Risk Assessment and Remediation Technologies for Brownfield Sites

Robert F. Willes, Ph.D.
Cantox Inc.

Richard V. Laughton, QEP
Pollutech

Cassels, Brock & Blackwell
"Issues in Contaminated Land"
April 17, 1998

POLLUTECH CanTox

QUESTIONS ?

- what is a “brownfield” ?
- how clean is clean ?
- how do you get it clean ?
- how do you assess the risk ?
- how do you manage the risk ?
- can you insure the risk ?

POLLUTECH **CanTox**

What is a brownfield ?

- not a greenfield, but similar
- may already be serviced
- “lightly” contaminated site
- “economically” viable to use

How clean is clean?

- **land use**
  - parkland
  - residential
  - commercial
  - industrial
- **criteria used**
  - background
  - generic
  - SSRA

SECTION

Background approach 5

5.0 Using the background approach

The background approach involves restoration of a site to ambient conditions as found in the natural environment, or to the levels which existed prior to site contamination. This approach may be used at any contaminated site. To facilitate the use of this approach the ministry has compiled and provided background soil criteria which may be used as surface soil criteria (Appendix 2, Table F). These soil criteria are organized by two land-use types: agricultural and all others. The category of all others includes parkland, residential, industrial and commercial land use.

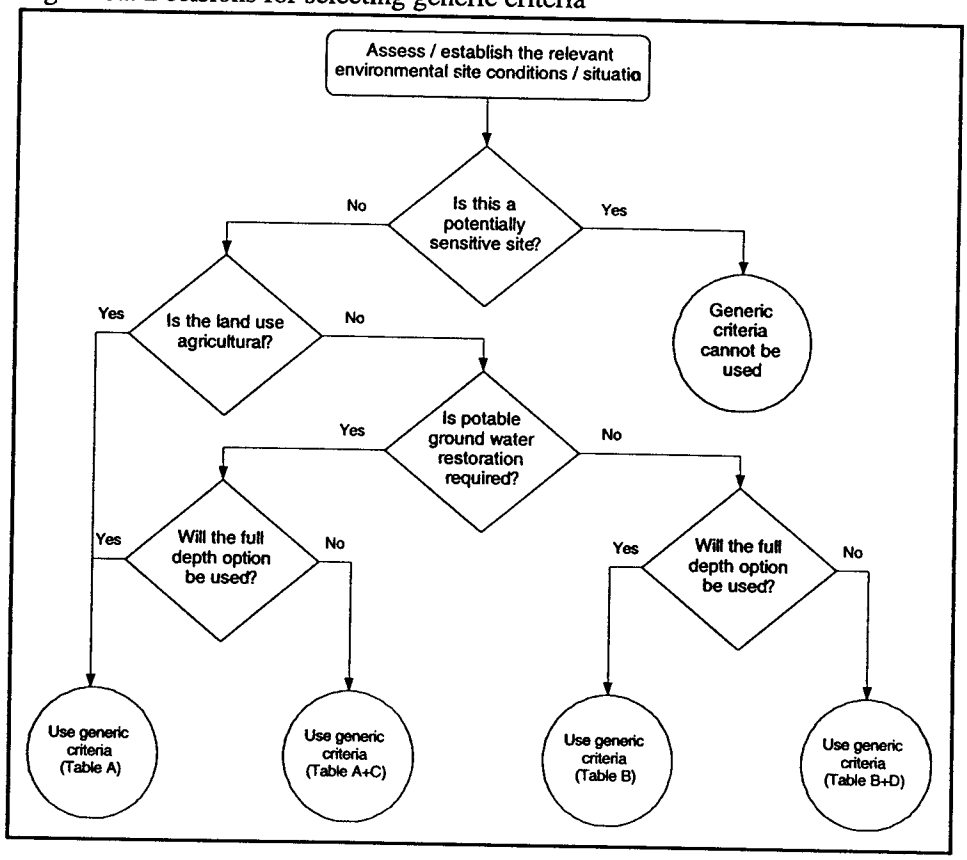
The background criteria may also be used when:

- generic criteria for a particular land-use designation are not provided in Tables A – D (Appendix 2);
- the site has been identified as a potentially sensitive site, which requires use of criteria more protective than the generic criteria, and a proponent does not wish to undertake a site specific risk assessment (section 6.1).

SECTION

Generic approach 6

Figure 6a: Decisions for selecting generic criteria



1 use Table F (background criteria) or conduct ecological risk assessment / site specific risk assessment when generic criteria cannot be used.

