

14.0 CONCLUSIONS /RIDLEY

Based on Mr. Ridley's review of the available data the following conclusions are made.

14.1 The leachate from the toe drain collection system and monitors 8A and 11A are diluted by an unknown factor.

* 14.2 The quality of the background groundwater chemistry in the Queenston shale at the site is not known.

14.3 A lot of the chemical analyses of groundwater from the monitors do not satisfy a condition of electroneutrality. Greater than 60% of the analyses exceeded a charge-balance error of 15%.

* 14.4 Lateral groundwater flow velocity in the shale, depending on the fracture porosity that is assumed, could be greater than indicated in the GLAL report. (Regions consultants had estimated a plume velocity ~~of~~ 15 metres/year. Ridley's was a range of 17.6 - 1759 metres/year - see pp 2520 - 2521 Vol. 13 of Transcripts)

* 14.5 Bearing in mind the disparities concerning the leachate chemistry, the background groundwater chemistry and the lateral groundwater flow velocity in the shale, conclusive statements regarding delineation of the plume is not possible.

* 14.6 CH₂Cl₂ in the plume have the potential to migrate at a greater rate than simple seepage theory predicts.

14.7 Assuming there is no reaction of leachate with the till, one dimensional diffusion without advection predicts the breakthrough of leachate through the till in less time than analysis by simple seepage theory. If advection, anion

* means conclusions most relevant to Site F or hydrology in general area of Site F

exclusion and adverse leachate-till reaction are incorporated into the analysis, the time for breakthrough will decrease even more.

- * 14.8 The efficiency of the RTD for collection of leachate is low. Large volumes of leachate from the original non-engineered site are exfiltrating unimpeded into the shale. ~~from~~ (e) from central portion Burlington landfill)
- * 14.9 The toe drain for the proposed continued use area is conceptual in nature. Consequently, the efficiency of collecting leachate that exfiltrates from the continued use area is not known. Thus, no definitive statement can be made concerning its ability to protect the upper reaches of Falcon Creek northwest of the groundwater divide and Indian Creek east of Phase B. (Phase B is at north-east end of site)
- 14.10 The potential impact of leachate that exfiltrates from the continued use area on the hydrogeologic regime could be substantial if the annual volume of exfiltrate is equivalent to the annual groundwater flow volume. However, the concentration of leachate and background groundwater chemistry must also be considered in the impact scenario.
- * 14.11 A plume is presently migrating in a southeasterly direction from the original non-engineered site. The extent of this plume and the impact of the leachate on the hydrogeologic regime is not known.
- * 14.12 It is not known if the leachate and till are compatible. Moreover, laboratory testing of the hydraulic conductivity of (the till using distilled water as a permeant over short testing durations may have indicated falsely low hydraulic conductivities). If actual field hydraulic conductivities are greater than the lab testing has indicated then all calculations

concerning leachate leakage losses, efficiency of leachate collection, and time for leachate breakthrough will be incorrect.

14.13 The existing monitoring program is not suitable for sampling and analysis for dissolved organic constituents.

14.14 A new monitoring program is desirable on site. The monitors should conform to guidelines necessary for reliable sampling and analysis for dissolved organic constituents. They should be located upgradient of the landfill, within the refuse of the landfill, at the southeasterly toe of the landfill and at the southeasterly border of the landfill property.



14.15 There is no ground or surface water monitoring program off site.

14.16 A monitoring program is desirable off site. At least one monitor should be installed southeast of Highway 403 particularly if the on site monitoring program (14.14) has indicated that the plume has migrated off site. Surface water sampling and analysis should be conducted in Falcon Creek at locations within Aldershot.



14.17 There has been no known off site reconnaissance of the Falcon and Indian Creek courses delineating areas of bedrock outcrop and/or areas of groundwater discharge between the landfill site and Burlington Bay or Lake Ontario.



14.18 Hydrogeologically there is the potential for upward hydraulic gradients to exist southeast of the landfill site.



14.19 The original landfill site in its ^{shale} ~~present~~ form should never have been selected for landfilling of refuse.

14.20 It cannot be unequivocally stated that "the proposal can be carried out without creating unreasonable environmental risks" until the following conditions are addressed.

14.20.1 General

- a)- accurate determination of leachate chemistry
- B)- vertical profile concentration of background groundwater chemistry to at least 30 m into the shale
- C)- new onsite monitoring program
- D)- delineation of plume

14.20.2 Phases A and C (over original site)

- a)- extension of RTD in a northwesterly direction parallel to the East Ditch to connect to the underdrain system
- B)- investigate Mr. Well's proposal for Phase A

14.20.3 Phases B, D and C (over engineered site)

- a)- determination of the hydraulic conductivity of till using leachate or a representative fluid
- B)- determination of long term integrity of the till in a leachate environment
- C)- rigorous analysis of the effectiveness of the expansion toe drain

- 9)- install monitors in the upper reach of Falcon Creek northwest of the groundwater divide and in Indian Creek east of the North East Ditch

14.20.4 Original Landfill Site

- 4)- evaluate the effectiveness of the RTD for collection of leachate
- 3)- investigate the use of horizontal drains in direct hydraulic contact with the RTD

14.20.5 Offsite Monitoring and Reconnaissance

- a)- ground and surface water monitoring offsite
- B)- field reconnaissance to determine areas of bedrock outcrop and/or areas of groundwater discharge