TABS ON CONTAMINATED SITES

Contaminated Sites Program - Federal Sites

This is one in a series of Technical Assistance Bulletins (TABs) prepared by Environment Canada - Ontario Region for Federal Facilities operating in Ontario

TAB #26

RESTORATION CRITERIA IN ONTARIO'S LAND-USE GUIDELINE

DESCRIPTION: Three approaches to site restoration namely; background, generic, and site specific risk assessment (SSRA), are discussed. The background approach involves the use of soil quality criteria, developed from an Ontario wide sampling program for background concentration (ug/g) of 117 chemical parameters, to restore a site to ambient soil concentrations or naturally occurring background conditions. The soil criteria are organized by two land-use types; agricultural and all others, including parkland, residential, industrial and commercial. The generic approach uses soil and groundwater criteria, developed using conservative and protective environmental exposure models. A flow diagram that will guide a proponent in selecting the appropriate set of generic criteria for the various restoration options, available in the generic approach, is included. The SSRA approach also uses soil and groundwater criteria to restore sites. Unlike the generic approach, this approach allows the incorporation of considerations, which are specific to the site, in the development and use of the criteria. Risk assessment and risk management are integral parts of the SSRA approach. The differences between level 1 and level 2 risk management and the administrative requirements associated with each level are also discussed.

NOTE: If you are uncertain whether provincial or municipal laws apply to your federal facility operations or to you, consult your legal services unit.

1. INTRODUCTION

Restoration criteria, in the new Ontario land-use guideline, deal with an extensive list of chemical parameters found at contaminated sites in the province. The criteria were developed with more accurate and rigorous exposure models, and land-use and/or designation and the depth of soil contamination were taken into consideration. Generally, the criteria provide better protection to human and environmental health and the natural environment.

2. APPROACHES TO SITE RESTORATION

When the decision to restore a site is made, one or more of three approaches, namely: Background, Generic and Site Specific Risk Assessment (SSRA) may be used. The selection of one or a combination of approaches usually depends on:

i. the present and desired physical condition of the site;
ii. the intended use or reuse/redevelopment of the site; and,
iii. the administrative process accompanying each approach.

BACKGROUND APPROACH

The background approach involves the use of soil quality criteria to restore a site to ambient soil concentrations or naturally occurring background conditions. The background soil criteria were developed from an Ontario-wide sampling program at rural and urban parks unaffected by local point sources of pollution. The soil background concentrations (ug/g) for 88 out of 117 listed chemical parameters are provided. The soil criteria are organized by two land-use types: agricultural and all others. The latter category includes, parkland, residential, industrial and commercial. Refer to Appendix 2: Table F, of the main guideline document ("Guideline for Use at Contaminated Sites in Ontario", 1997) for a detailed list of chemical parameters.

When To Use The Background Approach

Background criteria are used in the following circumstances:

- when generic criteria for a particular land-use type are not provided.
- when the site has been identified as a potentially sensitive site requiring the use of criteria more protective than the generic criteria and the proponent does not want to undertake an SSRA.

In each of the two cases above, background criteria can be developed by the proponent if they are not listed, and in turn,the information should be provided to the MOE for review. Sampling and analytical procedures for proponents to use when developing background criteria can be found in the document entitled: "Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss, Bogs and Snow", (MOEE, 1993).

GENERIC APPROACH

The generic approach involves the use of soil and groundwater criteria which have been developed to provide protection against the likelihood of adverse effects to human and ecological health and to the natural environment. These criteria were developed using environmental exposure models which rely on conservative and protective assumptions about exposure to contaminants.

When To Use The Generic Approach

There are various restoration options available within the generic approach, The answers to the following four questions serve to guide a proponent in selecting the appropriate set of generic criteria for use in soil and groundwater restoration.

- **Is this a potentially sensitive site?**
- **What is the intended land use for this site?**
- **What type of groundwater restoration is required?**
- **To what depth will soil restoration be conducted?**

A flow diagram which illustrates how the answers to the four questions lead to the appropriate generic soil and groundwater criteria is shown in Figure 1.

Is the Contaminated Site potentially Sensitive?

Three categories of potentially sensitive sites are identified in the guideline.

- Contaminated sites which include: (a) a provincial nature reserve established under the Provincial Parks Act by the Ministry of Natural Resources (MNR); (b) an area identified in resource management plans or inventory reports and zoned as a nature reserve by MNR; (c) a provincially or regionally significant area of natural or scientific interest (ANSI) designated by MNR; (d) a local environmentally sensitive area identified by a municipality, a conservation authority or other non-provincial body; (e) a fish habitat identified by MNR; (f) a habitat of vulnerable, threatened or endangered species of birds, wildlife, fish or plants as listed by MNR; (g) a wetland identified as being significant by any planning jurisdiction; and, (h) a provincial park as designated by MNR under the Provincial Parks Act.
- Sites with less than 2 meters of overburden and soil overlying the bedrock in the contaminated area or in the contaminated plume area, and which lie hydraulically down gradient of the source of the contamination.
- Identified inorganic chemicals that exceed background criteria, and the pH level is outside the range used to develop the generic criteria.

