

## Supplemental Guidance for Risk Assessments

The purpose of this document is to assist risk assessment practitioners and Contaminated Sites Approved Professionals, in the identification of suitable sources of guidance related to the performance of risk assessment and toxicity assessment at contaminated sites in British Columbia.

This guidance supplements existing guidance provided in Director's protocols for risk assessment and will be updated as new documents are made available or are approved as Director's protocols.

### Screening level risk assessments

Screening level risk assessments (SLRAs) are intended to evaluate whether contamination at a specific site meets or exceeds benchmark screening risk criteria. The SLRA process involves a simple assessment of exposure pathways and receptors.

Contaminated sites that meet SLRA benchmark screening risk criteria are considered to satisfy provincial risk-based standards. No further remediation is required at these sites as long as site conditions do not change.

### Quantitative risk assessments

#### Human health risk assessments

#### Deterministic Risk Assessment

For use in deterministic risk assessment, the ministry recommends use of general Health Canada risk assessment guidance listed below:

#### **Health Canada risk assessment guidance**

- Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) (Environmental Health Assessment Services, Safe Environments Programme, Health Canada, September 2004):  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/index_e.html)
- Guidance on Peer Review of Human Health Risk Assessments for Federal Contaminated Sites in Canada (Environmental Health Assessment Services, Safe Environments Programme, Health Canada, September 2004):  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/index_e.html)
- Guidance on Peer Review of Human Health Risk Federal Contaminated Site Risk Assessment in Canada - Health Canada Toxicological Reference Values (TRVs) (Environmental Health Assessment Services, Safe Environments Programme, Health Canada, September 2004):  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_iii/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_iii/index_e.html)

Furthermore, the ministry strongly recommends specific use of the critical human receptors, physiological parameters, exposure routes and scenario assumptions and associated equations

abstracted from Tables 2, 3, 4, 5 and 6 of Health Canada's 2004, *Federal Contaminated Site Risk Assessment In Canada Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) guidance*:

[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/identification\\_e.html#table2](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/identification_e.html#table2)

[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/table-tableau\\_3\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/table-tableau_3_e.html)

[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/frequency-frequence\\_e.html#table4](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/frequency-frequence_e.html#table4)

[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/table-tableau\\_5\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/table-tableau_5_e.html)

[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_i/relative\\_e.html#table6](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_i/relative_e.html#table6)

For exposure parameters and equations not included in general Health Canada guidance, the Ministry recommends the following US Environmental Protection Agency (US EPA) guidance:

***Risk Assessment Guidance for Superfund (RAGS) (U.S. Environmental Protection Agency)***

- [RAGS, Volume 1, Part A \(1989\)](#)
- [Supplement to RAGS, Volume 1, Part A: Community Involvement in Superfund Risk Assessments \(1999\)](#)
- [RAGS, Volume 1, Part B \(1991\)](#)
- [RAGS, Volume 1, Part C \(1991\)](#)
- [RAGS, Volume 1, Part D \(2001\)](#)
- [RAGS, Volume 1, Part E \(2004\)](#)
- [RAGS, Volume 3, Part A: Process for Conducting Probabilistic Risk Assessment](#)
- [Proposed Guidelines for Carcinogen Risk Assessment, U.S. Environmental Protection Agency \(1996\)](#)
- [Guidelines for Reproductive Toxicity Risk Assessment, U.S. Environmental Protection Agency \(1996\)](#)

- [Guidelines for Neurotoxicity Risk Assessment, U.S. Environmental Protection Agency \(1998\)](#)

**Probabilistic Risk Assessment**

Stochastic risk assessment methods can provide better information on the variability and uncertainty in risks at a site. When stochastic methods are used, selection of input distributions and their applicability to British Columbia must be documented.

For use in probabilistic risk assessment, the ministry recommends use of the following general US EPA risk assessment guidance:

- [Policy for Use of Probabilistic Analysis in Risk Assessment at the U.S. Environmental Protection Agency \(1997\)](#)
- [Guiding Principles for Monte Carlo Analysis, U.S. Environmental Protection Agency \(1997\)](#)

**Source and selection criteria for Toxicity Reference Values**

TRVs include, tolerable daily intakes (TDI), reference doses (RfD) or reference concentrations (RfC), benchmark doses (BMD), minimum risk levels (MRL), and cancer potency slope factors (CPS) among others.

TRVs from Canadian agencies generally incorporate Canadian, as opposed to foreign, policy assumptions and values. Canadian agency TRVs are widely used within Canada for public health and environmental decision making outside of the contaminated sites field. For this reason, use of Canadian TRVs will generally provide for greater consistency between contaminated sites risk assessment and risk assessments conducted on food, water and air.

