

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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OFFICIAL REPORTERS
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BEFORE: Dr. D.J. Kingham - Acting Chairman
H.H. Lancaster, Q.C. - Member
S. Tanner - Member



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Hearing conducted at The Oakville
Granary Commercial Centre, 105 Robinson
Street, Oakville, Ontario, on
Tuesday, September 15, 1987

VOLUME 28

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



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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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Per: C. F. Nethercut, C.V.R.



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Oakville, Ontario
September 15, 1987

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

2 DR. KINGHAM: Thank you. Please be seated.

3 ALFRED A. SOBANSKI, (resumed):

4 JAMES BEECHINOR, (resumed):

5 DR. KINGHAM: I think we will wait for
6 just a minute.

7 MR. ESTRIN: Yes.

8 DR. KINGHAM: I guess we are ready to
9 proceed.

10 CROSS-EXAMINATION BY MR. ESTRIN, (continued):

11 Q. Yesterday, gentlemen, we were
12 discussing a document which I think you might still have
13 handy, and if you don't please get it out and it hasn't
14 been marked an exhibit, Site D, time to reach upper
15 granular unit from landfill base.

16 DR. KINGHAM: Would you like to mark that
17 as an exhibit?

18 MR. ESTRIN: Yes.

19 DR. KINGHAM: M-162.

20 --- EXHIBIT NO. M-162: Document entitled "Site D, time
21 to reach upper granular unit
from landfill base"

22 MR. ESTRIN: Q. I have one further
23 copy available. Now, Mr. Sobanski, you had a comment
24 relative to some of the calculations on here. You looked
25 at the third line of numbers and there is a subheading



1 before mounding under water table without collection
2 system operating, and do you have the document?

3 MR. SOBANSKI: A. I'm sorry, I'm looking
4 for a microphone here.

5 Q. You recall that when we were
6 discussing these calculations yesterday, in the third
7 line, and in particular which obtained an advective
8 velocity time of nine years to reach the upper granular
9 unit from the landfill base under the assumptions set out
10 on the left of nine years, and is that where we are at?

11 A. You are in the second one of the
12 first set of information.

13 Q. Really the third line?

14 A. The third line, 7.2×10^{-7} .

15 Q. And we get a downward seepage
16 velocity of 7.2 and a time to reach the UGU of nine years
17 by advective velocity?

18 A. I looked at it.

19 Q. Yesterday I think you reacted and
20 maybe speculated that there was not enough water to get
21 down to the upper granular unit if the downward seepage
22 velocity was 7.2. Have you had an opportunity or have
23 you done any calculation as to how much water would be
24 available?

25 A. I have. I have looked at this, and



1 given the parameters that are outlined in this table I
2 am satisfied with these calculations, that they would
3 indicate these higher velocities. In terms of the
4 overall, I point out, however, that I feel our numbers are
5 better and they are supported by the tritium data which
6 has been obtained on the site and certainly we would
7 consider the upper calculation to be the more accurate.
8 However, as I said yesterday, if other models are pre-
9 sented, they are certainly there for the Board's
10 consideration.

11 Q. In answer to my specific question
12 you are now, I take it, satisfied that assuming that down-
13 ward seepage velocity, there would be sufficient water to
14 go with that?

15 A. It would amount to infiltrating
16 something in the order of eight inches a year. We could
17 -- we might be able to get that much through the cover
18 material, given that this is a failed condition with a
19 mound developed within the landfill itself. So, when we
20 use, going back to the table we had, Table 10 I believe,
21 where you see a gradient of 0.85, this is considering a
22 failed system and in fact the gradient is considerably
23 less under normal conditions but it would indicate
24 mounding within the fill itself and with the liquid
25 level building up in which case we would now come down



1 to lower periods of time, whether it is nine years or 28
2 years, and depending on how far we want to push numbers
3 and to whose advantage. Again I must point out in this
4 case that there isn't a great problem with knowing that
5 there is mounding going on within the fill and there are
6 numerous manholes in the area and we would know whether
7 or not the hydraulic trap is working, and given the design
8 and the calculation, if the hydraulic trap doesn't work
9 properly, in time we may have to put in a back-up system.
10 Monitoring of course is something that is carried out
11 semi-annually and sometimes quarterly, and whether the
12 number is reached and whether it is 81 years to arrival
13 to the lower zone or whether it is 28 years or nine years,
14 first of all the leachate system won't fail overnight and
15 it won't fail the first day it's put in, but it would fail
16 after many years perhaps. Then we have, even in that
17 case, time to prepare in the event that there were to be
18 a failure.

19 Q. Just to remind ourselves of the
20 numbers, we have set out the time to reach the UGU on
21 Exhibit 162 and these are all simply advective velocities
22 and not reduced by the further factors of dispersion?

23 A. That is correct, yes.

24 Q. The topic I think we sort of ended
25 on yesterday was you had a hydraulic conductivity or used



1 a hydraulic conductivity of 8.0×10^{-3} using the pumping
2 test results for the upper granular unit, and I asked
3 you yesterday about how thick the aquifer was at that
4 time.

5 A. Mr. Beechinor looked into this last
6 night so I will let him respond to that.

7 Q. At that location.

8 MR. BEECHINOR: A. Well, if you recall we
9 chose a location to conduct our pumping tests where the
10 granular unit was the thickest and coarsest. I have with
11 me the original driller's log and it indicates that eight
12 feet of screen was set for that pumping test and it shows
13 about seven or eight feet of sand and the drillers did
14 not penetrate any further through the sand other than
15 seven or eight feet and I would expect that the sand
16 continues up to approximately ten feet and consequently
17 we used three metres as the aquifer thickness at that
18 point in our calculation.

19 Q. Let me see the well record. Can we
20 look -- we looked at borehole 2-85 and there you had the
21 upper granular unit extending from 173.57 to 174.47 or
22 2.1 metres; right?

23 A. That is right. I checked that last
24 night.

25 Q. Where was the pump test hole in



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Sobanski, Beechinor,
cr-ex (Estrin)

1 relation to borehole 2-85?

2 A. There is a borehole in one of the
3 interrogatories and it's east of drilling site HC 2-85.

4 Q. How far approximately?

5 A. I believe it is ten metres or
6 something like that and we can check the interrogatory.

7 Q. Can we get up the plan that shows
8 where HC 2-85 is?

9 A. I think we can see it on this one,
10 Drawing 18. This is 2-85 and it's difficult to visualize
11 the distance between the two wells at this scale as they
12 look very close.

13 Q. Put your finger on 2-85.

14 A. Two-eight-five is here and pumping
15 well No. 2 is just east of that location.

16 Q. Now, your drilling log 2-85, if I
17 can just start with that, is that a continuous core?

18 A. No, it's not.

19 Q. So, what was ...

20 A. I'm sorry, 2-85 is a continuous log.

21 Q. You have a continuous log, so I take
22 it someone in your firm actually looked at the continuous
23 core sample as it came out of the ground; is that correct?

24 A. That's right.

25 Q. Someone in your firm has come to



1 the professional opinion that the upper granular unit
2 extends from 173.57 to 174.47?

3 A. That is correct.

4 Q. Now, you drill a hole or someone
5 drills a hole a few metres away from that and now how
6 deep is this unit?

7 A. Well, the thickness of the unit
8 according to the driller's log and the sample as well is
9 in the order -- it's at least seven feet thick and it
10 could be thicker.

11 Q. Have you an extra copy of the log
12 here?

13 A. I don't, that's the original.

14 Q. Are you looking at another ...

15 A. I have another one.

16 Q. That is what I mean.

17 A. Okay.

18 Q. Do we have a copy? I wonder if I
19 could give the Board the original copy just to look at
20 for a moment and we can make copies, but I see I do happen
21 to have a copy.

22 MR. McQUAID: Are you going to produce it?

23 MR. ESTRIN: I didn't know he was going to
24 produce it. I will undertake to make copies at the break.

25 MR. LEDERER: With the greatest of respect,



1 that's not good enough. I would like to see what the
2 witness is referring to. I have a job to do which is,
3 apart from everything else at this stage, to protect the
4 witness and make sure he is not being misled, and I can't
5 do that without the document. It does strike me as it
6 appears to Mr. McQuaid it is a bit surprising if
7 Mr. Estrin had the document that he did not produce it
8 or at least have copies ready.

9 MR. ESTRIN: This is a document your
10 witness produced to justify an answer to a question that
11 arose yesterday, and it seems to me that if he was going
12 to refer to it he could equally anticipate the need to
13 have copies. Shall we have an adjournment while we make
14 copies? We were quite prepared to go with the document
15 they were referring to, 2-85, but they wanted to challenge
16 their own document.

17 DR. KINGHAM: Could we get a copy made of
18 this quickly or the necessary number of copies and we can
19 just stand by?

20 MR. ESTRIN: Q. While we are waiting for
21 that, tell me, please, who drilled this well that is
22 referred to in the Ministry of the Environment log?

23 MR. BEECHINOR: A. A firm called
24 O'Connor Welldrilling Limited.

25 Q. What equipment did they use?



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Sobanski, Beechinor,
cr-ex (Estrin)

1 A. A cable tool.

2 Q. What kind of sampling did they do?

3 A. They sampled every, if I recall
4 they sampled every two feet.

5 Q. When you say "recall", were you
6 there?

7 A. Yes.

8 Q. Did you make any notes?

9 A. I think I relied on the driller to
10 prepare the log and I looked at the samples to see whether
11 or not his logging was accurate and we concurred and then
12 he prepared the log.

13 Q. You sampled every two feet; is that
14 right?

15 A. That's my recollection.

16 Q. How much of a sample every two feet?

17 A. It would be more or less -- he would
18 get a handful of soil from the cable tool.

19 Q. What was the technique for collect-
20 ing the samples, was it by hand?

21 A. Yes.

22 Q. You would agree with me that that
23 method of sampling and analysis is far less sophisticated
24 than what you used in your continuous coring?

25 A. Yes.



1 Q. Forgetting this particular issue,
2 which kind of sample is more accurate, continuous where
3 you get everything that is there essentially?

4 A. That is more accurate.

5 Q. So, which do you want to go with?

6 A. Given that it is a different
7 location, I will go with the driller's log.

8 Q. Okay. How much sand have we got?

9 A. At least seven feet.

10 Q. And as much as?

11 A. It could be as much, as I would
12 estimate up to ten feet, and that's why we use that number.

13 Q. Based on that kind of sample. So,
14 first of all we can draw the conclusion that the upper
15 granular unit has now been extended by a factor of 33
16 per cent at that location in its depth, if you want to go
17 with ten feet?

18 A. As opposed to what?

19 Q. As opposed to two metres.

20 A. As opposed to two metres?

21 Q. Right. You have now increased the
22 depth of the upper granular unit by 33 per cent.

23 A. At that location.

24 Q. How many feet away from borehole

25 2-85?



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Sobanski, Beechinor,
cr-ex (Estrin)

1 A. We have got the interrogatory and
2 it indicates that the pumping well 2 is three metres from
3 HC 2-85 and the second pumping well, OW-2, is 12.19 metres
4 from HC 2-85.

5 Q. The record you provided is which
6 pumping well?

7 A. It is pumping well 2.

8 Q. So the distance again?

9 A. It's three metres.

10 Q. Three metres?

11 A. Right.

12 Q. From borehole 2-85?

13 A. That's right.

14 Q. Twenty-one or 22 feet?

15 A. Ten feet.

16 Q. I'm sorry. Ten feet away. Ten
17 feet away from borehole 2-85, and you are telling us that
18 the upper granular unit has now increased in its depth
19 by 33 per cent?

20 A. I'm telling you what is there and
21 what we saw.

22 Q. That is the conclusion we can draw
23 from that?

24 A. From the data.

25 Q. Yes. Interesting. Now, have we got



1 the copies?

2 DR. KINGHAM: We will mark this as M-163.

3 --- EXHIBIT NO. M-163: Water Well Record

4 MR. ESTRIN: Q. Let's look at this water
5 well record. This was prepared by a private welldriller
6 and you just told us that and it's simply recorded on
7 MOE stationery because that is required by law; right?

8 MR. BEECHINOR: A. That is right.

9 Q. The area of concern and interest is
10 beginning at 34 feet..

11 A. Well, if you note -- not necessarily,
12 because if you note on the left-hand margin under the
13 column that says "Most Common Material," at 20 feet the
14 sand starts and so using that information and subtracting
15 41 from 20 it could be thicker than the seven I have
16 indicated.

17 Q. Perhaps we could have 20 feet of
18 sand and is that what you are saying?

19 A. There is a unit there that the
20 driller has described as a unit with predominantly sand
21 and, to a lesser extent, clay.

22 Q. Mr. Beechinor and Mr. Sobanski, I
23 want your best professional opinion. Is that the upper
24 granular unit starting at 20 feet and, if not, what is
25 it?



1 A. I would think likely it's not. I
2 would think that the driller in that case probably des-
3 cribed a sandier phase of the upper till. It's the upper
4 till, I would suggest.

5 Q. So that is a sandier phase of the
6 upper till in that other borehole that Mr. Sobanski said
7 really wasn't representative of the upper till in that
8 case; is that right?

9 A. It could be.

10 Q. We have another indication of that
11 sandier phase of the upper till; is that right?

12 A. It's possible.

13 Q. It becomes even more relevant to
14 include that value from HC -- from borehole 1-85 where
15 we found there to be -- in calculating the geometric
16 mean of the upper unweathered unit, and now we get con-
17 firmation from this that in fact sandier phases exist in
18 more than one location; correct?

19 A. Well, based on our drilling out
20 there, and I saw many of the cores and I was out there
21 throughout much of the drilling, the dominant texture of
22 that upper till is a silty or a clay silt till. There
23 are incidents of siltier phases or phases in that upper
24 till, but in no way would I suggest that they predominate
25 or dominate or are significant within that upper till.



1 Q. Let's just deal with that. If we
2 come back to the document that was marked yesterday as
3 Exhibit M-161, you were taking issue with one of those
4 holes as being in the unweathered upper unit, but assuming
5 it was, that would represent 20 per cent of all the data
6 that you have on that unit. It would tell us that out of
7 five holes, one showed that unit at that location and now
8 we get another ...

9 A. You would have to think about the
10 thickness of those various locations and do it on a per-
11 centage basis.

12 Q. The number of locations that you
13 sampled and you found it in 20 per cent, or one out of
14 five; right?

15 A. We found ...

16 Q. ... a sandier phase of the un-
17 weathered upper till?

18 A. Over a distance of 100 feet if you
19 find one foot of a siltier phase of the upper till, I
20 wouldn't call that significant.

21 Q. I'm not asking about significant, but
22 I am saying that that represents a 20 per cent factor, you
23 found it in one out of five holes. Now we find another
24 hole on this MOE log and we find it again, and what is the
25 percentage now, it's two out of six or 33 per cent; one



1 out of three holes finds it and what if we sampled more?

2 A. Well, as I say, you can find sandier
3 silt phases in the upper till and if you calculate the
4 thicknesses of those units over, say, the five sampling
5 locations and compare that to the thickness of the silty
6 clay or clayey silt texture units, it would be a very
7 small proportion of the overburden texture of the upper
8 till.

9 Q. The fact is that your own sampling
10 has now found it in 33 per cent -- one-third of the holes
11 you sampled in that unit; fair enough? I am not talking
12 about the extent in the hole, but the number of holes in
13 which it was.

14 A. I don't see to what point your
15 point is relevant.

16 Q. You have excluded borehole 1-85
17 from calculating the geometric mean of the upper un-
18 weathered till and that's why I say it is relevant to you.

19 A. I wanted to review -- in addition --
20 that is right, but Mr. Sobanski points out that there are
21 more than five or six holes on the site.

22 Q. I'm not saying that there aren't.

23 A. Yes, you are.

24 Q. In the unweathered upper granular
25 unit it's only in five holes you tried to obtain



1 hydraulic conductivities through piezometers in that
2 unit and there are more holes and, if so, let's know
3 about them. You only included three and we have told
4 about two more we thought ought to be in there and you
5 agreed on one and we are only debating the fifth one and
6 now do you want to suggest there are even more holes we
7 should consider?

8 A. I would agree. For determining
9 hydraulic conductivity in that unit we have used the data
10 that you discuss.

11 Q. The problem yesterday was that one
12 of you at least was suggesting that HC 1-85 should not
13 be included in the geometric mean because it really wasn't
14 representative of that unit.

15 A. That's right and it is not.

16 Q. In your opinion?

17 A. That's right.

18 Q. Okay. Let's go back to M-163,
19 the water well record. Now, we have sand between 20 and
20 40 feet at this location.

21 A. Well, let's clarify that, all right?

22 Q. That is more than three metres.
23 It's more than six metres.

24 A. There is a unit described by the
25 driller that has more sand than clay and when the driller



1 sets the screen he sets the screen in the permeable unit,
2 and the permeable unit at that drilling site was a medium
3 sand to a coarse sand. That began or that unit began,
4 which we denote the upper granular unit, that unit began
5 I believe -- I am missing the log here for a moment, the
6 driller's log. Anyway, that unit started ten metres
7 below ground surface.

8 Q. The screen was set at the depth
9 to the top of the screen and is that what you are looking
10 at, 32 feet?

11 A. That is right. That is where I
12 would suggest that the top of the upper granular unit is,
13 32 feet below ground surface. Now, that is not to say
14 that, as this log points out, that there isn't a slightly
15 sandier phases in the till above the upper granular unit,
16 and that appears to be the case and I can't dispute that,
17 that's what the log says, but the unit we described as
18 being the upper granular unit starts where the top of
19 the screen is.

20 Q. Thirty-two feet?

21 A. Thirty-two point eight feet.

22 Q. Thirty-three feet more or less?

23 A. Which is about ten metres below
24 ground surface.

25 Q. Okay. How do you know exactly what



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1 depth, you say 32.8.

2 A. Well, I just did a calculation, but
3 I would say 32 feet.

4 Q. You said 32.8, so tell me how you
5 got that.

6 A. That was a conversion because I
7 knew it was ten metres below ground surface and I did a
8 conversion.

9 Q. You measured the depth of the hole
10 or are you going from some report of the ground surface,
11 the elevation? Was the hole measured?

