredible,  
2 I am saying we have a zone which has continuity to  
3 it and the wells themselves are obtaining supplies  
4 and there are no reports of shortages and so they  
5 are getting some recharge to those wells and so they  
6 have a unit that is providing them with some water  
7 supplies. So, it has some continuity to it and I  
8 believe through monitoring on this side of the site,  
9 on the landfill site...

10 Q. On which side, for the  
11 record?

12 A. On the landfill side of the  
13 site, and also there in the wells themselves, that  
14 we could detect the contaminants -- on-site and  
15 off-site wells I should say.

16 Q. I want to take you to the  
17 next paragraph and that's it and I am on page 400  
18 of this exhibit of Dr. Cherry's:

19 "In one of the very few detailed  
20 three-dimensional studies of  
21 contaminant movement in sandy  
22 deposits, Childs et al (1974)  
23 observed that 'plumes migrate  
24 along zones... that, although they  
25 are texturally similar, show



1 subtle differences in fabric that  
2 result in slight variations in  
3 permeability. Bifurcations indicate  
4 that detection of a shallow plume does  
5 not negate the existence of the  
6 other plumes of the same constituent at  
7 depth.'"

8 I suggest that all of this, to the  
9 extent you have agreed that we have got the kinds  
10 of heterogeneities in the granular unit, that we  
11 should have some concern at least, about the  
12 monitoring program as being the salvation of this  
13 site?

14 A. The monitoring program is  
15 required at every site and this site isn't different  
16 -- each site has its own unique characteristics,  
17 but with respect to the bifurcations indicating  
18 the detection of a shallow plume not negating the  
19 existence of other plumes of the same constituent  
20 at depth, we are not proposing to monitor one  
21 zone but all of the significant zones and to over-  
22 come any of these problems. We are talking about  
23 the shallowed weathered zone and the upper and lower  
24 granular units and we are talking about the bedrock  
25 all being monitored and we feel with proper



1 monitoring we won't let a plume from this site  
2 slip by. It's a large landfill site and I don't  
3 believe that it will follow little finger paths  
4 about the size of my thumb in various directions  
5 and shoot it off toward a well. We have a very long  
6 front of waste and if there is a failure, I believe  
7 we will see in all of those monitoring wells some  
8 changes, but I can't believe a site of that size  
9 of relative uniform consistency, that we won't find  
10 anything if the site starts to leak.

11 Q. Ultimately, your ultimate  
12 monitor is people's wells?

13 A. That would be the final  
14 analysis, but I believe all our on-site wells will  
15 also show it if there is a problem.

16 Q. Except to the extent that  
17 any of these diagrams from Dr. Cherry's book have  
18 any relevance to the site?

19 A. We have a field case there  
20 and we know there are some inconsistencies, but  
21 some of the things we are talking about here are  
22 sand boxes too.

23 Q. In finishing up, Mr. Chairman,  
24 I should be about five more minutes. You did say,  
25 and if you want to have the transcript in front of



1 you that is fine, but it's Volume 22 and have we  
2 a copy available for the witness, Volume 22.

3 Mr. Tidball at page -- around page  
4 5076 is asking you about purge wells and towards  
5 the bottom of the page, on 5076, and you start  
6 reading from your report calculations indicate  
7 only two purge wells would be required, and then on  
8 page 5078, you say, at line 5 .... has the Board  
9 got copies? You say:

10 "We don't know, as we say in this  
11 case the exact number, and it is based  
12 on the conditions we found at OW-2."

13 And I take it you are talking about the number of  
14 purge wells required, but I wanted to take you down  
15 to line 7 where you say:

16 "In fact, if we had pumped that  
17 well long enough, which is the  
18 northern well, it may be that it in  
19 itself can serve as a single pumping  
20 well and, as we mentioned before,  
21 we were able to spread a cone we  
22 felt from PW-2 out to HC 2-85,  
23 or HC 2-86 and it may be that  
24 pumping one well would serve to  
25 induce the capture of the water



1 that comes under the site because  
2 the leakage through the till is not  
3 all that great and it may be in fact  
4 we may only need one well, but  
5 what we have said for the time being  
6 until we know more about that zone, and  
7 we require more information from  
8 observation wells about that zone,  
9 but there may be one on the east  
10 side and there may be one also on the  
11 west side...."

