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REVIEW OF THE HYDROGEOLOGICAL STUDY
FOR THE
BURLINGTON LANDFILL EXPANSION -
PRELIMINARY REPORT

Prepared for

Canadian Environmental Law Association

Monenco Ontario Limited

May 1984



MONENCO ONTARIO LIMITED

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1984-05-07

Our File: CEW 8086-6

Mr. R.K. Timberg
Staff Lawyer
Canadian Environmental
Law Association
8 York Street
5th Floor South
Toronto, Ontario
M5J 1R2

Dear Mr. Timberg:

Re: Review of the Hydrogeological Study for the
Burlington Landfill Expansion -
Preliminary Report

We are pleased to present our preliminary report on the Review of the Hydrogeological Study for the Burlington Landfill Expansion.

The report describes the history of Monenco's involvement with the review for the Canadian Environmental Law Association (CELA) and then, at CELA's request with the Environmental Assessment Board for Ontario. The above request brought about the appointment of Mr. Kevin J.D. Ridley, a Monenco hydrogeologist as the Board's expert witness in hydrogeology and related fields.

The review, although preliminary in nature, has highlighted areas of concern. It has recommended that a more sophisticated analysis of some of the existing data be undertaken as well as stress the need for further investigation.

Should you require further details or clarification on any aspect of this report, please do not hesitate to call.

Yours very truly,

Kevin J.D. Ridley
Hydrogeologist

KJDR/wlg
Encl.

cc: Mr. Harold Browne

1.0 INTRODUCTION

The Canadian Environmental Law Association (CELA) requested consulting services to review reports prepared by the Region of Halton and to appear at the upcoming Environmental Protection Act Hearing in relation to the proposed expansion of the Burlington Landfill. A three volume report entitled "Burlington Landfill Site Application for Continued Use" prepared by M.M. Dillon Limited (MMDL) (March, 1984) as well as a number of other related reports about the Site were delivered to our offices on April 5, 1984. Work on the review commenced on April 9, 1984 and has continued to present on 'an occasional' basis because of the limited finances of our original client. The major component of our review is the hydrogeology and related fields. The bulk of the review is, therefore concerned mainly with Volume 2 which is entitled "Hydrogeological Study" and was prepared by Gartner Lee Associates Limited (GLAL). Work performed to date, in addition to the preliminary technical review of the above includes:

- a meeting with CELA and a representative of their clients, the West Burlington Citizens' Group
- a meeting with Ms. I.R. Pawlowski, a hydrogeologist with the Ministry of the Environment, Ontario (MOE)
- a site visit sponsored by MMDL and GLAL and attended by representatives from MMDL, GLAL, Ecoplans Limited (EL), Conestoga-Rovers and Associates Limited (CRAL), MOE and the Region of Halton
- a meeting with members of the West Burlington Citizens' Group
- a meeting with representatives from the City of Burlington and their consultants (EL and CRAL), their lawyer, their solid waste management committee, CELA and some members of the West Burlington Citizens' Group

- numerous telephone conversations with Mr. R.E.J. Leech (GLAL), CELA, West Burlington Citizens' Group and Ms. I.P. Pawlowski (MOE).

On May 1, 1984 a Monenco hydrogeologist, Mr. Kevin J.D. Ridley, met with Messrs. R. Eisen and M. Jeffreys, both members of the Environmental Assessment Board for Ontario and Mr. H. Browne who is the Board's Registrar. Discussed at this meeting was the appointment of Mr. Ridley as the Environmental Assessment Board's "expert witness in hydrogeology and related fields pursuant to Section 18 (9) of the Environmental Assessment Act in respect to the Hearing concerning the Burlington Landfill Expansion". On May 2, 1984 at a second meeting with the above Board Members and Registrar a formal document confirming Mr. Ridley's appointment was signed. Mr. Ridley is now the Board's expert witness in hydrogeology and related fields, (i.e. Mr. Ridley is now retained by the Board). However, in the above agreement, although Mr. Ridley is to remain professionally impartial he can "render guidance and advice to CELA which represents West Burlington Citizens' Group". A copy of this document is included in Appendix A.

2.0 TECHNICAL REVIEW OF THE HYDROGEOLOGY AND RELATED MATTERS

This letter report serves to summarize the review to date of the material submitted to Monenco, the bulk of which concerns Volume 2 of the proposal for expansion of the Burlington Landfill Site. The review is by no means complete in its present format and should be considered preliminary in nature. A final report will be submitted to the Board after all evidence from the Proponent has been heard and analysed. Moreover, the interpretations and any conclusions arrived

at in this preliminary document are subject to reinterpretation in light of any new evidence that may arise during the Hearing or from any other credible source.