12 A. The hole was measured.

13 Q. At that time?

14 A. Yes.

15 Q. Who measured it?

16 A. The driller.

17 Q. Were you there when he measured it?

18 A. Yes.

19 Q. How did he measure it?

20 A. With a sounding line.

21 Q. Which is what?

22 A. It is a measuring tape that is
23 graduated in feet or metres.

24 Q. So, 32.8 metres is where it begins?

25 A. What it says here is the top of the



1 screen is 32 feet and that's where it begins.

2 Q. What is 32.8?

3 A. Thirty-two point eight was just a
4 quick conversion I made without checking what was on the
5 log.

6 Q. Okay. Let's go with 32 feet. It's
7 32 feet to what-- is it to 40 feet?

8 A. At least 41 feet.

9 Q. At least to 41 feet? Why? You are
10 now talking predominantly clay and do you want to include
11 that in your upper granular unit?

12 A. Sorry, that's right.

13 Q. Thirty-two to 40 feet.

14 A. We set the screen at 32 feet and
15 the screen is eight feet long which takes it to 40 feet.

16 Q. But how long was the length of the
17 screen?

18 A. Eight feet.

19 Q. So you don't know exactly where the
20 sand begins below the top of the screen?

21 A. When a driller installs a screen,
22 he sets the screen in the best formation.

23 Q. It could be out?

24 A. It could be out inches, in that
25 range, but I would say the top of the granular unit at



1 that location is 32 feet.

2 Q. Let's go with eight feet. How many
3 metres is that?

4 A. It's under three. It's about two
5 and a half.

6 Q. Two point four. So, that is what
7 I was getting at yesterday. You used three in calculating
8 the hydraulic conductivity from that pumping test and it
9 came out to 8.0×10^{-3} ?

10 A. That's right.

11 Q. I was suggesting it was really 2.1
12 metres thick based on what you said is a more accurate
13 way of observing a continuous coring. So, let's take
14 that for a moment. If we take 2.1 metres thick as being
15 the UGU at borehole 2-85, then all the hydraulic conduc-
16 tivity values given on page 46, Table 6 of Volume 1, will
17 be increased by approximately 42 or 43 per cent?

18 A. They would be increased, but I would
19 have to check to see what it is exactly.

20 Q. I would suggest the increase would
21 be 42 or 43 per cent and almost a half an order of
22 magnitude.

23 A. Yes.

24 MR. SOBANSKI: A. Half an order of magni-
25 tude is ten times.



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1 Q. It is?

2 A. I'm sorry, half an order of magni-
3 tude is five times.

4 Q. I said almost a half an order of
5 magnitude.

6 A. One-third.

7 Q. Forty-two to 43 per cent.

8 A. That's wrong. It's not the same as
9 orders of magnitude.

10 Q. Would you agree that the change
11 would represent a 42 or 43 per cent change or increase?

12 MR. BEECHINOR: A. Yes.

13 Q. Okay. Let's go back ...

14 A. But I prefaced this-- you will
15 recall I prefaced the situation. When we located that
16 test site for the pumping test, we chose what we
17 considered to be the thickest zone of upper granular
18 unit and the coarsest zone of upper granular unit we
19 could find on the site, and in that sense we have con-
20 ducted a pumping test in what we considered the most
21 permeable area and the most extensive area of the upper
22 granular unit.

23 Q. Maybe you were just lucky. How
24 did you know that that was the thickest unit?

25 A. We had done significant test



1 drilling on that site before we had decided to do that
2 pumping test at that location.

3 Q. And if you moved a few metres away
4 what else would you find?

5 A. I think our interpretation in the
6 report shows what we would find. To the west the granular
7 unit diminishes in thickness and there is a boundary
8 condition to the east of the pumping test.

9 Q. Let's come back to that value from
10 page 46 of your report. The geometric mean of the upper
11 granular unit you have given as 8.2×10^{-3} ?

12 A. That is right.

13 Q. You got that based on a three-metre
14 thickness and if you go to the 2.1-metre thickness that
15 your very accurate continuous coring shows exists there,
16 we can increase the conductivity by 42 to 43 per cent at
17 that location.

18 A. The thickness of the upper granular
19 unit is indicated to be 2.1 metres at HC 2-85 which seems
20 to be, based on the driller's log, thicker where the actual
21 pumping well is located.

22 Q. Well, even a little bit thicker,
23 2.1 to 2.4?

24 A. That's right.

25 Q. But less than three?



1 A. That is correct.

2 Q. Let's go with the difference between
3 8.2×10^{-3} and what a 42 per cent change using your 2.1
4 number at borehole 2-85 would indicate. I suggest it's
5 a hydraulic conductivity of 4.2×10^{-2} which is the
6 number you will find we have used on the document, Exhibit
7 M-162, in the bottom right-hand corner where under the sub-
8 heading "Time to move through the UGU to site boundary,
9 hydraulic conductivity" and on the left we have your
10 mean of 8×10^{-3} but on the right we have put 1×10^{-2}
11 which is a 43 per cent increase, and you see why we have
12 chosen to put that there?

13 A. Yes.

14 Q. Now then you calculated, looking
15 at Exhibit M-162, that using your gradient of 0.001 it
16 would take six to ten years to go through the UGU?

17 A. That's right.

18 Q. And, if we make a 42 per cent
19 change in that number, I suggest the range would be 47
20 years.

21 A. Very well.

22 Q. So you understand where we get 47?
23 We can discuss the other matter in a moment. Okay.
24 Let's go to that. The other assumption we have added in
25 is changing the gradient to 0.0035, and actually I think



1 you have just given us some new data on that, so rather
2 than doing that I would like to examine your data first.

3 A. I would point out that at the three
4 data points we determined the gradient in the upper unit,
5 they were all 0.001.

6 Q. You are now looking at your sort of
7 raw calculations?

8 A. That's right.

9 Q. What were those data points?

10 A. The gradients between 3-86 and 4-85
11 and the gradients between 4-85 and 1-86 and the gradients
12 between 2-85 and 2-86.

13 Q. Could you repeat those?

14 A. The gradients between 3-86 and 4-85
15 and 4-85 and 1-86 and the gradients between 2-85 and 2-86
16 and in all cases that lateral gradient was 0.001 and we
17 have no basis, in my opinion, to go to something else.

18 Q. As soon as we have had a chance to
19 examine your data we will come back to this. I guess I
20 can do this. Now, in order not to lose the thrust where
21 we are ending up, even though we will have to come back
22 and discuss the specifics of the changing gradient, but
23 referring to M-162, let's assume for the moment we can
24 demonstrate the gradient in the upper granular unit as
25 0.0035 and assume that without agreeing for a moment, but



1 I simply want to ask you if you would then agree that
2 the hydraulic conductivity values would be in the order
3 indicated and the travel times would be in the order
4 indicated at the two different hydraulic conductivities,
5 8×10^{-3} in less than three to four years and under $1.2 \times$
6 10^{-2} less than four years and that those numbers have not
7 had applied to them any further reduction for diffusion
8 or dispersion, but it's a straight mathematical conversion.

9 A. I understand that.

10 Q. As I understand it, you are dividing
11 the previous results by 3.5?

12 MR. SOBANSKI: A. These numbers on your
13 paper aren't quite right but they are close. They are
14 a little bit on the high side.

15 Q. It's less than ...

16 A. Less than 3.4 is a fairly precise
17 number.

18 Q. We'll take less than three, that's
19 fine.

20 A. For example, in that case it would
21 be ten divided by 3.5 which is 2.9.

22 Q. We were trying to be conservative
23 in this context so it's a sort of opposite approach I
24 appreciate, but we haven't tried to take it down to the
25 extreme number. But based on mathematics and with that



1 assumption, you would agree that that is a number that
2 could be obtained and without any accounting for further
3 diffusion or dispersion at that rate which probably would
4 be somewhat minimal because we are dealing with rapid
5 movement. Okay, we'll come back to that after you have
6 had a chance to look at the gradient data. The end
7 result is, gentlemen, still looking at Exhibit M-162, if
8 we start with the time to reach the upper granular unit,
9 and going back up the page under a hydraulic conductivity
10 of 7.2×10^{-7} and a revised geometric mean increased by
11 a factor of three, you have told us -- I'm sorry ...

12 A. I'm sorry, I didn't like the way
13 you put that, you said my revision.

14 Q. The revision to your geometric mean
15 based on your data increased by a factor of three.

16 A. That's the same thing again.

17 Q. And it gave us an advective velocity
18 downward to the top of the UGU of nine years and that has
19 not yet been reduced by diffusion or dispersion which
20 would increase the time of it. Take that number and you
21 can add it to one of the numbers at the bottom of the
22 page, time to move through the UGU to the site boundary
23 for the total travel time and if you add nine, for example,
24 and 2.4 which are both advective numbers you get 11.4 as
25 the time it would take using simply advective velocities



1 or probably less than ten years if you applied the
2 diffusion and dispersion. Is that fair enough?

3 A. That is what these numbers calculate
4 or measure.

5 Q. So what we have here is a number
6 of ten years or perhaps a little less to compare to your
7 60 years which you have used for that travel time. That
8 is what these numbers compare to?

9 A. Yes. We feel that our figures are
10 valid.

11 Q. Let's turn to another topic, the
12 hydraulic trap. Mr. Sobanski, have you tried to calcu-
13 late the volume of leachate that would be collected in
14 each year by your hydraulic trap over the lifetime that
15 the trap would have to operate?

16 A. No, I haven't.

17 Q. How difficult a calculation is it?

18 A. It would take some time as there
19 are various sources for water within the system.

20 Q. And there are also other variables
21 as to how much water would end up being collected by the
22 leachate collection system within a year. For example,
23 one of those variables, I would suggest, is the storage
24 capacity of the waste.

25 A. Yes.



1 Q. Is it possible in your professional
2 opinion to calculate before the site begins to operate
3 the specific number in terms of a volume or a flow then
4 that you would expect would reach any particular manhole
5 at any particular point in time over the lifetime of the
6 site?

7 A. Exactly, no.

8 Q. What would be the range in which
9 you could come, closest you could come to by way of a
10 range?

11 A. I believe that even that would be
12 a guess. There is a great deal of discussion right now
13 as to how much infiltration we get through final covers,
14 and we don't have an exact number for it.

15 Q. Could you please put back up H-39B,
16 the hydraulic trap concept? You will remember yesterday
17 there was also an exhibit where you drew the height of
18 the mound and perhaps we should have that handy. Now, as
19 I understand your concept there are, I am going to suggest,
20 four potential scenarios that should be assessed as to
21 the viability of the hydraulic trap. The first one is
22 one which I think you have considered, you obviously have
23 considered; you assume it works and that the maximum rise
24 in leachate or mounding, if you like, above the base of
25 the landfill would be 1.5 metres?



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1 A. Yes.

2 Q. In order to arrive at the maximum
3 mounding of 1.5 metres above the base of the landfill, you
4 have assumed that the hydraulic conductivity of the waste
5 is 1×10^{-4} ?

6 A. That's correct.

7 Q. And also assumed that all your
8 collector tiles are working perfectly?

9 A. Yes.

10 Q. Perhaps so that we are clear when
11 we talk about collector tiles and other things, if we
12 could bring out the design diagram for that system, the
13 design report, and this is what the collector pipes look
14 like. This is in Volume 3, Drawing No. 2, and maybe we
15 should divert to that for just a moment so we can have
16 a better idea of what this collector system by way of
17 collector pipes and sub-headers looks like.

18 DR. KINGHAM: What exhibit are you
19 referring to?

20 MR. LEDERER: The design and operations
21 report which is Volume 3 and you would have it as H-41.

22 DR. KINGHAM: Will we need that now?

23 MR. ESTRIN: Just to look at. I could
24 put up my copy, but it's just to understand something and
25 it won't be marked, I don't think, but in case I am wrong



1 about what happens perhaps we should have it available.

2 MR. LEDERER: We may have mounted these
3 drawings in preparation from Mr. Hiraichi's evidence and
4 we could look for it during the break.

5 MR. ESTRIN: In the meantime I could
6 proceed. Perhaps we could hold this up, but it's Drawing
7 No. 2.

8 Q. Now, when we speak of collector
9 tiles; could you point those out? Are those the small
10 dashed lines running north and south?

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

12 Q. Then the thicker lines, and there
13 are thicker lines that run essentially east-west and
14 those are called sub-headers?

15 A. Yes.

16 Q. Perhaps we should wait for the real
17 exhibit. In cell 1 there is a sub-header to the south
18 and to the north, or is there not?

19 A. There is a tile, perforated tile
20 along the north side and a sub-header or what they are
21 calling a sub-header on the south side, and Mr. Hiraichi
22 would have to describe those.

23 Q. The sub-header on the south side
24 also serves cell 2, or does it?

25 A. No. It appears there is another



1 one on the other side of the dyke.

2 Q. The theory essentially as I under-
3 stand it is that the cells are where the waste will go;
4 right?

5 A. Yes.

6 Q. And the collector pipes are designed
7 to take the leachate generated to the sub-headers; right?

8 A. Yes.

9 Q. And from the sub-headers they go to
10 an eventual collection point on the whole site?

11 A. Yes. They flow -- my understanding
12 is they flow through a solid pipe outside the landfill
13 area, outside of the cells.

14 Q. Now, if we look at your report,
15 Volume 1 at page 127, you at the top of the page refer
16 to Figure 22, which is the next page, and what you have
17 done there, as I understand it, is to model downward migra-
18 tion of contaminants through the unweathered till by
19 diffusion and as I understand what you have done there,
20 you have assumed that the hydraulic trap is working.
21 Oh, perhaps we can get our copy back before you put that
22 up.

23 Turning to your report on page 127 you
24 have modelled downward migration of contaminants through
25 diffusion and you come to the conclusion that diffusion



1 will not cause a problem at the boundary of the site if
2 you have contained the leachate within a working hydraulic
3 trap. Is that what you say there?

4 A. Yes.

5 Q. So, as you say at the top of page
6 127:

7 "For non-adsorbed and weakly adsorbed
8 contaminants, penetration into the till
9 from the landfill is limited to approxi-
10 mately 0.5 metres. Moderately adsorbed
11 contaminants penetrate to only 0.1 metres."
12 One could add assuming the hydraulic trap is mounding or
13 is working and a maximum amount of 1.5 and with a hydrau-
14 lic conductivity of the waste of 10^{-4} ?

15 A. Yes, that's right.

16 Q. Using all those assumptions, then
17 your next statement is your conclusion on the point:

18 "The hydraulic containment produced as a
19 result of the leachate collection system
20 would effectively prevent the off-site
21 contaminant of water resources."

22 A. Yes, that's right.

23 Q. That is one scenario and you have
24 obviously considered that. Let me put to you another
25 scenario; that the hydraulic conductivity of the waste



1 which you have assumed is out by one order of magnitude,
2 and that is sort of scenario 2A, and B would be to forget
3 that but let's assume there is a partial failure of the
4 collection tiles, and for example only in one of those
5 cells, let's say cell 4 or 5, for example. Have you
6 considered either of those scenarios in determining
7 whether or not the conclusion that we have just referred
8 to on page 127 is valid?

9 A. Yes, I have and to the extent that
10 that is why we have a monitoring and contingency system.
11 Obviously if these numbers are off, if our estimates are
12 off, then the hydraulic trap will not work perfectly, in
13 which case we have said over the long term one might have
14 to implement then a contingency system.

15 Q. Specifically have you done any
16 calculations to determine what difference one order of
17 magnitude difference in the hydraulic conductivity of
18 the waste would make or partial failure of collection
19 tiles in one cell would make?

20 A. We have told you that if we get
21 that type of failure, the hydraulic trap won't be working
22 and then we have to fall back on contingencies. It isn't
23 a matter of calculating at all, it doesn't matter. If
24 it fails and we have said in time if the system fails we
25 would likely have to install a contingency system.



1 Q. So, in the scenario I have put to
2 you, first of all it would be natural attenuation that
3 would come into operation?

4 A. Yes.

5 Q. And then the fact that you had a
6 problem must be picked up by monitoring?

7 A. Yes.

8 Q. And then it has to be caught by
9 purge wells?

10 A. Yes, or the perimeter drain,
11 depending on how the failure occurs, and other perimeter
12 systems. It is pretty standard though with landfills.

13 Q. Under those assumptions, the
14 different hydraulic conductivity for the waste or a
15 failure -- a partial failure of collector tiles in one
16 cell, you would still be collecting leachate, wouldn't
17 you?

18 A. Yes, and you would collect leachate
19 at this site whether there is a system failure or not.
20 You must collect leachate from any landfill site.

21 Q. You would still be collecting
22 leachate and it would still be showing up in your man-
23 holes, hopefully?

24 A. Yes.

25 Q. But you wouldn't know unless you



1 happened to have adequate monitoring devices in the area
2 of the failure or off-site, you wouldn't know except by
3 those, and just by looking in your manholes, whether or
4 not you had a problem because you would still be collect-
5 ing leachate in your sub-headers and you have already told
6 us you can't predetermine how much leachate you expect to
7 measure at any particular point in time?

8 A. I disagree with that. You do have
9 some indication of whether or not your system is failing.
10 You will be monitoring levels in your perimeter pipes and
11 you can say there may be a failure in the centre, but you
12 will also be monitoring how much leachate you are taking
13 out of the system. If you start to see declines in the
14 amount of leachate coming through the system, then you
15 start to suspect that something is wrong and something
16 has gone wrong somewhere. If you suddenly are not
17 collecting leachate which you think you should have, or
18 once you get some operating data to know how much
19 leachate is produced per acre, if it isn't showing up
20 and your leachate collection rate is declining, then it's
21 going somewhere and you have to determine why, but in the
22 meantime you still have a perimeter monitoring system to
23 tell you if you have a problem developing or not. Your
24 fall-back position is always your monitoring system at
25 any landfill site.



1 Q. First of all, you have made an
2 assumption that at the time of one of these scenarios
3 I put to you you will in fact have built up enough
4 leachate and a history of leachate collection such that
5 you can somehow observe that the rate of leachate which
6 you are collecting has now declined?

7 A. Yes, that's right and I believe
8 that we could do that.

9 Q. But you may not get a mounding of
10 leachate sufficient to put leachate into your manholes
11 for a few years after the site goes into operation?