Sites where the above conditions apply, should be restored to background levels or an SSRA may be

used to modify the generic criteria. The municipality does not have to be consulted on this type of SSRA. Peer-review of the report must take place prior to submitting it to the MOE for review. For additional information on using SSRA at sites, see "Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario", (MOE, 1996b). The local MOE district office, in consultation with the Standards Development Branch, can also provide additional guidance.

The respective titles of Tables A - D (referenced in Figure 1) are as follows:

Table A: Surface soil and groundwater criteria for a potable groundwater condition.
Table B: Surface soil and groundwater criteria for a non-potable groundwater condition.
Table C: Subsurface soil criteria for a potable groundwater condition.
Table D: Subsurface soil criteria for a non-potable groundwater condition.

What is the intended land use?

Land use types are usually designated in an official plan or zoned as: Agriculture (A); Residential/Parkland R/P); Commercial/ Industrial (C/I). Activities associated with Institutional bodies such as schools, daycare centres and hospitals should be included in the R/P category. Residential occupancy, a playground, open space or a daycare centre within an industrial or commercial site should be considered to be in the R/P category.

What types of groundwater restoration is required

Criteria for restoring contaminated groundwater to potable and non-potable levels are provided. The criteria for each restoration level consists of 117 chemical parameters. Restoration of groundwater quality to potable and non-potable levels are conducted in order to offer:

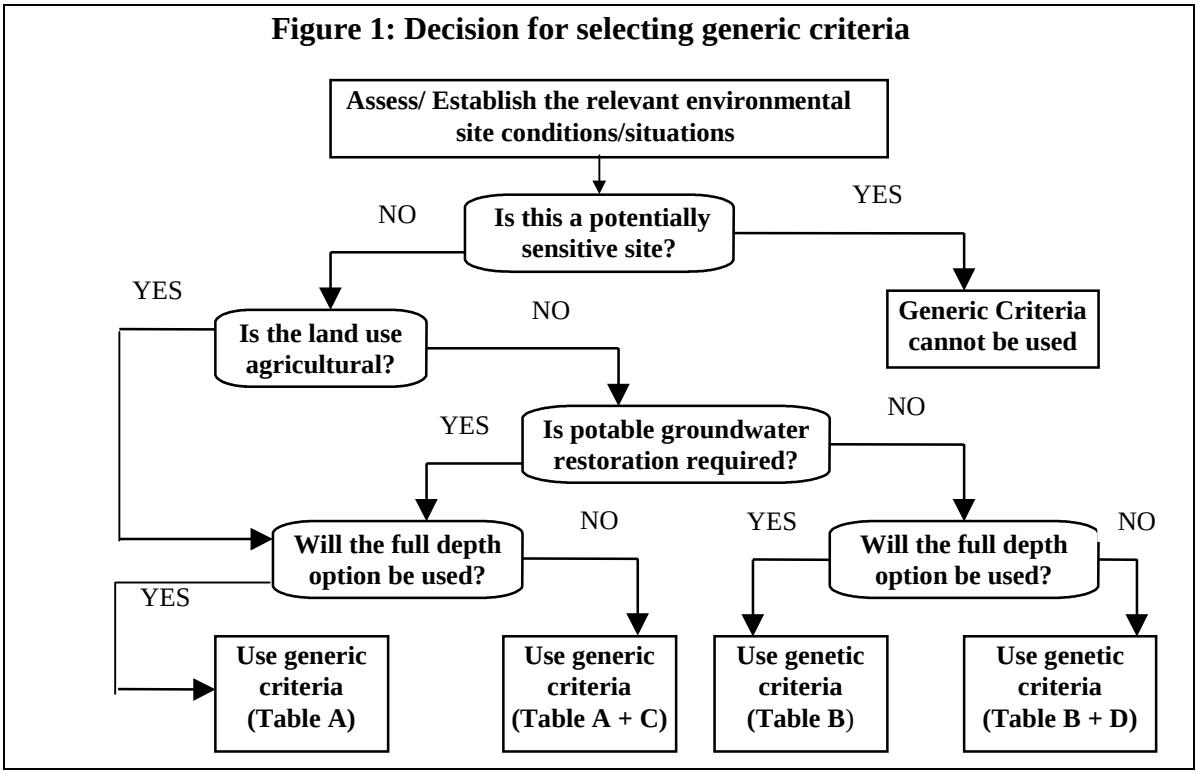
- protection against exposure from vapours which may migrate to indoor air (basement) from volatile chemicals in groundwater.
- protection for aquatic receptors in surface water which could be affected by the discharge of groundwater.
- protection of groundwater as a source of drinking water for human health criteria and for aesthetic guidelines (applies only to potable levels).

Conditions for using non-potable criteria

All of the following conditions must be met:

- area served by a communal or municipal water supply that does not rely on local groundwater.
- present or future surface or groundwater

Figure 1: Decision for selecting generic criteria



sources of drinking water supply will not be adversely affected, including water for agricultural and aquacultural purposes.
- municipality has been informed.