Mr. Ridley's general impression of Volume 2 of the proposal is it cannot be regarded as comprehensive. Besides having some technical and analytical shortcomings there were instances where items were not addressed shedding doubt on the expected impact of the proposed expansion on the hydrogeological regime. Moreover, some of the analyses apparently do not consider all the available facts and options. In general, the hydrogeological study in its present form does not stand on its own and does not appear to be in a completed format although it is presented as a final and not a draft report.

The following is a summary of Mr. Ridley's major concerns with the hydrogeological study based on the information that has been submitted to Monenco for review.

2.1 EXECUTIVE SUMMARY

The summary is misleading, especially for the lay reader. Areas of concern include:

- the good containment and cation exchange attenuation properties of the glacial till;
- the likely location of the southerly extent of the plume;
- the inability to detect the front edge of the plume due to masking effects of the background water quality in the shale;
- that leachate chemical parameters downgradient of the fill generally do not exceed background levels and those that do are attenuated;
- that contour modification of Phases A and C on the existing landfill will not measurably change the existing hydrogeological setting;
- that the continued use proposal will not interfere with the existing plume.

2.2 CONTINUED USE AREA

Areas of concern in this section include:

- not addressing the solubility of calcite, dolomite and any extractable amorphous constituent of the till in a leachate environment (calcite averages 27.1% of the till mass);
- using distilled water as a permeant in the "permeability" tests;
- assuming the porosity of the fractured shale as 5%;
- the method of analysis used to determine an average vertical flow velocity through the unfractured glacial till;
- lack of reference to individual boreholes when stating ranges of chemical data.

2.3 EXISTING LANDFILL SITE

Areas of concern in this section include:

- the fate of the leachate that is not removed by the underdrain system;
- the wording in the second paragraph, page 0-41 with reference to the southern portion of the existing site stating "leachate will ex-filtrate..." and the "plume will develop...";
- the lack of recent analysis of leachate from monitors in the refuse;
- concern that the two leachate analyses are not representative of the true leachate chemistry;
- the implication that water quality deteriorates with depth citing 16 I, 16 II, and 16 III as an example when this is not the case as well as implying that the above three monitors plus 17 I are representative of background water quality in the shale;
- that although the chlorinated hydrocarbons - chlorobenzene and 1, 1, 1 trichloroethane are not detected in the toe drain leachate sample they are detected in monitor 17;
- the inclusion and selectivity in Table 2 of only some of the chemical data, the omission of data from other relevant monitors, ignoring other major dissolved constituents in Table 2, no

explanation in the text concerning the "% attenuated" fate of chloride at 16 III, and an explanation of the attenuation process responsible for reduction in chloride concentration;

- the statement on page 0-45 that "the limits of the plume are likely between monitor location 16 and Highway 403,...." which is more definitive than what appears in the Executive Summary and does not appear to consider temporal change of chemical concentration data from monitor 17;
- the statement on page 0-45 that "at the leading edge of the plume most chemicals and parameters are undetectable due to natural groundwater quality";
- the statement on page 0-45 that "those that are detected are almost completely attenuated, as shown in Table 2" when Table 2 considers only some dissolved constituents at a select number of monitors;
- the omission of detailed chemical analysis of SW3 and the sedimentation pond;
- the implication that the higher conductivity of SW3 relative to SW1 is likely from naturally saline groundwater discharge;
- there are no groundwater flow cross sections for C-C' and D-D'.

2.4 PHASES B AND D - ASSESSMENT AND DEVELOPMENT

Areas of concern in this section include:

- no mention of any physical or chemical reaction of the leachate with the till causing the seepage velocity to deviate from assumed mean values;
- the statement on page 0-52 that "it is unlikely that contaminants could be traced any significant distance as shown by the studies at the existing site";
- the whereabouts of the "mass balance calculations" referred to on page 0-52;
- the statement on page 0-52 that "there is in most cases no measurable change in the downgradient chemistry as a result of the landfill";

- the statements on page 0-53 that "there is a large cation exchange capacity" for the till and "it is unlikely that these contaminants could be detected".

2.5 PHASES A AND C - ASSESSMENT AND DEVELOPMENT

Areas of concern in this section include:

- the engineered under-drain system that controls leachate volumes and levels only covers about 25% of the present landfill area, yet Phases A and C will extend southeasterly over areas that are not engineered;
- the statement on page 0-64 that "the additional leachate produced over time will not alter the existing conditions";
- the statement on page 0-64 that "the uncollected leachate will move away from the site within the existing contaminant plume".

2.6 MONITORING PROGRAM

Areas of concern in this section include:

- the frequency of monitoring of the leachate to date;
- no recent monitoring of leachate from beneath the landfill;
- no offsite monitoring of ground and surface waters.

2.7 CONCLUSIONS AND RECOMMENDATIONS

After reading the report there is some difficulty in fully comprehending the meaning of the first three conclusions (page 0-71) and agreeing with the fourth conclusion. Moreover, in light of the above comments concerning the bulk of this report it is felt that the recommendations are not sufficient.