12 A. No, we will have leachate before
13 that.

14 Q. How long?

15 A. Six months. We would be seeing
16 leachate fairly quickly and that is the experience and
17 theoretical calculations say no, but in fact we have
18 seen places in other landfill sites like Brock West where
19 we get some leachate very quickly and we say could it be
20 10^{-5} permeability and it could also be a much higher
21 permeability of 10^{-2} , because there are zones within the
22 garbage where the water moves through very rapidly and
23 forms leachate. There is another possibility we haven't
24 even discussed, and it's off the top of my head, but in
25 some cases we might even consider actually pumping the



1 cells themselves by putting wells in, and that's a fairly
2 new concept that Beatty from Morrison Beatty has applied
3 at a couple of landfill sites.

4 Q. Well, you agree that unless you
5 know what to expect and have a way of determining whether
6 or not you are meeting that expectation, you would have
7 to rely on monitoring?

8 A. Certainly. By all means you have
9 to rely on monitoring. What else could you do?

10 Q. In the meantime, until you have
11 found it on the monitors and got your purge wells in,
12 it would depend -- you would have a period of time?

13 A. Yes, you do.

14 Q. But the question is how much time.
15 You say 60 years, and I put to you that it could be ten
16 years.

17 A. That would still be adequate time.

18 Q. Assuming that over that ten-year
19 period the leachate hadn't also gone somewhere else
20 beyond or around the monitor in question and that ended
21 up revealing it to you?

22 A. I think that that is very specula-
23 tive.

24 Q. Mr. Sobanski, don't you want to be
25 conservative?



1 A. There is a difference between
2 conservatism and speculation.

3 Q. You haven't considered that and
4 say it's speculative?

5 A. Yes, I think it's speculative and
6 I think we have considered it in some detail.

7 Q. I suggest you haven't considered
8 it in detail. You have considered it in the context of
9 a general approach.

10 A. No, that's not true. The concept
11 is still that you do the best, you crunch the numbers as
12 best you can, and you know there are pluses and minuses
13 and you provide monitoring and contingencies to check on
14 your design. A design may not be perfect but that is
15 why the monitoring is there and that is why the contin-
16 gencies are there. It's no different than a sewage
17 treatment plant. We put them in and design them for a
18 certain amount of BOD outfall, but it may not turn out
19 that way and they look at contingencies in those cases
20 too, but it's a waste management system and it has ade-
21 quate contingencies built into it to collect leachate and
22 it's no different than any other landfill site, other
23 than we see the potential here to protect the environ-
24 ment even better because we can make this hydraulic
25 containment system, but it isn't contingent and the



1 integrity of the site isn't totally dependent upon the
2 hydraulic trap system.

3 Q. It is totally dependent on that or
4 contingency measures beyond that?

5 A. That is correct and that is true
6 at any site.

7 Q. You designed sites where attenuation
8 was the primary mechanism and with collector drains, if
9 necessary; right?

10 A. Have I done that? I may not have.

11 Q. Others have?

12 A. Other people have.

13 Q. They have been approved?

14 A. I pointed out in here and given

15 what the Ministry wants these days that those sites
16 are a thing of the past unless you have very long buffers,
17 very large buffers, and the natural attenuation site will
18 not be able to meet the boundary criteria established
19 by the Ministry where you deal with normal boundaries of
20 100 metres or so. Not on these large sites. If it was
21 a little, wee site or a little, dinky site sitting in the
22 field then maybe you could, but not with the large sites
23 with the short flow systems we have. You can't provide
24 enough dilution.

25 Q. Let's go to a third scenario



1 relative to hydraulic traps where the system is not in
2 operation. You have made calculations for that case
3 and that is the attenuation scenario?

4 A. Yes.

5 Q. Your suggestion is that that is
6 really the worst case as I understand it and you have 60
7 years to get at it before it gets off-site?

8 A. These would be the numbers that our
9 calculations indicate, yes.

10 Q. Let me suggest in that scenario
11 where you are assuming a rising of leachate-- in that
12 scenario where no leachate collecting system was in
13 operation, the third scenario I am putting to you, and
14 you are relying on attenuation, here you are assuming
15 the leachate rises only to the current water table?

16 A. No.

17 Q. No? How far?

18 A. The failed case, and you saw the
19 gradient was 0.85 in the failed case through the upper
20 unweathered till, and that is not the current situation
21 up there. The current situation has a gradient of about
22 0.35 and we have considered a greatly increased mound
23 within the landfill in the failed case and have used 0.85
24 as a gradient through the upper unweathered till.

25 Q. Can you translate that for me as to



1 how high the mound would be?

2 A. I can't translate it without looking
3 back at our figures. It would be about ten metres, I
4 suppose.

5 Q. Is that an average height?

6 A. About ten metres above the base of
7 the cells, and I could come up with a better number, but
8 mounding has been considered in the failed case.

9 Q. Where in your report?

10 A. Right in those numbers.

11 Q. Which numbers?

12 A. The numbers in the table you had
13 yesterday, Table 10, where you have a gradient of 0.85
14 across the unit, 0.85 across the upper unit.

15 Q. Based on?

16 A. It's up on top, the second number
17 down, and that considers mounding within the fill in a
18 failed case.

19 Q. Can you tell me what total head
20 that would represent?

21 A. I can't tell you off hand, but I'm
22 guessing at about ten metres.

23 Q. Could you check that over the break?

24 A. Mr. Beechinor, can we check it over
25 the break?



1 MR. BEECHINOR: A. I think we can check
2 that.

3 MR. ESTRIN: Would this be an appropriate
4 time to have a break?

5 DR. KINGHAM: This would be an appropriate
6 time for a break. Would 15 minutes give you enough time?

7 MR. BEECHINOR: Oh, sure.

8 DR. KINGHAM: Fifteen minutes.

9 --- Recess

10 DR. KINGHAM: Thank you. Please be seated.
11 Mr. Estrin?

12 MR. HODGSON: I apologize, Mr. Chairman.

13 MR. ESTRIN: Q. Before we broke, gentlemen,
14 we were trying to clarify the scenario of -- the third
15 scenario which was no leachate collection system in
16 operation. You have made calculations for this case
17 and in terms of time to off-site your figure is 60 years
18 and we suggested possibly as little as ten years, but
19 your time period was based on a certain gradient as you
20 pointed out, Mr. Sobanski, and that then assumed a
21 certain height of leachate in the garbage; right?

22 MR. SOBANSKI: A. Yes.

23 Q. The height of leachate you were
24 assuming and thereby taking a gradient was what height?

25 A. I still haven't -- I haven't



1 investigated it totally to my satisfaction. My colleague
2 advises me that we appear to have taken it back to ground
3 level, but I haven't checked the number personally and I
4 haven't seen our own calculations on it from our files.

5 Q. Could you please put back up the
6 diagram that shows the mound, the sketch of the mound?

7 DR. KINGHAM: It's probably behind that
8 exhibit.

9 MR. ESTRIN: Q. Okay. Mr. Lederer points
10 out that it might be helpful to distinguish between the
11 mound of garbage and the mounding of leachate. The pencil
12 line you drew yesterday on H-39-D11 would indicate the
13 mound of the top of the garbage after final cover.

14 MR. SOBANSKI: A. I will label that as
15 "top of waste mound plus final cover."

16 Q. When I am discussing the mounding
17 of leachate with you, we are discussing the rise in the
18 level of a liquid, leachate, somewhere from the bottom
19 of the landfill which is the blue line, somewhere up
20 towards the top of the mound of garbage?

21 A. Yes, that is correct.

22 Q. Calculations that you have done in
23 your report would seem to indicate that the total mound-
24 ing of leachate that you have considered in determining
25 the gradient that you referred me back to in Table 10,



1 the gradient of 0.85, that the total height of the mound-
2 ing of leachate that you were considering in that
3 scenario was 3.5 metres.

4 A. That is what I am advised and I
5 would still like to look at that in the office and see
6 the actual numbers, but that is what I was advised.

7 Q. Three point five metres would
8 correspond to the level of the water table essentially?

9 A. The water table and close to ground
10 level as well.

11 Q. Okay, close to ground level. So,
12 have you then in any of your reports considered what I
13 suggest would be the worst case, and that is a fourth
14 scenario; after construction of the landfill the mound
15 can rise to a height well above the original ground
16 surface, assuming failure of collector tiles even allow-
17 ing the sub-headers to work?

18 A. Well, first of all I would question
19 you would ever fail all of the tiles in a landfill, but
20 we have shown what consideration we made of a failed
21 system and that failure suggests that even with a mound
22 to ground level, some contaminants could escape the site
23 and impact the boundaries and this would necessitate
24 implementing a contingency system and you could take the
25 severe case of putting it up to the top of the waste mound



1 and it would still suggest the same thing, that the
2 property boundary conditions that the Ministry would set
3 could not be met and in that case the simple situation is
4 that if the hydraulic trap -- if we have problems with
5 the hydraulic trap, in time we might have to put in a
6 contingency system, regardless of whether we deal with a
7 high mound or a low mound. If the trap isn't working,
8 at some time in the future we may have to deal with a
9 contingency system on the site.

10 Q. Mr. Sobanski, we gave you the hand
11 calculation taken from your report as to why we suggest
12 3.5 metres is the accurate height of mounding that you
13 have used to derive a gradient of 0.85 and you are going
14 to check that.

15 A. Yes, we will.

16 MR. ESTRIN: I wonder in the meantime if we can
17 mark it as an exhibit, subject to you getting back to us,
18 and I have copies based on THCL, page 88, no leachate
19 collection.

20 DR. KINGHAM: We will mark that M-163.

21 I'm sorry, M-164, I'm sorry.

22 --- EXHIBIT NO. M-164: Calculation of head drop and
23 travel time to upper granular
unit based on THCL data

24 MR. ESTRIN: Q. This is based on THCL,
25 Table 10, page 88, no leachate collection which we showed



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1 you yesterday and then head drop.

2 MR. SOBANSKI: A. I don't have it here.

3 Is this ours?

4 DR. KINGHAM: Since it's THCL, you could
5 perhaps tell us what "THCL" is.

6 MR. ESTRIN: Trow-Hydrology Consultants.

7 Q. Mr. Sobanski, I'll have to get that
8 one back from you and Mr. Lederer has a copy you can have.
9 Here we go and this is M-164 and so we will need to make
10 a note that you will confirm that or otherwise.

11 MR. LEDERER: I wonder if we might title
12 this in some fashion so it can be identified later as
13 it doesn't really have a name on it and it would avoid
14 us having to start searching.

15 MR. ESTRIN: Can we call it calculation
16 of head drop and travel time to upper granular unit
17 based on THCL data?

18 DR. KINGHAM: Calculation of head drop and
19 travel time ...

20 MR. ESTRIN: ... to upper granular unit.

21 Q. Now, you have just told me that
22 you haven't calculated the height of mounding that would
23 result under this fourth scenario. We have given you a
24 sheet of paper and discussed with you briefly at the
25 break and with the other consultants here the height of



1 mounding that could be calculated from formulae you have
2 used as to what the mound would be assuming leachate
3 collection tiles failed but the sub-headers still
4 functioned. Do you have a copy of that sheet? It's
5 called height of mounding and possibly we could make that
6 an exhibit now and again perhaps it needs some additions?
7 Are those all the same?

8 DR. KINGHAM: No.

9 MR. ESTRIN: These copies seem to have been
10 mixed up.

11 DR. KINGHAM: Can we leave this called
12 height of mounding and make it M-165?

13 --- EXHIBIT NO. M-165: Sheet re height of mounding

14 MR. ESTRIN: Q. Looking at Exhibit M-165,
15 Mr. Sobanski, the first matter that has to be looked at
16 is simply the spacing between collectors. On your
17 collection system diagram, Drawing 2, Volume 3 on Site D,
18 the spacing between collectors is approximately 390
19 metres if you want to look ...

20 MR. SOBANSKI: A. I'm sorry. Could you
21 go back again and could I have that one more time as the
22 number caught me by surprise?

23 Q. The average spacing between sub-
24 headers -- sorry -- between sub-headers is 390 metres.
25 I just want to make sure you understand it and obviously



1 you will have a further opportunity to confirm this.
2 The wording is "spacing between collectors" which should
3 read "spacing between sub-headers."

4 DR. KINGHAM: We will mark that change as
5 to spacing between sub-headers.

6 MR. ESTRIN: On M-165.

7 Q. What we are trying to do is figure
8 out what the mounding would be and the document might
9 have added to it in terms of its heading "height of
10 mounding assuming failure of ..."

11 DR. KINGHAM: That is already written
12 down on here, Mr. Estrin.

13 MR. ESTRIN: Right.

14 MR. SOBANSKI: It's actually variable and
15 in one case it's 390, dealing with sub-cells 4 and 5, and
16 it's about 390 metres. When we get into cell 3, although
17 this is not a continuous sub-header, we have a distance
18 of about 210 metres and in sub-cell 2 itself we have a
19 distance of about 180 metres and cell one is a little
20 bit more difficult to handle in that it doesn't have a
21 sub-header around one side but it does have manholes,
22 and there we are down to about 180 metres.

23 MR. ESTRIN: Q. Mr. Sobanski, it's
24 accurate to think of mounding happening first of all
25 within any particular cell. We could isolate on a



1 particular cell in order to determine what the height of
2 the mound within a particular cell would be between sub-
3 headers; right? We could do it, say -- look at cells 4
4 and 5.

5 MR. SOBANSKI: A. What you are saying
6 here for sub-headers is 390 metres and that would apply
7 to cells 4 and 5 but not to the other cells.

8 Q. Let's look at cells 4 and 5 where
9 you agree that the average spacing between the sub-headers
10 is about 390?

11 A. Yes.

12 Q. From that we can determine the
13 height of mounding through the formula $m = \frac{L}{2} \sqrt{\frac{q}{k}}$
14 and just adopting your values and using the calculation,
15 the number arrived at is 19 point two metres for maximum
16 mounding and it's fair to not take the maximum number, but
17 the average height of mounding which can be derived from
18 integrating under the curve as I understand it, and you
19 arrive at an average mound of 15.1 metres. After you
20 have got that number and compared it to the face of the
21 landfill you can arrive at the change or drop in
22 head and the number of 181.2 is your number which you
23 have used and 194 is simply the height starting from the
24 base of the landfill and heading 15.1 metres and that
25 gets us to 194.1 metres and we subtract the two and that



1 gives us the head driving the upper granular unit, 12.9.
2 Mr. Beechinor, while Mr. Sobanski is thinking about that,
3 possibly you could set up the diagram that shows the
4 sketch of the mound.

5 A. Not wanting to hold things up, and
6 subject to checking these figures which are mathematical,
7 I guess we can proceed along this basis. What you are
8 suggesting is if we can bring this, as I see it, all tiles
9 throughout the total system all plug off, period.

10 Q. Just in 4 and 5?

11 A. Whatever. We are dealing with a
12 different number for up here so let's accept that, but
13 there is a different number for other parts of the site
14 and we are saying right now that everything plugs off
15 and now what we will deal with is only these two drains
16 which are capable of draining the leachate within the
17 mound.

18 Q. Could we go back ...

19 A. Just let me collect my thoughts for
20 a moment because I am accepting subject to checking the
21 numbers so we don't spend a lot of time on these as I
22 just saw these a couple of minutes ago. The scenario
23 is certainly, it certainly is a worst case scenario, and
24 probably as bad as one could possibly imagine considering
25 that quite a few of the interim tiles can actually be



1 cleaned by flushing through the manholes, and that is
2 the way the system was designed, so that means everything,
3 the whole site goes all to pot, and if you want to use
4 that worst case scenario I guess you could use that worst
5 case a scenario and I don't agree with it, but we can
6 carry on with the numbers.

7 Q. Until you know that you have a
8 problem and also you have cleaned out your tiles, you
9 have the ability to develop this mound?

10 A. As I said before, if you can clean
11 the tiles out then the mound will re-establish itself
12 once you lower the water table or the hydraulic trap,
13 rather.

14 Q. I guess the essential question is
15 how fast and in what period of time you recognize this
16 is happening and what period of time you take for
17 remedial measures.

18 A. We are saying a fairly rapid
19 deterioration of this. If you talk about plugging off
20 everything here and just have the external tiles
21 collecting the edge, I think you would know fairly
22 rapidly from the amount of leachate you are getting that
23 you would have a problem and there wouldn't be that much
24 leachate coming out of the system if everything else were
25 plugged off.



1 Q. Perhaps, Mr. Sobanski, if you were
2 retained to monitor it every week you would know that,
3 but unless you are able to produce this chart which you
4 said was impossible to produce as to how much leachate
5 one can expect to collect at any point in time, I don't
6 see how an average employee of the Region of Halton can
7 safely determine that.

8 A. I doubt it will be in the hands of
9 a Region of Halton employee as I imagine they will have
10 a consultant monitoring this site and having input into
11 it.

12 Q. Not knowing what to look for
13 because you can't calculate it.

14 MR. LEDERER: Not suggesting any of the
15 employees of the Region of Halton are merely average,
16 sir.

17 MR. ESTRIN: No.

18 Q. Well, Mr. Sobanski ...

19 MR. SOBANSKI: A. Anyway, let's carry on
20 with your scenario.

21 Q. What we have I think come to now is
22 the head drop of 12.9 metres in this scenario is an
23 accurate calculation. We can go back and look at some
24 data that we have not yet looked at on a previous
25 exhibit, if I can find my copy, Exhibit M-162. You will



1 see in the middle of Exhibit M-162 there is the sub-
2 heading "Mounding after leachate collector tiles failed -
3 sub-headers operating" and do you have that one there?
4 It looks like this (indicating).

5 A. I am sorry? Oh, sorry, I have the
6 wrong number. That is 162?

7 Q. Yes.

8 A. Yes, I see it.

9 Q. Now, what we have done here is take
10 that head drop which, subject to check you will agree is
11 12.9, and taken in the first line your hydraulic conduc-
12 tivity in both tills and derived a downward velocity and
13 arrived at a travel time of 22 years, and we have not
14 reduced it yet as you would say is appropriate to take
15 into consideration diffusion and dispersion. Is that
16 fair enough, it's a straight arithmetic calculation?

