

ADVICE TO APPLICANTS AND TO CONSULTANTS IN PREPARING
HYDROGEOLOGIC REPORTS FOR PROPOSED LANDFILL SITES

ONTARIO MINISTRY OF THE ENVIRONMENT
WATER RESOURCES BRANCH

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PART I - MINISTRY POLICY AND SUGGESTED APPROACH

The Ministry's policy with respect to landfill sites is to control ground-water quality to protect both existing and potential reasonable uses of water on adjacent property. It should be noted that of the numerous factors and concerns to be dealt with by a proponent, this document deals only with those related to hydrogeology.

This document suggests an appropriate approach for the preparation of hydrogeologic reports on site investigations undertaken to support applications for approval under Part V of the Environmental Protection Act. Note that approval of a landfill site can involve proceedings under the Environmental Protection Act (Part V), the Environmental Assessment Act or the Consolidated Hearings Act. In many cases it will be up to the applicant to choose which way he will proceed in order to best suit his needs and his circumstances. It is only under the Environmental Protection Act that the approval decision remains with the Ministry of the Environment Director. In such cases, the Ministry is in a position to insist that the scope of site investigations encompass the suggestions in this document. Under the Environmental Assessment Act and Consolidated Hearings Act the Ministry role is different, and the suggestions in this document will form part of the Ministry's advice to the appropriate decision-maker.

a) Ground Water Use

The uses of ground water in the vicinity of the site should be assessed and an estimate made of the existing and possible needs and uses for this ground water in the future. Both the quality and quantity of the ground waters should be described in terms of their

suitability for these uses (i.e., a technical assessment of what the resource could be used for based on its quantity and quality). This assessment can generally be based on an office review of records and will seldom involve any significant amount of field work. It does not involve a planning assessment based on potential development in the area although any such existing assessment should be considered. The purpose of this assessment is to determine existing and potential reasonable uses so that acceptable discharge levels can be specified. If sought, this specification will be made in accordance with the commitment in Part II of this document "The Role of the Ministry".

There should also be some discussion provided of any other existing and potential sources of contaminants in the vicinity so that these contaminants can be considered in the determination of an acceptable discharge from the site.

b) Surface Waters

The quality, amount and existing and potential uses of surface waters in the vicinity of the site should also be addressed with respect to any impacts on these surface waters that might occur directly or as a result of an impact on the quality or quantity of the ground water caused by the proposed site. The Ministry's policy on surface waters is presented in the booklet "Water Management Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment", November, 1978.

c) Site Impact on Water Use

The impact of the proposed landfill operation on the ground and surface waters and their uses on and off site should be assessed. As it is difficult for the Ministry to support sites which have not been evaluated in quantitative terms, this assessment should have a quantitative basis with the level of contamination being addressed as well as the length of time the contamination will be present within the site. Discussions with the Ministry, as outlined in

Part V of this document, can be held in order to consider the appropriate extent and sophistication of the analysis needed for this assessment

The Ministry considers the state-of-the-art in the prediction of contaminant attenuation to be relatively inaccurate and thus such calculations and estimates should incorporate a large safety factor. An estimate of the confidence level or the expected range for all estimates and a worst case estimate (maximum possible impact) of the effect of the landfill on the environment should be provided. The worst case estimate is necessary input to determine the magnitude of the safety factor that will be required and the consequences of failure. It is not intended to be a probable estimate of site impact.

d) Site Contingency Plans

The Ministry considers a contingency plan to be a plan designed to accommodate any failure in the design of a landfill. As failure may develop in a number of ways, it may be appropriate to address several contingency plans for a site. A contingency plan is considered to be a backup measure only.

It would also be appropriate for the Applicant to address the cost of the contingency plans and the method(s) by which they will be funded as well as the likelihood that the various plans will have to be implemented.

Proposed measures with a high level of probability of being implemented are not contingency plans but are considered to be a part of the landfill design and should be funded accordingly.

e) Monitoring Program

The purpose of a monitoring program is to determine:

1. if the landfill is operating as designed and predicted monitoring results are being obtained.

2. if the contingency plans should be implemented, and
3. if contingency plans are functioning as expected.

If the landfill is not operating as designed, a proper monitoring program should, by early detection of any failure, allow some options with respect to contingency plans and decrease the cost of implementing any contingency plan.

A predictive monitoring program may be appropriate. Predictive monitoring requires that anticipated monitoring results be specified in advance. This allows the level of understanding of the hydrogeologic system to be appraised by comparing the predictions with the monitoring results.

Monitoring plans and contingency plans are inseparable. In the event that a monitoring plan and contingency plan are required the purpose or objective of the monitoring plan should be discussed. Conditions (monitoring results) which would initiate a predetermined response should, in so far as is possible, be specified (e.g. contaminant levels which would initiate the activation of a contingency plan).