What depth of soil restoration will be used?
Where the vertical extent of the contamination at a site is more than 1.5 metres below the final grade, the following two options for the depth of soil restoration may be used.
- Full depth restoration is when soil quality is restored for the full vertical and lateral extent of the contamination.
- Stratified restoration involves the use of two different sets of criteria at a site. For each chemical parameter, one criterion is used for soil at and above 1.5 metres and another for soil below 1.5 metres

SITE SPECIFIC RISK ASSESSMENT (SSRA) APPROACH
The SSRA approach allows the incorporation of considerations, which are specific to the site, in the development and use of soil and groundwater.

Risk Assessment
Risk assessment is the process of estimating the likelihood of undesired effects on both human and ecological health.

Human health and ecological risk assessment
Table 1 is a comparison of the criteria modification process used during an assessment of the risk to human and ecological health Issue No. 1 shows the sequence of the four elements involved in each assessment.

Risk Management
The risk management process is the development and implementation of a decision, strategy or technique to control or reduce the level of the estimated risk. The guideline distinguishes between two basic types of risk management decisions, termed Level 1, and Level 2 risk management.

Level 1 Risk Management
This refers to situations when risk assessment incorporates risk management decisions that do not change the level of risk in the assessment. This type of risk management is used as follows: (a) at sensitive sites; (b) when no generic criteria are available; and, (c) when it is the chosen restoration approach.

Administrative Requirements Associated with Level 1 Risk Management
- The MOE must review the risk management plan and provide comments.
- The proponent should consult with the municipality.
- There must be communication with the community for their input.
- An independent peer-review of the documentation and correction of concerns raised in the peer-review process should take place before submitting the plan to the MOE.
- There are no Orders involved.

Level 2 Risk Management
This refers to those situations when the risk assessment involves changing the level of risk, or when the results of the risk assessment are applied through risk management measures or techniques.

Table 1: Criteria Modification During Human Health and Ecological Risk Assessment.

Issue	Human Health Risk Assessment (HHRA)	Ecological Risk Assessment (ERA)
1. Elements of the risk assessment.	Hazard identification/Problem formulation → Toxicity assessment → Exposure assessment → Risk characterization.	Receptor characterization → Exposure assessment ▶ Hazard assessment ▶ Risk characterization
2. Components of generic critera modified to reflect factors at site.	Selected human health	Terrestrial and/or aquatic ecological
3. At sensitive sites.	Necessary to adjust the model of generic criteria on the movement of contaminants from soil to groundwater.	Necessary to adjust models of genetic criteria to account for sensitive receptors or site conditions not considered in the former models.

Administrative and Management Plan Associated with Level 2 Risk Management

In addition to the requirements for Level 1 risk management, the following are also associated with a Level 2 risk management:

- A provincial order or issuance is introduced to direct the proponent to maintain risk management measures, and register a Certificate of Prohibition on title to the land, Pursuant to Sections 18 and 197 respectively, of the EPA (Ontario).
- The municipality must agree to the SSRA approach prior to completing the risk assessment.
- The municipality and proponents must also agree on the following: responsibilities for operating, maintaining and monitoring the risk assessment measure(s). However, the MOE will not be a party to these agreements.
- Contingency provisions must be included in the design of the risk management measure(s).
- Indemnification and financial assurance for potential future problems must be identified.
- Administrative controls or agreements which, if required, must be established to ensure that the risk management measures are not subject to alteration without prior notification to the municipal or other land-use authority.

REFERENCES

CCME (1991). *National Guidelines for Decommissioning Industrial Sites*, CCME/WM-TRE013E.

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MOEE (1996c). *Rationale for the Development and Application of Generic Soil, Groundwater, and Sediment Criteria for Use at Contaminated Sites*.

GLOSSARY OF TERMS

Background Concentration: The naturally occurring concentration of a chemical in the soil, groundwater, air or sediment, in the local environment, which is typical of the conditions in urban or rural setting.

Criteria: Numerical values for the concentrations of chemical substances in soil, groundwater and sediments that relate to the suitability of the site, for specific uses and land-use categories.

Full Depth Restoration: Soil quality is restored for the full vertical and lateral extent of the contamination.

Generic Approach: The use of soil and groundwater criteria which have been developed to provide protection against the likelihood for adverse effects on human health and the natural environment.

Overburden: Unconsolidated material that, nearly everywhere, forms the surface of the land in the absence of true soil and rests on bedrock.

Potable Criteria: The soil and groundwater values which establish when groundwater quality is suitable for human consumption

Stratified Restoration: Involves the use of two different sets of criteria at a site. For each chemical parameter, one criterion is used for soil at and above 1.5 metres, and another for soil below 1.5 metres.

Site Specific Risk Assessment (SSRA) Approach: Involves the incorporation of one or more characteristics (e.g. sensitivity receptors, pathways, nature of contaminant, etc.), which are specific to a site, in the models used to develop the generic criteria for the site.

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