17 A. That's what you have given but I
18 didn't check those numbers because I didn't know what
19 they were about.

20 Q. Perhaps over the lunch break you
21 could do that check.

22 A. Yes, carry on.

23 Q. If we go to the second line, the
24 same head drop, and the only thing we change is the
25 hydraulic conductivity to what we suggest is the accurate



1 revised geometric mean as discussed earlier, you are
2 going to get a seepage velocity of 0.88 and therefore
3 the time to get down to the granular unit in that
4 scenario is eight years or less if you add in dispersion
5 and diffusion.

6 A. I think just one part of that is --
7 I think we have to agree to disagree on what the hydraulic
8 conductivity of the upper till is, but, with that aside,
9 the calculation comes out to a value which I would have
10 to check.

11 Q. The implication of that scenario
12 where we get down to eight years if we accept what we
13 say is the more accurate geometric mean, or less than
14 eight years, you would still be collecting leachate in
15 your sub-headers and you won't know from looking in the
16 manholes necessarily on a quantitative basis, based on
17 any previous prediction that there is a problem, but
18 in only eight years or less that mounding if it is not
19 taken care of gets the leachate down to the upper
20 granular unit?

21 A. I don't believe that for a minute.

22 Q. But that is what your data and way
23 of calculating things would indicate is the result.

24 A. No, not at all. You are talking
25 eight years. You will hardly have the cells filled in



1 eight years.

2 Q. You get mounding ...

3 A. Eight years after site closure?

4 Q. After mounding has developed.

5 A. Eight years after mounding, but when
6 will you develop that? You say I can't monitor the site
7 and I disagree on that, Mr. Estrin, totally.

8 Q. We'll come to monitoring in a moment,
9 but let's talk about the physical processes that lead to
10 the worst case scenario. You say mounding can occur and that
11 that is a worst case scenario up to the heights ...

12 A. This isn't the worst case scenario
13 because you could go for worser cases than this. You
14 could use your 10^{-5} scenario for the garbage and actually
15 have the liquid above the landfill site, but then that
16 wouldn't be a good case to put forward.

17 Q. We haven't tried that.

18 A. That's right. But you alluded to
19 a 10^{-5} permeability for the garbage and that would change
20 it entirely and would raise your mound by another order
21 of magnitude. The thing is that we can carry on through
22 your calculation and it's no problem and now you are
23 saying eight years as some hypothetical time in the
24 future and that is what the numbers say.

25 Q. That is what the numbers say. Your



1 reaction is either because of monitoring and other
2 remedial action we will deal with it if that occurs?

3 A. That's right.

4 Q. Okay, but we are just agreeing ...

5 A. You have certainly given me a
6 failure situation which I have never experienced.

7 Q. Well, Mr. Sobanski, as you told us,
8 the oldest leachate collection system essentially in
9 Ontario is essentially 15 years.

10 A. In that order and it's still
11 working well.

12 Q. And we are talking about leachate
13 collection systems in this case which will have to work
14 40 years or 60 years or 80 years; who knows?

15 A. That's right, and that is why in
16 all likelihood and perhaps in the fullness of time the
17 internal system may not last that length of time and
18 this is true at any landfill site and consequently you
19 have to have contingencies. It's true at every landfill
20 site, the point you are making.

21 Q. You understand it and I came to
22 understand it, but it's a question of making sure that
23 everyone understands.

24 A. Oh, yes.

25 Q. Now, when we start talking about



1 faster velocities, as these numbers would indicate in
2 Exhibit 162, you are going to reach your ten per cent
3 concentration of the initial input of contaminants into
4 the landfill at the boundary in a considerably lesser
5 time than you calculated in your report; is that fair
6 enough? You have got a ten per cent concentration
7 assuming a certain travel time, 60 years through the
8 till and upper granular unit, and you get ten per cent
9 after 60 years for chloride 100 metres from the garbage.
10 But, if the travel time is ten years or so, then that is
11 a considerably faster velocity and the results would be
12 the maximum concentration that will eventually be
13 reached will be considerably higher than you calculated
14 in a lesser time?

15 A. The ten per cent I believe will
16 occur faster and I will defer, however, if we start
17 talking about Ogata-Banks. I would like to defer to
18 Mr. Feenstra.

19 Q. You haven't calculated that?

20 A. Obviously I haven't calculated your
21 scenario and I admitted to that some time ago, at least
22 two hours ago I would think.

23 Q. There is another diagram I wanted
24 to show you called "Sketch Illustration of Hydraulic Trap"
25 and we have an overhead and I wonder if we could put this



1 on and there are some hard copies.

2 DR. KINGHAM: If you want this entered as
3 an exhibit, this will be entered as Exhibit M-166 and
4 it has a title "Sketch Illustration of Hydraulic Trap."

5 --- EXHIBIT NO. M-166: Diagram entitled "Sketch
6 Illustration of Hydraulic Trap"

7 MR. ESTRIN: Q. Over on the left-hand side
8 of this diagram is an illustration, I suggest, of the
9 height of mounding or maximum height of mounding that
10 you assumed in your calculations of 1.5 metres and you
11 have also calculated an average height of mounding and
12 the elevation was 180.2 if you add the heights together.
13 In that scenario the hydraulic trap is working. I am
14 saying on the left is your data and your assumptions.

15 MR. SOBANSKI: A. The 180.2 is what again?

16 Q. The average height of mounding if
17 the maximum height of mounding is 1.5 metres.

18 A. I will accept that for now but I
19 do want to go through this.

20 Q. Sure. Then, on the right what we
21 have is a scenario for mounding not to the maximum we
22 just discussed, but to a maximum height of 4.5 metres as
23 opposed to 15 metres -- sorry -- let me start again.
24 The maximum height of mounding on the right-hand side is
25 4.5 metres?

A. Yes, that's totally understandable.



1 Q. We just discussed the maximum height
2 of 19 metres and we reduce both of them to the average,
3 and the discussion we just had was based on an average
4 head mounding of 15 metres and this would be less than
5 4.5. The suggestion is what we made as a scenario to
6 you before, this could be derived from either a k value
7 for the waste which you have resumed in the end result
8 is too high or that two-thirds of the collection tiles
9 in any particular cell have failed, and not even all of
10 them, but just two-thirds.

11 A. Just two-thirds?

12 Q. Just two-thirds of the collection
13 tiles in a particular cell.

14 A. I understand your scenario.

15 Q. In that scenario you can calculate
16 based on just the head difference over the distance, the
17 average height of mounding is 182.5 and subtract from
18 that the 181.6 and divide that by the height over which
19 it is moving and you get the velocity or the gradient of
20 0.13 which is down. Now, the point is whether it is
21 0.13 or 0.12, anything as I understand it greater than
22 one, or greater than zero rather, would give you a down-
23 ward gradient?

24 A. Certainly, yes. This is very
25 similar to the case we actually have in our report and



1 assuming that it's 3.5, which I have to check, and you
2 have used 4.5 averaging which is probably about the same
3 as we have.

4 Q. So you have discussed a scenario
5 similar to the one on the right-hand side of this diagram?

6 A. Yes.

7 Q. As a scenario realistic enough in
8 your opinion to evaluate it?

9 A. That is what we assumed. You could
10 take it right to the top of the mound, and all sorts of
11 scenarios can be made. We did what we thought was
12 realistic, but apparently your investigators think this
13 may be realistic too.

14 MR. ESTRIN: Could we mark this?

15 DR. KINGHAM: We already have, as M-166.

16 MR. SOBANSKI: I would have to check it
17 but it says here, and perhaps you could give me one
18 piece of information, but it says that this trap has
19 failed due to Trow-Hydrology Consultants' assumed value
20 for the k of the waste is too high, but what have you
21 assumed as k in that case?

22 MR. ESTRIN: Q. 10^{-5} .

23 MR. SOBANSKI: A. So we have brought
24 10^{-5} back in, but haven't put the mound up in the air?

25 Q. Or B.



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1 A. But this is 10^{-5} .

2 Q. Yes.

3 A. But that doesn't agree with the
4 figures you gave before which would have resulted in a
5 higher mound than 19 metres.

6 Q. I don't know if we have that
7 problem in this scenario or not. I don't think it does,
8 but would have to check it.

9 A. Well, it's or which means either
10 one of these sits by itself.

11 Q. If you doubt it, just check it and
12 tell us.

13 A. Well, yes, but the last one you
14 gave me was at 10^{-4} and you had 19.2 metres for an
15 average of 15.1 metre mound and that one would have stuck
16 in the air had it been at 10^{-5} but now you have put it
17 back to me and said the mound is 4.5 metres and it's a
18 little inconsistent to me.

19 Q. I suggest we are dealing with
20 different types of failure situations, both of which are
21 realistic.

22 A. No. You say "or", you say we have
23 a failure or and in one case you say it's 10^{-5} but you
24 gave me another number before for the height of the
25 mound being somewhat in the order of 19 metres and now



1 you come back and say it's 4.5 metres at 10^{-5} -- before
2 it was 10^{-4} with 19 metres and now we have 10^{-5} but it's
3 only 4.5 metres high and I say the two numbers aren't
4 consistent.

5 Q. The problem you are forgetting
6 about ...

7 A. I think you are getting confused
8 in your scenarios.

9 Q. The scenario in (a) does not assume
10 a failure.

11 MR. LEDERER: When you say (a) ...

12 MR. ESTRIN: M-166, scenario ii) (a).

13 MR. LEDERER: Do you mean No. i) or ii) (a)?

14 MR. ESTRIN: ii) (a).

15 MR. SOBANSKI: What we have here, we have
16 had a scenario on M-165 and on 166 what we are looking
17 at are two different scenarios?

18 MR. ESTRIN: Q. Yes.

19 MR. SOBANSKI: A. So we have three
20 scenarios?

21 Q. Yes. I'm sorry, but what would
22 be your preferred time to break for lunch?

23 DR. KINGHAM: We can continue on to a
24 convenient break point and any time between now and 1:00.

25 MR. ESTRIN: I think this would be



1 convenient if it's all right with the Board because I
2 assumed it might have been more difficult to get to the
3 point I am at and I don't think I have missed anything
4 but I think I could proceed more quickly if I had a
5 chance to break and review my notes.

6 DR. KINGHAM: Is an hour and 15 minutes
7 adequate?

8 MR. LEDERER: Before you rise, I have on
9 several occasions made reference to material being
10 provided in advance, and I don't want to make that point
11 again, but I hope when Mr. Sobanski tries to use these
12 calculations I want to be clear that if he feels he
13 doesn't have time to do this properly it would be better
14 for him to come back and say he needs more time rather
15 than attempt a hasty review.

16 DR. KINGHAM: I think we can agree with that
17 and that is why -- it was with that in mind I was going
18 to say is an hour and 15 minutes long enough.

19 MR. SOBANSKI: I'm not sure because it's a
20 bigger problem than just looking at how much is leaking
21 through and it revolves around can the flow system under-
22 neath handle the increased infiltration and it's not a
23 simple matter of saying "I will stuff it in." You have
24 to find out whether the systems below can take it out and
25 whether the scenarios are realistic, and can you pass that



1 much water through the system? It may be that it can, but
2 until I really work the matter through from top to bottom
3 we can't be sure. You could put as much water on it as
4 you want, but in some circumstances the zones below may
5 not be able to transmit the water away and in which case
6 you would get higher mounding without pushing much more
7 fluid through.

8 MR. ESTRIN: A practical solution is
9 since we are breaking tomorrow I don't think I will be
10 ending today and I know you will be occupied tomorrow,
11 but perhaps someone else could check the calculations.

12 DR. KINGHAM: Perhaps we could allow for
13 clarifications on Thursday in any event on some of this
14 material which has been put in at the last moment.

15 That being the case, we will aim for an
16 hour and 15 minutes to prepare yourself for any of the
17 more immediate answers and you are on an enforced diet,
18 Mr. Sobanski, and somehow or other you don't have time
19 for lunch. Thank you.

20 --- Luncheon recess (12:25 p.m.)

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

22 DR. KINGHAM: Thank you. Please be seated.

23 MR. ESTRIN: When you suggested an
24 enforced diet I didn't think it would apply to myself and
25 my whole team, but as a result that is what happened. It's



1 probably not a bad idea. From time to time anyway.

2 Q. Mr. Sobanski, over the lunch break
3 did you have an opportunity to check any of those
4 figures?

5 MR. SOBANSKI: A. I checked part of them
6 and what I have got through so far seems to be mathemati-
7 cally correct, but I haven't finished it all. We had a
8 bit of a problem in determining where some of the data
9 came from and to assist us so we can assist the Board I
10 could possibly ask Mr. Estrin for just a couple of para-
11 meters. I mentioned and I still feel that in looking at
12 this I would like to look at the total system as opposed
13 to just one layer of the system or two layers of the
14 system because various layers do interact with one
15 another. The two questions are, and I believe we found
16 the answer to one of them from looking through the
17 diagrams, but on Exhibit M-166, could I ask, please, the
18 well that is shown there as having a water level elevation
19 of 181.6, I believe that is Morrison Beatty (IN)OW-4 and
20 I would like that confirmed.

21 Q. Yes.

22 MR. LEDERER: I'm sorry, what was the
23 number?

24 MR. SOBANSKI: It was Exhibit M-166 and
25 I had asked which well was shown on there with its water



1 level -- its water level and that is Morrison Beatty
2 (IN)OW-4. Another question which Mr. Estrin and I had
3 a short exchange on, I believe we need some direction
4 from his consultant so we can fully let the Board
5 appreciate what the implications of these various scenarios
6 are. We would like to know what time frame for failure
7 his consultant is looking at, please, and at what point
8 and for how long if that could be provided.

9 MR. ESTRIN: Q. We will try and give you
10 that information at the end of today.

11 MR. SOBANSKI: A. Thank you.

12 Q. This morning Mr. Beechinor gave me
13 one copy of the data which he thought he might have had
14 back at the office with regard to gradients. We have
15 been working at it all morning and we didn't have a chance
16 to make a copy of the sheet, the two sheets I will be
17 dealing with, and so I want to get into it but I don't
18 think I am actually referring to the sheets, although I
19 think it would be fairer for Mr. Lederer to have a copy
20 of it at least so he can follow it. I guess I can simply
21 give him my copy to look at while we are doing this
22 because, as I say, I am not intending to put this in but
23 I want to take some information out of here and put it
24 on another exhibit and that is all I am using this for.

25 DR. KINGHAM: I was thinking that everybody



1 should have a chance to look at this if anyone is going
2 to have a chance to look at it.

3 MR. ESTRIN: Right at the moment it is
4 extracting -- all I'm asking him is where did he measure
5 and point on a map.

6 DR. KINGHAM: Can you not do that without
7 the document?

8 MR. ESTRIN: I can but he will have to look
9 at it to refresh his memory. That is all.

10 MR. HODGSON: Is that his document?

11 MR. ESTRIN: His document.

12 DR. KINGHAM: Is this the witness' docu-
13 ment?

14 MR. ESTRIN: Yes.

15 MR. LEDERER: This is not something I have
16 seen before and it was produced to Mr. Estrin as the
17 result of a query made over the last few days. It seems
18 to me that in order to be fair to everybody we really
19 should have copies for everyone and we are asking for a
20 problem if we don't because someone will get confused
21 and somebody who is following in cross-examination will
22 not follow this correctly and in some fashion they will
23 have difficulty.

24 MR. ESTRIN: We could get copies made but
25 there was no one to get them done over lunchtime because



1 there was no one operating the Xerox machine and it was
2 locked.

3 DR. KINGHAM: This is the only copy you
4 have of this document in this room?

5 MR. ESTRIN: Mr. Beechinor has a copy and
6 we have one that is marked up and that is not one that
7 should be copied because we have written on it but we
8 could go with Mr. Beechinor's original.

9 MR. LEDERER: We could do it in five
10 minutes and I don't want to hold things up but personally,
11 I have not seen this before because I didn't know it
12 would be coming in.

13 MR. ESTRIN: Do you have more than one
14 copy?

15 MR. BEECHINOR: I have one other copy.

16 MR. ESTRIN: Perhaps we could send that up
17 for copying.

18 MR. LEDERER: If it's in the hands of my
19 friends and they feel they are prejudiced in some way by
20 proceeding while copies are being made ...

21 DR. KINGHAM: I understand the basis of
22 this is you want to ask some questions about specific
23 locations so let's get the copies made.

24 MR. ESTRIN: Yes, I'm sorry.

25 DR. KINGHAM: Let me canvass and see if



1 that causes any problems. We will all get copies but
2 it may take a few minutes. Let's proceed on that basis
3 and we can get copies of a clean one made and, Mr. Estrin,
4 you can put your questions.

5 MR. ESTRIN: We don't need the whole thing
6 copied. Just the first page ...

7 MR. McQUAID: Are these Mr. Beechinor's
8 figures?

9 DR. KINGHAM: These are Mr. Beechinor's
10 figures.

11 MR. McQUAID: I would like a copy of
12 everything.

13 MR. ESTRIN: That will take a little longer,
14 I am sure.

15 DR. KINGHAM: So we will arrange for
16 copies of the entire ...

17 MR. ESTRIN: Immediately we need the first
18 and second page.

19 MR. LEDERER: Surely it makes sense to
20 copy the whole thing because everyone will want to see
21 it because then Mr. Estrin has something that no one else
22 has and so in fairness ...

23 DR. KINGHAM: The intent was to copy the
24 entire document and the request was to copy pages 2 and
25 3 first, but since everyone will get everything perhaps we



1 should copy the whole document.

2 MR. ESTRIN: Very well. We can look on
3 this together.

4 Q. The topic I wanted to discuss with
5 you is the gradient in the upper weathered till. You
6 will recall that we left that because you thought you
7 had some more data to support the number you arrived at
8 in the report. In the report the number you used for
9 the gradient was 0.004 as the average value.

10 MR. BEECHINOR: A. That is correct.

11 Q. Now, could you please put up
12 Drawing 17.

13 A. Seventeen?

14 Q. Yes.

15 DR. KINGHAM: Which drawing is that?

16 MR. ESTRIN: Drawing 17 from the Site D
17 report.

18 Q. Mr. Beechinor, the first thing I
19 want to ask you is you tried to determine the gradients
20 as I understand it between seven different points; is
21 that correct? Let me tell you what I think they are
22 and you can tell me if I have it right. First of all,
23 between borehole 1-86 and 2-86?