It is recognized that there is considerable uncertainty in predicting monitoring results and in any predictive monitoring program, new predictions can be made to accommodate the monitoring data as they are collected. Review and reassessment of the levels that would initiate contingency measures will be necessary in most cases. A major advantage to the predictive monitoring approach is that it ensures that there is a regular organized review of monitoring data as they are collected and that the Ministry can be alerted of significant monitoring results.

f) Maintenance

The long-term maintenance of a landfill, including leachate and gas control facilities, monitoring devices, the landfill cover, vegetation, etc. and the assignment of responsibility for conducting these operations should be addressed. Where known, the uses of a

site after filling has been completed should be specified, particularly those uses that may affect the hydrogeologic regime and the production and migration of leachate and gas. Any constraints to future uses of the site should also be specified.

Any future uses of landfilled sites (for 25 years after closure) must be approved by the Minister of the Environment under current legislation. There is an advantage to an applicant who is going through a Hearing process to make an early commitment to future use.

g) New Technology

Where a proposal involves emerging technology that has not been subjected to performance testing at normal landfills, this technology should be identified and any references or data (or experience) available on this technology should be provided.

h) Data

All of the hydrogeologic data that have been collected should be provided. It is not necessary to provide all of these data in final form (e.g. legible copies of handwritten field records are acceptable). All data are required because:

- i) they are necessary for a complete review of the Applicant's assessment; and,
- ii) a complete record of all testing and test results is desirable for future reference in the event that problems which require remedial action develop over the long term.

PART II - THE ROLE OF THE MINISTRY

a) Contact with the Ministry

The Ministry's Regional offices will be the first Ministry contact for matters dealing with proposed landfill sites. The Regional office of the Ministry will either provide direction to applicants and consultants on technical matters and Ministry procedures or indicate the group in the Ministry where such direction may be obtained.

b) Guidance from the Ministry

Before a consultant is selected, the applicant may meet with the Ministry personnel to determine the Ministry's general position on the site. Following this meeting the Ministry will provide preliminary written comments on the anticipated scope of a site investigation. These preliminary comments are intended to aid the applicant in the preparation of the terms of reference for the site investigation and together with this document should be provided to prospective bidders.

After a consultant has been selected by the applicant the consultant may wish to meet with the Ministry for his benefit to discuss the proposed investigation and to determine the Ministry's position and general views on the proposal.

General guidance as to the extent and sophistication of the site assessment recommended by the Ministry will be provided on a case-by-case basis by Ministry personnel in discussions with the applicant or his consultant. This will be done in accordance with Ministry policy and guidelines. Where appropriate, preliminary agreement should be reached on critical issues as well as the specific objectives of the consultant's work plan. In these discussions, consideration will be given to such factors as the sensitivity of the environment, the consequences of site failure, the margin of safety provided in the design, and the present and planned land uses and ground-water uses in the vicinity.

in order to allow the consultant to proceed with the investigation and design of the landfill, he may ask that a preliminary opinion be provided at as early a stage as possible as to the level of contamination, if any, that can leave the site and the magnitude of the safety factor that should be used in the site assessment based on the sensitivity of the environment. The results of the completed site investigations may indicate that this preliminary opinion should be modified. Some uncertainty cannot be avoided in the absence of firm data on the quality and quantity of the ground-water resource and the complexity of the hydrogeologic system at the site. These firm data cannot be obtained without a field investigation. While the Ministry wants to be as helpful as possible it is expected that request for guidance would be accompanied by sufficient data.

Ministry personnel will provide guidance on the level of protection that should be provided for that specific environment. Particular methods by which this can be achieved will seldom be specified. It is felt that this field is properly the responsibility of the applicant or his consultant. The Ministry has no set of universally applicable methods or requirements which must apply to all sites. It is not the Ministry's responsibility to specify methodology or to direct the applicant or his consultant, step-by-step, in site assessment. The Ministry will only provide general advice on its current policy and what it considers to be acceptable practice.

c) Scope of Ministry Assessment

The Ministry will conduct a detailed review of hydrogeologic reports presented by an applicant or his consultant, and will assume a high level of responsibility for the assessment of their conceptual suitability and technical soundness. This will include an examination of the "raw" data and of the site. A report of this review will be prepared in which concerns and deficiencies are identified. The applicant or his consultant will be given an opportunity to respond to the Ministry's review before the Ministry's review is finalized. The intent of this step is to avoid misunderstandings on technical matters, to allow the applicant to

respond to the Ministry's technical concerns, and to identify the real issues before a final position on the reports is established by the Ministry. The Ministry must always be open to new information which could bring about a modification of its position.

d) Level of Presentation

The following examples do not represent a listing of required data or designate avenues of investigations which must be followed. They illustrate examples of the level of detail which should be presented in reports (not in investigations) to facilitate the review of these reports.

- i On cross sections, data such as the stratigraphy, the position of piezometer seals and screens, flow lines and equipotential lines and values should be presented where appropriate.
- ii Calculations and the sources of data used for calculations should be shown and, where appropriate, references should be provided for the equations that are used. For example, measurements and graphs for permeability testing and water balance data should be provided.
- iii Where appropriate, epm charge balances for chemical analyses should be provided together with percent discrepancies and, where necessary, explanations of these discrepancies.
- iv The methods used in drilling and constructing any well points and piezometers should be described as well as any testing or analyses used to determine the validity of the data obtained from these installations and,
- v Methods used in developing monitoring wells and obtaining and analyzing samples should be identified.