

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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1 WITNESSES:

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3 James Beechinor (Recalled)

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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 14, 1987

VOLUME 27

APPEARANCES:

T.R. Lederer and
H.D. Hodgson

for the Regional
Municipality of Halton
(Proponent)

J.R. Tidball

for the Ministry of the
Environment

T. Vigod
J.F. Castrilli

for the West Burlington
Citizens Group

D. Estrin,
F.E. Leitch and
H. Dahme

for the Corporation of the
Town of Milton

S.R. Garrod and
A. Nurvo

for the Milton Area Citizens
Coalition and several
affected Milton area
landowners

R.B. Tuer, Q.C.
E.A. Cronk and
F. Perrier

for National Sewer Pipe
Limited

L.F. Longo

for Azova Investments
Limited

M.J. McQuaid, Q.C.
and C.J. Tzekas

for the City of Burlington

C. Mansfield

for the Ministry of Natural
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
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Toronto, Ontario
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Per: C.F. Nethercut, CVR



1 ---Upon commencing at 10:00 a.m.

2 MR. LANCASTER: I am very happy to
3 be back and I apologize for the delay to all parties.
4 We have lost some time and perhaps we might make some
5 up. You will notice that at the request of my
6 doctors and the two Chairmen have agreed that tempor-
7 arily Dr. Kingham will take over the Chair of the
8 hearing until I feel or they feel it is possible I
9 can take over the reins one once. Again, I apologize
10 for the delay occasioned.

11 Thank you very much for your
12 consideration.

13 DR. KINGHAM: I will say for the
14 other members of the Board that we are glad to have
15 you back in great health and great shape and we will
16 move on as quickly as we can.

17 Just a few housekeeping matters.
18 Between now and Christmas the only days we know
19 of where there might be any difficulties are, of
20 course, the statutory holidays, Remembrance Day and
21 Thanksgiving Day, and we might as well make sure we
22 have those days clear as days we will not be sitting.
23 That is of course the 11th of November and I think this
24 year it is the 12th of October.

25 There is one other commitment that



1 the two EAB members have and that is a full Board
2 meeting on Thursday the 1st of October and so that
3 is a day we will not be available. Otherwise, as
4 far as we can tell we are clear for all other days
5 and, as Mr. Lancaster pointed out, he will resume the
6 Chair as soon as everybody is comfortable with that.
7 In the meantime I will try and do my best.

8 Mr. Lederer, I guess we are about to
9 resume.

10 MR. LEDERER: Not so fast! Just one
11 or two matters. If I may take up with the Chairman
12 I would want to say and my friends want me to say
13 that as a group we are only too pleased to have
14 Mr. Lancaster back with us and to repeat something I
15 said to him privately; if for any reason you feel
16 tired or wish to have a break we would only be too
17 happy to stop the matter at your request and feel
18 free to make such a request rather than take un-
19 necessary risks with your health, because obviously
20 that is the most important point for us all.

21 MR. LANCASTER: Fine.

22 MR. LEDERER: I have I believe an
23 updated Exhibit list for everyone and I hope it will
24 be of some assistance because for the few few days
25 we will be struggling trying to remember some of these



1 numbers.

2 There are three other things I
3 wanted to mention. First of all I indicated at the
4 outset of the hearing, now some time ago, that as
5 always in these situations we have been confronted
6 with some difficulties in putting together our case
7 because we didn't know or have any idea of what issues
8 were in the minds of our opponents, if I may use that
9 word, and these things only become clear as witness
10 statements are developed over the course of the
11 hearing.

12 We have received some information
13 from Mr. Estrin and it has become clear to us that
14 geochemistry will be more of an issue here than
15 perhaps we thought and hoped and this has required
16 us to rethink our approach with respect to that
17 issue.

18 Some of the work that Mr. Sobanski
19 and Mr. Beechinor have dealt with, some small part
20 of it related to geochemistry, and that work was
21 done by a man named Stan Feenstra who was a sub-
22 consultant to Hydrology Consultants and it has become
23 obvious we will have to call him to give evidence
24 and we propose to do so.

25 We would ask, therefore, that the



1 cross-examination dealing with that subject matter
2 be delayed until he is here to explain precisely
3 what his contribution was to this process. We do not,
4 as of yet, have a witness statement and this decision
5 was only made in the latter part of last week.
6 We are only too aware of the 30-day rule which is in
7 place here and our hope, frankly, is that we will be
8 able to call Mr. Feenstra immediately after
9 Mr. Sobanski and Mr. Beechinor, and frankly that will be
10 the most logical thing, but it won't comply with the
11 30-day rule and we will have to discuss that with
12 the various lawyers involved, because it isn't fair
13 to ask them to attempt that until they have the
14 information from us, but I expect realistically we
15 won't have it until next week, we are trying to get
16 it together as quickly as we can and obviously we
17 want to make sure it is correct in every way.

18
19 The other two matters deal with the
20 timing for the hearing. I have been informed that
21 there has been a death in Mr. Sobanski's family, and
22 I don't feel it particularly appropriate to discuss
23 who it is or what the relationship is, but I understand
24 the funeral will be on Wednesday and I have suggested
25 to Mr. Sobanski that he ought to be there and it is



1 only fair, so I am asking the Board not to sit that
2 day, the day after tomorrow.

3 It seems to me no matter what happens
4 we ought to be prepared to allow people to recognize
5 these kinds of events. I have not had an opportunity
6 to discuss that with all the lawyers here, but I
7 presume it is something that can't really be
8 objected to.

9 Secondly, tomorrow morning, for what
10 I presume will be the only time, both Mr. Hodgson and
11 I have some conflict. I have a meeting inside the
12 firm beginning at eight o'clock in the morning and
13 Mr. Hodgson has a very brief court motion beginning
14 at 9:35 and the Board's custom was to begin at 9:30
15 every day other than Monday, but we would appreciate
16 it if the matter could stand down until ten o'clock
17 tomorrow or perhaps 10:30, and I think ten is
18 probably safe, but perhaps we could be given that
19 latitude on the starting time tomorrow.

20 DR. KINGHAM: Okay. Several things.
21 Certainly we will be prepared to start tomorrow at
22 ten. If neither of you will be here it is clearly the
23 thing to do.

24 MR. LEDERER: I expect you won't
25 start without me ...



1 DR. KINGHAM: We won't start without
2 you and the Wednesday situation is quite clear, we
3 will have to accommodate that. The business of
4 starting at 9:30 on days other than Monday, we thought
5 we might start at 9:30 on Mondays to recoup time,
6 if that meets with the approval of all of you, and
7 I don't know if Monday is particularly special in
8 terms of starting a half an hour later, so we would
9 be prepared to do that.

10 Are there any other submissions on
11 this matter, or shall we proceed that way? If not,
12 I guess we have the housekeeping in order and it
13 seems to me Mr. Estrin you were in full stride on the
14 19th of June.

15 MR. ESTRIN: I was in some stride, although,
16 as I recall, it was a very warm day and the air
17 conditioning had broken down and perhaps we will
18 have to recapitulate to some extent.

19 Actually before we get ...

20 DR. KINGHAM: Mr. Tidball, did you
21 have something? I didn't see you.

22 MR. TIDBALL: I was waiting until I
23 knew we were going to start with the witnesses for
24 sure. There was an undertaking, and it might be
25 relative to Mr. Estrin's cross-examination so I



1 think it should be filed, but there was an undertaking
2 in my cross-examination on Site D by Mr. Sobanski and
3 Mr. Beechinor and it has to do with, you will recall
4 the diagrams and had to do with the contaminant
5 pathways, and I asked Mr. Sobanski if he had completed
6 such a drawing for the bedrock aquifer at Site D
7 and he indicated he had just done it and made it
8 available to me, actually the last day that we
9 were supposed to start again with Mr. Estrin's cross-
10 examination, and I have given it to all counsel, and
11 I am sure everyone has lost it and I could make more
12 copies and perhaps we could file it.

13 DR. KINGHAM: Okay. We had not set
14 aside a number for this, had we?

15 MR. TIDBALL: I don't believe so.

16 DR. KINGHAM: All right. We
17 assume the list is right up to date and it ends with
18 M-158, so this would be E-159.

19 ---EXHIBIT NO. E-159: Chart
20

21 DR. KINGHAM: Have I missed anyone
22 else who wanted to say anything before Mr. Estrin
23 resumes? I guess not.

24 Over to you.

25 MR. ESTRIN: I was going to say before



1 getting into any substantive questions, I wanted to
2 ask these witnesses whether over the summer,
3 particularly since my cross-examination will focus
4 on Site D, whether they have arrived at any new
5 data or produced any new plans or found any errors
6 they would like to correct in the report and,
7 more particularly, Mr. Sobanski indicated in June when I was
8 cross-examining him that the leachate collection
9 system was then under review and I advised him and
10 Mr. Lederer's office last week if in fact
11 there were any revisions to be made to that leachate
12 collection system that was then under review and
13 I advised him and Mr. Lederer's office last week
14 that if in fact there were revisions to be made
15 to that leachate collection system or any new
16 data to be relied on in connection with it, I would
17 certainly like to have it at the earliest possible
18 moment.

19 ALFRED A. SOBANSKI (Recalled):

20 JAMES BEECHINOR (Recalled):

21
22 MR. ESTRIN: I would like to ask those
23 questions and see if such new data or corrections,
24 calculations or opinions have been produced over the
25 summer with respect to Site D.



1 CROSS-EXAMINATION BY MR. ESTRIN (Cont'd):

2 Q. Now, I don't want any details,
3 but just an answer in general terms; yes or no.

4 MR. SOBANSKI: A. In general terms,
5 Mr. Estrin, we received from your consultants some
6 monitoring data that has been ongoing at Site D and
7 they have been monitoring four nests of wells, I
8 believe, and we have been receiving that information
9 from time to time.

10 The other matter on the design of
11 the site, we have reviewed the information that has
12 been provided. There is one area on the site where
13 the tile system may have been dug in too deep, but
14 Mr. Hiraishi, I believe, will deal with it and the
15 design is very flexible and can accommodate changes
16 readily that will not interfere with the overall
17 concept at the site, and conceptually everything
18 works.

19 This is still a conceptual design and some
20 more more details may have to be worked out in small
21 areas.

22 Q. When is Mr. Hiraishi coming on?

23 MR. LEDERER: After Mr. Crysler who
24 is next and assuming we cannot deal with Mr. Feenstra
25 immediately after, and if you turn to the witness volumes



1 and look at volume 2, we are now dealing with
2 Mr. Sobanski, panel 9, and we will go to panel 10
3 which is Mr. Crysler and then panel 11 which would
4 be Mr. Hiraishi. That is obviously the logical
5 way and the way it has always been.

6 DR. KINGHAM: Your plan to bring in
7 Mr. Feenstra after Mr. Sobanski?

8 MR. LEDERER: I would like to do that,
9 but it will require some latitude to the guideline we
10 have been working to and ultimately that may not be
11 possible, but that is our present hope.

12 MR. ESTRIN: Q. The data with respect
13 to the one area at Site D where the tile may be too
14 deep; is that something that has been worked out?

15 MR. SOBANSKI: A. It hasn't been worked
16 out fully and ultimately some more drilling may
17 be required in that area to resolve exact depths.

18 Q. When you say "exact depths",
19 that would be depths...

20 A. Depths of tile and there is
21 a great deal of flexibility in the design.

22 Q. The drilling would be necessary
23 to determine what?

24 A. Mr. Hiraishi will have to
25 explain how they selected the tile depth and how it was



1 decided, but in the vicinity of 25G it would appear
2 that a small area of tile may too deep, and in terms
3 of the design it is not all that critical.

4 However, it may be argued that it
5 would be preferable to raise the tiles in that area
6 by a couple of metres; but other than that the rest
7 of the site we checked as well and it appears to meet
8 the criteria that we have set.

9 Q. All right. Any changes or
10 corrections with extent to the upper granular unit, the
11 UGU, as a result of looking at your data or thinking
12 about the matter over this summer?

13 A. We haven't changed anything on
14 the upper granular unit. We have said that we are
15 assuming for purposes of conservatism that it is
16 extensive.

17 Q. What about gradients? Have
18 you any changes you wish to make with respect to
19 the numbers provided in your report with respect to
20 gradients?

21 A. No. Some gradients have changed
22 slightly on the site, but I will not reinterpret that.
23 We have looked at the deepest water levels on the
24 site and I believe the design still meets the principle
25 of the hydraulic trap.



1 Q. Some gradients have changed,
2 and are you referring to any particular unit?

3 A. In our report we had said there
4 are gradients from various units into the granular
5 units, and that still remains the same. That is
6 mentioned in our report.

7 Q. But you say some gradients have
8 changed and do you know which units where you found
9 them changed?

10 A. I would have to look at that
11 information.

12 Q. I would appreciate it if you could.

13 A. Overall in HC 1-85, which was
14 monitored by Geocon through the summer, there were,
15 other than water levels which are fluctuating, and
16 I haven't calculated the actual gradients, it would
17 appear it is fairly similar to what we measured and
18 ours was slightly different and between units 3 --
19 between piezometers 3 and 4, piezometer 4 being in
20 the weathered zone and piezometer 3 being in the
21 upper unweathered till, at that time there was a
22 slight upward gradient from the upper till into the
23 weathered zone. That has now reversed and it is
24 downward in all cases.

25 These are data collected in Geocon



1 through August.

2 At Morrison Beatty 4, OW-4, we find
3 the gradients in that particular area are somewhat
4 variable and sometimes there is a discharge gradient
5 as we measured in April and at other times there is
6 a recharge gradient and it is varying to some degree.

7 Hydrology Consultants 2-85, nest
8 2-85, in April of 1986 showed downward gradients
9 throughout the piezometer nest and Geocon found the
10 same type of situation.

11 At Hydrology Consultants 4-85 it
12 was found there was a downward gradient from the
13 upper till to the lower granular unit and an upward
14 gradient from the overburden/bedrock contact to the
15 lower granular unit, so the flow is up and down
16 toward the lower granular unit and Geocon found the
17 same in their information.

18 At HC 2-86 there was a small upward
19 gradient between the upper till and the upper weathered
20 zone found by Trow in 1986. The work by Geocon shows
21 the same gradients in '87 throughout August.

22 At that same nest there was a small upward gradient
23 from the overburden/bedrock contact toward the granular
24 unit and Geocon found the same gradient.

25 The water levels have changed from



1 time to time from the time they were measured in
2 1986, and I reviewed these and I felt that the lowest
3 water levels Geocon had measured still fell within
4 the design criteria I had set for the hydraulic
5 containment system.

6 Q. Aside from Geocon's data, have
7 you any other data you have with respect to gradients
8 on the site?

9 A. Yes. We took one set of data
10 ourselves and that was in June -- on June 9, 1987, and
11 they show much the same patterns as Geocon's and
12 for the record I can read these in, if you like.

13 Q. If you have them summarized
14 on a piece of paper we could photostat them so
15 everyone has a copy.

16 A. That would be fine.

17 Q. When Mr. McQuaid was asking
18 if you have the Geocon information on a piece of
19 paper, he will be asking for it anyway and I don't
20 know if you have it, but I haven't seen it myself
21 and neither have my consultants, and if it is not
22 in a form you think is appropriate you can advise us?

23 A. I have no problem in providing
24 these data. They are handwritten, but they could be
25 provided.



1 Q. Would that indicate where your
2 readings were done?

3 A. Yes, it would. Again they were
4 done in the same wells.

5 Q. All right. Is there any other
6 data with respect to gradients at D?

7 A. No. That is the limit of them.

8 Q. As a result of those measurements,
9 have you done any recalculation of gradients?

10 A. In terms of magnitude?

11 Q. Yes.

12 A. No.

13 Q. What about hydraulic conductivities
14 at Site D. Have you any reason to change any of the
15 value you put in your report as a result of work
16 done or reconsiderations of that data during the
17 summer?

18 A. No, we did not do any work on
19 hydraulic conductivities.

20 Q. What about chemical data, is
21 there any new data on that?

22 A. There was no new chemical data
23 collected at Site D.

24 MR. ESTRIN: I mentioned, Mr. Chairman,
25 that when we were last at -- when we had begun to take



1 Mr. Sobanski and Mr. Beechinor through some cross-
2 sections, I think it will be helpful to divert from
3 that topic for a moment and what I want to do is
4 recapitulate on a couple of factual matters and
5 then I can go directly into some of the data about
6 Site D after I do a bit of generalizing.

7 Q. I wonder if you could find
8 Exhibit H-39-D2, which I think is a large map with
9 wells and ponds, and Mr. Beechinor may recall that is
10 the one where we added some wells and ponds.

11 All right. It looks like we never
12 necessarily added a legend to that one, the yellow
13 and pink additions indicated, or did you? I can't
14 see them from here.

15 MR. BEECHINOR: A. There is no
16 legend on it.

17 Q. Just to refresh our memory, you
18 will recall I took you to the number of wells within
19 one kilometre of the site and within a half of
20 kilometre, 500 metres, and just to deal with ones within
21 500 metres, this is summarized, and I am looking at
22 the transcript of Volume 23, page 5353, and I am
23 looking at line 22 and the question beginning at the
24 bottom of that page, and the question was:

25 "Q. Today we determined that the



1 accurate number of wells within 500
2 metres on either side appears to be --
3 well, you have in your report that I
4 referred you to today 22 wells?"

5 And Mr. Beechinor says:

6 "Yes, we had 22 wells between 100
7 metres and 500 metres and we have four
8 wells on the site.

9 Q. So according to your report of
10 1985 the 17 number would jump up to
11 about 22?"

12 And then I say:

13 "Q. I just would like to consolidate
14 all this data in one place. Then,
15 moving over another 500 metres and going
16 to the right, the total wells
17 on site within one kilometre taken
18 from 2C is 31 wells and that's the
19 same number I think you reported
20 today.

21 A. That's right. I think our
22 report in total would come up to
23 approximately 35.

24 Q. Today?

25 A. Today."



1 So, I think the number that we agreed
2 with Mr. Beechinor was that there were 35 wells within
3 one kilometre of D and 22 wells within 500 metres
4 of D and not the figure of 17 that had been used in
5 his earlier report. Those numbers do not include
6 four wells presently on-site.

7 We also at that point in the
8 discussion were contrasting that, and to be fair,
9 do you want to check that or will you leave it at
10 that; is that your recollection of it?

11 A. My recollection of what is in
12 the transcript is the way I would still view it.

13 Q. And contrasting that with F,
14 the evidence was that there were no wells, as I
15 recall in your evidence, within one kilometre?

16 A. That is correct.

17 DR. KINGHAM: You have just succeeded
18 in making it a bit less clear. I thought we had
19 it clear on June 19, but the point I want to clarify
20 is you said 35 wells and 17 wells not counting the
21 four on-site.

22 MR. ESTRIN: With respect to Site D,
23 35 wells within one kilometre.

24 DR. KINGHAM: Including the 4 on-
25 site; is that not what you said on the 19th of June?



1 MR. ESTRIN: I don't know if the number
2 of 35 includes the four wells on-site or not.

3 MR. BEECHINOR: The figure of 35
4 should include the four wells on-site.

5 DR. KINGHAM: To be clear, the 17
6 did not include the four wells.

7 MR. ESTRIN: The figure of 17 was first
8 of all used by Mr. Beechinor and Mr. Sobanski in an
9 earlier report as the number within 500 metres, and
10 we agreed that there were in fact 22 wells within
11 500 metres, plus four more on the site.

12 Q. Is that right?

13 MR. BEECHINOR: A. That's right.

14 Q. And zero wells within one
15 kilometre of Site F?

16 A. That is right. Let's clarify
17 that. Zero wells downgradient of Site F, because
18 there are wells upgradient of Site F.

19 Q. Yes, upgradient, but they are
20 not of concern in this kind of an analysis?

21 A. That's right.

22 Q. The other thing I wanted to
23 confirm, and Mr. Sobanski may already have answered
24 as best he can at this point, but I wanted to confirm
25 the base contour of the landfill and, Mr. Sobanski, has



1 anything changed as a result of your discussions with
2 Mr. Hiraishi as to what will be the base contour of
3 the landfill.

4 MR. SOBANSKI: A. Not at this time,
5 but again we have flexibility in that design.

6 Q. How much?

7 A. Flexibility in design?
8 Oh, Mr. Hiraishi is going to discuss how much
9 flexibility he feels there is, and in some cases he
10 might be able to exclude sections if it was absolutely
11 necessary.

12 Q. I guess what I am getting at is
13 has there been any discussion which would cause you
14 to either dig deeper to bury the garbage or stay
15 higher, keep the base elevation higher at any point?

16 A. Nothing that I have reviewed
17 so far.

18 Q. Except for the area you
19 mentioned a few minutes ago, which was 25G, you said
20 in that area the leachate collection design elevations
21 as shown in the design and operations report at this
22 time say the same?

23 A. No, I said they can be raised
24 there if it is felt they are too low.

25 Q. At that location?



1 A. In that general area of 25G,
2 the manhole at 25G.

3 Q. Other than that, there have been
4 no discussions about raising or lowering the elevation
5 of the leachate collection system?