24 MR. BEECHINOR: A. That is correct.

25 Q. And then between 2-86 and 3-86?



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1 A. That's right.
2 Q. And 1-85 and Morrison Beatty OW-4?
3 A. Right.
4 Q. Between 3-84 and MB-OW-4?
5 A. That's right.
6 Q. Between 5-84 and MB-OW-4?
7 A. Let me follow you so I can refresh
8 my mind as we are going through these. One-85 and 84.
9 All right. HC6-85 and MB-4?

10 Q. Yes.
11 A. All right.
12 Q. That makes a total of seven
13 different points, seven different data sets?

14 A. That is right.

15 Q. I wonder if you could illustrate
16 where they are by taking a ruler and showing them to us
17 and by using this red pen. This will take a few
18 minutes.

19 --- (OFF THE RECORD DISCUSSION)

20 MR. ESTRIN: Q. Mr. Beechinor, as I under-
21 stand it you measured the gradients between boreholes
22 from looking at your sheet; is that what you did?

23 MR. BEECHINOR: A. Yes.

24 Q. You have not marked that diagram
25 in that manner. Let me show you what I mean. You have



1 one of your gradients derived, as I understand it, between
2 HCl-86 and HC2-86; is that right?

3 A. HCl-86 to HC2-86. That appears
4 to be cross-gradient and that doesn't appear to be the
5 case.

6 Q. But is that what your ...

7 A. Well, HCl-86 to HC2-86 is 0.002.
8 I would say that there is something wrong with that
9 number.

10 Q. What I am asking you, I am specifi-
11 cally asking you if your calculations illustrate that you
12 tried to obtain ...

13 MR. LEDERER: Just a minute.

14 MR. ESTRIN: We haven't marked this as
15 an exhibit and I am just drawing another line on in a
16 different colour.

17 MR. LEDERER: My concern is, and I guess
18 if it's not an exhibit and it's not in evidence then my
19 objection may well not be taken, but at some point I don't
20 want this to be Mr. Estrin's evidence but Mr. Beechinor's,
21 if at some point it becomes important that Mr. Beechinor
22 in effect creates the exhibit.

23 MR. ESTRIN: If he agrees with what I have
24 done we will find out.

25 Q. One of the gradients you considered



1 is between HC1-86 and HC2-86?

2 MR. BEECHINOR: A. It appears to be on
3 here.

4 Q. Have you a pen that marks in a
5 different colour? Have you another colour, orange or
6 something?

7 DR. KINGHAM: Perhaps you could let
8 Mr. Beechinor mark it.

9 MR. ESTRIN: Q. As I understand it you
10 are measuring between boreholes?

11 MR. BEECHINOR: A. Yes.

12 Q. Let's move on. Then, another one
13 was between HC2-86 and HC3-86, just between the two
14 boreholes, and could you draw a straight line? Then
15 would you agree with me that you have drawn a curved
16 line between HC3-84 and Morrison Beatty OW-4 and you
17 measured a straight-line distance between those two holes?

18 A. It is measuring what we are doing
19 here which is measuring the contours represented by the
20 wells at the boreholes and we would take it, even though
21 we are measuring the water level at a particular borehole,
22 we would take it perpendicular to the contour to get the
23 gradient.

24 Q. It seems to me you have to start
25 measuring in order to get a number to draw a contour.



1 A. The contours would have been put on
2 -- for instance for the water table we would have a
3 measured elevation standpipe, as are plotted here in fact
4 at 184.06 and HC6-85 and 184.52 at HC5-85 and this
5 contour would represent the contour elevation 184 of the
6 water table.

7 Q. To assist you and what I am trying
8 to clarify is that you have measured a distance between
9 HC3-84 north of OW-4 as shown on your worksheet, a
10 distance of 700 metres, right, and you have used a
11 distance of 700 metres?

12 A. Between HC3 ...

13 Q. ... and Morrison Beatty No. 4.

14 A. Then I ...

15 Q. HC3-84 to Morrison Beatty OW-4?

16 A. Right.

17 Q. Your worksheet indicates the
18 distance is 700 metres?

19 A. That's what it says.

20 Q. I say that represents a straight
21 line between those two points and you can check it if
22 you like because we do have a scale here for you. Here
23 is a 1:500 scale.

24 A. I would measure about 650 metres.

25 Q. If you made it a curve?



1 A. Seven hundred.

2 Q. You would agree that your 700
3 distance was taken as a straight line?

4 A. Yes.

5 Q. Okay. I am suggesting to you ...

6 MR. LEDERER: I am sorry, but I am beginning
7 to get lost and the reason I'm lost is because I don't
8 have the copy. Could we just have a minute?

9 MR. ESTRIN: Q. You don't need -- you
10 can check this overnight, but I am going to suggest to
11 you that all your distances were measured as straight-
12 line distances between the boreholes you were looking at.
13 Could you check that over night?

14 MR. BEECHINOR: A. I can check that over
15 night.

16 Q. If that is the case, then the next
17 thing I wanted to ask you is -- well, looking at the
18 contour of the water table there, which is shown by the
19 black lines which were originally on there before we
20 started marking that Drawing No. 17, the water table
21 contour is generally a reflection of the surficial
22 topography, generally?

23 A. Generally.

24 Q. In other words, and we have already
25 heard evidence about this, there is a height of land



1 represented within that triangular shape that we see;
2 correct?

3 A. That is correct.

4 Q. And there is also a height of water
5 table there?

6 A. That is correct.

7 Q. So that one of your gradients is
8 purportedly taken through a height of land and through
9 a height of water table?

10 A. That is the one I indicated that
11 appears to be incorrect. It can't be.

12 Q. You can't do it that way?

13 A. That is right.

14 Q. Let's look at another one. Let's
15 look at the line you have drawn between HC3-86 and HC2-86
16 and that is that other blue line in a north-south
17 direction. Could you point that out to the Board? You
18 would agree that based on the surface as we see it, we
19 are essentially looking at the side of a hill?

20 A. Yes.

21 Q. What you have done as I understand
22 it, Mr. Beechinor, what you are trying to do, if you look
23 at me for a minute, if there is a slope you are trying
24 to determine the slope by going in that direction and if
25 the slope is as my paper is, you are trying to get the



1 slope up and down, but if you have measured the slope as
2 it is there, in effect you have measured the slope across
3 the side of a hill?

4 A. Well, I think it's angled and
5 that reflects the position of our monitoring points.

6 Q. But for whatever reason you have
7 chosen to do it, what that represents is not the greatest
8 gradient you will get between those points because in
9 effect you are measuring the slope between two points on
10 a hill as opposed to the top and bottom of the hill?

11 A. That is correct, but on other
12 spots on-site, for instance between HCl-85 and MB-OW-4,
13 the calculation directly involves the slope and so I
14 would agree that there are some imperfections, but on
15 balance and on the range we are going to be picking up
16 something that is representative of the gradients on-site.

17 Q. Let's look at another one, the
18 measurement that you did between HCl-85 and Morrison
19 Beatty OW-4.

20 A. That's right.

21 Q. Can you point that one out? Is
22 there not a valley indicated by the contour map just
23 north of MB-OW-4?

24 A. There is a depression in the water
25 table at this location, yes.



1 Q. And that again interferes with
2 getting an accurate number; correct?

3 A. Let's do a measurement on that one.
4 All we are measuring at that point is the head difference
5 between HCl-85 and MB-OW-4 and that is all you can say.

6 Q. Did you not assign a gradient in
7 your worksheets?

8 A. That's right, there is a gradient
9 there and that is the gradient between those two moni-
10 toring points.

11 Q. What is it? What is it you show?
12 First of all, before you answer that ...

13 A. The gradient is 0.009.

14 Q. Point zero zero nine and the value,
15 or the mean value, the average value you were working
16 with for this upper weathered till was 0.004. Do you
17 think that that is accurate, given the valley?

18 A. I think it is representative of
19 the gradient between those two monitoring points.

20 Q. You don't think it is affected by
21 a valley in the same way that a mounding of the water
22 table ...

23 A. It may be affected by the depression,
24 sure.

25 Q. "It may be." What is your



1 professional opinion? You are just doing a calculation
2 of distance over what?

3 A. Say 550 metres.

4 Q. What is the other factor that gets
5 into the gradient?

6 A. The change in head.

7 Q. Assuming that the plane is uniform?

8 A. Yes.

9 Q. But it isn't because of that
10 depression.

11 A. It would still be uniform.

12 Q. So, 1-86 to 2-86 you would agree
13 is not a valid data point?

14 A. I am going to look at that one
15 because it indicates that it may not be, but I want to
16 look at that.

17 Q. And then 2-86 to 3-86 and that one
18 goes on the side of a hill and I suggest to you that that
19 is not proper data and is not a correct method for deter-
20 mining the gradient.

21 A. Well, if there was a well immediately
22 down-gradient of HC2-86 it would be better, there is no
23 doubt about it, but there is no well there to measure the
24 gradient. So we used the available data and we used
25 enough of the available data so that we have a full range



1 of the possible gradients on the site.

2 Q. Let's look at from 1-85 to OW-4,
3 which we agreed does go through a valley, and I am suggest-
4 ing to you that that affects its validity. You might
5 want to think about that but I am suggesting it's not as
6 accurate as it ought to be.

7 A. It affects the water level, sure,
8 but it does not affect the validity of it.

9 Q. Not the validity of the number you
10 took, but it affects the determination of the gradient
11 between those two points?

12 A. That is a natural feature which
13 affects the gradient, true, but that is what we are
14 taking into account on-site.

15 Q. Then 3-84 to MB-4, that measurement
16 between 3-84 and MB-OW-4, I suggest, does not measure the
17 head along the flow path.

18 A. Which one are we on? Three-84
19 to MB-4?

20 Q. HC3-84 and MB-OW-4.

21 A. Our gradient is measuring this and
22 the actual flowpath is a little bit circular but it's close.

23 Q. Do you want to put on a straight
24 line? Could you put it on in blue?

25 A. Okay. You see because I went



1 directly from HC3 to MB-4, my gradient will be steeper
2 than measuring a gradient that makes a circle such as
3 that flowpath. So, if anything, I am being a little bit
4 conservative and I have steeper slopes than in fact
5 would be measured if you followed the flowpathway.

6 Q. If it's a valid way of doing it.
7 Let's look at the next one, 3-84 to Morrison Beatty OW-4,
8 and we just did that so 5-84 -- the next one is between
9 OW-4 and OW-5, and those appear to not be problematic
10 because they match the flowpath, more or less.

11 A. More or less.

12 Q. The last one is 6-85 to MB-OW-4
13 and that actually crosses a flow line. Would you like
14 to draw that one on in a straight line, 6-85 to OW-4?
15 Could you draw that one on? You will see that actually
16 crosses one of your flow lines.

17 A. That's right, and again what I will
18 be measuring is a steeper slope than this flowpath.

19 Q. Aren't you actually measuring the
20 shallower flow?

21 A. Well, my distance if I use this as
22 my distance and follow the contours, that distance would
23 be longer than the line that I have taken.

24 Q. Could you check the distance
25 between those two holes, OW-4 and HC6-85 on the map?



1 A. Which ones?

2 Q. That one and Morrison Beatty OW-4.

3 A. Six hundred and fifty.

4 Q. That's a straight line. So, you
5 didn't use a curve?

6 A. I didn't use a curve and I would
7 estimate the curve would be about 800 metres if I used
8 the curve.

9 Q. You didn't use the curve but used
10 a straight line and you crossed your flowpath and it is
11 valid data; right?

12 A. Not invalid data.

13 Q. It's pretty meaningless?

14 A. You are measuring the gradients
15 between two monitoring points and what will happen is
16 the gradients that I report will be a bit steeper than
17 they actually are.

18 Q. It's real data but it's meaningless
19 interpretation for what you are trying to do with it?

20 A. I don't agree with that.

21 Q. You have reported the results on
22 page 50 which I suggest are based on inaccurate methodo-
23 logy in all but two of those seven cases.

24 A. Well, we defined a range of
25 gradients we measured on the site as between monitoring



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1 stations between 0.001 and 0.009.

2 Q. You obtain an average of 0.004?

3 A. Correct.

4 Q. Using all of that data, which I
5 suggest five out of seven are questionable on as not
6 providing meaningful results, but I would like to ask
7 you if there isn't another way of doing what you were
8 trying to do which would actually give you more reliable
9 results?

10 A. Another way of doing it is measur-
11 ing the distance between the water table contours and
12 the gradient.

13 Q. Yes. Let me assist you. I take
14 it you haven't done that?

15 A. Not recently.

16 Q. Did you do that at some point?

17 A. I would imagine, yes, we did that
18 at one point as well.

19 Q. If you did that and used that
20 methodology and you averaged those and came up with a
21 number that was twice 0.004, i.e., 0.008, you would have
22 a different gradient by a factor of two?

23 A. If that were the case.

24 Q. Do you know whether you have done
25 that and it might be in your materials?



1 A. It's not in my materials but I will
2 check that.

3 Q. In case you can't find it, what I
4 have prepared is an overlay to go over Drawing 17 and I
5 want to suggest to you that if you try to take the
6 gradients at the points I am indicating it would be
7 representative and you would get a different value than
8 you came up with. Perhaps you could assist me in putting
9 this up there. We are going to get this confused with
10 the lines underneath. Have we another copy of this?
11 This has a bunch of arrows on it and have we got a clean
12 copy?

13 Before we proceed I wonder if for the
14 purposes of identification of the last 20 minutes could
15 we mark Drawing 17 as an exhibit and with the red arrows
16 and the blue lines as put on by Mr. Beechinor?

17 DR. KINGHAM: Yes, we can mark it and I
18 guess that would have to fall into the same category
19 as the other ones associated with H-39 except -- perhaps
20 we had better give it a Milton number and keep it up in
21 the sequence as M-167 I think is where we are at, and
22 the record will show that the red lines put on it were
23 the original lines put on by Mr. Beechinor as being his
24 data points for the calculation of gradient and the blue
25 lines were subsequently added by Mr. Beechinor and also



1 part of the calculation of the gradient.

2 --- EXHIBIT NO. M-167: Drawing 17 from Exhibit H-39
3 with red and blue lines put on
4 by Mr. Beechinor

5 MR. ESTRIN: Q. Would you agree that the
6 overlay fits the Drawing No. 17 and the orange lines in
7 some cases are on the overlay -- we can see where they
8 are and in some cases they directly overly your flow
9 lines?

10 MR. BEECHINOR: A. Yes.

11 Q. In other cases they are in
12 slightly different but still very similar locations?

13 A. Yes.

14 Q. What you can do -- Mr. Beechinor,
15 what those orange lines represent is an attempt to take
16 simply the distance between two contours and to determine
17 the change in gradient between one line and another?

18 A. Yes, that is correct.

19 Q. And, as you say, that is a perfectly
20 apt methodology for determining gradient; right?

21 A. One has to be careful in doing this.
22 You know for instance that this line -- what is the base
23 line for starting this line or ending this line, and that
24 is the difficulty here and you can't necessarily define
25 specific locations to start your measurement and end your
measurement, but generally it is a very acceptable way of



1 doing it.

2 Q. What I want to show you,
3 Mr. Beechinor, is a summary of the gradients taken from
4 that overlay or as calculated and taken from that overlay
5 and you can of course check these calculations over night,
6 but what I am suggesting is if you take gradients from
7 your Drawing 17 at the locations indicated, what you get
8 is an average gradient of 0.008 or twice the value used
9 in the report.

10 A. Well, I'll accept for the moment
11 that that is the case for the areas and the lines you
12 determine your gradients on. Now, I will point out
13 that for instance if this line had been extended back to
14 HC4-85 ...

15 Q. Could you tell us what letter that
16 is?

17 A. HC4-85.

18 Q. What is the letter in red?

19 A. G.

20 Q. Yes, on the west side so referring
21 to line G.

22 A. If that line extended back to HC4-85
23 and if we used that additional distance to determine your
24 gradient, the gradient would be less. It may be less.
25 Similarly with this long flowpath over here, here is a



1 very flat gradient which has been left out in your cal-
2 culation.

3 Q. One can argue about exactly where
4 the lines could be drawn, but you would agree that the
5 basic approach we have used is the standard approach and
6 it is a valid approach?

7 A. Yes, but I don't know if it is
8 representative of all the gradients.

9 Q. You will have the opportunity to
10 consider that. I wonder if we could mark the sheet
11 summarizing these gradients as an exhibit.

12 DR. KINGHAM: Certainly, M-168.

13 --- EXHIBIT NO. M-168: Drawing 17 from Exhibit H-39
14 summarizing gradients

15 MR. ESTRIN: We should also mark the
16 clean copy of Drawing 17 showing the overlay where the
17 gradients were determined in Exhibit 168 as perhaps the
18 next exhibit.

19 MR. BEECHINOR: Is this the hydraulic
20 head data that is in the report or is this new hydraulic
21 head data?

22 MR. ESTRIN: The H is the distance
23 between those two, the difference in elevation, and that's
24 all it is. Your contours and your maps but just taken
25 right off them.



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1 DR. KINGHAM: So, we would want to call
2 that M-169 and I would ask if our friends from Halton or
3 if someone from Milton, if they could mount those two
4 together for future reference.

5 --- EXHIBIT NO. M-169: Drawing 17 from Exhibit H-39
6 showing overlay where gradients
were determined

7 MR. BEECHINOR: Should I mark it on the
8 overlay?

9 MR. ESTRIN: Q. Perhaps on the left-hand
10 side.

11 MR. BEECHINOR: A. M-169.

12 Q. Mark the base of the map for a
13 moment.

14 A. M-169?

15 DR. KINGHAM: That is correct.

16 MR. ESTRIN: Here is a pen that will
17 write on the overlay.

18 MS TANNER: Is the map underneath not
19 No. 167?

20 MR. ESTRIN: There was an M-167, but it
21 has different markings.

22 MS TANNER: The same map but different
23 markings?

24 MR. ESTRIN: M-167 is the same base map
25 but with a number of markings by Mr. Beechinor and M-169



1 is a base map without any markings but attached to that
2 is the overlay.

3 Q. The next thing I would like to turn
4 to is the gradient in the upper granular unit. By the
5 way, before we leave the gradient in the upper weathered
6 till, do you recall when we were looking at the Gartner
7 Lee report on this area that was also the gradient they
8 used of 0.008?