3.0 RECOMMENDATIONS

Other scenarios concerning the impact that the present landfill and the proposed expansion will have on the natural hydrogeological regime using the current physical and chemical data bank can be formulated. Major areas that can be re-interpreted by re-analysis of existing data are:

- the location of the front of the plume;
- the mean linear groundwater velocity in the shale;
- the time for leachate to breakthrough the 1.5 m thickness of till;
- the "detectability" of leachate in the groundwater downgradient of the site.

The present hydrogeological study could be greatly improved if the existing data were re-evaluated using a more sophisticated analytical approach.

NO

.1 A simulation model study should be performed on the advancement and breakthrough of the leachate from the till because of the complexity of the interactive and simultaneous processes that occur in a soil-water-leachate system. This would allow a more rigorous analysis of the breakthrough phenomenon and include the use of advection - dispersion in place of the mean linear seepage velocity.

2nd Report

.2 There is a controversy concerning the location of the front edge of the contaminant plume particularly since there is no offsite monitoring. Because of the fractured nature of the shale beneath and downgradient of the site the reliability of an analysis using the simple mean linear groundwater velocity technique is probably suspect; especially since, to our knowledge, there are no fracture porosity values for shale cited in the literature. It is recommended that a range of

porosity values be employed in the simple analysis or a more comprehensive analysis of the movement and location of the plume be conducted using a predictive model.

- 2nd Report*
- .3 The groundwater chemistry recorded at monitors 16 and 17 which are downgradient of the landfill site should be re-analysed. All options concerning the origin of their chemistry should be discussed.

Besides presenting alternative interpretations of the existing data it is felt that more data and a more extensive monitoring program are needed. The following recommendations concerning the above are listed below.

- Report 2*
- .1 The hydraulic conductivity of the till should be determined using a representative sample of leachate. A leachate sample from the base of the refuse near the center of the original or the 1980 engineered expansion of the landfill site should be used for testing. Testing should be conducted over the time period of weeks to months. A complete chemical analysis of the leachate should be conducted.

- NO*
- .2 Leaching - dissolution experiments should be conducted with the till in conjunction with an XRD analysis before and after completion of the above task. Soil extraction analysis should also be conducted on the till.

- NO*
- .3 A sedimentation pond should be incorporated to intercept all surface drainage from the eastern side of the landfill.

- Report 2*
- .4 A ground and surface water monitoring program should be instigated downgradient of the site. This would involve the installation of at least one multi-level device southeast of

Highway 403 and a surface water sampling program at various sites along the Indian and Falcon Creeks within the community of West Burlington.

- Report 2*
- .5 An offsite reconnaissance for outcrops of the Queenston Shale and any springs in the valleys of the Indian and Falcon Creeks should be conducted throughout the community of West Burlington.

- Report 2*
- .6 The onsite monitoring program should be expanded to include stations along the North Service Road - one by the entrance road to the site and another in the vicinity of the southeast corner of the site. Preference should be given to multi-level devices.

APPENDIX A



Environmental
Assessment
Board

(416) 965-2531

1 St. Clair Avenue West
Toronto, Ontario
M4V 1K7

✓ May 2 ✓ RST
~~April~~ 27, 1984

Re: Burlington Landfill Expansion

To: Mr. Kevin J. D. Ridley

You are hereby appointed by the Environmental Assessment Board as its expert witness in hydrogeology and related fields pursuant to Section 18(9) of the Environmental Assessment Act in respect of the above Hearing. Section 18(9) of the Environmental Assessment Act reads as follows:

The Board may appoint from time to time one or more persons having technical or special knowledge of any matter to enquire into and report to the Board and to assist the Board in any capacity in respect of any matter before it.

You are directed to investigate the hydrogeology and related matters involved in the proposal and to report to the Board and to the Hearing your findings as to the hydrogeological impact of the proposed expansion, its possible effects on the environment as defined by the Environmental Protection Act and whether, in your opinion, the proposal can be carried out without creating unreasonable environmental risks and, if so, under what terms and conditions.

During your investigation and during the course of the Hearing, you are directed to specifically consider the impact that the proposal will have on ground and surface water and also to consider the proposed plan for leachate collection and treatment.

You will be expected to submit a written report of your findings and conclusions; to be in attendance at the Hearing during the giving of evidence of other experts in the field of hydrogeology; to explain and evaluate such hydrogeological evidence as may be required by the Board; to testify orally; to render guidance and advice to the Canadian Environmental Law Association which represents West Burlington Citizens' group; and to generally render assistance to the Board in your area of expertise.



Environmental
Assessment
Board

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These terms of reference may be altered as the Hearing progresses and as circumstances require.

If you are in agreement with the above, please sign duplicate copy.

Kevin J. P. Piddley