6 A. Not in any specific area. There
7 is a great deal of flexibility in where those tiles
8 can be, as I recall.

9 Q. When you say "flexibility", so
10 I understand that, is that flexibility east and west
11 and north and south or up and down in the till?

12 A. Up and down in the till.

13 Q. When you say flexibility in that
14 sense, are we talking a range of centimetres or metres?

15 A. Metres.

16 Q. From your point of view as a
17 hydrogeologist, have you been asked by Mr. Hiraishi
18 to provide your views on what would happen if the
19 leachate collection pipes were, say, a metre or two
20 metres deeper than already proposed?

21 A. Yes, I have been asked that.

22 Q. Have you done any calculations?

23 A. No. I just sort of used my
24 logic in feeling that it wouldn't be that critical.

25 Q. Does the same opinion and



1 methodology hold if you were coming to the conclusion
2 that it wouldn't matter if you raised them a metre?

3 A. If we raised them the question
4 would arise only if there were a systems failure.
5 If there were a systems failure, then tiles that may
6 be near the lower till because of the current depth;
7 one could argue that it is going to get into the
8 lower zone faster, but the fact is that the modelling
9 shows that if there is a systems failure, then we would
10 probably have to collect leachate in any event.

11 So if the system fails, we have to
12 collect it and so it doesn't really make an awful lot
13 of difference if the tiles are a bit too deep in
14 some areas to give him the grades he may like for
15 self-cleaning of tiles. The only critical time is
16 if the system failed, and if the system fails we know
17 we will have to collect leachate by some other means,
18 so it doesn't really matter in the long run.

19 Q. I take it there is some
20 general need in such systems and it is advisable
21 there be some kind of gradient in the tiles to collect
22 leachate, and that is necessary?

23 A. Not necessary.

24 Q. Unless you pump all the time
25 or pump it?



1 A. That's right.

2 Q. This system has been designed
3 on a gravity system to drain to a sump?

4 A. Yes, but you can drain drain
5 tiles that are flat because they have infinite
6 permeability essentially, and it is preferable to have
7 some grade on them to clean out if you get some fine
8 particulate matter getting into the system, but
9 Mr. Hiraishi again should discuss that with you, but
10 we have put in systems that are flat and they have
11 been accepted by the Ministry.

12 Q. Does some of the reconsideration
13 you have been discussing with Mr. Hiraishi relate
14 to what you said a minute ago, his concern or desire
15 that there be increased gradient at some points?

16 A. I think it would be best to
17 discuss that with him.

18 Q. By the way, as a matter of
19 interest, how long have these kind of leachate
20 collection systems been used in Ontario in your
21 experience?

22 A. Oh, fifteen years or so, I guess.

23 Q. They are really a development
24 from agricultural drains, the concept?

25 A. No, I don't believe so.



1 Q. They are something different?

2 A. No, drains are used for all
3 sorts of purposes, for construction, buildings, et
4 cetera, and it is a method that geotechnical engineers
5 or hydrogeologists would use to control groundwater
6 in any circumstance, not just agricultural drainage.

7 Q. But I wanted your opinion. Are
8 you saying we can look to any experience on agri-
9 cultural field drains to evaluate any aspect of the
10 likely performance of leachate collection drains, or
11 is it a completely separate concept?

12 A. In my opinion I wouldn't do that
13 at all. In agricultural drainage we just put the tiles
14 in and they are dragged into place off a big roll,
15 and you have a plough type of deal that just puts them
16 right in place and the hole is closed right behind
17 them and that is not how these drains are constructed
18 at all. They are put into graded beddings and some-
19 times they have filter wrapping on them and all sorts
20 of things can be used on them and they are far more
21 sophisticated than field drains.

22 Q. We are talking about a sophisti-
23 cated form of engineering that has been used in
24 Ontario and which started approximately 15 years ago
25 and that is the extent of the experience in Ontario?



1 A. Maybe even longer than 15
2 years.

3 Q. When was the first time you put
4 one in?

5 A. The first ones we put in were
6 at Bröck, this is speaking on the ones I have put in,
7 it would have been at Brock West and that has been in
8 close to 15 years.

9 Q. Is that a Metro...

10 A. A Metro site, yes, and I believe
11 the first tiles were put in there in the mid-seventies
12 and they are on top of a liner.

13 Q. On top of a liner?

14 A. Yes.

15 Q. When was the first time you have
16 used a leachate collection system as part of a
17 hydraulic trap system?

18 A. I thought of the concept before,
19 but it isn't in every environment that you can install
20 this. This is the first one that was put forward
21 as a hydraulic containment system and there may be
22 others in the province that were just not recognized
23 as having those characteristics.

24 Q. In this proposal you would be
25 linking this 15 year old technology to this other



1 concept for the first time?

2 A. We shouldn't look at it as
3 15-year old technology, as it has evolved over the
4 years when it has gone in and the materials used
5 for tiles has changed significantly and we have gone
6 from metals to plastics and in my opinion it will
7 change in the future. The beauty of any of these designs
8 is that one should always be looking at the latest
9 technology as new cells come into play and if there is
10 new technology available in terms of types of tile,
11 or types of bedding material, then they should be
12 employed.

13 You don't commit to one technology
14 immediately, it is something that can evolve. So,
15 in fact, you may have one cell that is done by
16 relatively old technology and your final cells
17 as the landfill is completed are done by the most
18 recent technology, but that is something that happens
19 with everything.

20 Q. Is it evolving?

21 A. It is evolving.

22 Q. Let me understand. It is your
23 opinion, I take it, that both sites F and D can
24 be made through engineering hydrogeologically suitable?

25 A. Yes, that is correct.



1 Q. Accordingly it is your view
2 that the Board in this case clearly has a choice
3 from a hydrogeological perspective?

4 A. I believe so in the context
5 of what I said in terms of my analysis for certain
6 reasons, I favour one site over the other. I feel
7 though that both of these sites can be made to be
8 environmentally safe.

9 Q. In your evidence-in-chief you
10 indicated that you were involved early in the site
11 selection process, the Phase 2, Stage 2A study which
12 is Exhibit H-10, and perhaps we could get that out.
13 I am particularly looking at section 3 beginning at
14 page 29. As I understood your evidence, this was
15 prepared by Trow under your supervision?

16 A. Yes, that is correct.

17 Q. As I understand it the purpose
18 of this was to assist in the first level of screening
19 of sites in Halton?

20 A. Yes.

21 Q. At pages 29 and 30 you
22 indicate you selected, using your words from the
23 transcript, "evaluation factors that reflect current
24 concepts in siting landfills in environmentally
25 suitable areas."?



1 A. Yes.

2 Q. Agricultural capability was one
3 of those factors at that stage?

4 A. Yes.

5 Q. I understand that agricultural
6 capability was not a hydrogeological factor, but the
7 purpose was to identify low capability agricultural
8 lands and to assess the feasibility of using such
9 lands for waste disposal as opposed to having to use
10 good agricultural land?

11 A. Yes.

12 Q. I take it that that was a
13 principle which you and the others involved in the Region's
14 site selection process thought prudent to address in
15 the overall process ; if you have a choice you
16 don't landfill on good agricultural lands, if you
17 have a choice?

18 A. I think it is a factor. I
19 don't think it is necessarily the only factor.

20 Q. But if you are looking at that
21 factor?

22 A. At that factor, yes, that
23 factor alone would lead you to identify poor
24 agricultural lands as being more desirable, and using
25 that factor. However, as we pointed out, the factor



1 overall was not used in our assessment.

2 Q. But in this case, assuming the
3 evidence is that D has very good agricultural lands
4 and F does not, the Board, from a hydrogeological
5 perspective, a public health and safety perspective,
6 has a clear opportunity to follow the principle you
7 were addressing at that time and avoid the use of
8 good agricultural lands?

9 A. We were addressing that
10 principle because there was no one else on the team
11 at the time to address it, but since that time we
12 have an agricultural expert who is far more capable of
13 speaking to that matter than me, but it is not a
14 hydrogeological concern, and certainly I wouldn't
15 want the Board to look at agricultural capability
16 as something to do with hydrogeology as your question
17 implied.

18 Q. I think you misunderstood the
19 question. I am not asking for any opinion at all
20 with respect to agricultural ability, but I am saying
21 assume the evidence is that D has very good agricultural
22 land relative to F and F does not, and if you
23 assume that and you don't have to comment one way or
24 the other; your evidence is from a hydrogeologic pers-
25 pective or a public health and safety perspective is



1 this Board has a clear choice, just using those two
2 matters, to avoid the use of good agricultural land
3 because you have said that site F can be used
4 hydrogeologically?

5 A. Again I have the same problem
6 with your question. The Board has and can consider
7 it in terms of its agricultural capability but not
8 in terms of hydrogeologic suitability, because this
9 isn't a hydrogeologic matter.

10 MR. LEDERER: When Mr. Estrin says
11 in the question from a hydrogeologic perspective, he
12 is implying as Mr. Sobanski suggested in his first
13 response that there is some relationship between
14 agricultural and hydrogeology which is not his
15 evidence, and I think that's the problem with the
16 question. I think Mr. Estrin is asking is all other
17 things being equal and if one is good agricultural land
18 and if you have land that isn't, where do you go. I
19 think that is the question.

20 MR. ESTRIN: I would be glad to
21 accept your assistance and would you like to answer
22 that question?

23 MR. SOBANSKI: A. I don't agree with
24 that, I am sorry. It is too big and it is one issue
25 and it is a factor that has to be considered, but there



1 are all kinds of other factors, social factors and
2 everything else, and this falls in the same category.

3 MR. ESTRIN: Q. You are now getting
4 into site selection on many topics which is not your
5 area or forte?

6 A. That is correct, and agricultural
7 capability is not my forte either.

8 Q. Going back to hydrogeology,
9 Site F is fine and it will protect public health and
10 safety?

11 A. Yes.

12 Q. You will recall your letter
13 of January 23, 1987 to Walker, Wright, Young which
14 is found as Appendix A to H-14, the green bound
15 volume and summary comparison of the two sites?

16 A. Yes, I recall. It is here some-
17 where.

18 Q. This was Appendix A, the letter
19 of January 23rd, 1987.

20 MR. LEDERER: Perhaps Mr. Estrin
21 could give us a short opportunity to read the letter
22 as it has been some time.

23 DR. KINGHAM: Where is this found?

24 MR. ESTRIN: H-14 and it follows
25 a chart about halfway back. It is numbered up to



1 about page 40 and then there follows a series of
2 charts and then you get to the Appendix, a letter
3 of January 23rd, 1987.

4 Q. Taking you through the last
5 paragraph of your letter on page 4, you say:

6 "Considering the advantages of each
7 site, we feel those of Site F out-
8 weigh those of Site D. In particular,
9 Site F is better from the point-of-
10 view of public health and safety
11 because there are no groundwater and
12 surface water users. Therefore, we
13 favour Site F over Site D."

14 I want to ask you a number of things arising out of
15 that getting somewhat back to basics. First of all,
16 let me put this to you: hydrogeology I take it is
17 an evolving science?

18 MR. SOBANSKI: A. Yes, it is.

19 Q. By that perhaps we can both agree
20 that might mean techniques for measuring in situ,
21 in field parameters are changing and so are methods
22 of analysis which are involved?

23 A. Yes, that is correct.

24 Q. And there are also evolving
25 techniques for using and predicting from such data



1 and by that I mean, for example, modelling which is
2 used exclusively in these studies was not used
3 basically ten years ago in anything near the sophisti-
4 cated form it is today?

5 A. That is correct.

6 Q. And perhaps not even used
7 in that sophisticated a form five years ago?

8 A. About five years I think they
9 were starting to use them, or in that order.

10 Q. Fair enough. Let me put to
11 you another matter that I suggest -- that I can pose
12 in the same area. There are many examples of
13 hydrogeologic predictions in the past, and not you
14 specifically but the profession in general, which have
15 been in error, or, putting it another way, remedial
16 work has become a major part of the practice?

17 A. Remedial work has certainly
18 become part of the practice. Our experience hasn't
19 been -- we haven't had a lot of bad cases, but I
20 know there are some bad cases around.

21 Q. Certainly it has become more
22 and more common to impose as an absolute requirement
23 in respect of landfill sites in Ontario long-term
24 monitoring?

25 A. Yes, indeed.



1 Q. Let me suggest that even today the
2 predictive aspect of the science of hydrogeology
3 should not be taken as capable of providing absolute
4 certainty and, for example, it will be nine years
5 and no more or no less until leachate arrives at
6 point "X".

7 A. I agree.

8 Q. You would also not want to say
9 that at nine years at that point it will have a
10 very specific oncentration?

11 A. That is correct.

12 Q. Or that leachate would arrive
13 at point "X" only via the one route you were evaluat-
14 ing, because there may be other ways it gets there
15 that you haven't thought of or which could be thought
16 of?

17 A. I suppose in a worst case
18 scenario something could be missed and it would be
19 possible and of course the answer to all of these are
20 the contingency plans, because that recognizes these
21 problems.

22 Q. Another sub-principle arising
23 out of this is that even engineering techniques such
24 as leachate collection systems can be the subject
25 of failure, and I am talking about engineering systems



1 and they can be the subject of failure?

2 A. Yes.

3 Q. From your evidence a few moments
4 ago I think you would agree that a leachate collection
5 system, for example, as used in landfills in Ontario
6 have not been tested for the lifetime that a waste
7 disposal site proposed, for example, in this case
8 of 20 years will operate, let alone for the time it
9 will yield leachate needing containment and collection
10 which could extend the time, you would agree, 40 years,
11 100 years or more?

12 A. We have evidence, some evidence
13 to suggest that certainly our older systems are
14 lasting reasonably well, and we have 10 to 15
15 years of experience in them as still being sound.
16 However, Mr. Hiraishi I suppose is better able to
17 speak to it than I, but having designed some
18 sites we certainly don't have 50 years experience
19 to know they will last that long.

20 Q. Let's remind -- remind me if
21 you would --

22 A. Remember as well, we do design
23 these systems with the ability to clean components
24 and to fix things up and we also have fall-back
25 contingencies in the event they do fail.



1 Q. That reminds me that Site D and
2 Site F are both premised as having an operating life
3 of approximately 20 years.

4 A. Yes.

5 Q. You will agree that beyond that
6 time in which garbage would be disposed you would
7 wish to be able to collect leachate being generated
8 after closure for a period of time?

9 A. Yes.

10 Q. What period of time would you
11 say is apt?

12 A. We have suggested in here, I
13 believe, from our monitoring a period of 40 years.

14 Q. Beyond closure?

15 A. About 20 years beyond closure,
16 or 20 years of active monitoring during the site
17 life and 20 years thereafter. It is difficult to say
18 how long a site may have to be monitored. It will
19 depend upon criteria that the Ministry may develop
20 in terms of quality guidelines over the next few
21 years as well.

22 So, speaking today, many of the older
23 sites that have been out of operation and that have
24 been closed and out of operation for five or ten
25 years, the leachate strengths are relatively weak in



1 terms of many of the components, but in terms of having
2 an exact number, we don't have exact numbers on how
3 long the Ministry would require the monitoring
4 of sites.

5 Q. But your predictions or calcula-
6 tions of perhaps needing to collect it and contain
7 it for perhaps 20 years beyond closure are based on
8 a number of other assumptions such as how fast that
9 leachate will travel through the till layers and how
10 much of it will be adsorbed and otherwise attenuated
11 over the period of time you have predicted it would
12 take to go through those layers; fair enough.

13 A. I agree, but however, this is
14 why we do have contingency systems, because that is
15 a primary system and we put in contingencies beyond
16 that so that if these systems fail then we will
17 still be able to capture this leachate if the system does
18 fail .

19 Q. Let me take this a bit further
20 as a matter of generality. If the leachate ends
21 up going through the till layers faster than you
22 predicted, the strength of it at the boundary, which
23 we considered to be 100 metres away for your purposes,
24 would therefore be stronger and if it goes faster,
25 the strength of the leachate in general terms would



1 be stronger than what you have calculated it to be
2 at that point, and is that fair enough generally?

3 A. I would have to look back at
4 the equation. I can't answer that right offhand,
5 but again that assumes there is no leachate collection
6 system and you are assuming a failed system; I
7 presume?

8 Q. Yes.

9 A. I would have to check the equation
10 on how the strength behaves under the factor of
11 velocity.

12 Q. Perhaps you could check that and
13 we can come back to that topic in specific terms
14 at a later point in time today or tomorrow?

15 A. Yes.

16 MR. LEDERER: What exactly is it?

17 MR. ESTRIN: I am asking him to tell
18 us whether he in fact evaluated the contaminant
19 strength at the boundary of the site under situations
20 where the leachate would be travelling faster than
21 he has predicted it would travel.

22 DR. KINGHAM: For clarity, did you say
23 in the case where a leachate system has failed?

24 MR. ESTRIN: In two cases; (a), where
25 it is not operating at all and, (b), where it has failed,



1 as there is a difference.

2 MR. LEDERER: I presume we are dealing--
3 I presume this is with respect to one site or the
4 other?

5 MR. ESTRIN: D.

6 MR. SOBANSKI: There is no problem
7 with the question, but I might point out again that
8 you do monitor and you do have contingencies to look
9 after those types of failures.

10 MR. ESTRIN: Q. That prediction of how
11 strong the leachate will be at a given point in
12 time leads you to determine how long the leachate
13 collection system must continue to operate. Is that
14 fair enough? You want to stop at a certain level
15 or mass or concentration of contaminant going beyond
16 the boundary of the site and you will do that through
17 your hydraulic trap by other means.

18 MR. SOBANSKI: A. Yes.

19 Q. If it turns out the concentrations
20 at the boundary are higher than you predicted, say, 40
21 years from start-up, you would then have to operate the
22 leachate collection system longer?

23 A. No, I don't believe so. It will
24 have to do with how quickly the mass above leaches away
25 within the garbage as to how long we will have a



1 problem at the boundary, at the boundary in terms
2 of purge wells and if a purge well plugs you put in
3 a new purge well. It is a system that can be
4 replaced and if it lasts ten years you put in another
5 well.

6 Q. I haven't got to contingencies yet.

7 I am just assuming you have a situation where
8 you want to make sure it doesn't get off-site and
9 if the strength of that leachate has not been
10 attenuated going through the ground in 40 years,
11 and to the extent you have predicted, I am just saying
12 that you will have to deal with that leachate for a
13 longer period of time through one mechanism or another,
14 either through your leachate collection system or
15 through contingencies?

16 A. You don't necessarily deal
17 with that a longer time, but you will have to deal
18 with a higher strength leachate, initially at least.
19 However long it takes a landfill to leach away is
20 the amount of time we will have to deal with it.

21 Q. That's what I am trying to get
22 at?

23 A. But the impact calculation for
24 Site D indicates that in a failed system or a normal
25 system that you can't meet boundary conditions in



1 any event and so whether it's --you would have to
2 put in a contingency and it is difficult at Site D
3 to separate the design from the contingency.

4 Q. So Site D isn't the same site
5 without contingencies?

6 A. Yes, it can be a safe site with-
7 out contingencies as long as the primary system
8 doesn't fail and the contingencies are there to
9 back up the primary system, the underdrain system.

10 Q. The primary system is this
11 hydraulic trap?

12 A. That's right.

13 Q. That is an engineering system?

14 A. It is. It is two systems.

15 Q. Two systems, a leachate collec-
16 tion system plus pumping.

17 A. It is two systems in that it is an
18 attenuation system through the glacial tills and it
19 is a mechanical system on top of that one.

20 Q. I grant you that but you would
21 agree with me that it would be advisable to look
22 carefully at the concentrations that would be
23 expected at the boundary of the site under different
24 reasonable scenarios for attenuation over time?

25 A. I am not sure that that would



1 solve anything. The calculations we have done with
2 a failed system says that if it fails you will
3 ultimately have a problem at the property boundary.
4 If the chloride concentration is 300 , which
5 exceeds the criteria, or it is 500, which exceeds the
6 criteria, then engineering-wise it is the same problem.
7 You have to take it and put it in a sewage treatment
8 plant.

9 Q. Right, but my question is, how
10 long will you have to do that, or how long will you
11 have to operate your contingencies, and that, I
12 suggest, is a function of trying to calculate the
13 strength over time?

14 A. I would have to think about
15 that a bit. I am not sure. We can put that down
16 as another thought to come back to.

17 Q. That whole discussion I think
18 you and I implicitly were premising on dealing with
19 containment and attenuation of things other than
20 organics, fair enough?

21 A. That includes organics as well,
22 because the organics were modelled at that site also.

23 Q. They were modelled but I think
24 there is a statement in your report that there is
25 no basis today for assuming organics will be -- will



1 decline in strength in the same manner as ions and
2 other things such as metals or whatever?

3 A. Some organics, because some
4 organics do decline in strength, and I don't think the
5 jury is in on all organics because some of them do
6 attenuate.

7 Q. But there is no basis, to use
8 your own words, of determining in a graphic form and
9 trying to predict that point in time what the strength
10 of particular organics are going to be coming out
11 of that landfill?