9 MR. BEECHINOR: A. I don't recall. Was
10 that correct?

11 Q. In Exhibit 155, M-155, if we look
12 at page 26 there is a statement in the middle of the
13 first paragraph:

14 "The average lateral flow rate in the
15 fractured zone is estimated to be 8×10^{-6}
16 m/s ... based on parameters noted in
17 Section 4.2.1.3 and a water table gradient
18 of 0.008."

19 A. I see that.

20 Q. Let's look at the gradient in the
21 upper granular unit. You have used a value of 0.001 as
22 the lateral gradient in that unit from Table 10 to your
23 report.

24 A. That is right.

25 Q. Can you turn to the third page of



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1 your hand calculations? Does the Board have a copy of
2 these?

3 DR. KINGHAM: We do.

4 MR. ESTRIN: Q. Under the heading of
5 "Upper Granular Unit." You told us this morning that
6 you used three data points to get the gradients in the
7 upper granular unit.

8 MR. BEECHINOR: A. That is correct.

9 Q. You told us at each one it was
10 0.001?

11 A. That is correct.

12 Q. So no doubt you used 0.001. Let's
13 look at your calculations or what data you used. First of
14 all you use the gradient between HC -- perhaps we had
15 better put up the overlay for the upper granular unit,
16 Drawing 18. Looking at Drawing 18 from your Site D
17 report. I think you told us this morning that your
18 first gradient was obtained between HC3-86 and HC4-85?

19 A. That is correct.

20 Q. Would you look at borehole 3-86 as
21 shown on Drawing 18? Point it out to the Board.

22 A. The borehole location?

23 Q. Yes.

24 A. HC3-86.

25 Q. That borehole, according to your



1 drawing, is outside your contour lines for the upper
2 granular unit, or the limit of the upper granular unit.
3 It is outside your limit for the upper granular unit?

4 A. Well, what we did when we deter-
5 mined the gradients of the granular units, and I will
6 say granular units because we had limited monitoring
7 points, so we used monitoring points in the upper granular
8 unit and the lower granular unit to help us establish the
9 gradient of the granular units overall.

10 Q. Let's look at how many data values
11 you have in the upper granular unit, shall we? I
12 suggest that the net result out of these three sets, only
13 one is in that unit and that is the gradient between
14 2-85 and 2-86 and I can take you through that more
15 slowly but maybe you can agree with me.

16 A. That is correct.

17 Q. So you have only one data -- one
18 measurement obtained in that upper granular unit and I
19 suggest to you that it may not be the gradient between
20 those particular points and for example the surface may
21 not be flat. The answer to that or the response to that?

22 A. Could you repeat the question?

23 Q. I said that with only one data or
24 set of data for the upper granular unit, the one value
25 you obtained may not at all be the gradient between those



1 points as the surface may not be flat and the same
2 problems as in the upper weathered situation?

3 A. That is the information we have
4 and we have no information to suggest otherwise.

5 Q. Let's go back for a moment. HC3-86.
6 You are saying the three sets of data you presented are
7 either in the upper granular unit or in the lower granular
8 unit?

9 A. That's right.

10 Q. Look at HC3-86 and which piezometer
11 were you relying on? You might want to look at Section
12 E-E or G-G. It doesn't matter which.

13 A. I would suggest here that there
14 seems to be something wrong with the numbering system in
15 the preliminary data sheets and the problem could be, and
16 that is why I think I should stop here and look at the
17 data, but these were prepared in the field and the
18 numbering system for the borehole logs was done for
19 the report, but I would like to be absolutely sure that
20 these monitors are numbered according to the way we
21 presented the information and I'm not sure of that at
22 this point in time.

23 Q. That's fair.

24 A. I pulled this out of the file last
25 night and brought it over.



1 Q. I certainly think, and I want you
2 to check it because I suggest to you that using the
3 numbering system you used there is no piezometer at
4 HC3-86 in either the upper or lower granular unit and
5 isn't that what your map would indicate or your cross-
6 sections would indicate?

7 A. That is why I suspect there is
8 something wrong with the numbering system here. It's
9 quite likely it should be Comcor or one of the other wells.

10 Q. Now, the one valid set of data you
11 have for the upper granular unit, that is between
12 boreholes 2-85 and 2-86, let me suggest to you that that
13 is located such that if you used that point to determine
14 the gradient, what you are measuring is a gradient at
15 about 45 degrees to the flow according to your own map ?

16 A. Again it's a situation where we
17 are using the data that we have.

18 Q. You prepared a contour map of this
19 situation and you could have gone by that map and seen it
20 was not appropriate to measure across it. You ought to
21 be measuring perpendicular to the flow lines -- parallel
22 to the flow lines, pardon me. Right?

23 A. That is the normal practice.

24 Q. It sure is and you want to use
25 normal practice, unless there is a good reason not to.



1 Is there any good reason not to?

2 A. I think the way we have done it
3 gives you a steeper gradient than you would otherwise
4 get. Now, I think what we should do is check the
5 contours and I will satisfy myself that by using that
6 approach we come up with a similar answer.

7 Q. Let me put it to you this way.
8 You only have one data set and the gradient is at least
9 0.001 and you really don't know anything more than that
10 for the upper granular unit?

11 A. We have a number for the upper
12 granular unit, a gradient.

13 Q. Based on one measurement between
14 two points 530 metres apart and you could easily have
15 significant differences in hydraulic conductivity at
16 other portions of the site; right? You will remember
17 we got into that this morning, transmissivity and depth
18 of the aquifer and is the unweathered upper granular
19 unit -- is the upper granular unit two metres deep or
20 three metres deep or six metres deep and that all affects
21 the gradient .

22 A. I think the effect is variable.

23 Q. You have one point between two
24 locations 530 metres apart over a very large site; right?
25 Therefore, I would like to suggest, coming back to



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1 Exhibit M-162...

2 A. M-162?

3 Q. That is the chart of time to reach
4 the upper granular unit and time to move through the
5 upper granular unit, and looking at the bottom of Exhibit
6 M-162 we have put in an assumed gradient of 0.0035 and
7 what I am suggesting to you is that there is no basis
8 based on your extremely limited data for not assuming
9 a higher gradient than 0.001 and 0.0035 used in Exhibit
10 M-162 is a reasonable scenario.

11 A. At this point I am uncertain and
12 what I want to do is check it.

13 Q. Please do that. The next topic,
14 gentlemen, I would like to go on to is contingencies.

15 DR. KINGHAM: Before we go on to contin-
16 gencies, do you want to mark this large volume of field
17 data at this stage or should we wait until it has been
18 verified?

19 MR. ESTRIN: It might be best.

20 DR. KINGHAM: I think we will just hold it.

21 MR. ESTRIN: Q. If you turn to page 131
22 of your Site D report you are discussing contingencies.

23 MR. LEDERER: Which page?

24 MR. ESTRIN: Page 131.

25 DR. KINGHAM: This is page 131 of H-39?



1 MR. ESTRIN: That is right. It really
2 starts at page 130.

3 Q. You say:

4 "The Ministry of the Environment requires
5 that contingency control systems be con-
6 sidered and conceptualized for all new
7 sanitary landfill sites."

8 MR. SOBANSKI: A. Could you direct me to
9 where you are?

10 Q. The top of page 130.

11 A. Okay.

12 Q. I take you to the heading of 10.2,
13 "Primary Contingency" and the heading there is "Natural
14 Attenuation." So, you have described the primary
15 contingency for Site D as natural attenuation; correct?

16 A. That is correct.

17 Q. What I want to suggest to you,
18 gentlemen, is that natural attenuation is not very nice
19 to think of as an effective contingency in this situation
20 if your velocities are much higher than you have chosen
21 to think they are, and we have been discussing that for
22 the last day or so, but your velocity down and out through
23 the granular unit is 60 years for ten per cent concentra-
24 tion and we have suggested it could be as little as ten
25 years and you agreed if it is ten years then over that



1 period of time you will have much higher concentrations
2 of chloride at the boundary. For example, let's look
3 at your Figure 15 in that regard and that is at page 110.
4 According to 15 you have projected the decline in
5 chloride concentrations in the landfill leachate and
6 you start off with the assumption that you have 1,500
7 milligrams per litre and if you take it out to 60 years
8 or 45 years or whatever it is, but in 60 years certainly
9 you are down to about what, is it 100 milligrams per
10 litre?

11 A. In that order.

12 Q. As what is available to then go
13 out through the natural attenuation system?

14 A. Yes, that's right.

15 Q. What if we take the time as being
16 ten years from the original concentration of 1,500? You
17 would agree at that point in time you would have a con-
18 centration in the landfill of about 800 milligrams per
19 litre?

20 A. After five years?

21 Q. After ten years.

22 A. After ten years. Something in that
23 order, around 800 or so. In the period from five to ten
24 years we say it will be averaging around 800.

25 Q. That concentration assumes your



1 original 1,500 is the right number and if it's higher
2 than that you will have a higher concentration at any
3 point in time?

4 A. I believe that the 1,500 is a
5 reasonable value.

6 Q. We will come back to that. What I
7 really wish to deal with is to just say that it is incon-
8 sistent to suggest natural attenuation equals a primary
9 contingency for this site as you have described it on
10 page 131?

11 A. I disagree.

12 Q. You have already told the Board
13 that you wouldn't put this site in there just based on
14 natural attenuation?

15 A. That is correct.

16 Q. And your calculation of attenuation,
17 natural attenuation, is arguably much too optimistic, I
18 suggest, based on the variations in gradient that we have
19 been discussing, based on the potential variations in
20 hydraulic conductivities that we have been discussing
21 and you have been overly-optimistic.

22 A. No, that is not correct. Six metres
23 or four to six metres of clay till is a good liner and a
24 good attenuator.

25 Q. But you can't just make general



1 statements.

2 A. I can make that general statement,
3 it is a good attenuator.

4 Q. You have to take into account the
5 velocity and you have to take into account the head.

6 A. It takes into account all kinds of
7 things. With this material we slow the material down and
8 we haven't considered biodegradation and all sorts of
9 other mechanisms. We have looked at a very simplistic
10 model. There is a good system in operation at Brock
11 West where the liner is four inches thick and it's doing
12 a good job of attenuating after ten years and this in my
13 opinion is a good ...

14 Q. Are you the consultant on Brock
15 West?

16 A. I am.

17 Q. Could you make available to us the
18 reports on which you are relying?

19 A. If Metro wants them released we
20 could release them.

21 MR. LEDERER: I think I would want to
22 think about that because I am not sure how far it is
23 appropriate to go with something like this.

24 MR. ESTRIN: Q. You have been looking at
25 Brock West for how long? Were you the original consul-
tant?



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1 MR. SOBANSKI: A. I wasn't the original
2 consultant, the firm was.

3 Q. The firm was?

4 A. Yes.

5 Q. Brock West started up how long ago?

6 A. It's over ten years now.

7 Q. I take it you have monitoring
8 reports?

9 A. Yes.

10 Q. That is what you are making or
11 basing your opinions on?

12 A. Yes.

13 Q. Are these annual monitoring reports
14 given to Metropolitan Toronto?

15 A. They are -- actually Metro hasn't
16 been doing them frequently and this last year was quite
17 a major report and there is another major report due this
18 year to show how the liner is working and the liner is
19 working quite well.

20 Q. Were these reports done pursuant
21 to any requirement in the Certificate of Approval?

22 A. Yes, there was a new Certificate of
23 Approval issued and it required these be done.

24 Q. These are public documents?

25 A. They are public documents but it is



1 that thick (indicating) and I won't undertake to produce
2 ten copies without some sort of reason for it.

3 Q. I would be happy to consider the
4 copying if you could provide me with one copy so I could
5 determine if it is relevant.

6 MR. LEDERER: That's the whole point,
7 whether it's relevant and how far this kind of inquiry
8 ought to go. In theory we could bring in every report
9 and there is obviously a limit somewhere, but it is some-
10 thing I would like to think about and presumably there
11 will be some kind of inquiry into that site and I
12 don't think reacting to that makes it particularly rele-
13 vant or helpful as the issue is whether or not there
14 is experience quite apart from what the numbers can tell
15 you on which one could draw to verify or consider the
16 opinions you are formulating in a particular case.
17 Mr. Sobanski has given you that and I don't know if there
18 is any more that can be said to make it relevant.

19 DR. KINGHAM: We have heard your point.

20 MR. ESTRIN: Unless I can't get it for
21 one reason or another as being a public document from
22 the Ministry of the Environment, I am not going to request
23 that Mr. Sobanski or Mr. Lederer produce it, but I don't
24 think we can summarily say it is not relevant because
25 Mr. Sobanski has said more than twice that "based on



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1 Brock West" x follows and so I think I should at least
2 look at Brock West to see if there is anything further
3 we should see, and I agree this is not an inquiry into
4 Brock West.

5 MR. SOBANSKI: And I think you should
6 look at Keele Valley as well.

7 MR. ESTRIN: Q. Why is that?

8 MR. SOBANSKI: A. That's a liner situation
9 with a liner five-feet thick, but I don't have those
10 reports but again they are public information and as to
11 how well materials can be held back with these tight
12 liners.

13 MR. LEDERER: Perhaps Mr. Estrin could
14 extend the courtesy of telling me if he proposes to get
15 into this. He can advise me so I can formally consider
16 what position we wish to take with respect to it.

17 MR. ESTRIN: Certainly. If I intend to
18 use those two reports he is talking about, and which I
19 don't know about, but I will tell you in advance.

20 Q. Now, let's go to what you say is
21 the secondary contingency. I'm sorry, but when would
22 you like to take the afternoon break?

23 DR. KINGHAM: When it is convenient to
24 you, any time from now or in the next half hour.

25 MR. ESTRIN: Q. How are you doing? Would



1 you like a break?

2 MR. SOBANSKI: A. I would like a break.

3 DR. KINGHAM: Now would be a good time.

4 --- Recess

5 DR. KINGHAM: Thank you. Please be seated.

6 MR. ESTRIN: Mr. Chairman, going back for
7 a moment to Exhibit M-166 which was the sketch illustra-
8 tion of the hydraulic trap, Mr. Sobanski said he wanted
9 to check that and the other data. I wanted to hand out
10 a sheet which I think will clarify the assumptions that
11 go with M-166 because there seems to be some confusion
12 about it when I went over it with Mr. Sobanski, parti-
13 cularly item (ii), failure of the hydraulic trap, and this
14 sheet simply makes the assumptions that lie behind that
15 clear and I would like to give that to Mr. Sobanski.

16 MR. LEDERER: Has this been shown to
17 Mr. Sobanski before?

18 MR. ESTRIN: I am asking him to look at
19 it over the break so he can fully understand it in case
20 there is any problem.

21 DR. KINGHAM: I understand this is res-
22 ponse to his questions about the assumptions?

23 MR. ESTRIN: Yes. If anyone else wants a
24 copy ...

25 MR. LEDERER: These are the points raised



1 by Mr. Sobanski.

2 MR. SOBANSKI: This does not respond to
3 the question I asked in terms of timing. This explains
4 the basis of the two modes of additional failure that
5 were brought up in Exhibit M-166. You will recall
6 Mr. Estrin and I had an exchange on 10^{-4} versus 10^{-5}
7 garbage permeability, and this as I read it is meant to
8 respond to that, as to what those two assumptions are
9 based on. I still ask if we could be provided today
10 with the time frame that their consultants are consider-
11 ing for the failure.

12 MR. ESTRIN: Q. If we are able to do that
13 by the end of the say we will certainly do that. Where
14 we were at just before coffee was your discussion on page
15 131 of secondary contingencies, perimeter drains and
16 purge wells. I want to particularly focus in on the
17 purge wells and just to clarify, the perimeter drains
18 would be a contingency in respect of leachate going out
19 laterally through the weathered upper till?

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

21 Q. Dealing with your contingency
22 proposed for the leachate that would go down and out
23 through the upper granular unit, that is the purge wells?

24 A. Yes, that is correct.

25 Q. I have never seen a purge well and



1 is it something like using -- it's a well with a pump
2 pumping the aquifer?

3 A. Yes, that is correct. It is a
4 conventional water-type well, although one may consider
5 perhaps special screen construction or something of that
6 nature.

7 Q. As I understand it in very simplis-
8 tic terms, and tell me if I am wrong, what you are trying
9 to do is put the toothpaste back in the tube?

10 A. Not really, no.

11 Q. Let's look at that.

12 A. The landfill is the tube and we
13 didn't intend to put it back there but would intend to
14 put it into the system that takes it to a sewage treat-
15 ment plant.

16 Q. What you are trying to do is keep
17 the leachate on-site, collect it and get it out of there
18 in a controlled way through tanker trucks and whatever;
19 right? You didn't want it to get down and out off-site?

20 A. That is correct. It would be
21 taken, as I said, to a sewage treatment plant.

22 Q. But if your hydraulic trap doesn't
23 work properly and if we go to the contingency situation,
24 it has gotten away, it has gotten out of the site and
25 you have got to suck it back?



1 A. Not necessarily suck it back. You
2 would install it ahead of the arrival of an unacceptable
3 front and you would intercept it before it had to be
4 sucked back.

5 Q. If the leachate was still under the
6 site you would potentially put a purge well on the site
7 hoping to keep it from going further off-site?

8 A. Yes, that is correct.

6A 9 Q. If it was off-site you would do
10 what, intercept it or bring it back to the site by a well
11 on site?

12 A. That type of a system I think would
13 apply to a site that has already caused contamination and
14 that you came to after a period of time where you might
15 try to bring it back. In a new site you monitor for
16 these things and present predictions as to what is going
17 to happen and then if you feel that the boundary criteria
18 are going to be exceeded, then the wells are installed
19 ahead of that period of time when the boundary conditions
20 would be exceeded and you start to collect.

21 Q. Now, as I understand it, your
22 testimony, the essential ingredient that makes this site
23 acceptable in your opinion hydrogeologically from a
24 public health and safety viewpoint is the collection
25 system and the hydraulic trap working?



1 A. Yes, that is what we have been
2 saying. The hydraulic trap is important and the attenua-
3 tion is important and, failing these, then there would
4 be a backup system go into place.

5 Q. So the real backup system is the
6 purge wells?

7 A. Yes, it is and the perimeter tile.

8 Q. For the other component of potential
9 escape?

10 A. That is correct.

11 Q. But as to the down and out flow, it
12 is a purge well?

13 A. Yes, it is.

14 Q. So, I suggest it is really not quite
15 accurate to describe purge wells under the heading of
16 secondary contingencies. It is really your primary
17 contingency?