SECTION

SSRA approach 7

7.0 The site specific risk assessment approach

The site specific risk assessment (SSRA) approach allows the incorporation of considerations which are specific to the site in the development of soil and groundwater criteria. This approach includes both risk assessment and risk management.

Risk assessment is the technical, scientific examination of the nature and magnitude of risk and uses a factual base to define the health effects of exposure of individuals or human and ecological populations to contaminants in different exposure situations. Risk assessment involves estimating the likelihood of an event and providing an expression of what that event might be. Protection of human and ecological health and of the natural environment must be considered when the site specific risk assessment approach is selected for use.

The SSRA approach may be used to:

- modify the human health or ecological components of a generic criterion through consideration of site specific exposure pathways and receptor characteristics;
- develop all human health or ecological components of a site specific criterion.

How do you get it clean ?

conventional processes:

- "dig and haul"
- "pump and treat"

in situ processes:

- soil flushing
- soil vapour extraction

How do you get it clean ?

ex situ processes:

- soil washing
- solvent extraction
- thermal desorption

biological processes:

- phyto-remediation
- bio-remediation

United States Environmental Protection Agency | Solid Waste and Emergency Response (5102G) | EPA 542-F-96-006 April 1996

EPA

A Citizen's Guide to In Situ Soil Flushing

Technology Innovation Office | Technology Fact Sheet

What is in situ soil flushing?

In situ soil flushing is an innovative treatment technology that floods contaminated soils with a solution that moves the contaminants to an area where they are removed. "In situ"—meaning "in place"—refers to treating the contaminated soil without digging up or removing it.

The specific contaminants in the soil at any particular site determine the type of flushing solution needed in the treatment process. The flushing solution is typically one of two types of fluids: 1) *water only*; or 2) *water plus additives* such as acids (low pH), bases (high pH) or surfactants (like detergents).

Water is used to treat contaminants that dissolve easily in water. An *acidic solution* is a mixture of water and an acid, such as nitric acid or hydrochloric acid. Acidic solutions are used to remove metals and organic contaminants, such as those typically found in battery recycling or industrial chrome plating processes. For example, zinc contamination—which can result from plating operations—would be treated with an acidic solution. A *basic solution* is a mixture of water and a base, such as sodium hydroxide. (Ammonia is an example of a base commonly used in households.) Basic solutions are used to treat phenols and some metals. A *surfactant* can be a detergent or emulsifier. Emulsifiers help mix substances that normally do not mix such as oil and water. For this reason, surfactant solutions are effective at removing oily contaminants.

Researchers also are investigating the use of water plus *organic solvents* as a flushing solution. Organic solvents such as ethanol are used to dissolve certain contaminants that water alone cannot dissolve.

How does it work?

Figure 1 on page 2 provides an illustration of one type of in situ soil flushing process. The process begins with the drilling of injection wells and extraction wells into the ground where the contamination has been found. The number, location, and depth of the injection and extraction wells depend on many geological factors and engineering considerations. Wells may be installed either vertically or horizontally. In addition to placing the wells, other equipment—such as a wastewater treatment system—must be transported to or built on the site.

A Quick Look at In Situ Soil Flushing

- Injects a washing solution into unexcavated soils to flush out contaminants.
- Is most effective on soils with low silt or clay content.
- Requires the drilling of injection and extraction wells on-site.
- Is a transportable technology that can be brought to the site.
- Requires greater understanding of the site's geology than some other technologies.

POLLUTECH

CanTox

What is Risk ?

- risk = hazard x exposure;
- the "hazard" potency (toxicity) is determined by characteristics of the chemical;
- The exposure is determined by:
  - concentration of chemical in the media (air, water, soil)
  - the amount of media taken into the body (inhale, swallow, etc.)
- The exposure is affected by:
  - land use (park, residential, etc.)
  - the receptor (child, adult, fish)

How to manage risk?

- remediate to criteria
- mitigate to control exposure
  - registration on title
  - sever land with registration
- insurance

Can you insure it ?

- cost capping
- pollution transfer liability
- property transfer
- contractors releases
- consultants E&O
- UST's, lead, asbestos, etc.

SUMMARY

- is it really a “brownfield” ?
- what is the end use ?
- can you assess the risk ?
- what are the alternatives ?
- is it economically viable ?
- can you manage the risk ?

POLLUTECH Environmental Limited
768 Westgate Road
Oakville, Ontario L6L 5N2

Tel : 905-847-0065
Fax : 905-847-3840

http://www.pollutech.com

CanTox Inc.
2233 Argentia Road, Suite 308
Mississauga, Ontario L5N 2X7

Tel : 905-542-2900
Fax : 905-542-1011

http://www.cantox.com

POLLUTECH **CanTox**