12 A. That is right.

13 Q. So your contingency system
14 or your leachate collection system will have to
15 function to deal with organics perhaps for 100 years
16 or 200 years, depending on the strength at the
17 boundary?

18 A. Are we talking the primary
19 system?

20 Q. Any system.

21 A. I don't know how long it will
22 be. I have no idea. I am sorry, but I don't think
23 anyone knows how long these systems will have to be
24 in place.

25 Q. Well, I think that leads into



1 my next point. Accordingly, when one relies on
2 engineering devices as well as predictions based on
3 an evolving science to protect public health and
4 safety, it is best to be as conservative as possible,
5 both as to predictions from data and as to the
6 potential failure of engineering devices?

7 A. Yes, we consider these in all
8 of our site inspections.

9 Q. You agree with those principles?

10 A. Yes, we have to be conservative.

11 Q. I take it you would believe it
12 to be appropriate to be conservative, and by that I
13 mean evaluate realistic worst case scenarios in
14 assessing the environmental impact of leachate
15 generation and the methods of containing it and
16 controlling it?

17 A. Yes.

18 Q. Let me suggest to you that this
19 realistic conservatism is most important to be used
20 in assessing impacts at a site such as D where the
21 potential to harm public health and safety is
22 greater if not significantly greater than at F?

23 A. That has come into our assessment,
24 the fact that there are wells close to D and it is
25 the reason for the statement that we prefer F over D



1 because of those potential problems.

2 Q. Therefore let me suggest that
3 you would understand and agree that if an independent
4 analysis or recalculation of your data indicates
5 different results than you have reported, it would be
6 prudent that such results be considered by the Board
7 before a final choice is made, particularly at Site D?

8 MR. LEDERER: With all due respect,
9 I am not certain asking a question like that in the
10 abstract is fair, because what results and what do
11 they show and are they done properly and what
12 assumptions do they rely on? I am not sure it is
13 fair really in the abstract to say if we gave you some
14 other data you would obviously have to look at it,
15 but the degree you rely on it surely depends on what
16 it is and the quality of it.

17 MR. ESTRIN: I was not asking him
18 to rely on anything I would say in answering that.

19 MR. LEDERER: And we are certainly
20 prepared to accept that.

21 MR. ESTRIN: Q. What I am suggesting,
22 Mr. Sobanski, is if we go through your numbers,
23 you would agree that perhaps they might be used
24 or recalculated in a different manner and you could
25 agree to the recalculations and whatever the results



1 are it would be prudent to look at those results
2 before making a final choice. You do want to be
3 conservative.

4 MR. SOBANSKI: A. Well, you can
5 be conservative to the point where no site in the
6 province could ever be approved and that to me would
7 be rather silly. We have lots of good landfill
8 sites in the province which aren't creating any
9 problems and that is the way we viewed these two
10 sites.

11 Certainly, if valid other calculations
12 are made, then that is fine, but we are dealing with
13 opinion as to which is right and we have worked a
14 long time on these sites and we feel the assumptions
15 we have made here and the measurements we have made
16 here are valid and can be validly used to draw the
17 conclusions we have.

2A 18 Q. All I am essentially saying now
19 is if one takes your data and finds that you
20 may not have considered all of it, then the other
21 factors which may go into determining an average
22 gradient or whatever -- if you agree on a particular
23 question, that perhaps there is other data that is relevant
24 in coming up with a number that you have reported
25 and used in your calculations, and maybe it would



1 also be prudent to run the scenario with the new
2 numbers.

3 MR. LEDERER: With all due respect,
4 and I must say the same thing, but if Mr. Estrin
5 has some other calculations let's see his evidence
6 and let's evaluate it and we can evaluate it along
7 with all the other evidence, but a question like this in
8 the abstract is not fair to the witness and he
9 has no idea what Mr. Estrin is talking about.

10 DR. KINGHAM: I appreciate the concern,
11 that the question is very abstract, or the series of
12 questions are very abstract, and it seems to me there
13 is a fundamental question you are asking and the
14 fundamental question, if you calculate other numbers,
15 would you not consider these in your conservative
16 approach, and that seems to be a yes or no type of
17 question. It remains to be seen whether evidence is
18 introduced at some stage and whether there are other
19 numbers. Is that a question to which you can give
20 a yes or no answer?

21 MR. SOBANSKI: It is very difficult
22 not really knowing -- certainly if Mr. Estrin has a
23 model to put forward, then the Board should consider
24 it.

25 MR. ESTRIN: Mr. Chairman, I am ready



1 to turn to another topic...

2 DR. KINGHAM: This is a suitable time
3 if you do wish to turn to another topic and we will
4 take a 15-minute break.

5 ---Recess

6 DR. KINGHAM: Thank you, please be
7 seated. Mr. Estrin?

8 MR. ESTRIN: I told the witnesses
9 I would refer them to a paper that I actually gave
10 them in June by Cherry, MacQuarrie & Ruland.

11 DR. KINGHAM: We will label this
12 M-160.

13 ---EXHIBIT NO. M-160: Paper by Cherry, MacQuarrie
14 and Ruland dated. May 13, 1987

15 MR. LEDERER: Before Mr. Estrin goes
16 on with this, he indicated to me that he gave this to
17 the witnesses in June and I don't know if that is
18 the case, he certainly did not give one to us, and it
19 makes it a bit difficult because, of course, if
20 questions are asked we can't make an assessment if
21 it is in context or not and the kind of objections
22 one would normally make in this kind of situation.
23 It will obviously take some time to review it, so
24 I don't propose we stop, since we just had a break,
25 but perhaps it's a point people might remember in



1 future. At the moment he asks a question which will
2 cause difficulty I will ask for an adjournment to
3 review this and it is not the best way of conducting
4 this in my submission.

5 DR. KINGHAM: Mr. Sobanski did you
6 have this?

7 MR. SOBANSKI: Yes, toward the end
8 of the hearing Mr. Estrin handed it to me and said
9 at some stage he would be asking questions on it.

10 DR. KINGHAM: I appreciate you want
11 to be vigilant.

12 MR. LEDERER: The situation would be
13 different if Mr. Sobanski didn't have a chance to
14 review it.

15 MR. ESTRIN: Q. Mr. Beechinor, I
16 understand you attended the presentation of this
17 paper?

18 MR. BEECHINOR: A. I did.

19 Q. Who did present it, was it
20 Dr. Cherry?

21 A. Dr. Cherry.

22 Q. It was presented, -- just so
23 we can be clear, PCAO means the Pollution Control
24 Association of Ontario?

25 A. That's right.



1 Q. At a seminar on proposed municipal land-
2 fill regulations. You would agree with me, either
3 of you gentlemen, that this paper discusses in an
4 overview way the validity of current hydrogeologic
5 site selection and engineering techniques including
6 those used by you in a general way?

7 MR. SOBANSKI: A. It is a very general
8 paper, I believe, given to a general conference. It
9 isn't very specific. It is sort of an idealistic
10 approach, I think, to many of these things.

11 MR. LEDERER: At some point ...
12 I am sorry, it seems more than one of us is getting up.

13 MR. MacQUAID: I am sorry, but I
14 would like Mr. Estrin to lay the foundation for why
15 this technique of putting in a document this way is
16 being used. As I understand it, it is not a document
17 that Mr. Sobanski viewed or relied on and it certainly
18 is not listed in his report, and then the question
19 comes up of what is the foundation for just putting
20 forward an article from three authors, Cherry,
21 MacQuarrie & Ruland to this witness. I want to know
22 for the benefit of conducting my case in cross-
23 examination, and I guess for my own witnesses, the
24 usual technique which I am sure the Board will be
25 familiar with, if it is a textbook or some reference



1 paper or something of that nature which the witness
2 has relied on, then of course it can go in and questions
3 can be asked about it.

4 If it is data or material of a
5 technical nature which Mr. Estrin has prepared and he
6 wants fair comment from the witness, and he will
7 be calling the witness to prove that data or technical
8 material, then it can also be put to the witness,
9 but we can't go to textbooks and pull out articles
10 from wherever you want and then put them to any
11 witness we want and then say do you agree with this
12 or not because we don't have the authors of these
13 reports before us and neither we nor the Board, we
14 can't weigh the credibility or qualifications of
15 the authors versus the witness you have in front of
16 you.

17 I don't think the foundation has
18 really been laid for an article from out of the
19 blue or from third parties who are not part of this
20 proceeding or witnesses who will be heard at this
21 proceeding and I question whether the technique
22 will be of any assistance to the Board at all.

23 DR. KINGHAM: Mr. Lederer, did you want
24 to add something?

25 MR. LEDERER: I share Mr. McQuaid's



1 concern. I might say that to the extent we have
2 heard anything about this at all to this point, it
3 was referred to as a general paper and there is
4 always an inherent difficulty in taking something
5 general and transposing it to something specific like you
6 have before you here. It seems to me, given what
7 Mr. McQuaid has said and if you add that to it, it raises serious
8 questions as to the probitive value this can have
9 and it may appear to be more than it really is and that
10 can have the effect of really misleading us all.

11 DR. KINGHAM: Mr. Estrin?

12 MR. ESTRIN: Well, Mr. Chairman,
13 it had not fully sunken into my conscious that the
14 document would be given an exhibit number because
15 I handed it out. It may well be appropriate, but
16 there are different purposes for marking documents
17 as exhibits and generally this Board has the ability
18 to mark anything as an exhibit, even for the purpose
19 of identifying it as something to which the witness
20 has referred for the purposes of cross-examination.

21 Sometimes it is not marked as
22 an exhibit until the document has been gone
23 through and the witness has identified those things
24 in it with which he agrees or not. I think in this
25 case I intend to ask the witness a number of questions



1 relating to the specifics of the document and I
2 think you will see the relevance of it by the time
3 those questions are asked, and it may be a case when
4 something like this comes up again -- I think the
5 problem is that if a number of questions are asked
6 it should be given a number, but what weight that
7 document is given depends upon what the witness
8 has to say about it because if the witness can't agree
9 with it it stands for nothing except the fact
10 the witness was referred to it and the transcript will
11 clearly have that in it.

12 I don't think there is any prejudice
13 to anyone in the process of marking it with a
14 number as has been done, but I would be quite prepared
15 to have it unmarked if anyone wants and wait to
16 ask my questions.

17 MR. McQUAID: My objection is not
18 to marking, my objection is to the fact that
19 Mr. Estrin has not established a relationship between
20 this article by three authors who the Board will not
21 be hearing from, as I understand it, and then taking
22 their opinions or their views, as it were, and putting
23 them to this witness. That means we could all go
24 to any library we want to that is technical and find
25 opinions which may contradict Mr. Sobanski, but that



1 is not the way it is conducted because you must
2 deal with witnesses you hear from or are connected
3 to this hearing.

4 My objection is really to the fact
5 that presumably there are opinion in here which you
6 will not have the benefit of hearing firsthand
7 enunciated by the authors, and that is really my
8 objection. It is the lack of connection with the
9 hearing.

10 MR. ESTRIN: If I can reply to that,
11 I think that is overstating any semblance of what
12 the court rules are, and even if it was a court
13 rule you are not bound by it, but that is not the
14 rule. I have not asked Mr. Sobanski before my
15 friends got up about anything in the paper and even
16 what he knows about Dr. Cherry. I think it will
17 become apparent that he has cited Dr. Cherry about
18 three or four times in his report as an authority
19 on hydrogeology and not the only authority, but
20 he is one of several. To that extent, if I asked
21 him he would say yes, he recognizes him as an expert
22 in the area.

23 Beyond that, whether or not he
24 wishes to agree or not with anything in the paper
25 is a matter I want to put to him.



1 DR. KINGHAM: It might facilitate
2 the work of the Board if you explained the context
3 and the reason why you are introducing this. You
4 are presumably not introducing it as evidence and
5 you must have some rationale for having picked this
6 document.

7 MR. ESTRIN: I do indeed. The
8 context ... I want to know if Mr. Sobanski finds
9 either comfort in here because he has addressed
10 these kinds of statements in his work on these sites
11 and therefore thinks Dr. Cherry and the other people
12 are right when they say you should take this or that
13 into account, or whether or not some other things
14 these authors say are valid and were in fact taken
15 into account by him. I could have said this and
16 this, but I think it is relevant to know that these
17 are principles which are being put forward at this
18 time in the regulatory context and it is relevant
19 that Mr. Beechinor went and heard this presentation
20 and I think the Board would benefit it from it and
21 I think we would all be better off to hear whether
22 or not -- what are the present views with regard
23 to hydrogeological principles used in the regulatory
24 setting.

25 DR. KINGHAM: I think ...



1 Mr. Lederer.

2 MR. LEDERER: I am sorry, I didn't
3 take my final opportunity of reply, If I could be
4 permitted to do so.

5 First of all Mr. Estrin has talked
6 about what is being considered in the regulatory
7 context, but this isn't the regulatory context,
8 this is a paper presented at some form of profession-
9 al organization and the regulatory context is this
10 hearing and what Boards such as this would decide.

11 Secondly, he wants to ask, as I
12 understand it, whether or not certain principles
13 were considered, but that is setting this up as some
14 form of truth, as some form of guideline as to
15 what should be done.

16 My difficulty with that and the
17 one that I put to you earlier, is that when you deal
18 with general papers there is a problem in translating
19 them to a specific circumstance. If that is what
20 is going to be done, in my respectful submission,
21 it is not appropriate and there is a principle when
22 you use demonstrative evidence which this isn't
23 which says that if demonstrative evidence may be
24 so prejudicial just because of the graphic nature
25 of the presentation that it ought not to be called



1 and can be properly objected to, and that is what
2 you are getting into, that kind of principle.

3 Here is a general principle, did you
4 consider it and if you didn't there is some horrendous
5 wrong but maybe there isn't and you can't know that
6 because it is in the general context. I share
7 Mr. McQuaid's concern, albeit for different reasons,
8 and that is that there is a real concern as to the
9 probitive value this has in the way it is being
10 done.

11 MR. ESTRIN: All that can be said
12 is until you have heard the questions you can't rule
13 on the probitive value of it and if there is any
14 doubt in the Board's minds let me ask the question
15 and then you can rule on it.

16 MS. CRONK: Excuse me, I am sorry
17 to rise after that exchange was concluded, but I
18 am concerned that if the general principle of
19 utilizing material of this kind in cross-examination
20 is going to be taken into account in this instance,
21 that the rule as I apprehend it, the proper rule
22 of evidence has been too properly stated and I
23 thought perhaps I could add when we were considering
24 this that one is always free, as I understand the
25 rules of cross-examination, to refer to a text or an



1 article written by an author who may never be
2 called as a witness before the Board receiving the
3 report so long as the witness being examined
4 recognizes the author as being an expert in the
5 field or authoritative.

6 If that is the case, the document
7 can be used in cross-examination, and you can
8 subsequently attach such weight as you merit proper
9 at the end of the day, but to have Mr. McQuaid and
10 Mr. Lederer put the rule to you that narrowly
11 concerns me because later this week I may be at
12 the podium myself.

13 DR. KINGHAM: We appreciate your
14 comments, but we arrived at the decision that we
15 will allow the document to be entered and we will
16 be very vigilant as we listen to the
17 nature of the questions to ensure that the kinds of
18 principles enunciated by all of you are adhered
19 to in the course of the questions. Mr. Estrin.

20 MR. ESTRIN: Q. Mr. Sobanski,
21 do you recognize Dr. John Cherry as being an expert
22 in the field of hydrogeology?

23 MR. SOBANSKI: A. Yes, I do.

24 Q. You have cited work or papers
25 by him in references to your reports?



1 A. Yes, that is correct.

2 Q. I would like to take you to the
3 bottom of the second last page, page 52 for those who
4 can read the numbers. I think in the Board's copies
5 the numbers have been improved.

6 MR. LEDERER: You are going to check
7 the rest of us?

8 MR. ESTRIN: I didn't have time to do
9 it.

10 Q. It is the statement in
11 paragraph No. 3 on that page which I just wanted to
12 draw your attention to, the statement being:

13 "It is not feasible to prevent small
14 but nevertheless significant quantities
15 of hazardous wastes from entering
16 essentially all municipal landfills.
17 Because small quantities of many common
18 hazardous organic compounds..."

19 A. I seem to be looking at the
20 wrong place. Are we at No. 4?

21 Q. No. 3.

22 A. No. 3., okay.

23 Q. "...may cause severe groundwater
24 contamination, municipal landfills
25 should be regarded as significant



1 potential threats to groundwater
2 quality."

3 Stopping there, you in your reports have
4 recognized that hazardous organic compounds are either
5 put into or are generated in the decomposition of
6 materials in municipal wastes, and have you taken that
7 into account?

8 A. Yes, there are hazardous materials
9 in municipal landfill leachates.

10 Q. Specifically hazardous organic
11 components?

12 A. Yes, there are.

13 Q. That should be assessed in looking
14 at the impact of a proposed site?

15 A. Yes, it should-- yes, it could.

16 Q. Then I want to take you to the
17 next paragraph, No. 4:

18 "At the present time, landfilling is
19 an unavoidable means of disposing of
20 most municipal waste...."

21 And I don't think you have to agree
22 with that, because it seems to be a fact of life?

23 A. I agree nonetheless.

24 Q. "...Also, eventual offsite
25 migration of contaminants is an



1 unavoidable consequence of landfilling
2 in nearly all types of hydrogeological
3 settings."

4 And the next sentence must be read with that:

5 "It is desirable that landfills be
6 situated in hydrogeologic settings where
7 impacts due to offsite contaminant migra-
8 tion will be minimal because the ground-
9 water is of little or no present or
10 future value,..."

11 Stopping right there, would you agree that in effect
12 that is what Site F represents, it is a site or a
13 hydrogeological setting where impacts due to offsite
14 contaminant migration will be minimal because the
15 groundwater is of little or no present or future
16 value?

17 A. I have a question mark from when
18 I read this, and it is some time ago when I read it,
19 but I have a question mark beside this because it is
20 a very general statement. "Eventual offsite
21 migration is an avoidable consequence" and I think
22 I would like to debate that with Dr. Cherry at
23 some time, because off-site -- if we had enough
24 attenuating distance, off-site contamination I don't
25 think would be measurable.



1 In the case of Site F, we are saying
2 that there may be some off-site measurable contamina-
3 tion, but then in the next part of it, whether it
4 is desirable or not is another matter, but certainly
5 this site does fall into it having a minimal type of
6 impact because the groundwater is of little or no
7 present or future value in my opinion.

8 Q. Then, continuing with that, he
9 says:

10 "It is desirable that landfills be
11 situated in hydrogeologic settings ...
12 or where the time to first offsite
13 arrival of contaminants is very long
14 and the maximum eventual offsite flux
15 of contaminants is small."

16 Stopping right there, would you agree that that is
17 the category that Site D would fall into if it
18 works out as you predicted, and "... the time to first off-
19 site arrival of contaminants is very long and the
20 maximum eventual offsite flux of contaminants is
21 small," if your engineering works properly?

22 A. Yes, I believe so, but I don't
23 know what Dr. Cherry means by very long and off-site
24 flux is small. I don't know how he would define
25 that. We are predicting in terms of 60 years or so



1 for arrival, 60 to 100 years, and would that qualify
2 in Dr. Cherry's mind as very long. I don't know. I
3 have worked with Dr. Cherry on a case where very long
4 was the Tricil case where we were dealing with 2000
5 or more years and I don't know how he would consider
6 60 years.

7 Q. But the end result of your
8 engineering for Site D is to delay the arrival of
9 contaminants at the boundary of the site for whatever
10 time is necessary to minimize the degree of contam-
11 inants that would go beyond the boundary in general
12 terms?

13 A. No. Our plan for Site D is
14 to collect all the contaminants and deal with any-
15 thing which may escape the system in time.

16 Q. What I am saying is, if your
17 collection system which is part of the design -- it
18 is designed to prevent -- is designed to prevent
19 more contaminants getting to the boundary, then
20 it would be appropriate?

21 A. Yes, it is, but again let's
22 not throw the contingencies out because it is the
23 backup to the system.

24 Q. Dr. Cherry and the other
25 authors have suggested two different ways of handling



1 the hydrogeologic impacts of a landfill, either they
2 suggest put it where migration of contaminants
3 will be minimal because the groundwater has little
4 or no present or future value, or put it in a setting
5 where you can minimize through engineering or through
6 the soil conditions the off-site impact?

7 A. You know, I don't argue with
8 those types of statements. He says it is desirable
9 and presumably he also recognizes it may not always
10 be possible to meet these conditions. I certainly
11 feel that the sites here that we are studying have
12 some of these attributes that he feels are desirable.

13 Q. Then I would like to take you
14 to the abstract which is the first page, and I would
15 like to just draw your attention to the first two
16 sentences:

17 "For more than 15 years in Ontario
18 hydrogeologic factors have been
19 included in considerations of site
20 selection and operation of municipal
21 landfills. In the early years little
22 was known regarding the impacts of land-
23 fills on groundwater, and therefore the
24 hydrogeologic concepts used in landfill-
25 ing were largely intuitive. As more has



1 become known about landfill impacts
2 on groundwater, the hydrogeologic con-
3 cepts have evolved. Field,
4 laboratory and modelling research con-
5 ducted during the past five years provides
6 impetus for changes in the perception
7 of the manner and the degree to which
8 landfills can impact groundwater."