12 And continuing on with the next sentence at line 24  
13 on the same page:

14 "We just don't have enough  
15 information on that zone yet to design  
16 a system, and that is in the report,  
17 and those types of contingencies  
18 would have to be looked at in more  
19 detail and a system designed for  
20 the site."

21 Stopping there, you agreed in  
22 answer to Mr. Tidball, that certainly you would  
23 need to know a lot more information in order to  
24 properly design your purge well system?

25 A. Yes, I would need at least



1 another pumping test on the west side of the site  
2 and a longer pumping test on the well that we have  
3 already conducted the pumping test on.

4 Q. But it is not just a  
5 pumping test because you are saying, as I understood  
6 it, that you don't have information on the zone?

7 A. We don't have the information  
8 and we are talking about the number of wells that  
9 would be required and we don't have a transmissivity  
10 and a storage coefficient on the upper zone on the  
11 west side of the site. Before you could design  
12 a purge well system and know whether or not we  
13 could handle it by pumping from this point, we would  
14 need a longer test here and we would have to get  
15 some transmissivity and storage coefficient data on the  
16 west side of the site to find out whether we needed  
17 a purge well on that side or not.

11A

18 Perhaps if it were finer grained  
19 we might need two here and we would have to conduct  
20 a pumping test to find out.

21 Q. Will you look at the bottom  
22 of page 5079 and you were asked a question at line 18:

23 "If you pumped it at a higher  
24 rate than what you are suggesting,  
25 I assume you would get an even



1 bigger drawdown?

2 A. Possibly. Again we would have  
3 to see what conditions are  
4 specifically on that side of the site."  
5 You were talking about pumping well

6 2, which is were?

7 A. HC2-85.

8 Q. And you say:

9 "... and saying that that is  
10 representative of conditions and  
11 we have already been discussing  
12 this morning whether the zone may  
13 even exist in some areas, and we  
14 would have to actually find out what  
15 it is in those areas and what the  
16 hydraulic conductivity is and then  
17 the numbers would have to be adjusted  
18 so we didn't have an adverse impact  
19 on the wells."

20 Mr. Sobanski, you haven't learned  
21 anything new about that upper granular unit since  
22 Thursday, June 18, 1987 by way of site testing, have  
23 you?

24 A. No.

25 Q. So your answer given at that



1 date stands, that the zone may not even exist in  
2 some area?

3 A. I just said this to you a  
4 few minutes ago, Mr. Estrin. If we were to put  
5 wells in there and and find just till, then we would  
6 have to offset them and find the zone itself.  
7 I haven't changed from what I said here.

8 Q. Looking towards the middle  
9 and the bottom of the page, I think that's the last  
10 reference I wanted to discuss with you, you were  
11 asked by Mr. Tidball whether it would be your  
12 intention to in fact pump both units and you say.  
13 if it was required:

14 "The upper granular unit, and if we  
15 assume for the moment that the  
16 upper granular unit -- if it is roughly  
17 as is shown -- and if we assume for  
18 instance that the upper granular  
19 unit occurs at HC 3 as we  
20 discussed, HC 3-86, we can't  
21 obviously construct a well in what  
22 was described in that unit. So, with  
23 the upper granular unit, we can con-  
24 trol most of the site, but in areas  
25 where it doesn't occur, then you



1 will have to either deal with the  
2 lower granular unit and pump it if it  
3 exists, or you will have to deal  
4 with the bedrock itself if that  
5 is the zone you have to worry about."

6 Now, Mr. Sobanski, you have been quite  
7 candid, you don't know exactly where either unit is  
8 at this time. Is that fair? You don't want to tell  
9 the Board you know with assurance where the upper  
10 granular unit goes under and out of the site and  
11 the same with the lower granular unit?