18 A. No, I don't believe so. You see,
19 you are thinking again of the worst case and of an
20 absolute total failure. If in my opinion there is a
21 failure they will be small failures in which case I
22 believe the contingency, the primary contingency of the
23 attenuation will take care of minor leakages, if that were
24 to happen. In the terms of a total failure, which is
25 the worst case scenario you put to me, then the secondary



1 contingency, the purge wells, would be required.

2 Q. But you don't have to have a total
3 failure in order to think of needing purge wells. If
4 you don't have your assumed travel time in order to find
5 out about the problem and start dealing with it ...

6 A. I believe you could have some minor
7 failure here at the site and have natural attenuation
8 look after it to the extent that we wouldn't have to
9 install purge wells.

10 Q. If your assumptions are correct.

11 A. Even if your assumptions are the
12 ones that one were to accept, some leakage could still
13 be taken from the site. You have given me a total
14 failure scenario and in a total failed scenario we would
15 require purge wells, but in a partial system scenario
16 with only perhaps the hydraulic trap only slightly
17 collapsed and with only a small amount of leakage from
18 the site, then the environment could accept some leachate
19 without bringing in the secondary contingency.

20 Q. But your calculation of 60 years
21 to get off-site was not based on total failure?

22 A. Yes, it's based on total failure
23 with the tiles essentially not working.

24 Q. But not with the mound up to the
25 top of the landfill and only mounding 1.5 metres above



1 the tiles.

2 A. But I told you before it doesn't
3 matter. If I say that by filling the bathtub just to
4 the top as we showed in the figure it creates a situation
5 that requires the contingency implementation, it doesn't
6 really matter whether I assume the mound is up here or
7 not because I know that that would be a worser case which
8 would also implement the contingency. Once I have
9 established if the system fails, and if the system fails
10 I am going to have to put in a contingency and it doesn't
11 matter how badly the system fails because the contingency
12 would have to go in.

13 Q. But there is a difference ...

14 A. Given that I have considered in my
15 case a total failure, except I didn't put as big an amount
16 on it as you did.

17 Q. Exactly. What I am suggesting to
18 you is that your velocity of 60 metres out to the boundary
19 -- of 60 years out to the boundary was not based on any
20 high mounding of leachate.

21 A. That is correct.

22 Q. So your 60 years was not based on
23 total failure?

24 A. It is. It's based on the fact that
25 the tiles are plugged.



1 Q. But the worst case scenario -- it's
2 not based on worst case because worst case you agreed was
3 mounding up to 15 metres?

4 A. I'm not sure. That's your worst
5 case and I thought we gave our worst case and I could
6 assume the permeability of the garbage is 10^{-3} and I
7 could have gone the other way, but all we are talking
8 about is which way we are going with the numbers.

9 Q. You are trying to suggest that it
10 is unreasonable to consider our worst case?

11 A. Just a second. Maybe I can explain
12 this again. I'll try one more time. If our system
13 says the tiles plug off, and regardless of how high we
14 raise the mound, we say the whole system plugs off and
15 our calculation indicates that we will exceed a certain
16 criteria at the boundary and I say to you in a failed
17 situation I must install the contingency and I say that
18 to you and I have told you that. You say you are not
19 giving me the case where it's a higher mound but I am,
20 it's the same situation. If the mound is higher the
21 system has failed and, let me finish, and we would have
22 to install the contingency. To the wells it doesn't
23 matter much whether the chloride concentration is 300
24 milligrams per litre or 1,000 milligrams per litre when
25 it arrives at it. It will be picked up and put into the



1 sewage treatment plant.

2 Q. I guess we are talking at opposite
3 ends because ...

4 A. I am pointing out a failure is a
5 failure and we readily admit that if the system totally
6 fails we would have to install purge wells maybe but it
7 depends on when they fail. It could be that the system
8 could fail 30 or 40 years down the road and it may be
9 that there isn't enough leachable contaminant left in
10 the waste to worry about it and monitoring would tell us
11 that.

12 Q. But that is ...

13 A. That is why we monitor it because
14 you can't predict that entirely.

15 Q. If you are able to monitor in a
16 comprehensive way, given the variability of the site, and
17 we will come to that I think on Thursday, but monitoring
18 or your ability to monitor and assume that your monitor-
19 ing is absolutely determinative of everything that is
20 going on underground is only as good as your assumptions
21 about the certainty of the stratigraphy under the site;
22 right?

23 A. Well, we will discuss that Thursday,
24 I guess. I'm not trying to be humorous, but if you want
25 to get into it now, that's fine. I just hope the Board



1 understands that to me a failure is a failure.

2 Q. You have said that about three
3 times and I'm sure the message is clear but I am sure
4 there is another problem in your assumption. Put aside
5 our worst case and let's just deal with your mounding
6 to the water table or 1.5 metres.

7 A. Yes, there is a failure.

8 Q. You have said if nothing was done
9 about it and we didn't know about it in effect we have
10 got 60 years to do something about it before it gets off
11 site through the upper granular unit.

12 A. Yes.

13 Q. I am suggesting, and forget about
14 our worst case, but if you plug in other assumptions
15 about hydraulic conductivity or gradient or whatever,
16 you could get that number of years down and we showed
17 you how we suggested it comes down to about ten years.
18 Now, forget about the worst case with the high mound.
19 Once you assume faster velocities you have to assume
20 higher concentrations at the boundary and therefore your
21 monitoring and your purge wells become even more
22 important.

23 A. Oh, yes, they are important
24 regardless of which scenario one uses, but you do have
25 lead time. This does not happen instantaneously. Sites



1 are monitored and if we see changes which are significant,
2 then the Ministry will require that we do it and we will
3 require that it be done. We don't want a site creating
4 an environmental problem and we go from there. We are
5 talking purge well contingencies and there are many other
6 levels of contingency that can be gone to as well.
7 However, you can monitor the site and if we accept your
8 scenario that it's ten years, we could detect that too, but
9 it's a question of the starting time and when you are
10 talking about this failure, surely it can't be the day
11 we open the hole. There must be a time frame and I want
12 that time frame so I have some idea because you want to
13 discuss lead times and I need that kind of information
14 to see how your people feel about it.

15 Q. You tell us when you estimate you
16 will have leachate characteristics, say, at 1,500 milli-
17 grams per litre?

18 A. We would have leachate characteris-
19 tics like that very shortly after the site is in place
20 and it could be within a year or so and that is one
21 scenario, but I can assure you that when we have the hole
22 open and we are digging around in there and we are putting
23 garbage away, we know if it's mounding or not because if
24 it's mounding we will drown in it and it won't be mound-
25 ing while we are working on it. But I would like your



1 consultants to provide me with that number because it is
2 your scenario, but these are built into the lead times we
3 have and in that time period you would start to monitor
4 the site before any garbage went in to establish back-
5 ground quality and that goes on on a semi-annual or
6 quarterly basis year after year until the Ministry is
7 satisfied there are no problems. At the same time you
8 could monitor the quality of the leachate itself coming
9 out of the system to see whether there is a problem and
10 it may be after 20 or 30 years the Ministry might say
11 there is nothing in there worth worrying about and all
12 you have to do is sort of collect from the toe of the
13 thing and don't worry so much about the groundwater.

14 Q. Assuming everything is fine?

15 A. These are long-term sites and these
16 things don't happen over night which is what I am saying
17 to you. You don't have catastrophic failures where
18 everything quits in one day. A pump can fail and some-
19 thing mechanical like that can be replaced very quickly.

20 Q. If the lead time is shorter or
21 the reserve time on natural attenuation is shorter, such
22 as ten years, and if your monitoring is not picking up
23 the plumes of leachate moving faster than other plumes,
24 for example, and let me illustrate. Have you a flow
25 chart or a chart?



1 A. I think there is one in back here.

2 Q. Now, you could have a flow of
3 leachate going through the ground surface, and let's say
4 this is the UGU. Theoretically you are saying you can
5 determine what it is at X point in time by modelling?

6 A. Yes.

7 Q. That is assuming you essentially
8 have plug flow?

9 A. Whatever type of flow, and we haven't
10 assumed plug flow but have assumed other factors.

11 Q. What I mean is you have assumed
12 that the leachate -- what is the term -- the leachate
13 plume is uniform and that its front is constant through-
14 out in that calculation. What you haven't assumed is
15 fingering, and I can't draw three-dimensionally.

16 A. I understand.

17 Q. Finger flow or whatever.

18 A. We have to appreciate, however, that
19 the zones we are talking about, and I understand what you
20 are after, but the zones we are talking about are not
21 particularly thick and we are dealing with zones a metre
22 or two thick, and there is no reason why the entire zone
23 can't be screened so you can see whether or not you are
24 getting fingering. If you are concerned with something
25 like that, I can assure you that when you put monitors



1 into this that the whole section would be screened and
2 you would be looking for that.

3 Now, in terms of its flowing around the
4 well, and you are also monitoring beyond the site in
5 domestic wells . If we were to see changes in those
6 to indicate we have missed something, then we would take
7 instant, immediate action and I have seen cases like this
8 with a pond that was contaminated, and not by leachate
9 but by some sediment, and the following day the municipa-
10 lity had troughs into the man's place and they were
11 hauling water to him and it was as simple as that to
12 feed his cattle and there was no problem, it was done
13 in days time, and it would be the same thing with any
14 contaminants, if they showed up in any of the domestic wells
15 which are part of the monitoring program and you
16 suspected something is bypassing the system, you would
17 take immediate, corrective action because it is something
18 you would want to straighten out.

19 Q. Your monitoring is carried out --
20 monitoring is basically done or could be more often than
21 once a year?

22 A. Quite often it's quarterly with
23 large sites and sometimes semi-annually and in the
24 tighter sites sometimes it's done semi-annually because
25 the groundwater velocities are fairly low. Tricil's



1 hazardous site for instance is semi-annually.

2 Q. We are not talking about velocities
3 as low as Tricil?

4 A. Indeed not, and Tricil is very low
5 but the velocities are still fairly low and in some sites
6 where we have landfills in sand and gravel, which perhaps
7 should not have been there, the monitoring is on a quarterly
8 basis, but the changes don't occur instantly, they do
9 fluctuate up and down and you sort of examine trends.
10 You can have some natural phenomenon going on which might
11 give you some response such as road salt and you have to
12 try and get this out of your background.

13 Q. That is a sort of an interesting point.
14 I guess people who have to end up paying to take remedial
15 measures, it may be human nature to tend to somewhat
16 discount anomalous readings until they have been corro-
17 borated?

18 A. Yes, that is true, but it's not as
19 though you would sit and wait for five more sets of
20 readings to see if there was something wrong or not.
21 If you had for example a well, a monitoring well and you
22 had a well near the site that had an anomalous reading,
23 I wouldn't respond to it immediately because you could
24 catch it on the next monitoring because the velocities
25 are relatively slow and we are still talking years, but



1 if you had that kind of an anomalous reading in a domes-
2 tic well then it would be something you would look at
3 right away and you would re-sample and see whether or not
4 that parameter was indeed there or whether it was indeed
5 caused by something else.

6 Q. What is the distance between one
7 side of that road and the other?

8 A. I believe the wells themselves are
9 something like 200 metres or more from the fill itself,
10 so you have double the distance involved to get to the
11 wells than you have from the landfill to the property
12 boundary itself, or something in that order without
13 measuring it off.

14 Q. Let's discuss the amount of water
15 and leachate that a purge well system would need to pump
16 and we will come back to how the leachate may be monitored.
17 At page 133 you give us a figure of 12.6 litres per
18 minute as that amount of water that would have to be
19 pumped by your purge well for 10,000 days or 27 years.
20 It doesn't have to be pumped that long, but if it was
21 pumped that long -- it might have to be pumped that long
22 so why not tell us about that. How did you deter-
23 mine how long it would have to be pumped and did you
24 assume a certain location for it?

25 A. This was an estimate that I did to



1 see what sort of interference would be caused with
2 domestic wells. In other words, if I had to pump a well
3 out there or a couple at 1.4 gallons per minute each,
4 that after 1,000 days I would create a certain amount of
5 interference with domestic wells, but 10,000 days in terms
6 of pumping times is considered pretty close to what we
7 would consider for perennial yield and at some point you
8 could expect the wells to stabilize. It was merely an
9 example. For example, if you found this zone required
10 that you pump -- we have it down as, say, three gallons
11 a minute and if you had to pump ten gallons a minute out
12 of it you would take out ten gallons and if it were less
13 and you found you could draw and create a cone of depres-
14 sion in the area that would protect wells at a lower
15 withdrawal rate, then you would use a lower withdrawal
16 rate. This isn't a proven system as I said in my
17 direct evidence or in my discussion with Mr. Tidball,
18 these aren't cast in stone. They are first estimates
19 based on the data we have now. So, indeed it may be
20 that somewhat more or somewhat less water than that would
21 have to be withdrawn, but the point of this ...

22 Q. Even based on your numbers for
23 hydraulic conductivity?

24 A. These are the numbers that come out
25 from our estimates and we know that they are somewhat plus



1 or minus, but these give us in the order of three gallons
2 a minute. We are saying it's not a lot of water but
3 keep in mind it isn't critical how much water particularly
4 comes out of these wells, because the bulk of the fluid
5 we are taking to the sewage treatment plant is coming
6 from the landfill itself which is handling very ripe
7 material and which is being collected in our tiles.

8 Q. Just a minute. I thought you weren't
9 going to purge wells if the leachate was staying in your
10 collector system and going to the sewage treatment plant.

11 A. If you had a failed system you would
12 still be collecting leachate from the site itself because
13 with a failed system the leachate levels in the site would
14 rise and you would have a perimeter tile system as a toe
15 drain and you would be collecting leachate from the raw
16 area itself and reducing the amount of impact on the
17 lower zone.

18 Q. Let me understand what you say.
19 You say even based on your assumptions of hydraulic
20 conductivity and the other things that go into the
21 formula on page 133, that figure of 12.6 litres per
22 minute could be 24. I don't want to misquote you, but is
23 that what you said?

24 A. It might be and I don't know what
25 the final number on this is and it would depend on how



1 the system tested out. It may be that this is all that
2 is required and this type of very slow withdrawal, ten
3 gallons per minute from No. 2 pumping well, we think we
4 are able to spread a cone over 500 metres and if pumped
5 longer, and that was after a period of 48 hours and the
6 draw-down cone was still expanding, and it could be we
7 could control the bulk of the site with just the one well
8 on that side pumping at ten gallons per minute initially
9 and then reducing it to whatever the leakage rate is
10 through the confining layer.

11 Q. Did you -- you have achieved or
12 calculated a certain draw-down and in domestic wells to
13 the west of the site of 1.7 metres based on the pumping
14 rate of 12.6 litres per minute?

15 A. It was based on a pumping rate of
16 half of that on one side of the site, I believe. I would
17 have to check back on the number, but it was a two-well
18 system I considered at the time, one on either side of
19 the site, and one well pumping at half of that rate would
20 create this type of cone.

21 Q. Did you do any calculation by hand
22 or anything in your notes that bears that out?

23 A. I have calculations on it but I
24 don't have them with me, but I believe this refers to
25 Drawing 24 and we have used the k values we obtained from



1 our tests, I believe.

2 Q. There isn't really any great amount
3 of information on Drawing 24 and that is one of our
4 problems. What is there on Drawing 24 that can help us?

5 A. I agree that that wouldn't be too
6 helpful.

7 Q. There are no purge wells shown?

8 A. No, there aren't any, I'm sorry.
9 Just a second. No, there aren't any purge well locations
10 shown on this particular drawing, I don't believe. I am
11 trying to think back to whether there are some -- there
12 is some potential on the design drawings and I'm not sure.

13 Q. Mr. Sobanski, I know you will be
14 occupied tomorrow, but is there someone in your office you
15 could give some direction to as to where your calculations
16 might be because we would certainly appreciate seeing them,
17 and if they are available tomorrow we would be happy to
18 arrange to get a copy. Would you agree that if every-
19 thing else stays the same that if you start pumping at
20 twice the rate then your draw-down is going to be approxi-
21 mately proportional?

22 A. If we were to pump at twice the
23 rate then, yes, the draw-down would be proportional.

24 Q. If you were going to pump at 24
25 litres a minute you will create a draw-down of 3.5 metres?



1 A. Possibly. If you are coming from
2 the direction of what happens with the higher mound, then
3 that is not necessarily correct.

4 Q. I am worried about people who live
5 along First Line and their wells.

6 A. They would be monitored as well
7 from the point of view of the water levels as is outlined
8 in here, and if we were to interfere with them adversely
9 then we would have to restore supplies and that would be
10 a condition of our taking water. Any impacts we have on
11 those people have to be remedied, and that could be done
12 by either deepening wells or moving them further back on
13 their property or by piping water in or by hauling water
14 and even in the worst case by running a watermain to them
15 and if it happened -- personally I am not a planner, but
16 I have difficulty visualizing that if we are talking
17 something in the order of 30 or 40 years that this area
18 will be on groundwater 30 or 40 years from now and that
19 is certainly not my experience from living in
20 Mississauga.

21 Q. Of course Mississauga and Brampton
22 have their own qualities of growth.

23 A. But Mississauga is nearly full now
24 and the next line of attack ultimately I suppose will be
25 the Halton Region for development.



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1 Q. So don't worry about wells?

2 A. I'm not saying don't worry about
3 wells because we have a great deal of concern about them
4 and we don't want to contaminate any wells, but it seems
5 to me in the long term the area will be served with
6 serviced water.

7 Q. You would agree that is a whole
8 other area that could enter into this hearing?

9 A. Oh, certainly, by all means.

10 Q. You would want to do your best to
11 protect those wells?

12 A. We are.

13 Q. What I am trying to get at is how
14 are you protecting those wells, first of all if you must
15 pump at 12 litres per minute where you will draw them
16 down, draw the nearest well down by 1.7 metres and if
17 you pump at 24, 3.5 metres, and if you pump at 48 you
18 will do it again by a doubling factor and you may be in
19 a position of depriving people of the use of their
20 present wells.

21 A. I don't believe so. I believe the
22 numbers we used are based on the pumping tests we have
23 run and I think for now they are realistic in terms of
24 projections as to what we would expect out there.