9 Would you agree with those sentences. I think you
10 would based on what you told me earlier?

11 A. To some degree. I believe
12 Dr. Cherry is referring to a research oriented,
13 perhaps, approach, a more rigorous approach to
14 assessing landfill sites, but certainly the Ministry
15 of the Environment and formerly the Ontario Water
16 Resources Commission was aware of the impacts of
17 landfills, and some monitoring was carried out and
18 even at that time there was empirical data to indicate
19 which types of sites were better than others, and
20 even at that time we knew that sand and gravel
21 deposits were not a suitable place to put landfills
22 and that the tighter soils were.

23 Q. But we have come a long way?

24 A. We have come a long way and I
25 am not debating that, but even 15 years ago there was



1 some concept of which were the better environments
2 because we could see where the problems were arising.

3 Q. But we are dealing, as you yourself
4 agreed earlier, with an evolving science?

5 A. Yes, indeed, and I agree with
6 that.

7 Q. Then, if I could take you to
8 page 43, which I think is the next page, and just the
9 first paragraph which is somewhat similar to the
10 first three lines and really it is the last sentence
11 in that paragraph:

12 "Much of what is now known about these
13 effects (effects of landfilling on
14 groundwater) has been learned
15 through research conducted during the
16 past ten years and particularly during
17 the past five years."

18 A. That is true for Ontario. How-
19 ever, the Americans were studying landfill -- landfills
20 and contaminant migration for a greater periods
21 than ten years and Dr. George Hughes in particular
22 was active as were some researchers in California.

23 Q. Then I want to go into the
24 second paragraph on that page and if I could take
25 you to the sentence that begins:



1 "A major finding ..."

2 A third of the way down the paragraph:

3 "A major finding is that attenuation
4 is effective for many inorganic
5 landfill contaminants, but not for the
6 many potentially hazardous organic
7 contaminants that are mobile and
8 persistent."

9 Would you agree?

10 A. That's a harder question for me.

11 Dr. Cherry and much of the work I am familiar with
12 he has been doing, and I am not able to follow it
13 all because he is very involved, but it has been
14 done with contaminant migration at sand and gravel
15 sites, and certainly in sand and gravel areas he is
16 not finding very much attenuation.

17 I don't know as research goes on
18 what will actually be found, and I would say right
19 now it is an unknown. On the last page which is
20 Figure 4 of this document, Dr. Cherry shows a
21 disposal system on the left which is the field
22 study and then he shows the core results on the
23 right and, if I can describe it, the field setting
24 is Tricil's Hazardous Waste Disposal Site in Sarnia
25 with which I am rather familiar, and Dr. Cherry and I



1 in fact worked on this particular job together.

2 In this case they took a five-year
3 old cell and drilled a hole through the waste
4 disposal pit and into the underlying soils. They
5 then took that core and sent it to Dr. Pankow in
6 Oregon for analyses of various things such as
7 chlorides and volatile organics. They had to work
8 with very small samples and consequently they didn't
9 model the same things we modelled, but the interesting
10 part of this was that while in my recollection, and
11 I would never presume to contradict Dr. Cherry, but the
12 chloride which is the bottom curve on the right-hand
13 side follows through, as one can see, the equations used
14 to show how quickly materials diffuse through soils
15 and it follows it very closely.

16 The Tricil situation is one of a
17 very dense clay till in which we believe the pre-
18 dominant movement of contaminants will be by diffusion
19 because in terms of groundwater transit times using
20 D'Arcy's Law we are dealing with tens of thousands
21 of years in terms of transit time, but with diffusion
22 we are dealing with 2000 years to take it through
23 about 80 feet of material.

24 The interesting part of that curve
25 was the volatile organics and these had characteristics,



1 these volatile organics had similar characteristics
2 to phenol. Phenol moves at a velocity that is
3 relatively close to that of groundwater and the
4 retardation factor is relatively low. Many of these
5 volatile organics would have behaved in the same
6 way as phenol. In fact the volatile organics at the
7 Tricil site are moving at about one-quarter of the
8 rate that would be predicted by the models that were
9 used for the chlorides. The chloride model checks
10 out, but the volatile organics do not.

11 That was my understanding of how it
12 was discussed with me just before Dr. Cherry discussed
13 this information, and it was at a very preliminary
14 stage and he received that data sort of by telephone
15 and went to the stand with it in rough form.

16 However, if there is -- we know there
17 are bacteria in the environment and we know bacteria
18 attack organics, and I feel it is still a question
19 of debate as to whether or not there is bio-
20 degradation. Certainly if this velocity is one-
21 quarter of what is predicted, there is a possibility
22 that there is attenuation by some mechanism, whether
23 it be adsorption or biodegradation or some other
24 manner.

25 I know very little about microbiology,



1 but what I do read is that it is difficult to predict
2 just on the basis of time whether or not something
3 will be attacked by bacteria and it takes time to
4 establish the culture and in fact we can go along for
5 a prolonged period of time with no effect and no bio-
6 degradation and suddenly have the populations develop in
7 fairly rapid order attenuating materials by bio-
8 degradation and that is to some extent the degree
9 of my knowledge.

10 But in this case, when I read that
11 item saying there may be no attenuation, I am not
12 sure from knowing the data he presented that I would
13 agree with that. I would say the jury isn't in yet
14 on that matter.

15 Q. I wonder if you could turn to
16 page 111 of your report, H-39, and not leaving the
17 paper, but I just want to go there, your Site D
18 report, Volume 1. This page comes in the context
19 of your modelling and trying to predict the decline
20 in concentrations of chloride and other things in a
21 landfill over time?

22 A. Yes.

23 Q. At page 109 you say:

24 "The effect of a declining contaminant
25 input concentration is very significant



1 with respect to off-site migration
2 of contaminants through the groundwater."

3 And then you discuss this process of projected
4 declines and let's go then, Mr. Sobanski, to page
5 111, you say:

6 "At the present time there is no field
7 or laboratory evidence to suggest the
8 same pattern of declining concentrations
9 for organic chemical contaminants
10 derived from municipal landfills."

11 Correct?

12 A. Yes.

13 Q. Still correct. As you said
14 earlier this morning, I think, you just don't know
15 at what rate concentrations of such chemicals will
16 decline?

17 A. That is correct, but on the
18 other hand just discussing the figure from Dr. Cherry,
19 there may be some evidence there that there is some
20 decline based on his information, and I am putting in
21 something that isn't in his paper, just because of
22 personal knowledge, but there might be some evidence
23 that there are declines in some of the organic param-
24 eters and I don't pretend to know that they will
25 decline in all of them.



1 But, we know there is a lot of organic
2 attenuation in landfills, otherwise we wouldn't have
3 the copious quantities of carbon dioxide and methane
4 gas which are produced.

5 Q. Based on present knowledge you
6 don't want to put your professional opinion on the
7 line and say that trichlor or whatever will be at
8 a level of 30 parts per billion 10 years from now?

9 A. No.

10 Q. Accordingly I suggest that we
11 have to take that as the present state of the knowledge
12 in evaluating the potential impact on groundwater
13 users around landfill?

14 A. Yes. We believe we have.

15 Q. Let's go back to page 111 because
16 I don't think you have. You go in the next sentence
17 to say that after saying there is no evidence to
18 suggest the same pattern of declining concentrations
19 of organic chemical contaminants, you say:

20 "Some declines would be expected
21 however and for the purposes of the
22 simulation, similar patterns of
23 decline were assumed."

24 A. Yes, but our modelling indicates
25 we are predicting organics would also arrive at the



1 property boundary, but it is only a question of what
2 the peak concentration would be or how long it may
3 persist, but it is certainly recognized in our coupled
4 models that organics will arrive at the property
5 boundary.

6 Q. I am not quarrelling about that,
7 but I am trying to suggest is that you don't know what
8 the strength of those organics will be at the
9 property boundary?

10 A. Not exactly, no, but we know
11 they will be there and they may require collection and
12 treatment if the system fails.

13 Q. What I am trying to still get
14 at is that unless we know what the concentrations
15 are at the boundary, there is no reason for predicting
16 what they will be and we don't know how long you will
17 have to undertake your contingency measures?

18 A. That is correct, but as I point out
19 the contingency measure wells can be replaced and it
20 can be carried on forever, if necessary. I mean that
21 type of logic would mean that you couldn't landfill
22 anywhere.

23 Q. So everything comes down to
24 finding out at a future point in time what the
25 concentrations are at the boundary before you stop



1 running your pumping of leachate?

2 A. Yes. It is an integral part
3 of the process, monitoring to identify whether you
4 have a problem and installing contingencies if
5 necessary and running them and collecting leachate
6 for as long as you have to and it is required at
7 all landfill sites.

8 Q. We can come back to this when
9 we discuss your conclusions. The last sentence on
10 page 43 of this exhibit, and I didn't get the number,...

11 DR. KINGHAM: M-160.

12 MR. ESTRIN: Q. ... but back on page
13 43, the second paragraph, last sentence:

14 "To a large degree consideration of
15 the issues of landfill impacts on
16 groundwater should be focused on the
17 time predicted for hazardous
18 contaminants to travel from the land-
19 fill to offsite locations and on the
20 ultimate contaminant loading rate to
21 these locations, and to a much lesser
22 degree on a dependance on attenuation
23 in the groundwater zone."

24 Is that what your Site D study attempts to do?

25 It tries to at least for other than organics, it tries



1 to estimate concentrations and give us an estimate
2 on the ultimate contaminant loading at the boundary.
3 It does do that?

4 MR. SOBANSKI: Yes, it does.

5 Q. Then turn to the next page,
6 which is page 44, and I want to turn your attention
7 to the heading of Organic Contaminants and to the
8 second paragraph beginning with the sentence, the
9 third sentence:

10 "Because the drinking water stand-
11 ards for many organics are low, only
12 small quantities are required for
13 major groundwater contamination."

14 Then it gives an example of 5 kg of 1,2-dichlorobenzene
15 which could potentially contaminate one-half billion
16 litres of groundwater to 4 times the Ontario Provincial
17 Water Quality Objective of 2.5 mg/L:

18 "This quantity of groundwater would
19 supply 40 normal Ontario households
20 for approximately 50 years."

21 And then it gives another example:

22 "Only 0.12 kg of pentachlorobenzene
23 would contaminate the same volume of
24 water to 8 times the Provincial Water
25 Quality objectives of 0.03 mg/L."



1 Would you agree that because drinking
2 water standards where they exist for organics are
3 low, only small quantities are required for major
4 groundwater contamination?

5 A. If it is unattenuated, certainly
6 that is the case. I feel that there is a danger
7 in using numbers this way. It is like taking how much
8 dioxin is being produced and say there is enough to
9 kill every man, woman and child in the world. I
10 would like to know how much 1, 2-dichlorobenzene is
11 produced in the world, and perhaps there is enough
12 produced in every year to contaminate all the water
13 in the world, I don't know that number. I don't
14 like these kinds of numbers personally which take
15 a lump and say here is how bad a job you can do.

16 If there were millions of kilograms
17 of 1, 2-dichlorobenzene, it could be argued that
18 everything would be wiped out and if that was the
19 case, why isn't it. I don't disagree you could take
20 a number and use it that way, but I think there is
21 a danger in using a number that way.

22 Q. You have addressed in your
23 report the need to consider a whole list of EPA
24 priority organics in determining the impact of a
25 landfill?



1 A. The numbers that were reported
2 in our -- certainly we considered these and we
3 have taken some representative types of materials
4 and we don't have guidelines on what concentrations
5 we would be allowed on many of these things, but
6 much of that work was done by one of our partners
7 to look at the treatability of the leachate to
8 see what the concentrations of the materials were,
9 and he reported them to us and we included them in
10 our report as being present in the landfill leachate
11 and we didn't consider each and every one of those
12 in terms of contaminant migration.

13 Q. You have taken it and assuming
14 my question was concerned about the treatability, but
15 I am not at the sewage treatment plant?

16 A. I understand.

17 Q. I am still at Site D and I
18 am concerned about the potential for small quantities
19 of these organics if they get off the site and into
20 an aquifer of having the potential to contaminate
21 that aquifer?

22 A. Yes, in the circumstance you
23 suggest that if we weren't to collect them, then it
24 has the potential I suppose to contaminate, but that
25 certainly is not our intent at this landfill.



1 Q. No, I certainly hope not.

2 Just summarizing this dicussion, I think it is
3 summarized by the last sentence in the third paragraph:

4 "A conclusion that can be derived from
5 calculated examples such as these is
6 that severe groundwater contamination
7 may be caused by very small inputs of
8 industrial organic chemicals to the
9 groundwater zone."

10 And that's if they get there?

11 A. Yes.

12 Q. If you to the next paragraph
13 he says:

14 "The above examples are for two
15 organics of the possible 40 to 100
16 organic compounds commonly identified
17 in landfill leachate... It is also
18 estimated that less than 10% of the
19 total mass of dissolved organic carbon
20 in landfill leachate plumes consists
21 of identifiable compounds...
22 Therefore the full potential effect of
23 organics in leachate is not known."

24 Would you agree?

25 A. I would be difficult to disagree.



1 Q. For the purposes of our considera-
2 tions here, we should assume that -- or would it be
3 prudent to assume that that is the present state of
4 knowledge?

5 A. Yes, it is.

6 Q. There is another statement that
7 I don't think either he or you as a hydrogeologist
8 finds particularly unique to make, but you have been
9 in the landfill business a long time and so I would
10 like to ask you attempting to regulate input to a
11 municipal landfill will not be effective due to the
12 large volume of solid waste which must be disposed
13 of and the small diversive sources that work on
14 organic compounds in this waste we must accept
15 that toxic industrial organic compounds will
16 continue to be present in most municipal landfill
17 leachate?

18 A. Yes, I think there will always
19 be some organics of this type in leachates. We all
20 have, I suppose, our paint cans. I think in the
21 future this will be reduced as there are some
22 collections in operation in the province now run
23 by Syntath, which is an arm of Tricil, whereby people
24 can actually put out from time to time the hazardous
25 types of substances that they have and Syntath will



1 take them and dispose of them in an appropriate manner.

2 I also point out on this that landfills
3 certainly have organic contaminants but we also --
4 when we use that or throw that teaspoon of
5 contaminant into our landfill, there is the other
6 45 gallons that went out on to a field on to our
7 food and into the atmosphere.

8 So, it is not a problem related
9 specifically to landfills, and certainly landfills
10 have some of these contaminants, but they are also
11 spread through our environment and, as a matter of
12 fact, the larger part goes into the environment in
13 other ways.

14 Q. You are not saying it is
15 inappropriate to try and prevent impacts of those
16 organic compounds in the siting and approval process
17 for landfills?

18 A. No. Certainly Reg 309 has
19 gone a long way, but no regulation is perfect, but
20 it has gone a long way to identify producers and to
21 make sure that these types of materials go to an
22 approved the facility. My wife is a teacher and
23 teaches chemistry and they produce essentially no
24 waste in a year, or very little waste in the experiments
25 they are doing, and she is having to make out a



1 manifest that she is a licensed waste producer, but
2 she advises me that she will be lucky if she puts
3 out a half a gallon a year of any sort of waste.
4 So, really the regulation has become fairly strict
5 in order to remedy the problems that go on, but as far
6 as the Raid can which you spray through the air
7 and which you have inhaled and not worried about,
8 it goes to the landfill and it will produce a bit
9 of toxics and we can detect that with current
10 methods of analyses.

11 Q. I want to take you further into
12 this just for a moment and beginning with -- page
13 45, the first sentence in the middle paragraph:

14 "Many organic contaminants do not
15 undergo significant attenuation in
16 the subsurface."

17 And I think we touched on it before and you said
18 it could relate to different assumptions about
19 the kind of material you are dealing with and in
20 some cases we haven't seen it travel too far like that
21 Tricil?

22 A. This is not new in literature,
23 all the writers have said that many of these
24 substances are not attenuated significantly on the
25 subsurface, but on the other hand I am not trying to



1 downplay that, but I am not sure the jury is in
2 because organic substances in the groundwater have
3 not been studied for a very long period of time.

4 Q. But we know they get into these
5 landfills and accordingly it would be prudent to
6 address that fact when we are looking at the choosing
7 of landfill sites?

8 A. We do. We consider it in all
9 cases, and not only the chlorides but we are considering
10 the other materials with the chlorides and we normally
11 use chlorides because they are far more predictable,
12 but certainly in our volume here we have alluded
13 to the fact organics will migrate and we have
14 modelled a couple of organics and, yes, organics
15 can migrate from sites.

16 Q. I also wanted to draw your
17 attention to the last paragraph on page 45:

18 "This discussion has focused on
19 dissolved organic contaminants and
20 has not addressed non-aqueous phase
21 liquid (NAPLs), such as chlorinated
22 solvents. These compounds in product
23 form are immiscible in water and are
24 more dense than water, therefore they
25 can rapidly migrate into the subsurface



1 as a separate phase and act as a
2 long-term source for dissolved contami-
3 nants. At present it is not possible
4 to predict the migration of NAPLs
5 in the subsurface."

6 Have you any basis for agreeing or disagreeing with
7 that?

8 A. I would defer that question
9 to Mr. Feenstra. Mr. Feenstra is quite qualified to
10 talk to DNAPLs.

11 Q. What is it called?

12 A. DNAPLs. There should be a D
13 in front for dense, non-aqueous phase liquids.

14 Q. Do I take it those kinds of
15 contaminants are not the organics you were assessing
16 in your report?

17 A. We considered these as well,
18 the triholomethanes -- sorry. I am
19 not sure whether we referred specifically to that
20 type of a compound, but chlorinated solvents are the
21 DNAPLs and there are a variety of them and
22 Mr. Feenstra can talk to the DNAPLs.

23 Q. Would you defer to Mr. Feenstra
24 with respect to the statement: "It is not possible
25 to predict the migration of these at the subsurface."



1 A. Yes, I would, because Mr. Feenstra
2 has written a paper on it and I believe his PhD
3 thesis will be on that subject as well.

4 Q. If you would turn to page 48,
5 the discussion is molecular diffusion and let me just
6 back up for a moment. Ten years ago when you would
7 discuss the potential impact of a landfill you would
8 normally talk in terms of advection, the velocity,
9 the D'Arcy equation as to how fast it will likely
10 get through the soil?

11 A. That's correct.

12 Q. At the present time and for the
13 last few years it is prudent to also consider the impact
14 of molecular diffusion on the arrival time for
15 contaminants?

16 A. Yes, it is.

17 Q. You have done that in your
18 two reports?

19 A. Yes.

20 Q. I wanted to ask you or direct
21 your attention to how diffusion can operate, as I
22 understand it, quite seemingly independently of
23 advective velocities?

24 A. Yes, it can. If the advective
25 groundwater velocities are low enough, then diffusion



1 becomes the dominant force and you have to be at very
2 groundwater velocities for that to happen.

3 Q. He gives an example in the first
4 sentence of the last paragraph on that page:

5 "In a clay layer that is thin, such
6 as a compacted clay liner with a
7 thickness of 1 m, diffusion will
8 cause mobile contaminants such
9 as chloride to arrive at the bottom
10 of the liner within about 6 years.
11 This will generally be the case
12 regardless of whether or not water
13 flow is downward or upward through
14 the liner."

15 A. That is too general a statement
16 and it would depend on what the velocities are and
17 whether diffusion is the dominant force or not.
18 If it isn't, and if advective forces are still the
19 dominant force, then diffusion will not affect this
20 significantly.

21 Q. You have to assess what is
22 going on before you know how to take into account
23 the diffusion?

24 A. Yes, that is correct.

25 Q. If you turn to page 49, the



1 next page, just to finish off that topic, he says:

2 "It is now an opportune time for
3 consideration of molecular diffusion
4 to be included in regulations for
5 landfills in Ontario. In addition to the
6 downward migration of contaminants
7 through clay at the bottom of landfills,
8 diffusion can cause the contaminants to migrate
9 upward through compacted clay cover
10 layers on landfills."

11 A. Yes, that is correct.

12 Q. Do I take it that diffusion
13 can also operate at the bottom of the landfill?

14 A. Yes, it operates like a halo
15 around the site.

16 Q. Then he discusses the topic of
17 landfill leachate control systems, and I just wanted
18 to draw your attention to that. He says:

19 "They can be classified in two basic
20 types, landfills dependent primarily
21 on attenuation in the hydrogeologic
22 domain; landfills dependent
23 primarily on engineered liners
24 and leachate collection systems."

25 Stopping right there, I take it you have designed



1 | landfills primarily based on attenuation?

2 | A. Yes, I think I would quarrel
3 | with him at this time on these two basic types.
4 | I think there is a combination site now that is
5 | coming into the fore in Ontario where we are
6 | dealing with attenuation and we want that as part
7 | of our system, but we also recognize that leachate
8 | collection may be required on our larger sites,
9 | otherwise we will have problems. I wouldn't quite
10 | break them the way he has, and I would say the third
11 | type which is a combination.