12 A. We have given our interpretation  
13 to the Board of where it is as well as interpretations  
14 can be made. If when you go out and do additional  
15 drilling you find something that is different, then  
16 you will have to adjust the program to meet the  
17 needs. If, and we use that nice word if, but if  
18 you have glacial till along the edge of this site,  
19 then you have no problems at all.

20 Q. Except Dr. Cherry disagrees  
21 with you because he says that is the very kind  
22 of discontinuity you ought to be very concerned  
23 about when it comes to monitoring?

24 A. I am sorry, that's not right.

25 MR. LEDERER: There must be a



1 difference between Dr. Cherry writing a book in 1979  
2 meant to instruct, as I understand it, a beginning  
3 student in this area and work done on this site. When  
4 Mr. Estrin says Dr. Cherry disagrees, I think we  
5 are going some distance from the general text to  
6 a specific site study.

7 MR. ESTRIN: Q. The example given  
8 by Dr. Cherry if it existed at your site would be  
9 exemplified by, I suggest, that clayey till existing  
10 on the western boundary of the site and you not  
11 having an extended UGU off the site?

12 MR. SOBANSKI: A. If you don't  
13 have any extended upper granular unit off the site  
14 on this side, then you don't have a problem with  
15 those wells.

16 Q. Except that it may get into  
17 those wells by a circuitous pathway of the upper  
18 granular unit?

19 A. You have just said it isn't  
20 there and you said it's all till and that is  
21 Cherry's case. I'm saying if it is all till on  
22 this side, then those wells have no danger at  
23 all and there would be nothing to worry about if  
24 it's all till. You can't move the material to them  
25 in any reasonable length of time.



1 Q. Which is it, I thought you  
2 said a minute ago that those wells must be getting  
3 their water from somewhere because they have ample  
4 supply and so is it continuous or not?

5 A. I believe that upper granular  
6 unit is on that side of the site.

7 Q. But you are not willing to  
8 tell the Board based on present data that there  
9 aren't any kinds of discontinuities such that  
10 monitoring....

11 A. I have admitted to the Board  
12 that there are discontinuities in the data and if  
13 we drill a well and find we have something, that  
14 the upper granular unit is a few inches thick, it  
15 still can be there and can't be purged and so you  
16 move and find a thicker unit and construct a well  
17 in it.

18 Q. Mr. Sobanski, do you agree  
19 that it is prudent for this Board to take into  
20 account and try and form the best opinion it can  
21 as to the existence of discontinuities or  
22 continuities in the upper granular unit at Site D?

23 A. That's why the Board is here.

24 MR. ESTRIN: Thank you, Mr. Chairman,  
25 and subject to anything arising out of documents



1 yet to be produced, I have no further questions.

2 DR. KINGHAM: Do you want this  
3 entered as an exhibit?

4 MR. ESTRIN: I do.

5 DR. KINGHAM: It will be a Milton  
6 exhibit, M-184, Groundwater by Freeze and Cherry.

7 --- EXHIBIT No. M-184: Textbook entitled  
8 Groundwater by  
Freeze and Cherry.

9 DR. KINGHAM: Will you be starting  
10 after the break Mr. Garrod?

11 MR. GARROD: Ms. Cronk is ahead of  
12 me.

13 DR. KINGHAM: I thought perhaps that  
14 is why you had switched. We will resume in a few  
15 minutes.

16 --- Recess

17 DR. KINGHAM: Thank you. Please  
18 be seated. Ms. Cronk.

19 CROSS-EXAMINATION BY MS. CRONK:

20 Q. Just for something entirely new,  
21 I propose to put a few questions regarding Site F  
22 to you over the next few minutes and for the  
23 moment my questions will be directed to Mr. Sobanski.  
24 I propose to start first by discussing with you  
25 in general terms the various hydrogeological reports



1 or studies done over the years concerning Site F and  
2 its environs and I asked at the break that you put  
3 up the aerial view of Site F and you have done that.

4 Could I ask you as well to take out  
5 H-40, your Site F report, and if you could have that  
6 in front of you, and could you put up Drawing 2  
7 from that report. Can we agree that when we discuss  
8 Site F and its environs, that its environs include  
9 the Burlington landfill site to the west and  
10 Bayview Park on the east?