25 Q. Your pumping rate would jump--12.6



1 litres per minute which you say could be doubled and it
2 would also change if we changed, or if we assumed, say,
3 a three-times change in the hydraulic conductivity that
4 you used and instead of the numbers you used there and
5 if we used a k of 3.85×10^{-7} , and we would bring it up
6 to 35 litres a minute and if your calculations are of
7 a range which you might want to double for the sake of
8 error then it could be 35 to 70 litres per minute?

9 A. I would point out to the Board it
10 goes the other way too. We give our best estimates and
11 the values could also be lower, but that is something you
12 would determine with monitoring and if these wells ever
13 had to go in and then if you are adversely interfering
14 with supplies, then you would take whatever action is
15 necessary to restore them and this is not uncommon at
16 all in the province. It happens around our sand and
17 gravel pits and around our quarries and it happens all
18 the time and if you interfere with water supplies you
19 restore them.

20 Q. I guess the question for this Board
21 is if we have a choice we should approve a site that
22 could well lead to that scenario?

23 A. This is a typical scenario for a
24 landfill site where you are intercepting leachate and
25 in one way or another you are reducing the amount of



1 groundwater available to the aquifer and the infiltration
2 going in through the landfill cover will reduce the
3 infiltration in the area in general and that will be
4 picked up by tile collector systems and taken to a sewage
5 treatment plant. However, that happens at all landfill
6 sites and there is a reduction and those problems must be
7 dealt with at all landfill sites.

8 Q. You don't have to worry about the
9 use of that same kind of groundwater supply for people's
10 wells down-gradient of Site F?

11 A. No, not in my opinion.

12 Q. The pumping rate you discuss on
13 page 133 is independent of any scenario we have put
14 forward to you today about mounding occurring, our worst
15 case of, say, 15 metres average mounding?

16 A. It is.

17 Q. You would agree that if that kind
18 of mounding occurred, that would change the gradient you
19 assumed in your calculation on page 133?

20 A. Yes, it would change the gradient.

21 Q. At mounding of 15 metres the head
22 drop between the base of the landfill and the upper
23 granular unit would be approxi-
24 mately that figure of 12.9 metres we talked about earlier
today?

25 A. We accepted your scenario and I



1 have to accept it. I don't necessarily agree with it ...

2 Q. You are going to think about it and
3 tell us whether you can agree; not the scenario but the
4 numbers?

5 A. If you can provide me with some of
6 the things I am asking for I will.

7 Q. I guess I would ask you how long it
8 would take you for your worst case scenario to develop
9 and perhaps you would be good enough to tell me that.

10 A. My worst case scenario?

11 Q. Yes.

12 A. How long would I consider it to be?
13 Probably more than 20 years.

14 Q. On what basis?

15 A. I could return the question to you,
16 on what basis? We will be operating the site and I don't
17 believe it will fail before that and I think it will be
18 20 or more years and I believe the systems are good for
19 that.

20 Q. Okay.

21 A. I don't have absolute proof because
22 they haven't been in operation that long, but we have a
23 few that have been in operation for over ten and it
24 doesn't seem to me too improper to project that number
25 off a little farther.



1 Q. That is the kind of time frame or
2 the basis for the time frame you have in mind?

3 A. That's sort of minimum. I would
4 point out that it does take experience to develop these
5 numbers and just as an example, and it is a bit off topic,
6 but I understand that every year this woolmanized wood,
7 this green wood, gets a longer, guaranteed lifespan
8 because it keeps lasting longer in the ground. That is
9 what I have heard from a fencing contractor, they keep
10 extending the life of these materials because they don't
11 seem to deteriorate too quickly in the ground and are
12 very toxic to the types of bacteria, et cetera, that would
13 attack them, but that is second-hand, I am not an expert
14 on that, but it's true of collection systems as well.
15 As we gain more experience we can either say they are
16 dead at 20 years or after 20 years we can say we have
17 a lot of them that are still working and we can extend
18 the life beyond 20 years, and certainly I know of some
19 that have been working ten years, and not totally without
20 problems, they do have to be cleaned up from time to
21 time, but none the less the systems are still in operation
22 and functioning to my knowledge reasonably well.

23 Q. Mr. Sobanski, let's stick to page
24 133. You have assumed a gradient of 0.5 which you say
25 is estimated for mounded conditions and by that you mean



1 the leachate rising to the level of the water table or
2 rising only to 1.5 average above the collector tiles?

3 A. I'm not sure what this would be.
4 It gives you the gradient and we put the gradient at
5 about 0.3 and I have mounded it to take it to about 0.5
6 in this case and said I believe that at 0.5 we would
7 have enough of a gradient to overcome our trap and we
8 might start seeing some contaminants coming through after
9 a period of time.

10 Q. Let me suggest to you that the
11 gradient of 0.5 is based on an average height of leachate
12 of 1.5 metres above the collector tiles and you can
13 check your own calculations.

14 A. It may be, but it may be that it's
15 quite a minimal failure I have applied to it.

16 Q. That is what I am suggesting it is.
17 If you were to take the kind of scenario we talked about
18 earlier today, a mound, average mound of 15 metres in one
19 or two of the cells, 4 and 5 for example, you would
20 change that gradient and the gradient would be 12.9 metres
21 over the seven-metre horizon giving you a gradient of
22 1.8, and if you plug 1.8 into your calculation on page
23 133 and assume perhaps a little bit of a change, three-
24 times change in your hydraulic conductivity, you could
25 get a flow or Q of 128 litres per minute and we are



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1 talking an order of magnitude more than you have
2 calculated.

3 A. That would be very neat because we
4 sure don't see it in the well records up there, that the
5 wells are that good. But, if you want to make those kind
6 of assumptions I can't stop you.

7 Q. That is my point as well. If you
8 get that kind of flow, because of the mound of garbage
9 sitting up there and all that leachate that has been
10 generated through the garbage, you won't get leachate
11 adding to groundwater right now, fair enough? So, this
12 may be an extreme case, but let's take half that value
13 and let's go to five times more than you calculated.
14 What I am suggesting is you have not determined the
15 impact on adjoining wells.

16 A. Wait a minute now. I have given
17 you what I have calculated my impact to be because I
18 could turn it around and say I assumed one-fifth the
19 permeability you are talking about, and you are rounding
20 everything up but it could equally be rounded down.

21 Q. Unlikely, but you have tried to be
22 conservative.

23 A. Well, conservative is an estimate
24 and it isn't necessarily the absolute value. The absolute
25 value in all of these comes from monitoring and seeing how



1 they perform and no one can give a 100 per cent answer for
2 any of these numbers.

3 Q. But you have not determined the
4 impact on adjoining wells if you pump at, say, five times
5 the rate you put on it?

6 A. No, nor at one-fifth.

7 Q. Don't you think it would be approp-
8 riate to do that or do I simply understand it doesn't
9 matter if you impact the wells because you draw them down
10 too much and then the Region of Halton would have to take
11 other measures?

12 A. That is correct. The Region of
13 Halton will have to take other measures.

14 Q. Don't you think the people living on
15 First Line should have the benefit of having someone
16 calculate whether or not they are going to be deprived of
17 the use of their wells?

18 A. They have, right here on page 133.

19 Q. I'm telling you that I would like
20 a more conservative estimate.

21 A. The number that's been generated
22 is a good number and it's based on the information we
23 have and our best estimates of what is happening at the
24 site.

25 Q. You don't want to think of any



1 other numbers to put into the formula?

2 A. I'm telling you I can put in any
3 number you want, but it's another calculation and I could
4 equally take it down and not have as much impact and
5 still be within the reasonable range of hydrogeologic
6 parameters.

7 Q. So really the people who are
8 relying on their wells, what they have to do is assume
9 that if the upper range is resulting or you have not
10 bothered to think appropriately of what the upper range
11 would be, the Region of Halton would then at some point
12 in time have to arrange to replace their wells or take
13 other measures?

14 A. If the site impacts the people,
15 yes, then the Region of Halton will have to restore
16 supplies.

17 Q. Then I would like to go back to a
18 topic we were discussing yesterday and that is the
19 possible errors in the Hvorslev values. You will remember
20 this was in the upper granular unit and it was pointed
21 out by Mr. Tidball that the range of value was four orders
22 of magnitude Hvorslev versus pump tests, and when I brought
23 that up with you yesterday and tried to suggest that that
24 was some basis for suggesting the hydraulic conductivities
25 could be in the upper till, they could be greater than



1 Hvorslev indicated, you said they could also be slower
2 than Hvorslev had indicated. Is that what I heard you
3 say yesterday?

4 A. No. What I said yesterday was
5 that the tritium values indicate it could be lower.

6 Q. But, you said that based on tritium
7 you were coming to the opinion that it could be lower?

8 A. Yes, or something to that effect
9 and the record would have to be checked.

10 Q. Let me suggest to you that the
11 problem you outlined for us with regard to the Hvorslev
12 method of determining hydraulic conductivity in the
13 granular unit, specifically the smearing of the
14 sides of the boreholes
15 could also occur in the till such as the unweathered
16 upper till. Even if we don't want to go to four orders
17 of magnitude difference, I am saying that these problems
18 such as smearing will introduce an error in Hvorslev values even
19 in a till which is at least a bit on the low side and it
20 won't induce an error on the high side.

21 A. I think that Hvorslev tends to
22 generally underestimate permeability, if it is a problem
23 and where it is a problem. I don't know how far you want
24 me to go into that, but I personally feel that it's a
25 bigger problem perhaps in the granular units than it is
in the glacial tills.



1 Q. But the same kind of underestimate
2 caused by that smearing could happen in the upper unit?

3 A. In the upper unit if you are
4 talking -- yes, to some degree I suppose one could say
5 that.

6 Q. Therefore looking at Hvorslev one
7 would tend to say that the values there, based on
8 Hvorslev would be slower, if anything, and the real value
9 may be faster and not slower based on Hvorslev?

10 A. As long as we say "may be."

11 Q. I just wanted to clarify that with
12 you. The other basis you were suggesting that the real
13 values might be on the lower side than Hvorslev indicated,
14 I think you said in a sort of fleeting moment yesterday,
15 was the lousy chemistry at the site and somehow you
16 seemed to express some confidence that because of the
17 lousy chemistry, in your terms, that tended to indicate
18 that if there was going to be variability, Hvorslev would
19 be high and it would only go down from there. Is that
20 what I understood?

21 A. No. I was suggesting that I felt
22 we are not getting an indication of rapid flushing because
23 of the poor chemistry in the soils, the very high sul-
24 phates, and that doesn't seem to indicate that things are moving
25 rapidly away to replenish it with fresher water.



1 Q. From that you were conjecturing,
2 I take it, that if Hvorslev was wrong it would show it was
3 too fast and not too slow?

4 A. I don't believe I related it to
5 Hvorslev.

6 Q. I thought you did.

7 A. I may be wrong.

8 Q. I thought we got into it, but if
9 you want to make it clear that you are not relying on
10 the chemistry of the site ...

11 A. I was arguing the general principle
12 on just how fast things were moving and the chemistry to
13 me doesn't indicate to me that we have tremendously high
14 groundwater velocity because we do have some very, very
15 high sulphates in the groundwater at fairly shallow
16 depths.

17 Q. I don't want to leave the chemistry
18 on that general level. It seems to me if we look at
19 Volume 2, Appendix 11 of your report on Site D, you
20 presented the results of your chemical sampling and if
21 we turn to the third page we see your groundwater sampling
22 as I understand it was restricted to three locations,
23 HCl-85, HC5-85 and HC6-85?

24 A. Yes, that is right.

25 Q. Looking at the piezometer sampled



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1 in the case of HCl-85, it is possible that piezometer 3
2 is in the unweathered upper till, although that is one
3 we had some disagreement about yesterday, and you con-
4 cluded that the piezometer was either in a zone that was
5 not truly representative of the upper till for one
6 reason or another; right?

7 A. This was a discussion we had that
8 it appeared to be something that was very sandy and
9 silty.

10 Q. You were trying to say, if I under-
11 stood it, that it was not representative of the upper till
12 but that is one -- it's one of your three samples?

13 A. I'm looking at the one above it
14 which is No. 4 which has sulphates of 1,940 which is
15 the standpipe, and that is a shallow standpipe which has
16 1,940 sulphate and the chlorides we thought were too high
17 at 991 and to be typical of the upper zone and felt
18 perhaps that road salting had an effect on that particular
19 piezometer and the same for No. 6. We can see the upper
20 one there is 4,540 milligrams per litre of sulphate and
21 I'm offering this as an explanation that the chlorides
22 are more normal.

23 Q. Those are in the upper weathered
24 till?

25 A. I'm just checking. Yes, it's in



1 the upper zone, it's about five metres deep, a little
2 over six metres, 6.5 metres deep.

3 Q. That's in the weathered zone?

4 A. Yes, just, it's straddling it.

5 Q. And the other one?

6 A. No. 5.

7 Q. Is that also possibly in the
8 weathered zone?

9 A. Which one?

10 Q. Five-85, piezometer 3.

11 A. Yes, that's correct, and 1-85 as
12 well. They are all about the same depth, between five
13 and six metres.

14 Q. So really we are having -- how many
15 are really in the unweathered upper till?

16 A. All three of them are and one is
17 not so good.

18 Q. One?

19 A. One is not bad quality and the two
20 others are bad quality in terms of sulphate.

21 Q. We also said that two of them were
22 actually in the weathered?

23 A. That's what I'm talking about, the
24 upper material, and they are sort of at the contact between
25 the weathered and unweathered zone, but even at that high



1 elevation we are dealing with relatively poor quality
2 water and to me that doesn't indicate disastrous ground-
3 water velocities.

4 Q. So, at the most, you relied on two
5 data sources to reach a corroborative opinion?

6 A. That is my interpretation of those
7 results.

8 Q. Over a site that is how large? It's
9 53 hectares or approximately what?

10 A. That's correct, but those values
11 are unusually high for the middle of fields.

12 MR. ESTRIN: Mr. Chairman, I am about to
13 turn to another major topic and I am wondering whether
14 it wouldn't be inappropriate to break at this point.

15 DR. KINGHAM: If that could be possible.
16 Could you give us some idea so everyone can plan ...

17 MR. ESTRIN: I am going to try and ensure
18 to do my best and finish on Thursday. I don't want to
19 guarantee it, but I don't think I will be a whole day.
20 I will be a substantial part of the day and I'll do my
21 best to finish on Thursday, but there is a possibility
22 that I might not.

23 DR. KINGHAM: Before Mr. Sobanski puts
24 the microphone down just a clarification for me, if you
25 can. Is the assumption that the actual moisture content



1 contributed to leachate by the garbage itself is quite
2 low valid? The garbage is not a major generator of
3 water itself but the rain coming through it?

4 MR. SOBANSKI: That is correct. There
5 will be a little bit generated that will go in with it.

6 DR. KINGHAM: Whatever went in along with
7 garbage?

8 MR. SOBANSKI: If it's collected on a
9 rainy day you could have some leachate fairly quickly.

10 DR. KINGHAM: Does the dumpsite follow a
11 conservation of mass principle, that all you will pump out
12 from the edge of the site is more or less what rains
13 through it in the course of a year?

14 MR. SOBANSKI: That is correct and with
15 the hydraulic trap principle you are also drawing some
16 groundwater from the surrounding zones into the site.

17 DR. KINGHAM: Does that set a limit for
18 how much you would ever have to pump, namely a relation-
19 ship to the climate, the rainfall?

20 MR. SOBANSKI: The amount that we assume,
21 and it is an assumption, and it's 12 inches a year which
22 is what we are using because that is what the Ministry
23 is requesting of us to use for leachate generation and
24 at some sites it appears to be lower and perhaps at
25 others it may be higher.



Nethercut & Co. Ltd.

Toronto, Ontario

6043

Sobanski, Beechinor,
cr-ex (Estrin)

1 DR. KINGHAM: I appreciate that clarification.
2

3 MR. LEDERER: Just before you rise there
4 are one or two small things I could take care of in the
5 remaining moments. First of all, we had undertaken to
6 file a copy of Exhibit 100 or H-100 and these were the
7 overheads used by Dr. Macintosh when he was with us and
8 perhaps I could give those to you now.

9 Secondly, I indicated to the Board at the
10 outset of the week that we had determined that we would
11 or should call the individual who did the geochemistry
12 and we are informed that he did a report which as I under-
13 stand it was given to Hydrology Consultants, and one thing
14 we can do is distribute that report now and there will
15 be a witness statement but this at least will help us
16 with the lead in and we have copies for everyone.

17 MS TANNER: Should they be numbered now?

18 MR. LEDERER: Yes.

19 MR. HODGSON: We have reserved numbers.

20 DR. KINGHAM: We have numbers left over?

21 MR. HODGSON: H-86.

22 MS CRONK: What is the title?

23 DR. KINGHAM: We will file this as H-86,
24 evaluation of groundwater contaminant migration at the
25 candidate sites for the proposed Region of Halton landfill.



1 --- EXHIBIT NO. H-86: Evaluation of groundwater
2 contaminant migration at the
3 candidate sites for the proposed
4 Region of Halton landfill

5 MR. LEDERER: If I could just have a
6 moment. I would also like to file with the Board what
7 is a revised witness statement of Mr. Ralph Crysler,
8 the next witness, and subject only to whether or not we
9 can get Mr. Feenstra in, but unless anyone starts talking
10 about the 30-day rule this was given to counsel at the
11 end of June so it's a matter of filing it with the Board.

12 DR. KINGHAM: Shall we give this a number?

13 MR. LEDERER: It will be H8B-1.

14 DR. KINGHAM: Everyone has that.

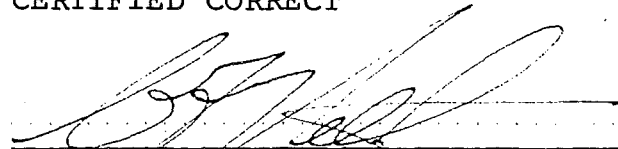
15 --- EXHIBIT NO. H8B-1: Revised witness statement of
16 Ralph Crysler

17 MR. LEDERER: Thank you.

18 DR. KINGHAM: All right. We will recon-
19 vene on Thursday morning at 9:30. Thank you.

20 --- Adjournment (4:18 p.m.)

21 CERTIFIED CORRECT

22 
23 C. F. Nethercut, C.V.R.