12 | Q. Okay. Then the last sentence
13 | at the bottom of the page under:

14 | "Hydrogeological conditions
15 | affecting leachate control systems
16 | include local water-table elevations
17 | and fluctuations, direction and
18 | magnitude of hydraulic gradients,
19 | soil hydraulic conductivity, geology
20 | and the attenuative properties of the
21 | underlying materials."

22 | Those would be at least some?

23 | A. Yes.

24 | Q. Then he talks about attenuation
25 | systems and going to the last paragraph under that



1 heading, the two last sentences:

2 "Attenuation-type landfills can
3 only be evaluated in terms of their
4 desirability if reliable predictions
5 of their impact can be made."

6 Do you agree with that?

7 A. Yes.

8 Q. He goes on:

9 "As yet there is considerable
10 uncertainty associated with even the
11 most careful predictions of the ultimate
12 severity of offsite contaminant
13 migration in groundwater."

14 You might not want to agree with that, but let me
15 hear what you have to say?

16 A. Well, not entirely. As I say,
17 these are very general statements and I feel we do
18 have a predictive capability for some of the
19 contaminants that move from landfills. I don't feel
20 it is quite as severe as it is being suggested by
21 this statement.

22 On the other hand, I don't say, as
23 I have already said, that at X distance and X time it
24 will be such and such a concentration, but we have,
25 I think, a feeling for better environments in the



1 province and perhaps none of them are perfect, and in
2 any case most sites or all sites have to be engineered
3 to be sure that you have an acceptable system and
4 you have to provide contingencies in the event you are
5 wrong. Certainly the general intent of the
6 Ministry's policies are that they recognize these
7 uncertainties, otherwise would we need the contingencies?
8 I certainly agree with that.

9 Q. Then he discusses leachate
10 collection systems and you have drawn our attention
11 to the fact that at Site D in particular we are in
12 particular not just putting in a leachate collection
13 system to be used in conjunction with a
14 concept called the hydraulic trap?

15 A. Yes.

16 Q. But, the hydraulic trap concept,
17 as I understand it, assumes -- for it to work -- that
18 the leachate collection system will function?

19 A. Yes.

20 Q. Just taking you to the last --
21 middle paragraph on page 51 which says:

22 "The disadvantages of this system are
23 that the collection systems are costly
24 and that their long-term reliability
25 is unknown. Collection and treatment of



1 | leachate may be necessary for
2 | centuries. The treatment of toxic
3 | chemicals in the leachate or the lack
4 | of facilities for such treatment can
5 | be limiting factors."

6 | We don't need to go on with that, and I won't ask about
7 | the cost, but my concern is focused on the statement
8 | about their long-term reliability which is an unknown
9 | and the collection and treatment of leachate may be
10 | necessary for, as he says, centuries, but let's say
11 | less than a century or 75 years or 100 years. We
12 | don't have that experience?

13 | A. Not that long, no.

14 | Q. Then if I can take you to page
15 | 52, I think we have dealt with implications 3 and 4 and
16 | that is all I really wanted to draw your attention to
17 | with regard to that.

18 | I hope that -- we have seen
19 | Mr. Sobanski and he was able to agree or disagree to
20 | specific items, and I think this paper just helps give
21 | an overview of certain general concepts that Mr.
22 | Sobanski and others in the field are using.

23 | Now, I would like to turn to another
24 | topic, to specifically focus on Site D, but I see it
25 | is now 12:30.



1 DR. KINGHAM: It is probably an
2 appropriate time since it is 12:30. So is an hour
3 and fifteen minutes -- we tried that last week and
4 we think it is probably adequate and that will save
5 us another 15 minutes to half an hour. So let's
6 reconvene in an hour and fifteen minutes and that
7 will be at a quarter to two.

8 ---Luncheon Adjournment at 12:30 p.m.

9 ---Upon resuming at 1:45 p.m.

10 DR. KINGHAM: Thank you. Please be
11 seated.

12 MR. ESTRIN: I am sorry, Mr. Chairman,
13 using an hour and a quarter is quite sufficient, but
14 sometimes when you are cross-examining in technical
15 areas it is a bit difficult. I am just looking
16 for someone.

17 Q. Could you gentlemen put up
18 your cross-section M-158 B-B¹ and I think it is
19 Exhibit 158 and it is B-B¹. I am sorry, get out D-D.
20 Before you hide the one behind, can we see where
21 that is or must we look at something else to find
22 out where that is?

23 MR. BEECHINOR: A. We have to look
24 at something else.

25 MR. LEDERER: Which one is this?



1 MR. ESTRIN: Drawing 8 from the Site D
2 report. This is drawing 5, I believe, which indicates
3 where D-D prime is and if I can hold it up to be
4 of assistance, would you agree with me that D to D
5 prime essentially cuts in more or less a north-south --
6 in the middle of the site from north to south in
7 a very generalized but angularized way.

8 Now, it is my understanding that
9 when the landfill reaches its maximum elevation, it
10 will be in the vicinity of 200 or 205 -- 204 metres
11 relative to everything on here; is that correct?

12 MR. SOBANSKI: A. I am not sure, I
13 would have to look at the drawings and I don't have
14 the design drawings.

15 Q. Here are the final contours.
16 We did discuss some other things with these gentlemen
17 over lunch and we didn't get a chance to get to this.

18 A. It varies between 202 and 204.

19 Q. Would you be able to draw or
20 sketch on that mounted drawing of cross-section
21 D-D approximately the height of the final contour,
22 the top final contour as projected?

23 A. That shouldn't go on this cross-
24 section here, the elevations you are referring to are in
25 the middle of the site and this is off to one edge



1 of the site and it would have very little contour
2 on it at all.

3 Q. Like you have done, wouldn't it
4 be possible to project it on there?

5 A. It would but it wouldn't be the
6 proper thing to do in this case because you are off
7 on the edge and the wells you have shown run down
8 the one side of the property, on the east side of the
9 property, and then just pick up a small corner in the
10 south part, but the height of the fill is over here
11 and along that cross-section you would be dealing with
12 190 metres perhaps or less in terms of height of
13 landfill.

14 Q. Would E be more useful or tell
15 me which is more useful so we can appreciate the height
16 of the mound?

17 MR. LEDERER: Height of the mound or
18 height of the base contour?

19 MR. ESTRIN: The height of the top of
20 the landfill.

21 Q. I wanted to use your cross-sections.

22 MR. SOBANSKI: A. That would be G-G,
23 I suppose.

24 Q. All I want for you to be able to
25 indicate is the relative height of the top of the



1 garbage when full to the present ground elevation,
2 whatever drawing is most appropriate to generally
3 illustrate that. You can do it in pencil and if
4 you want to correct it later on that's fine, I just want
5 an appropriate idea.

6 Thank you very much. What you have
7 done is you have marked on drawing 11, I believe it is
8 to H-39, the cross-section which is cross-section
9 G-G, the approximate final height of the proposed
10 landfill at that location.

11 MR. SOBANSKI: A. Very approximately,
12 yes.

13 Q. Just to repeat, the top contour
14 is somewhere between 202 and 204 metres?

15 A. I have it at 204 metres.

16 Q. The elevation of the ground
17 surface, say in the middle of the site, what is that
18 approximately?

19 A. About 183 metres.

20 Q. So we are going to have a pile
21 of waste when finally covered approximately 20
22 metres higher than the present ground surface at
23 its maximum?

24 A. Correct, yes, approximately.

25 Q. With that in mind let's talk



1 about what will be above the ground and let's remind
2 ourselves for the purposes of this discussion of the units below
3 ground, and if I could ask you to turn to your report...

4 MR. LEDERER: Before Mr. Estrin
5 proceeds, I am getting a bit concerned about how we
6 will identify all of this. This document was not
7 exhibited separately because it is simply a copy
8 pasted on a board of Drawing 11 in Exhibit H-39A.
9 Now we have a mark on it and I confess to some concern
10 about the marking because the visual expert has given
11 us some relative heights and a much more accurate
12 format, but now that we have this and now that it
13 stands out as very unique, at the least it should be
14 exhibited.

15 MR. ESTRIN: I think Mr. Lederer is
16 right.

17 DR. KINGHAM: Do we have any other
18 fall-outs from H-39? We are already at H-39 D-2,
19 so I guess we would make this H-39...

20 MR. LEDERER: We have an H --

21 DR. KINGHAM: Perhaps we should call
22 it H-39G since it is a cross-section.

23 MR. LEDERER: We are just having a
24 discussion and what the "D" may refer to, and I think what
25 it refers to is drawing so then it would be D-11 to



1 correspond with the number in the report.

2 DR. KINGHAM: You are suggesting

3 H-39 D-11?

4 MR. LEDERER: Yes.

5 DR. KINGHAM: But you are not sure?

6 MR. LEDERER: I am told by my colleague
7 that I can't rely on him and I am not sure what to
8 do about that.

9 MR. HODGSON: It should really be
10 H-39-11 with no D.

11 MR. LEDERER: What is H-39 D-2? It
12 would be H-39 D-11 as H-39 D-2 is the panel of wells,
13 so that would make it consistent.

14 ---EXHIBIT NO. H-39 D-11: Drawing on cross-
15 section G-G

16 DR. KINGHAM: That is again a 10 to 1
17 vertical to horizontal exaggeration. The vertical
18 scale is 10 metres and the horizontal scale is 100
19 metres?

20 MR. SOBANSKI: That is correct. So
21 it is H-39 D-11.

22 MR. ESTRIN: Q. If we could now
23 turn to your report on Site D, Exhibit H-39, Figure
24 1 at page 30. You have summarized the local
25 geology there and for the purposes of our discussion



1 it would be appropriate to write in, I believe, and
2 I will tell you what I am asking you and you can tell
3 me if you agree, but I would like to have us all
4 write in in the first block down from the top,
5 between zero and four metres, the upper weathered
6 till. Have I got that right?

7 MR. SOBANSKI: A. Yes.

8 Q. Okay. The next block between
9 4 and 8 metres would be the lower unweathered -- I
10 am sorry -- the upper unweathered till?

11 A. Yes.

12 Q. Then you have identified this
13 thin bed of silt and right below 8 metres, everything
14 there is essentially lower till, but if we go between
15 8 and 11 metres down we can label that lower till?

16 A. Yes.

17 Q. Between 11 and 12 we have the
18 upper granular unit?

19 A. Yes.

20 Q. The UGU, and then between
21 12 and 14, that would be lower till?

22 A. Yes.

23 Q. Then 2 metres of this lower
24 granular unit?

25 A. Yes.



1 Q. And between 16 and 24 there is
2 more lower till?

3 A. Yes.

4 Q. You have identified the gravelly
5 till at 24 metres and then we have bedrock?

6 A. Yes.

7 Q. Just to go from those terms
8 back to Drawing 11, or H-39 D-11, could you point out
9 these various units on that?

10 A. In this particular cross-
11 section, and remember that Figure 1 is a summary for
12 modelling purposes and so you will find some
13 differences when we go to site-specific areas, but
14 we have a more severe hatching which is a relatively
15 dark colour from surface going down to a dashed line
16 on H-39 D-11.

17 This is the upper till unit, the
18 clay till, which has a weathered zone within it.

19 Q. So the demarkation between the
20 weathered and unweathered zone in that till is not
21 shown on that drawing, on drawing Number 11?

22 A. It isn't.

23 Q. But generally speaking you
24 have identified that lower limit as being 4 metres
25 below ground surface?



- 1 A. About 4 metres.
- 2 Q. Could you show us where your
- 3 4 metres would be?
- 4 A. Four metres would be about like
- 5 so. It is difficult -- I can put it on...
- 6 Q. Could you put it on?
- 7 A. Yes.
- 8 Q. With a colour perhaps.
- 9 A. As soon as I get it on I
- 10 could then put it on in colour.
- 11 Q. Thank you. You have drawn a
- 12 red line through one of the boreholes and extended
- 13 it to indicate the approximate demarkation between
- 14 the weathered till and the unweathered till?
- 15 A. Yes.
- 16 Q. The thin bed of silt, how
- 17 is that identified, or is it?
- 18 A. Is it shown as the dashed
- 19 line about 6 metres below the red line.
- 20 Q. Then we come to the lower till,
- 21 and within that we have this upper granular unit
- 22 and lower granular unit and I think we can see some
- 23 of the upper granular unit at one of the boreholes?
- 24 A. At Morrison Beatty (IN)OW4
- 25 there is a semblance of the upper granular unit and
- it does not show at HC 3-86 because it was not continuous



1 at that point and below that...

2 Q. Below that is the lower granular.

3 A. Below that is the lower granular
4 unit and the lower till again, another unit of the
5 lower till, and in this case we did not hit the
6 gravelly till unit on the base of the shale which is
7 the final unit in that particular well.

8 Q. I wonder -- one more line I would
9 like you to put on there, the bottom of the landfill,
10 the base contour. The approximate elevation so we can
11 see how deep into the soil strata it is going?

12 A. This is variable from place
13 to place and I guess we should stick roughly where
14 we are, that will give some indication.

15 You will have to give me a
16 moment to locate myself here.

17 MR. ESTRIN: I think this is the last
18 line, and I apologize for this delay. Had we been
19 following the continuity I would have advised him
20 ahead.

21 DR. KINGHAM: I think it would be
22 advantageous that if we see ourselves making changes
23 to diagrams already in evidence, if those could be
24 done during break time, like coffee times and lunch
25 times, and then they could simply be verified when we



1 come back in because it is very time-consuming.

2 MR. ESTRIN: Q. If you could mark
3 a blue line over the previous red line, I take it
4 you are indicating at that location the base contour
5 of the landfill would be approximately equal to the
6 lower limit of the weathered zone and it would
7 extend to the bottom of the upper weathered till?

8 MR. SOBANSKI: A. That is correct.

9 Q. Would you agree in a general way,
10 and I don't need it to be precise, but in a general
11 way the base contour in some places may get a
12 little deeper than that?

13 A. Yes.

14 Q. So we may get the base into
15 the upper unweathered till in some locations?

16 A. Probably. I would have to check
17 it, but that is probably right. Again the 4 metres
18 isn't an exact depth but an approximation.

19 Q. So this landfill will be
20 basically excavated into the weathered upper till?

21 A. Yes, and likely into the lower
22 unweathered till as well in some places.

23 Q. And on average you told us
24 the bottom will be about 7 metres above the upper
25 granular unit on average, and that is the statement



1 in your report?

2 A. Yes, whatever the report says.

3 Four and three, 7 metres.

4 Q. For the purposes of assessing
5 the impact of this site, you felt it prudent to
6 assume that the upper granular unit extended
7 essentially across the site?

8 A. We did that, yes.

9 Q. Notwithstanding what we see
10 on the diagram, the localized identification of the
11 upper granular unit, you have assumed it extends
12 across where the garbage would be?

13 A. Yes. There are qualifications
14 to that in the report.

15 Q. You have also assumed that the
16 thin bed of silt, the dashed line, has no hydrogeological
17 significance?

18 A. That is right.

19 Q. I take it one of the basic
20 findings of your work was that Site D would not be
21 acceptable as a natural attenuation site?

22 A. Solely on natural attenuation,
23 that is correct.

24 Q. Now, if I could ask you to turn
25 to your report in the Executive Summary, and this is



1 H-39, page x, at the bottom of the page, and
2 perhaps you could read that paragraph?

3 A. "Without leachate collection
4 and treatment contamination of the
5 groundwater in the Granular Units
6 could impact domestic water supply
7 wells on adjacent westerly properties
8 which draw their water from these
9 units. Such impacts would occur
10 70 or more years hence. Similarly,
11 without proper control groundwater
12 contaminants could discharge to
13 surface water streams."

14 Q. Then, at the bottom -- you have
15 also identified the significant groundwater pathways
16 for contaminant migration through which such
17 contaminants could migrate off-site, and these are
18 summarized by you in your Executive Summary, I believe
19 on page vii at the bottom -- I am sorry, viii at the
20 bottom of that page, and could you begin reading
21 with "The significant groundwater pathways..."?

22 A. "The significant groundwater
23 pathways for contaminant migration
24 off-site are summarized as follows:

25 (1) Lateral migration of contaminants



1 to the site boundary through the
2 Weather Upper Till."

3 Q. Stop there. Point to where the
4 upper weathered till is. So everything above that
5 red line approximately?

6 A. Approximately.

7 Q. Continue at the top of page
8 ix.

9 A. "(2) Downward migration of
10 contaminants through the Unweathered
11 Upper Till and Lower Till to the
12 Granular Units with subsequent
13 lateral migration to the site boundary."

14 Q. You have illustrated those
15 groundwater pathways for contaminant migration
16 schematically, I believe, on that Figure 7 on page 94,
17 and assuming -- the top part of that diagram,
18 Figure 7 on page 94 assumes the assumption there
19 is no leachate collection system in operation?

20 A. That is correct.

21 Q. Without a leachate collection
22 system in operation, you have shown us schematically
23 the two major ones, which are lateral migration through
24 the weathered till and also migration downward through
25 the upper till to the lower till until it hits the



1 granular units and then off-site that way?

2 A. Yes.

3 Q. I take it from your discussion
4 that that one is the main downward and outward one
5 which you have evaluated and I gather you considered
6 that of the two downward and outward ones to be more
7 significant, a potential problem going down
8 further to the weathered till and going out?

9 A. We considered the lateral
10 migration through the upper till and the granular
11 units to be the major sources and as we presented the
12 drawing which went in this morning that showed lateral
13 migration through the shale bedrock doesn't seem to
14 be such a severe problem, but two pathways were
15 analyzed in this report and one was the lateral
16 migration through the weathered upper till and the other
17 was lateral migration through granular units.

18 Q. You have concluded that accor-
19 dingly there must be a hydraulic containment system,
20 designed, built and operating at this site in order
21 to form your professional opinion that this site could
22 be made compatible with public health and safety
23 requirements?

24 A. Yes. The modelling we have done
25 and the calculations we have made indicate that this



1 site requires a leachate collection system.

2 Q. That engineering concept, or
3 at least the hydraulic trap aspect of that engineering,
4 is briefly described by you at page xi of the Executive
5 Summary, I believe. Would you read the first two
6 paragraphs?

7 A. "Hydrogeologic conditions at
8 Site D are suitable for the construction
9 of a hydraulic containment leachate
10 control system. The concept involves
11 installing a leachate tile collector
12 system beneath the refuse at sufficient
13 depths to create a hydraulic sink into
14 which leachates and some groundwater
15 would flow.

16 The collected leachate would be treated
17 by an acceptable method.

18 With the hydraulic containment system
19 in operation, there would be no
20 significant movement of contaminants
21 out of the landfill into the ground-
22 water because the leachate collection
23 system would maintain a groundwater
24 gradient into the landfill, from
25 all significant water-bearing zones. "



1 Q. I wonder, but could you briefly
2 sketch very simply the concept of a hydraulic trap
3 for us, or if you would prefer to do that over the
4 break, that is fine too?

5 A. We could use one of the visual
6 aids, for example.

7 Q. Sure. You are referring to
8 H-39 D?

9 A. Although this particular figure
10 does not shown mounding between the individual tiles,
11 the general concept is that by drawing down the
12 water level within the landfill, the groundwater within
13 the weathered zone, for example, which is relatively
14 high on the site and a relatively high water table,
15 would be induced to flow into the tile drains.

16 Similarly, because of their position
17 and elevation and the elevation of the base of the
18 cells, water would also be induced, a small quantity,
19 to flow from other various important hydrogeologic
20 units, those being the upper granular unit, the lower
21 granular unit and the shale bedrock.

22 Q. I take it what is also
23 imagined is that if there is no hydraulic trap, or
24 it doesn't work properly, then the opposite at least
25 of some of those arrows would be applicable and



1 instead of groundwater moving towards the landfill,
2 particularly in the upper till, it would move
3 laterally in the opposite direction or away?

4 A. That is correct.

5 Q. Because you would be creating
6 a mound of leachate or water or both within the
7 landfill which would put some pressure on so that
8 that water would want to move out?

9 A. That is correct.

10 Q. It would also want to move out,
11 as you have identified it, downward and out and off
12 the site boundary through the granular units?

13 A. Essentially without contingencies
14 beyond that, the groundwater would mound within the
15 site and normal gradients would be established,
16 perhaps even slightly stronger downward gradients,
17 and the flow system would resume the way it is now
18 with generally a recharge gradient to the lower
19 units as well as lateral movement through the weathered
20 zone, and that is how we monitor and put in contingency
21 systems.

22 Q. In order to make the hydraulic
23 trap work, when the leachate rises within the
24 landfill to a certain elevation it must then be
25 removed?



1 A. Yes.

2 Q. And then --

3 A. In this particular case it can
4 be pushed/pulled. You can allow it to rise for a
5 period of time and then withdraw it as you choose
6 because the depth of penetration into this very
7 tight material beneath it will not be very far and so in
8 fact you could allow it to mound somewhat so it doesn't
9 create problems and a little bit would escape into the
10 soils and you turn on your system and take it out
11 and then it flushes back in when the trap
12 re-establishes.