11 MR. SOBANSKI: A. Yes.

12 Q. At page 3 of your Site F  
13 report, if you could turn to that, you have listed  
14 -- page 3 of the main report, not the introduction,  
15 not the executive summary, but starting at the  
16 bottom of page 3 under the heading of Previous Work,  
17 and it has been some time since we looked at this,  
18 but you set out a number of reports that either  
19 you or your team had reference to in preparing  
20 your own work and in arriving at your own deter-  
21 minations with respect to Site F, is that correct?

22 A. That is correct.

23 Q. Do I take it all the reports  
24 listed beginning at page 3 under Section 1.5 and  
25 carrying over to the bottom of page 4, were in fact



1 either reviewed by you personally or by members of  
2 your staff preparatory to doing your work on Site F?

3 A. That is correct.

4 Q. Do I take it then that the  
5 content of those reports and the work done by the  
6 consultants who authored those reports were taken  
7 into account by you and your staff in doing your  
8 work on Site F?

9 A. Yes, they were.

10 Q. It is my understanding as  
11 well that the list we see set out at those two  
12 pages is not exhaustive of the studies and reports  
13 that have been done concerning Site F and its  
14 environs and I take it it was not intended to be.  
15 It is not in fact exhaustive, is it?

16 A. That is correct. There were  
17 other reports prepared for the other two sites as well.

18 Q. Could we deal first with the  
19 Burlington landfill site to the west of Site F.  
20 It was established in approximately 1972, is that  
21 correct? I can give you a reference in the report.

22 A. If you don't mind.

23 Q. Could you put in front of  
24 you the plume delineation report of Gartner Lee,  
25 which is Exhibit H-83. You will need it anyway,



1 or I wouldn't trouble you to take it out. It would  
2 be of assistance if you have it.

3 DR. KINGHAM: The number?

4 MS. CRONK: H-83.

5 MR. SOBANSKI: I don't seem to have  
6 a copy.

7 MS. CRONK: Because we don't have  
8 a great deal of time left today, my records indicate,  
9 and Mr. Hodgson has confirmed, it is marked as  
10 H-83 and it will be needed tomorrow and if the  
11 Board can't locate its copies, we can find other  
12 copies for you tomorrow. Mr. Hodgson informs me  
13 that the Board was only provided with one copy and  
14 I will see what I can do to get others this  
15 evening for you.

16 Q. Just to short-cut this,  
17 there is nothing material that turns on the actual  
18 date, but my question to you for confirmation was  
19 that the Burlington landfill site opened in the  
20 early 1970s and I suggested 1972. If you look  
21 at page 3 of the plume delineation report, and it is  
22 opened for you there, it should be open at page 3.

23 MR. SOBANSKI: A. Yes, Gartner  
24 Lee says here under item 4,

25 "Waters which infiltrated into the



1 ground before the landfill was  
2 established in 1972 are unlikely to  
3 be affected by leachate."

4 They established the site was  
5 started in 1972.

6 Q. Have you any reason to  
7 disagree with that, Mr. Sobanski?

8 A. No.

9 Q. I'll give you Mr. Hodgson's  
10 copy of that study for a moment. Can we agree,  
11 based on your own investigation of Site F and what  
12 you know of the area in its vicinity from a hydro-  
13 geological perspective, that the hydrogeological  
14 setting of the Burlington landfill site is  
15 substantially similar to that of Site F.

16 A. I would expect them to be  
17 similar, substantially similar, yes.

18 Q. Perhaps we could review a  
19 few or highlight a few of the key aspects of the  
20 Burlington landfill site as it relates to its  
21 companion, or any discrepancy that may exist at  
22 Site F. Could you go to page 9 of that study?  
23 I am conscious of the fact you don't have this  
24 report and regrettably I didn't realize that and  
25 I don't have copies for you now, but I am content

argue  
if similar  
no  
leachate  
travel



1 to be specific from what I am reading, if you want  
2 me to go ahead and, if not, I am sorry, I can't  
3 solve it until the morning.