TRVs from US Environmental Protection Agencies are typically subject to more frequent peer review, revision and updating than those of many Canadian agencies. EPA values have been used by the Ministry in setting most of the numerical standards and criteria of the regulation.

Finally, it should be noted that TRVs from the World Health Organization often reflect an international as opposed to national level of scientific peer review.

Ministry selection of TRVs for use in risk assessment has been based on the following criteria:

- a) Extent of supporting documentation pertaining to the basis for the TRV,
- b) How recent or current is the science assessment on which the TRV is based, and
- c) Extent of scientific peer review provided for the TRV.

For these reasons the Ministry's preference is to recommend the use of US EPA, Integrated Risk Information System (IRIS) values:

<http://www.epa.gov/iriswebp/iris/index.html>

for all but the following:

1. dioxins/furans
2. PCBs
3. lead
4. methyl mercury

For the above four substances, Health Canada TRVs are generally preferred.

#### **Agency Sources for TRVs**

- Agency for Toxic Substances and Disease Registry (U.S.):  
<http://www.atsdr.cdc.gov/toxpro2.html>

- California Environmental Protection Agency:  
<http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>
- Health Canada, various sources including:  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie\\_ii/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/part-partie_ii/index_e.html)  
[http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/existsub/value-valeur/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/existsub/value-valeur/index_e.html)
- Netherlands National Institute of Public Health and the Environment:  
<http://www.rivm.nl/bibliotheek/rapporten/711701025.pdf>
- U.S. Environmental Protection Agency (IRIS):  
<http://www.epa.gov/iriswebp/iris/index.html>
- U.S. EPA, Region 9 Provisional Peer-reviewed Toxicity Values (PPRTVs) developed by the National Center for Environmental Assessment/Superfund Health Risk Technical Support Center as listed in the U.S. EPA Region 9 Preliminary Remediation Goals:  
<http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf>
- World Health Organization, various sources including:  
<http://www.inchem.org/>  
<http://jecfa.ilsa.org/index.htm>  
<http://www.who.dk/document/e71922.pdf>

#### **Ecological risk assessments**

Risk assessors are advised of the following ministry protocol and technical guidance related to the performance of ecological risk assessment for contaminated sites in British Columbia:

- Ministry of Environment. Protocol 1. Recommended Guidance and Checklist for Tier 1 Ecological Risk Assessment of

Contaminated Sites in British Columbia, prepared for Ministry of Environment, Lands and Parks, January 1998 (by W.G. Landis, A.J. Markiewicz, V. Wilson, A. Fairbrother, and G. Mann):

[http://www.env.gov.bc.ca/epd/remediation/policy\\_procedure\\_protocol/protocols/tier1/index.htm](http://www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/protocols/tier1/index.htm)

- Ministry of Environment. Technical Guidance 19. A Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater, Estuarine, and Marine Ecosystems in British Columbia, November 2003 (by D. D. MacDonald and C.G. Ingersoll):  
<http://www.env.gov.bc.ca/epd/remediation/guidance/technical/pdf/tg19.pdf>

#### **Ecological benchmarks or toxicity reference values (TRVs)**

The ministry's Tier I ecological risk assessment requirements provided in Protocol 1 prefers the use of specified effects levels (EC<sub>x</sub> values) for estimating risks to ecological receptors. For many contaminants, ecological benchmarks will not be readily available. In these cases, toxicity reference values (TRVs) need to be calculated. TRVs are the ecological equivalent of calculating a human health reference dose (RfD).

TRVs are accepted as ecologically relevant benchmarks with the caveat that ecological risk assessments are designed to protect species at the population, rather than at the individual organism, level. Note that this underlying ecological risk assessment assumption may not always apply in every case given that legislation can require the protection of individuals of a rare and endangered species. However, in general the types of endpoints that ecological risk assessments need to address for non-endangered species include: reproduction, growth, maintenance, and critical

developmental processes. Cancer is not usually selected as a chronic ecological endpoint.

The following sources should be used for ecological benchmarks:

- US Environmental Protection Agency, various sources including:  
<http://www.epa.gov/ecotox/ecossl/>  
<http://cfpub.epa.gov/ecotox/>  
<http://www.epa.gov/iriswebp/iris/index.html>
- Oak Ridge National Laboratory, The Risk Assessment Information System, Ecological Benchmarks:  
[http://rais.ornl.gov/cgi-bin/eco/ECO\\_select](http://rais.ornl.gov/cgi-bin/eco/ECO_select)
- California Environmental Protection Agency, Wildlife Exposure Factor and Toxicity Database:  
<http://endeavor.des.ucdavis.edu/calecotox/species.asp>
- other professional, scientifically peer-reviewed documents as needed and as approved by the ministry on a case-by-case basis.

*For more information, contact the Environmental Management Branch at [site@gov.bc.ca](mailto:site@gov.bc.ca).*