13 Q. I take it your study has provided
14 data which allows a calculation of the time that
15 contaminants would reach the site boundary without
16 this hydraulic trap in operation?

17 A. That was the basis of much
18 of the modelling that was done in the report.

19 Q. If we turn to, I believe it
20 is page 102, I think you have summarized the time
21 at which contaminants would reach the landfill
22 property boundary at a concentration of 10 per cent
23 of that which you assumed was the original level in
24 the landfill?

25 A. Yes.



1 Q. Your model, and this was done
2 through a model?

3 A. Yes.

4 Q. But it indicates that it would
5 get to the site boundary in the weathered upper till
6 with no leachate collection system in
7 operation within five years?

8 A. In that order, yes.

9 Q. It would get off-site by
10 going down and then through the granular units in
11 60 years?

12 A. Yes.

13 Q. To the shale bedrock, to be
14 fair, in 60. Let's try and break down that 60-year
15 period. I believe at page 99 you tell us, and
16 I am looking towards the bottom of the page, the
17 last couple of sentences:

18 "The first arrivals ($C/Co=0.1$)..."
19 This means the first arrival of a 10 per cent
20 concentration?

21 A. Yes.

22 Q. "...for the contaminants
23 occur at approximately at 6 to 10
24 years after arrival at the top of the
25 upper granular unit."



1 Stopping there, I understand that once the contaminants
2 have gone down and reached the upper granular unit,
3 it will take between 6 and 10 years to go horizontally
4 off-site?

5 A. Yes, that is correct.

6 Q. So we can break down your 60-
7 year period by saying that your modelling indicates
8 that it will take between 50 and 54 years to go
9 downward from the bottom of the garbage and to reach
10 the top of the upper granular unit?

11 A. Fifty years or so, yes.

12 Q. Now, I take it you started these
13 calculations by first of all determining what were
14 the advective velocities at work, and I am asking
15 you to look at page 88, Table 10. I take it what
16 you had to do first of all in determining these
17 time periods was to measure the soil characteristics
18 on the site and determine what that would mean in
19 a simple D'Arcy equation, a relatively simple
20 calculation?

21 A. These numbers are actually input
22 into the Ogata Banks equation, I believe.

23 Q. They are input, but let's forget
24 Ogata Banks in modelling and let's go back ten years
25 for a moment. This is what you start to do, to start



1 with any impact assessment, you have to determine
2 the hydraulic conductivity?

3 A. Yes.

4 Q. You have to determine the
5 gradient?

6 A. Yes.

7 Q. The effective porosity?

8 A. Yes.

9 Q. From that you determine a linear
10 groundwater velocity?

11 A. Yes.

12 Q. In centimetres per second as
13 you have done in the lower right-hand column
14 to convert that to metres every year?

15 A. Correct.

16 Q. So you have velocities there
17 which assume no leachate collection system in opera-
18 tion and also assume that there is only the advective
19 velocity calculation at work, and in this table you are
20 not allowing for other factors such as diffusion or
21 dispersion?

22 A. This would be under terms of
23 quadraflow.

24 Q. This is the so-called simple
25 type flow?



1 A. Yes.

2 Q. So, what you have gone on to
3 do then is take these velocities and assumed certain
4 factors for dispersivity and diffusion and put them
5 through a model to see what effect, in reality, as
6 realistic as models are, it would make. Is that
7 fair enough?

8 A. That is the essence of it.

9 Q. Your key times which we just
10 saw are on page 102 and these were -- these took into
11 account or were based on the advective velocities
12 which you derive from Table 10 and then you modelled
13 them and arrived at the numbers on page 102?

14 A. It was put into the Ogata Banks
15 equation on page 92.

16 Q. The output is on page 100?

17 A. The output is on several pages.

18 Q. But summarized.

19 A. Summarized on page 102, that
20 is correct.

21 Q. What I want to do now,
22 Mr. Sobanski, is discuss with you your times, five years
23 through the upper weathered till, 50 to 54 years
24 from the landfill down to the upper granular unit
25 and 6 to 10 years through the upper granular unit to



1 the boundary and what I will be asking you to
2 look at with me is whether or not the times you
3 have concluded could and indeed should be much shorter
4 than those times set out on page 102.

5 I would first like to turn to the
6 weathered upper till and, as you said, it will take
7 5 years to get off-site to the boundary, and what
8 you have assumed is that that is calculated, as I
9 understand it, as 100 metres from where the waste
10 is being buried?

11 A. Yes, that is correct.

12 Q. Would you agree that a key
13 component in the calculation of travel time is the
14 gradient?

15 A. Yes, it is.

16 Q. I understand, looking at Table
17 10, you used the number .004 as being the gradient?

18 A. That is correct.

19 Q. If this number is actually
20 larger, there will be a higher velocity, other things
21 remaining equal?

22 A. That is correct.

23 Q. Let's assume for the moment
24 that that velocity -- that the gradient is actually
25 .008 for the sake of argument. I would then suggest



1 that that would make the travel time at which your 10
2 per cent level would reach the boundary would be one-half
3 of 5, or approximately somewhere less than 3?

4 A. Approximately.

5 Q. The gradient you used, .004
6 as set out on Table 10, in calculating that
7 gradient, did you assume that the head of leachate,
8 i.e. the top elevation of the leachate without
9 the leachate collection system in operation, was
10 at the level of the water table?

11 A. I believe we did.

12 Q. I would like you to refer
13 to Drawing 17 and it may be mounted and I don't know,
14 but I would like you to put it up. Mr. Beechinor,
15 perhaps you could see if it can be put up?

16 What we see on Drawing 17 are eleva-
17 tions of the water table at certain points, namely
18 boreholes at which you have measured it, as of
19 April, 1986. Is that right? There are certain
20 numbers on this table?

21 A. That is right.

22 Q. Looking at hole HC2-86 towards
23 the bottom, there is a number in brackets below that
24 of 182.89?

25 A. Yes.



1 Q. That is the elevation of the
2 water table measured at that time?

3 A. That is correct.

4 Q. Similarly if we look at HC5-84?
5 and the elevation was 184.52 in brackets?

6 A. Yes.

7 Q. What you have done here by
8 drawing contours is attempt to link up the similar
9 elevations in the same way any contour map we
10 would be familiar with in a topographic sense?

11 A. Yes, that is correct.

12 Q. We see the triangle contour basi-
13 cally in the bottom middle of the site gives us the
14 184 metre contour?

15 A. Yes.

16 Q. And moving to the west we see
17 a 182 metre contour?

18 A. Yes.

19 Q. Further to the west we see
20 a 180 contour?

21 A. Correct.

22 Q. What you have done is you
23 determined, as I understand it, you can determine,
24 as you have done, the direction of shallow groundwater
25 movement based on these gradients. If you look at



1 your arrow and the legend and you have marked that
2 in as the direction of groundwater movement?

3 A. Yes, that is correct.

4 Q. You are telling us in which
5 direction groundwater in the shallow system is moving
6 based on that data?

7 A. Yes.

8 Q. From that data we see groundwater
9 in the shallow system is moving in basically two
10 directions, to the northeast towards Highway 25 and
11 the tributary to Oakville Creek?

12 A. Yes.

13 Q. And to the southwest towards the
14 Bronte Creek tributary and towards houses along First
15 Line which happen to have shallow wells?

16 A. I don't think that would be
17 correct.

18 Q. Can I leave out the houses on
19 First Line with shallow wells, and would you agree
20 it is moving towards the Bronte Creek tributary?

21 A. It is moving toward the Bronte
22 Creek tributary and we are showing a closure, and
23 it is interpretive, but we are showing closure and
24 in all likelihood the water from the shallow wells,
25 if these are shallow wells, the shallow flow system



1 might well move back towards this tributary as well,
2 and so what we are showing is that the Bronte Creek
3 tributary receives groundwater from both sides, but it
4 does not move necessarily directly at the wells,
5 it might be moving back from these wells, back
6 towards this tributary which is a very deep ditch
7 at this location.

8 Q. By the way, your clients are
9 planning on moving that creek tributary, on part of
10 the site, and it won't be through the site,
11 as I understand it?

12 A. The water will still be on
13 that side of the property though.

14 Q. But it will be moved from where
15 it is now further over by the road?

16 A. The deep ditch will still be
17 there and the designers, I don't know, the designers
18 would have to speak to that.

19 Q. Now, we have a slope to this
20 water table as shown by the contours on Drawing 17,
21 correct?

22 A. Yes.

23 Q. That would allow us to roughly
24 calculate the gradient in the shallow groundwater
flow system?

25 A. Yes.



3A

1 Q. So, we could use the difference
2 in contour elevations over a specific distance
3 between contours to roughly calculate the gradient?

4 A. Yes.

5 Q. Let's do that. I have a portion
6 here of this drawing with some areas highlighted and
7 perhaps we can put that up?

8 A. On page 50 we tell you what the
9 range is we calculated on the site and it is .001 to
10 .009 and averaging .004.

11 Q. That is exactly what I want
12 to discuss with you.

13 A. It is the second paragraph, the
14 second paragraph on page 50.

15 Q. First of all perhaps you could
16 tell me where you get your gradients that you
17 average to be .004 from?

18 MR. BEECHINOR: A. There is a
19 summary we prepared of all the gradients we
20 calculated from the various observation wells,
21 and if it hasn't been provided we can provide that.

22 Q. We did ask before the hearing
23 began for the various tests-- the heads rather
24 used in Drawing 17 and which was then used in
25 the calculation of Table 10?



1 A. We prepared a summary for both
2 sites of all the gradients and all the means used
3 in our calculations.

4 Q. If you have it, let's have it.

5 A. I don't know if I have it
6 right now.

7 Q. Is it in the building?

8 A. It could be.

9 MR. LEDERER: Perhaps what we could
10 do is have Mr. Beechinor canvass his records over
11 the course of the break.

12 MR. ESTRIN: We will come back
13 to this after I have that data.

14 Q. You might tell me, if you
15 know, how many data points were used?

16 MR. BEECHINOR: A. There were 15
17 to 20 data points, and I can't possibly remember
18 all of those. It might even be here, if we could
19 just have a couple of minutes.

20 Q. I would be happy if we could
21 do that.

22 DR. KINGHAM: Perhaps we could take an
23 early coffee break and we can reconvene in 17 minutes.

24 MR. LEDERER: Perhaps we could have
25 some requests for this in advance.



1 MR. ESTRIN: I did.

2 MR. LEDERER: I don't recall that, but
3 from this point on could we have it beforehand and
4 if it isn't at hand it would seem logical to phrase
5 the question before the cross-examination begins.
6 Now, we were asked to provide the Geocon water level
7 monitoring and this was some monitoring done by
8 Mr. Estrin's consultants and which Mr. Sobanski
9 indicated he had in handwriting this morning, and I
10 have copies of that.

11 DR. KINGHAM: I think we can say
12 as a general rule we would like it for the efficiency
13 of the hearing, if we could have as much of this
14 work done between actual sitting times as possible.

15 We will reconvene in 15 minutes.

16 Thank you.

17 ---Recess

18 DR. KINGHAM: Thank you, please be
19 seated.

20 MR. ESTRIN: Q. Mr Beechinor, I
21 think you indicated during the break that you think
22 you have more data and calculations arriving at
23 that gradient number back in the office?

24 MR. BEECHINOR: A. That's right.

25 Q. You think you can produce those



1 for us tomorrow morning?

2 A. I can.

3 MR. LEDERER: I believe we are missing
4 somebody fairly important.

5 MR. ESTRIN: Yes, and we will leave
6 gradients for a moment. I thought Mr. Beechinor
7 could handle that.

8 MR. LEDERER: This is what's known
9 as the dramatic entrance.

10 MR. ESTRIN: Q. Now, still on the
11 topic of how fast leachate moved outward laterally
12 to the site boundaries through the upper weathered
13 till; another factor besides gradient that goes
14 into that calculation and which can affect it in
15 a major way is porosity. Is that fair enough?

16 MR. SOBANSKI: A. Effective porosity.

17 Q. At page 47 I believe you
18 assigned the number of .001 to the fractured till?

19 A. Yes.

20 Q. Where did you get that number?

21 A. It was an estimate. As we said
22 in our evidence, I believe we feel that the numbers
23 we have given here are fairly conservative because
24 the tritium data suggests that in fact the trans-
25 missivity of the upper weathered till is lower and



1 the effective porosity is indeed a value which
2 is quite a bit different than .001. So this value
3 is an estimate of a type of effective porosity that
4 a weathered till may have.

5 Q. So it is an estimate based
6 on sort of your experience?

7 A. It is not really based on
8 experience. If I had my experience, these are issues
9 which are faced and we take conservative approaches.
10 and my experience is that these values more than
11 far over-estimate the velocities in weathered till,
12 and I based that opinion upon Tricil which we have
13 been monitoring wells at Tricil for 10 years that
14 are within a few metres of the waste, the waste
15 that was placed in the weathered zone, and we have
16 found no contaminants in the wells at Tricil.

17 Q. You are not trying to compare
18 the type of clay at the Tricil site to that which
19 you have here?

20 A. There is quite similar and
21 it is still weathered fractured clay and also we
22 have the tritium data at this site which indicates
23 that the permeability of this zone may be much
24 lower, in the order of 10^{-7} , and the numbers are
25 in the report, so we used 10^{-5} and we use a fracture



1 type of porosity to be conservative and the type of
2 number we calculate from the tritium is an average
3 linear groundwater velocity of 5×10^{-7} centimetres
4 per second which is two full orders of magnitude
5 lower than what we are using in our estimates here
6 to be conservative.

7 Q. It is your estimate. You
8 recall the Gartner Lee study and this was part of their
9 work for the Ontario Waste Management Corporation?

10 A. Yes.

11 Q. They produced a report which
12 is in evidence, M-155, and you told us that you
13 used this report, in fact it is in your report
14 that you referenced this for purposes of supplementing
15 your data on Site D?

16 A. I don't recall saying that,
17 but the number we used is correct. However, our
18 report still stands and on page 62 the tritium
19 data indicates the hydraulic conductivity of the
20 weathered zone is only about one-half order of
21 magnitude greater than the hydraulic conductivity
22 of the unweathered till and we go on to say that
23 we are using this other thing to be conservative.

24 Q. What significance the tritium
25 data has on all of this we will have to get to later



1 on, but I want to turn to what Gartner Lee had to
2 say on effective porosity in this area they studied
3 including proposed Site D in Exhibit 155, if you have
4 that handy. At page 24, there they have a summary of
5 confining layer characteristics and you will recognize
6 GL84-1 and GL84-4 as being two holes that are shown as
7 used in your calculations, shown in your cross-
8 sections?

9 A. They may be shown on our cross-
10 sections, but I don't know we used them in our
11 calculations. They drilled holes, but did not do any
12 tests to my knowledge of any sort on the wells.

13 Q. You did no calculation of porosity,
14 and there is specific methodology for determining
15 porosity but you didn't do such calculations?

16 A. Where?

17 Q. In determining effective
18 porosity at Site D?

19 A. No.

20 Q. You did no calculations. So,
21 what we see on page 24 is they have included data
22 from two boreholes actually on proposed Site D as
23 well as three others in the vicinity and you will
24 see on page 24, Table 2, there is a heading
25 Fractured Halton Till and they give an average porosity



1 of 0.0001, or one order of magnitude more or less,
2 I don't want to say which way because I don't know,
3 different than what you have used. If I take you
4 to the top of page 25 in the text it says in the last
5 sentence before 4.2.1.4, it says:

6 "The fracture porosity is considered
7 to be approximately 0.0001 and is
8 based on Desaulniers' (1981) investiga-
9 tions in similar fine-textured deposits."

10 You will agree you also referenced Desaulniers' (1981)?

11 A. That is right, and I should point
12 out again that we are talking about the Sarnia tills
13 when we talk about Desaulniers because that is where
14 his work was carried out.

15 Q. I thought you said the Sarnia
16 tills were applicable because Tricil is at Sarnia?

17 A. That is what he reports, but we
18 don't see it in monitoring and the monitoring does not
19 indicate that type of fracture porosity with high
20 groundwater velocity.

21 Q. It was Gartner Lee's opinion
22 that it would be approximately 0.0001 or 10^{-4} , putting
23 it another way?

24 A. Yes.

25 Q. I also wanted to refer you to an



1 article in the textbook published by the Royal
2 Society of Canda, 1976, entitled Glacial Till and in
3 particular at the chapter by Grissock, Cherry,
4 Vonhoff and Blumell entitled Hydrogeologic and
5 Hydrochemical properties of fractured till in the
6 interior plains region. I don't have any extra
7 copies, but I want to give you a one sentence reference
8 from that.

9 MR. LEDERER: Just a moment. I don't
10 know if this is the third or fourth time this has
11 come up, but I haven't been told about this. I haven't
12 seen it or reviewed it, I don't know if it was given
13 to Mr. Sobanski, and we will have one sentence but is it
14 in context or out of context? It would not be diffi-
15 cult it seems to me to say "Here I will refer to this."
16 We have had three months off and this is really not
17 appropriate in my respectful submission and not very
18 fair. If you are going to give this to Mr. Sobanski,
19 then I want to have the time to read it and that's not
20 unfair and entirely appropriate in the circumstnaces.

21 MR. ESTRIN: Mr. Sobanski can have all
22 the time he wants to read it, but it is not appropriate
23 I be forced to give it to him in advance because it
24 is his estimate and he has done no calculations
25 to come up with an important number, effective porosity,



1 and Gartner Lee have come up with another number and
2 I want to put to him that Dr. Cherry and others have
3 also come up with a different number than his and
4 that's what I want to put to him in one or two
5 sentences.

6 If he cares to examine the article
7 overnight and comment further tomorrow, of course he
8 is free to do that, but I don't think it is necessary
9 that we spend the time reading all the articles
10 together as he can do that tonight and come back.
11 I could say to him, and I can do it this way, but
12 I prefer to do it another way.

13 Q. Mr. Sobanski, assume that these
14 authors in this text said a reasonable estimate
15 of the average porosity of fractured till, excluding
16 inter-granular pore spaces in the till blocks
17 between the fractures is in the order of 10^{-4} ;
18 assume they said that in this text, that would be
19 .0001 which is the same number used by Gartner Lee.

20 MR. LEDERER: Assuming something is
21 in a text is meaningless. What does it mean? Assume I wrote
22 a novel last week, so what, maybe I did or didn't,
23 and maybe it is here or maybe it isn't, but with the
24 greatest of respect it is entirely appropriate
25 and entirely fair to expect Mr. Estrin to say "Here



1 is a document, I am going to refer you to, and please
2 review it" and that hasn't been done. I am asking that
3 Mr. Sobanski be given time to review it. I myself
4 don't know and maybe it is completely harmless, I have
5 no way of knowing, and it may be completely innocuous,
6 I have no way of knowing, and we have a right to know.

7 DR. KINGHAM: Are you familiar with
8 the text from previous experience to which Mr. Estrin
9 refers?

10 MR. SOBANSKI: I know of the text and
11 I know that Dr. Cherry now says the western tills,
12 the tills in Western Canada are different than the
13 eastern tills. They are different than the tills
14 of Southern Ontario and I have heard him say that.

15 DR. KINGHAM: In light of the fact
16 that we will still be questioning this witness tomorrow,
17 or cross-examining him tomorrow, is the answer to this
18 question critical now?

19 MR. ESTRIN: I would be happy to allow
20 him to comment on the article tomorrow and still
21 continue on this topic.

22 DR. KINGHAM: You can provide him a copy?

23 MR. ESTRIN: I will lend him my copy
24 overnight.

25 MR. LEDERER: I would like a copy as



1 well, and perhaps that could be arranged.

2 MR. ESTRIN: I don't have any extras
3 because I didn't intend on putting it in as an exhibit,
4 but I can if you want. If you want, I can make 15
5 copies.

6 MR. LEDERER: I don't know, I haven't
7 seen it.

8 MR. ESTRIN: Q. Let's just assume for
9 the moment that there is a factor of ten that could
10 be involved here, one order of magnitude with respect
11 to the actual number for the effective porosity.
12 Let's just assume that for the moment. If we make
13 that effective porosity number a smaller number, as
14 Gartner Lee did and add an extra zero to the right
15 of the decimal place, the result would be that the
16 velocity or the velocity in that till unit going off-
17 site of leachate would increase by a factor of 10?

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

19 Q. So instead of five years off-
20 site, it would be a half a year?

21 A. Yes, that is correct.

22 Q. That is an important number,
23 I suggest?

24 A. It is found by monitoring and
25 the trap will catch it anyway and, if it doesn't, if



1 the trap doesn't catch it, then we put in a back-up,
2 a tile drain around the site that captures it. It is
3 all taken into account by the fact that these numbers
4 are not precise. It is in the design.

5 Q. What we are talking about is
6 the potential for lateral flow through the fractured
7 zone of leachate getting into creeks, getting into
8 ponds and other similar surficial water bodies; right?

9 A. Yes, that is what we are concerned
10 with on all sites.

11 Q. But we are talking about that
12 concern relative to the speed of leachate going through
13 the upper weathered till?