4 DR. KINGHAM: Sure.

5 MS. CRONK: Q. The first reference is  
6 at page 9 of the plume delineation study report.

7 DR. KINGHAM: We have a copy.

8 MS. CRONK: Q. You will forgive me  
9 for retreating back for the moment, perhaps to basics,  
10 but as I understand it, both the Burlington landfill  
11 site and Site F are situated on the lower slopes of  
12 the Niagara Escarpment?

13 MR. SOBANSKI: A. Yes.

14 Q. Both are in areas heavily  
15 dissected by gullies and ravines?

16 A. A little hard to tell at the  
17 Burlington site now, but certainly the west side is  
18 a deeply incised ravine. Burlington, of course, is  
19 nearly full of waste now, but certainly on the west  
20 side we have a deep incision into the shale.

21 Q. If we look at the first  
22 sentence which appears on page 9 of the plume  
23 delineation report, which reads:

24 "The Burlington landfill site is  
25 located in Burlington, north of



1 Highway 403 between King Road and  
2 Waterdown Road. Regionally  
3 the site is situated on the lower  
4 slopes of the Niagara Escarpment  
5 in an area heavily dissected by  
6 gullies and ravines."

7 And would you agree it was the opinion of these  
8 authors that that was a characteristic of the  
9 Burlington landfill site?

10 A. That is right.

11 Q. From your report, it is  
12 characteristic of Site F?

13 A. It is.

14 Q. Can we agree the Queenston  
15 shale formation constitutes the bedrock below  
16 the entirety of both sites?

17 A. Yes.

18 Q. On the Burlington site I  
19 suggest the northern portion of the site is  
20 characterized by a dense to very dense clayey  
21 silt till?

22 A. Yes.

23 Q. And till at the Burlington  
24 site is absent in the southern part of the site?

25 A. That is in the report, yes.



1 Q. Does that sound a familiar  
2 note by way of comparison with Site F?

3 A. Very much so and I hope we  
4 wrote ours first.

5 Q. On Site F you described, so we  
6 are clear, silt to clayey till silt and you  
7 indicated --

8 A. Yes.

9 Q. That description was yours?

10 A. The description was very  
11 similar.

12 Q. On Site F we know the  
13 overburden is discontinuous as you move towards  
14 Highway 403?

15 A. Yes.

16 Q. Finally the groundwater flow  
17 at the Burlington landfill site and at Site F  
18 I suggest in general terms we could describe as being  
19 to the southeast and I can help you with the plume  
20 study over at page 10?

21 A. Yes, it says that flow is  
22 generally to the southeast with locally radial  
23 components of flow toward adjacent streams and  
24 low wetland areas.

25 Q. That is in fact the same



1 regional and local variation of the water table that  
2 applies at Site F?

3 A. That is correct.

4 Q. My understanding is, dealing  
5 with the Burlington landfill site, that initially the  
6 southern part of the lands forming that landfill were  
7 filled first, and am I right in that?

8 A. I believe so, yes.

9 Q. Do we have then based on the  
10 features we just discussed in fundamental terms,  
11 the same hydrogeological characteristics at the  
12 Burlington site and Site F insofar as you are  
13 concerned?

14 A. Generally, yes.

15 Q. Now, as I understand it, follow-  
16 ing the opening of the Burlington landfill site in  
17 the early 1970s and the filling of the southern  
18 lands as the first area filled, in 1980 the Region  
19 of Halton applied for approval of a proposed  
20 extension to the landfill site and are you familiar  
21 with that?

22 A. I am.

23 Q. And public hearings were  
24 ultimately held by the Environmental Assessment  
25 Board with respect to that extension application?



1 A. Yes.

2 Q. Ultimately that extension  
3 application was approved in June of 1980?

4 A. I am not sure what the date  
5 was, but it was approved.

6 Q. My understanding is that  
7 a number of hydrogeological reports and studies  
8 were prepared concerning the Burlington landfill  
9 site for the purpose of that hearing?