14 A. Yes. Again I remind the Board
15 that this is taken into account in the design and that
16 is why you have contingencies.

17 Q. Would you turn to page 25 of
18 Exhibit M-155, the Gartner Lee report?

19 A. 25?

20 Q. Yes.

21 A. I have it.

22 Q. Under the heading of Ground Water
23 Flow Regime, they are discussing PI-1N, which I think
24 we agreed at an earlier point in time corresponded
25 to include the area of Site D?



1 A. Yes.

2 Q. They say:

3 "At Site PI-1N there is potential
4 for lateral fracture flow in the
5 saturated portion of the fractured
6 zone. Directions of flow will follow
7 the slope of the water table and flow
8 will occur along interconnected
9 fractures."

10 Stopping right there, would you agree with that based
11 on your assessment?

12 A. It could, yes.

13 Q.. Then they go on:

14 "Ground water flow in the unfractured
15 portion of the confining layer will
16 be primarily downward as vertical
17 gradients on the site substantially
18 exceed horizontal gradients."

19 And would you agree with that?

20 A. I do.

21 Q. Then they discuss the water
22 table:

23 "The water table occurs in the fractured
24 zone and its shape is generally a
25 reflection of topography."



1 "You have told us this site has a topographic high
2 on it so water drains in the shallow system more
3 or less in all directions, or two essential directions?

4 A. In accordance with the figure
5 we see, Drawing 17.

6 Q. To the west and to the east:

7 "Shallow flow within the fractured
8 zone is most active over a narrow zone
9 which occurs within 2 m of the surface..."

10 When they say within 2 metres of the surface, they
11 mean 2 metres below the surface?

12 A. I think they are drawing a lot
13 of conclusions, very specific conclusions from wells
14 that are not even on the site, but which are sort of
15 scattered around on the roadways, but they are gener-
16 alizing, I believe. They don't have the data base
17 we have on this site.

18 Q. Well then, how deep is the
19 upper fractured till on the site on average? If I
20 gave you a figure of 4 metres, does that sound about
21 right?

22 A. In our report on page 47 we
23 refer to it as extending from ground surface to an
24 approximate depth of 4 to 5 metres.

25 Q. So Gartner Lee is saying in



1 | this report that shallow flow within that fractured
2 | zone is most active over a narrow zone which occurs
3 | within 2 metres of the surface and which varies
4 | seasonally with the water table:

5 | "Since fractures and fracture flow
6 | diminish with depth, it is considered
7 | that fracturing has very little effect
8 | on the flow below depths of about 5m."

9 | Would you agree as a general statement that that
10 | is about right?

11 | A. I don't know. I don't know how
12 | they arrived at 2 metres.

13 | Q. You said the depth of the upper
14 | weathered till is what, 4 or 5 metres?

15 | A. Yes.

16 | Q. So it sounds to me -- it means
17 | that that is where the fracturing ends?

18 | A. Yes.

19 | Q. When they discuss 5 metres and
20 | say it is considered that fracturing has very little
21 | effect below depths of 5 metres, that is correspond-
22 | ing with what you are telling us at least as to the
23 | depths?

24 | A. As to that part, I don't know
25 | about most of it occurring in a narrow zone of 2



1 metres and I don't know where they arrived at that.
2 We didn't conclude that in our report and I don't know
3 how they arrived at it.

4 Q. What is your conclusion?

5 A. I have no idea, because we didn't
6 make a statement like that.

7 Q. The next sentence:

8 "Movement in the fractured zone is
9 considered to be mainly lateral
10 with rates and directions of flow
11 dependent on elevation differences in
12 the water table."

13 You would agree with that?

14 A. Yes.

15 Q. "Flow will be towards local
16 discharge areas such as drainage
17 channels (tributaries of Sixteen Mile
18 and Indian Creeks) and topographic
19 lows."

20 A. Yes.

21 Q. The next sentence...

22 A. I am not sure about the topo-
23 graphic lows.

24 Q. There are ponds?

25 A. Our data doesn't support that



1 necessarily and we are showing our discharge
2 occurring to the tributaries of the streams.

3 Q. If there happened to be lows
4 between the site and the stream, that would be a low?

5 A. I don't know. That would be a
6 low, but that doesn't mean you have groundwater
7 discharge.

8 Q. But you could?

9 A. We don't see it on ours.

10 Q. What about ponds or dug-outs?

11 A. That is just a hole in the water
12 table and it doesn't necessarily mean that anything
13 is moving toward it. It may just be moving through it.

14 Q. "Just moving through it." Then,
15 they give us a lateral flow rate average in the
16 fractured zone in metres per second which they convert
17 to -- which they estimate to be 250 metres per year
18 based on parameters noted in section 4.2.1.3 and
19 a water table gradient of .008. So, they have used
20 a gradient different than your gradient which was
21 .004?

22 A. That's right, but they have
23 no data on-site at all and they have no wells they
24 constructed, no wells whatever in any of their holes.
25 All they did was drill stratigraphic test holes and



1 they conducted no tests on the wells or on these holes
2 whatsoever. That's my understanding. How are
3 they arriving at all these numbers? There is no
4 instrumentation whatsoever in any of their holes.

5 Q. Did you use their holes for
6 anything except the stratigraphic evidence?

7 A. No. There was nothing to use.

8 Q. In any event, they have used
9 two different numbers than you used and we can come
10 back to gradients when we see the further information.

11 In any event, the concern on the topic
12 we have just been discussing is the lateral flow
13 through the upper weathered till and, depending upon
14 either changes in the gradient or changes in the
15 effective porosity, we could change the time you have
16 calculated?

17 A. That is correct, up or down.

18 Q. If the gradient was twice as
19 big, the speed of travel would be twice as big, every-
20 thing else being equal?

21 A. That is correct.

22 Q. If the porosity was one order
23 of magnitude smaller, the rate of travel would also
24 be 10 times -- no, double. It would be double.

25 A. One order of magnitude would be



1 ten times.

2 Q. Sorry, ten times. And, each
3 of those factors, a change in the gradient or a
4 change in the effective porosity, operates independently.
5 What I mean is you could have a change in one and
6 if the gradient was recalculated as being .008 and
7 double what you indicated, and the effective porosity
8 was .0001, both of those factors would be cumulative
9 and you would even get a greater travel time?

10 A. That's correct.

11 Q. Excuse me for one moment.

12 The next topic I would like to address
13 with respect to travel time is the travel time from
14 the bottom of the garbage to the top of the upper
15 granular unit, and again assuming no leachate
16 collection system in operation.

17 Now, just to review that, you agreed
18 the total time you have calculated from the bottom
19 of the garbage to the boundary of the site downward
20 and outward through these other till layers, and
21 what we are discussing is independent of travel
22 through the upper weathered till; this is another
23 pathway?

24 A. Yes, that is correct.

25 Q. The time you calculated to go



1 from the bottom of the garbage essentially through
2 the upper unweathered till to the lower till
3 to the upper granular unit and out through the UGU
4 off-site is about 60 years?

5 A. Yes.

6 Q. Really, once it hits the upper
7 granular unit it zips out in 6 to 10 years?

8 A. I wouldn't call that exactly
9 zipping.

10 Q. But comparatively speaking?

11 A. It is only 100 metres.

12 Q. These numbers were arrived
13 at through this computer simulation we discussed
14 briefly and were derived from the linear velocities
15 found in Table 10?

16 A. Yes, partially, along with the
17 other factors that go into Ogata Banks.

18 Q. I am also including or counting
19 part of that time which involves determining the
20 concentration of the contaminants, at least 10
21 per cent, so you want to find at least 10 per cent
22 at the boundary and that is the time you are reporting?

23 A. That is the breakover we have
24 selected for the breakthrough time.

25 Q. So, for example, when you use



1 chloride, for example, and you say or report a figure
2 of 60 years to get to the bottom of the landfill out
3 to 100 metres from off-site, that is the time at which
4 you calculate 150 milligrams of chloride would be
5 deposited at the boundary?

6 A. Yes.

7 Q. In other words, 10 per cent of
8 what you assume to be the 1500 parts per million
9 which started off in the landfill?

10 A. Yes.

11 Q. We are dealing with a ground-
12 water environment that already has high chloride
13 levels, and you told us that. You told us that you
14 found chloride levels that are at or sometimes beyond
15 drinking water standards?

16 A. It varies. Some of the wells
17 exceed Ministry drinking standards and some don't.

18 Q. As I say, some are almost at
19 and some are beyond?

20 A. For example, if we look at the
21 deeper observation wells in the lower till, we have
22 three wells that do not exceed Ministry standards and
23 we have one that does.

24 Q. What page are you referring to?

25 A. Page 55.



1 Q. For example, at HC5-85 and
2 where is that, by the way -- I am sorry, HC1-85?

3 A. I have the map here. HC1-85
4 is in what we could call the north-west corner of the
5 site and it had a chloride concentration of about
6 32 milligrams per litre in the lower till. HC5-85 is
7 located in the toe of the site towards the east side,
8 having a chloride concentration of about 65 milligrams
9 per litre.

10 Q. I asked you first of all about
11 HC1-85 and I believe your report indicates...

12 A. HC1-85...

13 Q. The number is shown as between
14 233 and 1030 milligrams per litre?

15 A. That is right at HC1-85, and
16 I had it backward.

17 Q. Anything over 350 is above
18 the Ministry standard?

19 A. 250.

20 Q. 250 is above the Ministry
21 standard?

22 A. Yes.

23 Q. So we are three times that
24 at the upper range of HC1-85?

25 A. The two others were okay.



1 They were fine.

2 Q. In any event, what your calcula-
3 tion of 60 years tells us is that it will take 60
4 years to deposit 150 more milligrams of chloride
5 at 100 metres off-site?

6 A. Yes, that is right and the
7 difference between lower values is not very large
8 if you look at the curves.

9 Q. Let me suggest to you that
10 where we are dealing with the groundwater regime used
11 by people where the chloride content is already
12 high, and by that I mean at or about the Ministry
13 standards, it would be prudent to take a lower
14 concentration and figure out the arrival time for
15 that in terms of determining what the appropriate
16 time interval is to determine that impact? In
17 other words, instead of taking 10 per cent of 1500
18 milligrams or parts per million of chloride and
19 figure out what the times would be for the arrival
20 of one per cent, just for the sake of looking at that --
21 or rather a 15 milligrams per litre increase -- you
22 would have a shorter period of time, is that right?

23 A. Yes, there would be a shorter
24 period of time.

25 Q. Wouldn't it be prudent and



1 cautious in this kind of situation to look at an
2 increase even in that range, given that these wells
3 are already at or above Ministry standards?

4 A. No, I don't really think that
5 is all that critical at all. What we are doing
6 is saying that left to its own devices this site
7 could create a problem, and whether the breakthrough
8 time is 40 years or 60 years is really not all that
9 critical, but the point is that you know that without
10 a control system in the site you could have a ground-
11 water problem. So you put in the control system to
12 control that and you then monitor it, and I am not
13 too concerned whether it is 40 years to breakthrough
14 time or 60 years to breakthrough time. If the
15 system fails, we have to monitor it and install the
16 back-ups when they are required. The absolute
17 breakthrough time is not that important at all and
18 all it says is that you must be cautious, and if the
19 system fails watch for contaminants and if you see
20 them increasing you won't wait 60 years to start to
21 monitor, you will start right away as soon as the
22 site goes in, the monitoring will start, and you will
23 have 20 or 30 years of background data before you
24 ever have a problem if you ever do get a problem.

25 Q. That assumes you are monitoring



1 in the right places?

2 A. Yes, it assumes you are monitoring
3 in the right places and I can assure you this site
4 will be monitored in the right places.

5 Q. That is another day and another
6 topic?

7 A. That is fine.

8 Q. If we were to go back to your
9 Table 10, and if we were to just take the sum of
10 relevant groundwater velocities found in Table 10
11 to determine the speed at which contaminants would
12 get down through these -- the upper unweathered till
13 and the lower till to the granular unit and off-site,
14 if we just took the sum of the relevant groundwater
15 velocities as you have told us they are from
16 Table 10, we have calculated that that figure, to
17 reach the upper granular unit first of all, would
18 be 81 years and -- it would be 81 years. You have
19 come up with a total of about 60 years to get
20 through the till units and out through the upper
21 granular unit, but you have applied the modelling
22 to take into account dispersivity and diffusion and
23 other things and so you have done a more realistic
24 assessment than taking the simple groundwater
25 velocity?



1 A. Than the slug flow...

2 Q. In other words, a calculation
3 using Table 10 would show a longer travel time and
4 by applying the factors that you have, you have a
5 produced a smaller but more realistic time?

6 A. We have used this information
7 and a different technique to come up with velocities
8 and concentrations based on the Ogata Banks equation.

9 Q. Well, what I would like to do
10 now is use the straightforward method of adding
11 velocities taken from Table 10 which overestimates
12 travel time, because we don't have a computer thing
13 where we can do it right here in the room, but change
14 some of the inputs with respect to the unweathered
15 upper till zone.

16 One of the important inputs if we look
17 at Table 10, but to determine the velocity downward
18 from the landfill, and are you with me on the left-
19 hand side where it says unweathered upper till and
20 now you are looking at determining the velocity
21 downward from the landfill in that unit, and one of
22 the important inputs is hydraulic conductivity; correct?

23 A. They are all important.

24 Q. But that is one of them?

25 A. They all go into the equation.



1 Q. And at page 46 of Volume 1
2 at the bottom of the page you say that the hydraulic
3 conductivity of the unfractured upper till varied
4 from 5×10^{-8} to 1.7×10^{-7} centimetres per second and the
5 geometric mean is 8.1×10^{-8} centimetres per second and you then
6 used that number essentially in Table 10 for that zone,
7 8.1×10^{-8} ?

8 A. Yes.

9 Q. At the break I told Mr. Beechinor
10 that I was going to ask -- we have taken some of
11 your other data, which we say is also hydraulic
12 conductivity measured in this same zone, and added
13 those two other values in and recalculated the geo-
14 metric mean. Before I get into that, Mr. Beechinor
15 replied, "Oh, we have back at the office a bunch of
16 data which gave us the geometric mean of 8.1×10^{-8} ."
17 If there is other data, I guess I would like to
18 know it, but if we go back to the page where this
19 is reported on in general terms, if we turn back
20 to page 46 at the bottom of the page under the
21 heading of Upper Till, it says:

22 "This unit consists mainly of clayey
23 silt to silt till textures. The hydraulic
24 conductivities of the unfractured
25 upper till varied from 5×10^{-8} to



1 1.7 x 10⁻⁷ cm/s. The geometric mean
2 is 8.1 x 10⁻⁸..."

3 I guess I am really asking if you have back in the
4 office more data and thereby you would want us to
5 now change this number?

6 MR. BEECHINOR: A. I don't understand
7 the question.

8 Q. Is there more data back at the
9 office such that you want to check that before you
10 can agree that the geometric mean is as you have
11 stated there?

12 A. Certainly I don't have any
13 difficulty in checking the data to make sure that that
14 is the case.

15 Q. But I am asking you whether
16 you are not content to say that the mean you derived
17 was 8.1?

18 A. The mean we derived was 8.1.

19 Q. But you can't tell me exactly...

20 A. What points we used, I can't.

21 Q. But you could tell me that
22 tomorrow?

23 A. Sure.

24 Q. You could tell me what the data
25 was?



1 A. Yes.

2 Q. I have a number of questions
3 related to this. I had assumed there were only
4 three data points used in the determination of the
5 geometric mean until it was suggested that perhaps
6 there may be other data points back in the office
7 and so I think I had better leave this particular
8 topic until we find out how many in fact were used.

9 There is a point I would like to make
10 with you and I think you have already seen a memo
11 I gave to you before the break called Recalculated
12 Permeability Value in the Upper Till?

13 MR. SOBANSKI: A. I have a copy.

14 Q. What I want to suggest to
15 you is that there are two values for hydraulic
16 conductivity that you yourselves have reported for
17 the unfractured upper till which lie outside the
18 range which you have reported at page 46. What
19 I am referring to are the values for hydraulic
20 conductivity in the last two numbers at the bottom,
21 HC1-85 and HC6-85, and the number of 7.9×10^{-6} and
22 2.0×10^{-7} are not in the range you have reported
23 to give us a geometric mean on page 46.

24 Start with that question and assuming
25 those are the numbers found in your report for that



1 unit, then they lie outside that range; is that
2 correct?

3 A. That is correct.

4 MR. BEECHINOR: A. If so, that is
5 the case.

6 Q. Let's see where we get those
7 numbers. Turn to Appendix 12 of Volume 2 of your
8 Site D report.

9 DR. KINGHAM: Did you say Appendix
10 12?

11 MR. ESTRIN: Appendix 12.

12 Q. The first thing I want to ask you is
13 if we have correctly copied the numbers off this
14 table for HC1-85 piezometer 3 as the number I see you
15 get -- I see you are not at the page. Would you
16 agree with me that the conductivity you have reported
17 for that unit is 7.9×10^{-6} centimetres per second?

18 MR. SOBANSKI: A. Yes.

19 Q. That number is correct or
20 correctly taken from this table?

21 A. Yes, it is.

22 Q. And HC6-85, piezometer 2, and
23 the number that you report is 2.0×10^{-7} ?

24 A. Yes, that's correct.

25 Q. Would you agree that these two



1 values were not taken into account in your
2 determination of the geometric mean of the unfractured
3 upper till?

4 A. I don't know. That is something
5 Mr. Beechinor will check.

6 MR. BEECHINOR: A. I would say that that
7 is correct.

8 Q. That is correct?

9 A. You will note the variability
10 measured in piezeometer number 3 at HCl-86 which is
11 situated -- are we talking No. 1?

12 Q. 1-85.

13 A. I should check the elevation.

14 Q. We can go to the elevation and
15 you can check that obviously, and I want you to check
16 it, but I take it ...

17 A. Just looking at the geologic
18 setting, it appears to be in the lower till but I
19 would have to check the elevation.

20 Q. Before we do that, would you
21 agree that if we take the three numbers reported
22 from the '86 boreholes on the bottom of this page
23 I am showing you, HCl-86-3, HC2-86-4, HC3-86-3,
24 that will give you the mean you reported. If you
25 take those three numbers and get the geometric mean



1 of those, that will give you 8.1×10^{-8} . It is
2 8.12 to be exact.

3 A. Maybe.

4 Q. That is something you could
5 perhaps confirm?

6 A. Yes.

7 Q. Let's go and see where we
8 have derived the other two -- where these other
9 two numbers relate in terms of the stratigraphy. This
10 is set out for you on this memo, but looking at your
11 cross-section D-D borehole 6-85 on the south right end,
12 and that's it right there, and borehole 6-85 is on
13 the right end of that section.

14 If you look for piezometer 2, you
15 will see it appears to be in the upper till ; is
16 that right?

17 MR. SOBANSKI: A. Just one second.

18 MR. BEECHINOR: A. I agree. It appears
19 to be in the upper till.

20 Q. You have gone back and checked
21 your borehole log for the actual depths where the
22 actual installation of the piezometer is shown?

23 A. Correct.

24 Q. You are confirming that that
25 piezometer is measuring in the upper unweathered till?



1 A. That is correct.

2 Q. That would be a relevant value to
3 plug into your determination of mean hydraulic
4 conductivity for that till?

5 A. It would be.

6 Q. Do you want to then look at
7 HCl-85 which you will find on section E-E on the
8 left-hand side. We are looking for borehole 1-85,
9 piezometer 3 at the left-hand side, and you would
10 agree with me that that indicates it is in the upper
11 till as well?

12 A. That's what it indicates on
13 this section.

14 Q. Do you want to check the bore-
15 hole log?

16 A. Yes.

17 MR. SOBANSKI: A. We are just having
18 a discussion here. We are looking at what the log
19 says as well and that point, which occurs at about
20 elevation 175, it says it was the clayey silt till
21 but it also says for that zone there is an increase
22 in silt and sand content, so now we are talking
23 traces of clay. Just below that unit we have called
24 the contact of sandy silt till and it could be the
25 contact has been called a bit low and in fact the



1 sandy silt till occurs a big higher at that piezometer,
2 and just based on the description above it, so we
3 have traces of clay which indicates it is not the
4 clayey silt till any longer, but rather a question
5 of where that contact which shows on the borehole
6 log at elevation 174.24 -- it may be it could be a
7 couple of metres higher than that and it would appear
8 that this particular piezometer is not constructed
9 in the clayey silt till, but perhaps in a sandy silt
10 till or a silt till, but that's just based on the
11 description.

12 Q. Let's pin that down if we could.
13 You have two appendices and if we look at the borehole
14 log for borehole 1-85 which you will find in Volume
15 2, and you have got that, you would agree with me
16 that we have an elevation marking the top of what
17 you describe as the sandy silt unit, 174.24?