10 A. Yes.

11 Q. That is your understanding as  
12 well. Can you confirm for me my information that  
13 Gartner Lee and Associates Limited, the authors  
14 of the plume delineation report, were retained  
15 by the Region specifically for the purposes of  
16 providing hydrological evidence for that first  
17 extension hearing in 1980?

18 A. I am not sure whether they  
19 worked directly for the Region or M.M. Dillon, but  
20 they did the hydrogeology for that expansion hearing.

21 Q. M.M. Dillon were the  
22 consultants of the Region for that hearing?

23 A. M.M. Dillon was also retained,  
24 I believe, to do the engineering work, but I am  
25 not sure who the prime was and if they had two



1 consultants or if one consultant was a sub-consultant  
2 to the other.

3 Q. Whether they were the primary  
4 consultant or the sub-consultant, they were retained  
5 by the Region of Halton?

6 A. Yes.

7 Q. And subsequently Mr. Grant  
8 Anderson?

9 A. I couldn't tell you.

10 Q. Are you familiar with a report  
11 dated September 26th, 1979 prepared by Gartner Lee  
12 entitled The Burlington Landfill Site, Hydrogeological  
13 Study, Burlington, Proposed Burlington Landfill Site  
14 Expansion. Are you familiar with the existence of  
15 that report?

16 A. Yes, I have heard of its  
17 existence, yes.

18 Q. Are you familiar in general  
19 terms with its contents?

20 A. I am aware of its existence  
21 but I can't say I read that in detail myself.

22 Q. If I suggested to you that  
23 Gartner Lee and Associates, the authors of that  
24 report, concluded that the proposed expansion of  
25 the Burlington landfill was acceptable from a hydro-



1 geological point of view, can you confirm that that  
2 accords with your recollection of their work at  
3 that time?

4 A. Yes, it does.

5 Q. It is my understanding as  
6 well that Mr. Grant Anderson of the Gartner Lee  
7 firm testified before the Environmental Assessment  
8 Board with respect to the first expansion application  
9 we are discussing, and does that accord with your  
10 recollection of the facts as well?

11 A. I couldn't tell you who  
12 presented the evidence on their behalf.

13 Q. Do you know whether the City  
14 of Burlington called any evidence at that hearing,  
15 hydrogeological evidence with respect to that  
16 expansion? My understanding is that they did not.

17 A. I don't know. We weren't  
18 party to that hearing on what was happening at it.

19 Q. Perhaps we could move on to  
20 Gartner Lee's other involvement. It is my understanding  
21 that in the same year as that first extension  
22 hearing was held in 1980, the Gartner Lee firm was  
23 retained to carry on an annual monitoring program  
24 with respect to the Burlington landfill site; is  
25 that correct?



1 A. I couldn't say whether it was  
2 1980, but I know they have been monitoring the site  
3 for a number of years now.

4 Q. And that was at the behest  
5 and the retainer of the Region of Halton?

6 A. I expect it was.

7 Q. And you indicated that  
8 monitoring program continued for several years and  
9 it continues to date, as I understand it?

10 A. Yes.

11 Q. As I understand it, their  
12 mandate, if I can put it that way, or their terms  
13 of reference for that program, extended to and  
14 extends currently to an examination of both the  
15 groundwater and the surface water at the  
16 Burlington landfill site?

17 A. Yes.

18 Q. Is that your understanding?

19 A. Yes, it is.

20 Q. You have referred at page 3  
21 of Exhibit H-40, and it's a bit awkward, but perhaps  
22 you could keep your own report at pages 3 and 4,  
23 keep that open there, but over at page 4, item 3,  
24 you refer to a report entitled Burlington Landfill,  
25 1985 Monitoring Report for Halton Region by Gartner



1 Lee and Associates Limited, 1985. Do you see that?

2 A. Yes.

3 Q. I take it that is one of the  
4 annual monitoring reports Gartner Lee prepared in  
5 respect of the Burlington landfill?