18 A. That is correct.

19 Q. And you have reported the
20 elevation of the bottom of your piezometer as being
21 what?

22 A. 175.1.

23 Q. So the bottom of your piezeometer
24 is approximately one metre above what you have
25 called the sandy silt till?



1 A. Yes, that's right.

2 Q. According to your borehole
3 log it would be in the upper unweathered till?

4 A. Except when you just read the
5 description where it is, where it says increase in
6 silt and sand content and now they say with traces
7 of clay. All I am saying is that it may be question-
8 able as to whether that sandy silt tilt contact has
9 been put in the right place, and certainly from the
10 hydraulic conductivity, being nearly 10^{-5} , that is not
11 a clay till. It is too high.

12 I would suggest the contact shown on
13 here at 174.24 should in fact should have been drawn
14 higher because you are in a silt till there and that
15 is indicated both by the log and by the hydraulic
16 conductivity measured in that piezometer.

17 Q. In effect you are indicating
18 your borehole log description is really not indicative
19 of the interpretation you are now giving us and
20 you would want to draw that line higher?

21 A. I am saying the borehole log is
22 the borehole log, but it says it is sand and silt
23 there with traces of clay which is not consistent with
24 a description of sandy silt till.

25 Q. Putting it in simplistic terms,



1 | you are saying you would have to change your borehole--
2 | change the line I take it on E-E?

3 | A. You wouldn't change the line
4 | because we have also said in the report there are
5 | some sandy faces within this upper unit.

6 | Q. The unit is more variable?

7 | A. It is not extremely variable,
8 | but it has some variability in it.

3B 9 | Q. Which unit is variable?

10 | A. The upper till and it does
11 | have some sandy faces in it and that is pointed out
12 | in the text.

13 | Q. But you said within the upper
14 | till?

15 | A. We have 9 metres of the clayey
16 | silt till and I am saying to you that at about this
17 | point where the piezometer was installed, our logger
18 | noted that we are getting an increase, a significant
19 | increase in silt and sand, and he is saying he just
20 | has traces of clay, and so where do we pick this
21 | sandy silt till? It was picked at 171.24, but with
22 | that description it could have been a bit higher.

23 | Q. You seem to want to have it
24 | both ways, as I understand your evidence. You don't
25 | want to move the elevation of the unit up to coincide



1 with the reinterpretation you are giving us of this
2 log, and at the same time you insist the piezometer is
3 in that unit?

4 A. That is right. The reason we
5 are saying that is because that fine silty sand unit
6 appears to show up there as well and one could
7 interpret it as swinging a little higher if one
8 chooses, but right now we have a silty sand unit
9 also showing in this log a bit deeper down and there
10 are two ways of interpreting that and there are
11 interpretations and one is that this small sandy
12 silt unit is in fact part of the faces of the lower
13 silt till, in which case one could then swing the
14 contact a little bit higher for the clay till.
15 That is one interpretation.

16 The other interpretation is to leave
17 it as it is and we have a silty faces within the upper
18 till unit.

19 Q. In that case it would be
20 appropriate to take the hydraulic conductivity of
21 that as part of the overall hydraulic conductivity
22 of the upper till unit, correct? You wouldn't
23 want to ignore it, would you?

24 A. No, that would still be
25 consistent with the model we have done and where we



1 say the upper till would be in the order of 8 metres
2 thick. Here we are dealing with that piezometer
3 occurring at a depth of 9 metres and so this model
4 would still apply.

5 Q. Bear with me. Coming back to
6 this document headed "Recalculated Permeability
7 Value in the Upper Till" you have, I think, essentially
8 agreed that based on your own borehole logs the
9 two values from 1985 are from the upper weathered
10 till?

11 A. I am sorry.

12 Q. The two values for 1985,
13 the bottom two numbers, are in the unweathered upper
14 till?

15 A. In accordance with what is
16 shown on Drawing 9 I would say yes that is the
17 case. However, I pointed out that that permeability
18 is not indicative of a clay till and the description
19 in the logs as well indicates it is not a clay till.
20 So, there may be some question as to whether or not
21 we have interpreted the junction between the upper
22 till and the lower till correctly, No. 1, or,
23 No. 2, we may have a sandy faces of the upper till
24 within that borehole log.

25 Q. If we take that interpretation



1 and don't change section E-E, then it is simply a
2 different, it is a change but it is still part of
3 the unweathered upper till?

4 A. Yes, but I wouldn't apply that
5 permeability to it because of the description. The
6 permeability, and I am sorry, but the permeability
7 is not a clay till.

8 Q. Mr. Sobanski, you say you can
9 put it into the unweathered upper till even though
10 you would caution that it wouldn't be a value that would
11 necessarily be representative for the unweathered upper
12 till.. Is that right?

13 A. That isn't representative of the
14 unweathered upper till, no.

15 Q. But it is a value you obtained
16 for the upper unweathered till. I say to you that
17 it is only fair in assessing the geometric mean of
18 the hydraulic conductivity in the till to take that
19 number into account, and if you do that ...

20 A. I would disagree because it
21 is at the bottom of the section.

22 Q. Then I guess what you are
23 saying is that you have an upper weathered till which
24 is more variable than you have chosen to indicate
25 previously?



1 A. No, that is not true. Our text
2 mentions these kinds of zones within the unit and
3 they are not very common but they do occur.

4 Q. You don't know how common they
5 are or how extensive they are and whether they are
6 10 per cent of the till or 50 per cent or 75?

7 A. We have a pretty good idea, as
8 a matter of fact. This is probably one of the few
9 areas where we have a problem, and I would have to
10 check it, but we did mention there were some sandier
11 faces within this unit and they are mapped in the
12 logs.

13 When you deal with flow in a vertical
14 direction through tight into low permeability sedi-
15 ments, it is the tight sediments which control in
16 terms of permeability:

17 Q. Let's use the data you have
18 reported and I want you to confirm, and I don't know
19 if you have had a chance to do it, but if you determine
20 the mean of the numbers reported at the bottom of
21 this document you would get a geometric mean of 2.4
22 $\times 10^{-7}$?

23 A. That is correct, you would.

24 Q. With the discussion we have had
25 on the document, could we mark it as the next exhibit?



1 DR. KINGHAM: This is your memorandum
2 Recalculated Permeability Value.

3 MR. ESTRIN: In the upper till taken
4 from THCL data.

5 DR. KINGHAM: That would be M-161, I believe.

6 ---EXHIBIT NO. M-161: Recalculated Permeability
7 Value in the Upper Till
8 (taken from THCL data)

9 DR. KINGHAM: So, that is M-161.

10 MR. ESTRIN: Q. Mr. Sobanski, I am
11 still trying to deal with the velocities down and
12 out, from the garbage and out through the side, and
13 where is the other document that looks like this. I
14 showed you before the break another document, this
15 is Site D, Time to Reach Upper Granular Unit from
16 Landfill Base.

17 I want to take you to the first row
18 of numbers beginning on the left with 3.5 and the
19 total change in head and then go over. If we take
20 that first horizontal line of numbers, these are
21 your numbers taken from Table 10, and I think you
22 can confirm, and we have taken what you say is the
23 mean hydraulic conductivity of 8×10^{-8} in the
24 second column from the left and we have taken the
25 hydraulic conductivity for the lower till which you



1 recorded as 2×10^{-6} and we calculated the actual
2 seepage velocity of 0.086 and you have rounded that
3 off to 0.09 in Table 10 and have calculated that
4 just on that method it would take 81 years to reach
5 the upper granular unit. Those are all your numbers,
6 and really all I am asking you to do is say
7 yes you can reach that conclusion. We provided you
8 with a sheet which explains what we did and I think
9 Mr. Beechinor saw it briefly before the break?

10 MR. BEECHINOR: A. We haven't had an
11 opportunity to go through it.

12 Q. You can do that this evening,
13 but I am saying you can take the numbers, as you
14 reported them, and derive a straight linear velocity
15 to get to the upper granular unit using those
16 numbers?

17 MR. SOBANSKI: A. I would have to
18 check the numbers.

19 Q. You would have to check the
20 numbers, but these are your numbers, and it's a
21 question of using the right formula to get the number
22 of years?

23 A. Yes.

24 Q. I want to then go to the next
25 line, the second line, and the only change there is



1 to change the hydraulic conductivity in the upper
2 till from what you say is the mean to the recalculated
3 mean we just looked at in Exhibit M-161, and what
4 we have done there is simply substituted or re-
5 calculated the hydraulic conductivity for that upper
6 till, and when you get a chance tonight I would ask
7 you to check and see that that would give you 28
8 years to reach the upper granular unit and not 81.

9 You don't have to agree with that
10 tonight, but just the number and tell us tomorrow.

11 Now, the hydraulic conductivities
12 that you use in Table 10, and this is another question,
13 but they were all obtained by using the Hvorslev method
14 or slug tests, is that right?

15 A. Yes.

16 Q. As a result of pumping tests
17 you did at Site D in the upper granular unit you
18 got a range of value of about 4 orders of magnitude
19 different than the same unit tested by the Hvorslev
20 technique?

21 A. Yes, something in that order.

22 Q. You said that that is likely
23 due to problems with the Hvorslev method such as
24 smearing of the side of the hole?

25 A. The fact that Hvorslev does not



1 remove very much water and it tests the formation
2 near the borehole as opposed to a pumping test where
3 you develop a well and remove a lot of the fine
4 grained materials and consequently get a better
5 value for permeability in these types of materials.
6 You can't use pumping tests on things like tills, they
7 don't make enough water to conduct a pumping test,
8 but for the granular units in my opinion the pumping
9 tests gives you a better value.

10 Q. We are talking a difference
11 of a range of four orders of magnitude?

12 A. Yes, that's right.

13 Q. I don't even know if I could
14 think of an illustration of four orders of magnitude?

15 A. 10,000 is simple enough.

16 Q. In terms of everyday experience?

17 A. \$10,000 versus \$1.

18 Q. Instead of going 40 kilometres
19 an hour you would be going 40,000 kilometres an hour?

20 A. Yes, if you could go that fast.

21 Q. It is a difference between a
22 car and a rocketship?

23 A. No, no, no. In terms of
24 groundwater it is a lot different velocity and there
25 is no question it is. 10,000 times, and I think



1 everyone understands that.

2 Q. Let me suggest that the Hvorslev
3 method used in determining the hydraulic conductivity
4 of the unweathered upper till likely underestimates the
5 in situ hydraulic conductivity of that till by at
6 least a factor of two and possibly by more than 10.
7 I am not even suggesting you have to get over
8 one order of magnitude, but wouldn't it be fair and
9 you would like to tell me it could be at least a
10 factor of 2 and possibly more than 10?

11 A. Or lower by the same order.

12 Q. But that would be the range.

13 A. It could be lower or higher.

14 Q. The fact it was either -- either
15 way and those Hvorslev tests are very meaningful?

16 A. That may be, but we used what
17 we have and we can't apologize for that sort of thing.
18 It is standard procedure used by everyone including
19 our researchers and this is what we have to work
20 with.

21 Q. That is part of the evolving
22 science of hydrogeology. Hvorslev was back in the
23 1950's, I believe?

24 A. I am not sure, I couldn't tell
25 you; 1951.



1 Q. In any event, let's look at
2 the sensitivity of your off-site travel time down
3 through these till units and out through the upper
4 granular unit, assuming a very small, relatively
5 speaking, 3 times change in hydraulic conductivity
6 of the upper till, 3 times -- 10 times would be
7 one order of magnitude and I am not asking you to
8 go nearly that far but just a small change of 3 times?

9 A. How about 3 times less?

10 Q. If you would like to do that,
11 but I would like to discuss 3 times more.

12 A. The answer is obvious, it
13 will be 3 times faster.

14 Q. Is it? I don't know. Let's
15 look at the third line of this document and in effect
16 what we have done, you will agree, is simply multiplied
17 2.4×10^{-7} by 3 and come up with a hydraulic
18 conductivity of 7.2×10^{-7} which, as you suggest, cuts
19 by one-third in the end result the time to reach
20 the upper granular unit.

21 In other words -- well, we have
22 simply plugged in a factor of three?

23 A. I am having just a bit of
24 trouble following your numbers and our numbers, because
25 yours have changed and I am sort of wondering where



1 things are. Could you go back through the table
2 again and I would appreciate it very much.

3 Q. 7.2×10^{-7} is 3 times 2.4×10^{-7} ;
4 fair enough?

5 A. I see where you got the number.

6 Q. The next number for the hydraulic
7 conductivity of the lower till is 3 times what you
8 have reported it to be as well from Table 10 and so
9 we simply increased it?

10 A. I see.

11 Q. Which gives us a seepage
12 velocity in metres per year of .72 which allows us
13 to calculate the time to reach the upper granular
14 unit of nine years. As you say, it has cut the
15 travel time by a third from the previous one?

16 A. That's right.

17 Q. Mr. Sobanski, let's really
18 be helpful and fair to the Board. Given the results
19 of a comparison of the Hvorslev test to the pumping
20 test, when we suggest Hvorslev may be out by a factor
21 of 3 or more, it would doubtless be -- your best
22 opinion would have to be that it would be in the
23 direction of increasing the speed at which that
24 could travel through the soil. It won't decrease
25 in all likelihood?



1 A. I disagree with you. It could
2 go the other way too.

3 Q. On what basis?

4 A. Because of the lousy chemistry
5 at the site. It is not being flushed very quickly
6 and you have sulphates up in the thousands of
7 parts per million in most of these holes, even at
8 shallow depths, and because of our tritium results which
9 give us an indication of how quickly groundwater
10 is moving.

11 Q. I take it Mr. Feenstra will be
12 speaking to that, or do you want to go into that?
13 Have you done some calculations?

14 A. They are in the report.

15 Q. So you don't want to agree
16 that it could only go in one direction?

17 A. Well, what you are talking
18 about in terms of velocity and things like that also
19 applies to quantities as well in all likelihood and
20 now you are talking about moving 10 times as much
21 water downward which means instead of moving a
22 couple of inches downward you are talking of moving
23 20 inches downward and you can't do that in tight
24 till. You won't move that much water downward and
25 that would make it a sand and gravel or better.



1 Q. We haven't tried to take it
2 to a travel time or velocity that would be inordinate?

3 A. Yes, they are becoming inordinant.
4 I would have to check what I am saying to you,
5 but when you start doing this to it and given that
6 it has a certain grain size and a certain porosity,
7 it also means you are moving a lot more water and
8 you may not have enough water -- you may not have
9 enough water available to make your model work.

10 Q. You have told us before, that
11 you don't know with certainty what the effective
12 porosity is?

13 A. We have quite a good idea in
14 the massive till that it will be in the order of
15 20 or 25 per cent, and in the materials that are not
16 fractured, what you are talking about here, we have
17 an idea of that porosity within a reasonable
18 tolerance. If you are going to increase these
19 velocities you will have to give me a lot more
20 water than is available out there and we are talking
21 sand and gravel infiltration and not till infiltra-
22 tion.

23 Q. Perhaps you will have more
24 water after you develop your mound?

25 A. I would suggest we won't have a



1 high water table out there at all if we have the
2 types of infiltration you are talking about.

3 Q. We will get into that topic in
4 some detail I guess. You haven't done any calculations
5 to determine how much water could move?

6 A. Yes.

7 Q. Are they in here?

8 A. They are in the report.

9 Q. Where would I find them?

10 A. They are in the water balance.

11 Q. I am saying that you haven't
12 had the opportunity to take these velocities and
13 determine whether or not there is enough water to
14 in fact travel at these rates?

15 A. That's right.

16 Q. Would you like to do that
17 overnight?

18 A. I can do that, yes, and it
19 would be far more than you would put into a till
20 though, I am sure.

21 Q. A somewhat variable till, as
22 we are finding?

23 A. All earth materials have some
24 variations in them. We are not laying down a
25 sheet of glass or a piece of stainless steel here.



1 Q. The other thing we haven't
2 discussed from this page is the time to move through
3 the upper granular unit to the site boundary. If
4 you look at the bottom of the page, ignore the
5 middle part on mounding after leachate, and in the
6 middle of the page the time to move through the UGU
7 to the site boundary. What we have done here is
8 the gradient in the upper granular unit, if you
9 go down from the word gradient and UGU, we have taken
10 your value of .001 and we are assuming your
11 hydraulic conductivity of 8×10^{-3} and at page 99,
12 and that should be page 99 and not page 89 ...

13 A. I am having a bit of trouble.
14 The first number you gave me -- we are into this
15 mounding after leachate collection tiles...

16 Q. Skip that and move to the
17 bottom part, Time to Move Through UGU To Site
18 Boundary.

19 A. Yes.

20 Q. The left-hand side in the
21 first line below the word gradient, we are using
22 your gradient for this unit, your .001, and taking
23 your hydraulic conductivity, moving to the right
24 or to the middle of 8×10^{-3} and you have reported
25 that when you run that through your model at page 99,



1 and that should be 99 instead of 89, but the time
2 to get through the UGU on these assumptions is
3 6 to 10 years, and I am just reporting your own
4 data?

5 A. Yes.

6 Q. So, that is what we have done
7 there. In Table 10 we see you use this value of
8 8×10^{-3} and a gradient of .001. What I want to suggest
9 to you is that you also determined a more accurate
10 value for the hydraulic conductivity in the upper
11 granular unit through your pumping test and that
12 that number that you determined is 1.2×10^{-2} .

13 This, gentlemen, is a function of how
14 thick the unit is within which you were doing your
15 pumping test. Let me tell you about where we
16 got the number and you can check it out overnight,
17 okay? If you look in Appendix 10, Volume 2, the
18 fourth and fifth pages, I would like to ask you
19 about that.

20 There is a certain formula set out.

21 A. Could you give me a second
22 as it takes time.

23 Q. There is a formula that is set
24 out.

25 A. Mr. Beechinor is more familiar



1 with this table, so let me give it to him.

2 Q. I am asking him to look at
3 Appendix 10, Volume 2 about the fourth or fifth page
4 in and one is entitled The Theis Type Curve Solution and
5 the other is the Jacob Approximation, and in both
6 of those, in the formula you used, you have a value
7 for B, which I assume is the aquifer thickness.

8 MR. BEECHINOR: A. That is correct.

9 Q. In both of those you assumed
10 an aquifer thickness of 3.0 metres for B?

11 A. Three metres.

12 Q. Your hydraulic conductivity
13 is calculated from T, transmissivity, by dividing
14 by B, is that right, and K is equal to T over B?

15 A. That is right.

16 Q. Can you turn to borehole log
17 2-85 and would you agree with me, and I can give you
18 the elevations, but the upper granular unit extends
19 from 173.57 metres to 171.47 metres. That is
20 beginning at the bottom of the first page which says
21 sandy gravel and continuing to the top of the next
22 page to 171.47.

23 Does that correspond to the upper
24 granular unit in that hole?

25 MR. SOBANSKI: Just one moment, please.



1 DR. KINGHAM: I wonder if we have
2 enough things for these witnesses to check tonight.
3 Could they continue the check of this document based
4 on the information that is now in it or is there
5 something further you have to transmit to them?

6 MR. ESTRIN: I am not sure what time
7 the Board would like to rise.

8 DR. KINGHAM: We are thinking of
9 rising.

10 MR. ESTRIN: They could certainly check
11 that overnight, but possibly I could conclude.

12 Q. Does borehole log 2-85 not
13 tell us where the upper granular unit is?

14 MR. SOBANSKI: A. This is an observa-
15 tion well and it depends on what the pumping log
16 says and that is what we want to check because that
17 is what we used for the curve. You will recall
18 at this location we felt there was a boundary condition
19 coming into effect because of the thickness of the
20 unit and we knew there were nearby wells that
21 didn't have the unit at all, so we did some analysis
22 here to find out where that boundary was.

23 Q. I don't want to hold the Board
24 up, but I would be interested if at least you can
25 tell us what else it is you are checking and then



1 perhaps we can leave it.

2 MR. BEECHINOR: A. We are checking
3 to see if the information is in the interrogatories.

4 MR. ESTRIN: We can leave it there,
5 Mr. Chairman.

6 DR. KINGHAM: Just so we are clear,
7 the question you are asking is whether the thickness
8 of 2.1 versus 3 is a reasonable assumption, and you
9 are looking for some way that that can be answered
10 for tomorrow along with all of the other questions?

11 MR. ESTRIN: Right.

12 DR. KINGHAM: Before we do leave it,
13 I would like to ask the indulgence of all of you,
14 I guess, but where you have a question that you think
15 can be answered simply without prejudicing your
16 case, is there some way in which those simple questions
17 can be got into play earlier on in the proceedings?

18 I am thinking in particular about
19 your question about two values which you thought
20 were values that would fall into the upper till and
21 is it simply a matter of verifying whether certain
22 piezometers are in that and is there some way of
23 doing that without prejudicing the case because it
24 might save us a great deal of time and make the
25 hearing flow a lot smoother.



1 MR. ESTRIN: I will certainly attempt
2 to do that where it can be done in a manner that
3 does not prejudice the opinion being given.

4 DR. KINGHAM: With the witnesses
5 having quite a roster of homework, I guess we
6 will adjourn now and resume tomorrow as soon after
7 ten o'clock as we can.

8 MR. LEDERER: Thank you, sir, I
9 appreciate that.

10
11 ---Adjournment at 4:30 p.m.

12
13
14 Certified Correct

15
16 
17 C. F. Nethercut, C.V.R.

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25 (Page 5900 follows)