6 A. Yes.

7 Q. Obviously we have also had  
8 evidence that Gartner Lee prepared the plume  
9 delineation report which has been marked as an  
10 exhibit and that report represents more of the  
11 continuing work that Gartner Lee has been doing  
12 in respect of the Burlington site; is that fair?

13 A. It is.

14 Q. It was, as I understand it,  
15 supplemental to and not a component part of the  
16 monitoring program per se; is that right?

17 A. I believe this is a separate  
18 study.

19 Q. Could I ask you to turn to  
20 page 4 of the plume delineation report. Do you have  
21 that?

22 A. Yes, I do.

23 Q. I draw your attention first  
24 to paragraph 1, which reads:

25 "Gartner Lee Limited were retained



1 in 1980 by the Regional  
2 Municipality of Halton to carry out  
3 an annual ground water and surface  
4 water monitoring program at the  
5 Burlington landfill site. This  
6 monitoring program is ongoing,"

7 and moving to paragraph 2:

8 "The purpose of the annual monitoring  
9 program is to assess the impact of  
10 the existing landfill on local  
11 ground and surface water quality."

12 Do you see that?

13 A. Yes.

14 Q. That is a confirmation by  
15 the authors of the nature of their terms of reference  
16 for the monitoring program?

17 A. It is.

18 Q. It goes on to say:

19 "Previous attempts to map the  
20 leachate plume using inorganic  
21 parameters or routine water quality  
22 parameters have been generally  
23 unsuccessful due to the naturally  
24 poor water quality in the shale  
25 bedrock."



1 And then the authors go on to  
2 discuss the purpose of the plume delineation study  
3 to which I will return, but for the moment I take it  
4 that that is as stated, the purpose of the monitoring  
5 program.

6 Q. In 1980 we have then the  
7 phased expansion of the Burlington landfill site  
8 being approved by the Environmental Assessment Board  
9 and from that date forward in the same year,  
10 according to the passage we have just read, we  
11 have Gartner Lee conducting an annual monitoring  
12 program?

13 A. Yes.

14 Q. In 1984, I would ask you to  
15 confirm this, the Region of Halton applied to  
16 extend the capacity of the Burlington landfill site  
17 and that too was an application that came before  
18 the Environmental Assessment Board; am I right in  
19 that?

20 A. Yes.

21 Q. That application also resulted  
22 in public hearings?

23 A. Yes.

24 Q. The application was ultimately  
25 approved by that Board in July -- sorry, in June of



1 1984, is that correct?

2 A. I couldn't give you the date,  
3 but it was approved.

4 Q. In 1984 or are you certain?

5 A. It would be about in 1984.

6 We were still studying and carrying out our  
7 studies while that approval was in progress.

8 Q. Once again it is my under-  
9 standing, Mr. Sobanski, and I would ask you to confirm  
10 this if you are in a position to do so, that various  
11 hydrogeologists prepared a number of studies and/or  
12 reports and gave evidence at that second hearing  
13 before the Environmental Assessment Board with  
14 respect to that second proposed expansion; am I  
15 right in that?

16 A. That is my understanding.

17 Q. Gartner Lee was again  
18 involved on behalf of the Region in respect of that  
19 second hearing?

20 A. Yes, it was.

21 Q. This time it was Robert Leech  
22 of Gartner Lee was it not?

23 A. I believe I have heard that.

24 Q. Do you know Mr. Leech?

25 A. I know him to speak to him,



1 but we are not close associates, but I have spoken  
2 to him.

3 Q. Do you know him to be a  
4 hydrogeologist from Gartner Lee?

5 A. He is.

6 Q. Do you know him to be a  
7 principal of that firm?

8 A. I believe he is.

9 Q. I would ask you to look again  
10 if you would at page 4 of your Site F report where  
11 you have listed the reports to which you have had  
12 reference and you refer to a 1984 M.M. Dillon study  
13 entitled Burlington Landfill Site, Application for  
14 Continued Use, Volume 2, and that is item 4 you have  
15 listed and do you see that?

16 A. I do.

17 Q. You have told me in preparing  
18 your work for Site F, either you or members of  
19 your team would have reviewed that report?

20 A. Yes.

21 Q. That report, I suggest, is  
22 the Gartner Lee hydrogeological report prepared  
23 with respect to the second extension hearing before  
24 the Environmental Assessment Board?

25 A. Yes, I believe it is.



1 Q. Can you confirm for me that  
2 Gartner Lee concluded in that report that landfilling  
3 in the proposed continued use area, as it was being  
4 termed then, at the Burlington landfill site would not  
5 create a detectable change in water quality off  
6 the property?

7 A. I don't know in what terms  
8 they put it and I couldn't tell you that, but certainly  
9 having gone to the hearing they would have supported  
10 the application and said it was acceptable hydro-  
11 geologically.

12 Q. Perhaps to confirm that, if  
13 I might, and you will see a rather sizable volume  
14 which constitutes that report, so I do not have it  
15 copied and I propose merely to provide the  
16 relevant page to Mr. Sobanski and ask him to confirm  
17 it if he could, but the conclusions stated by  
18 Gartner Lee in that report.

19 I am directing you to page 0-5, the  
20 Executive Summary which appears in the M.M. Dillon  
21 report and I would ask you to look to the bottom  
22 of the page and to read the sentence beginning in  
23 the last paragraph and carrying over to the first  
24 two sentences on the next page. Would you read that  
25 to the Board?



1 A. This is the bottom paragraph  
2 on page 0-5 and it reads:

3 "The data presented in this report  
4 shows that a landfill site developed  
5 within the glacial till would not  
6 create a detectable change in  
7 water quality off the property.

8 However, it is preferred that an  
9 engineered system for leachate  
10 collection be developed to serve as  
11 the primary control mechanism with  
12 the natural hydrogeological setting  
13 functioning as a back-up system."

14 Q. Stopping there, I take it  
15 we can agree now that the report is in front of  
16 you that Gartner Lee did as you suggested, support  
17 in hydrogeological terms the continued use of the  
18 additional area at the Burlington landfill site?

19 A. They did.

20 Q. They expressed their  
21 conclusion to the Region in that report that to do  
22 so, to go ahead and use the continued use area at  
23 Burlington, would not create any detectable change  
24 in water quality off the property; isn't that so?

25 A. That is correct and there is



1 one proviso. They talk about it being developed  
2 within glacial till.

3 Q. Mention was also made in the  
4 passage you read to their recommendation that an  
5 engineered system for leachate collection be  
6 created?

7 A. That is correct.

8 Q. And that they suggested should  
9 be the primary control mechanism?

10 A. Yes, they do.

11 Q. And the natural hydrogeological  
12 setting should function as a back-up system?

13 A. Yes.

14 Q. That, in effect, I suggest  
15 is virtually identical to the recommendation you  
16 have made for Site F; isn't that so?

17 A. Yes, it is.

18 Q. I mean by that your primary  
19 collection system at Site F, as you propose it, is  
20 to be the underdrain system?

21 A. That is correct.

22 Q. And the primary first back-up  
23 will be the natural attenuation characteristics  
24 of the shale?

25 A. Of till, till in the north



1 and shale in the south, yes.

2 MS. CRONK: Mr. Chairman, I am  
3 conscious of the time. I do intend to spend some  
4 time briefly reviewing what these reports are and  
5 hopefully for the assistance of the Board, but I  
6 am moving into an area that I would prefer to deal  
7 with in a package, and might I suggest we adjourn  
8 now and reconvene and pick it up in the morning?

9 DR. KINGHAM: It's a bit of a short  
10 day, but maybe it's better if we keep it all together.  
11 We hope we won't have thunderstorms tomorrow.

12 MS. CRONK: I am in your hands and  
13 if you wish me to continue, I can't guarantee I  
14 will be six minutes.

15 DR. KINGHAM: We will start tomorrow  
16 at 9:30 sharp.

17 MS. CRONK: Thank you.

18 --- Adjournment (4:27 p.m.)  
19  
20

21 --- CERTIFIED CORRECT  
22

  
C.F. Nethercut, CVR

23

24

(Page 6550 Follows)

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