

Guidance on Human Health Risk Assessment at Federal Contaminated Sites When Exposures are Acute or Subchronic

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Introduction

- Most human health risk assessment (HHRA) guidance is related to evaluation of chronic health risks
- There can also be a need to address short-term risks for **non-carcinogens**
 - circumstances may exist where acute and/or subchronic health risks may “drive” the results of the HHRA

Background

- Assessment of short-term exposures has been a focus of some assessments for substances such as:
 - PM_{2.5}, NO_x, SO₂, Ozone, Formaldehyde
 - Pesticides
- However, there is currently little formal guidance for short-term HHRAs of Canadian federal contaminated sites for non-carcinogens

Background

- Some guidance for evaluation of short-term risk does exist:
 - Canadian Soil Quality Guideline for Cyanide (Health Canada, 1995)
 - A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines (CCME, 2006)
 - US EPA, ATSDR and others
 - Scientific literature

*Ross to include citations and also for EPA and ATSDR

Background

- Calabrese et al. (1997) noted that certain US soil standards developed for protection of chronic endpoints may not be protective of acute endpoints
 - toddlers typically consume only 30-40 mg soil per day whereas acute episodes of 10 g of soil may occur on a less frequent basis (a couple of days/year for about 30% of toddlers)

*Calabrese, E. 1997... Ross to add

Scenarios where Short-Term Risk Assessment May be Important

- Sites that are only visited seasonally
 - Example 1: A summer camp for 2 weeks
 - Example 2: A First Nation's hunting camp used only in the summer
- Sites where exposure periods are short
 - Example 1: Excavation activities for 1 month
 - Example 2: Evaluation of spill cleanup

Considerations in Short-Term Toxicity Assessment

- Approach for development of acute and subchronic toxicity reference values (TRVs) follows an approach that is similar to that for chronic TRVs
 - However, acute and subchronic TRVs are not readily available

Considerations in Short-Term Toxicity Assessment

- Key Issues:
 - Acute and subchronic TRVs should be established for a time period that is at least as long as the exposure period for human receptors being considered
 - Short-term TRVs may not necessarily be applicable for repeat short-term exposures
 - There is no generic default adjustment factor for deriving acute or subchronic TRVs from chronic values

Considerations in Short-Term Toxicity Assessment

- As an example of how there are no general default factors, consider the ATSDR MRL dataset:

Ratio of Acute to Chronic MRLs		Ratio of Subchronic to Chronic MRLs	
n = 41	Arith mean = 25 But range = 1 to 200	n = 44	Arith mean = 9 But range = 1 to 100

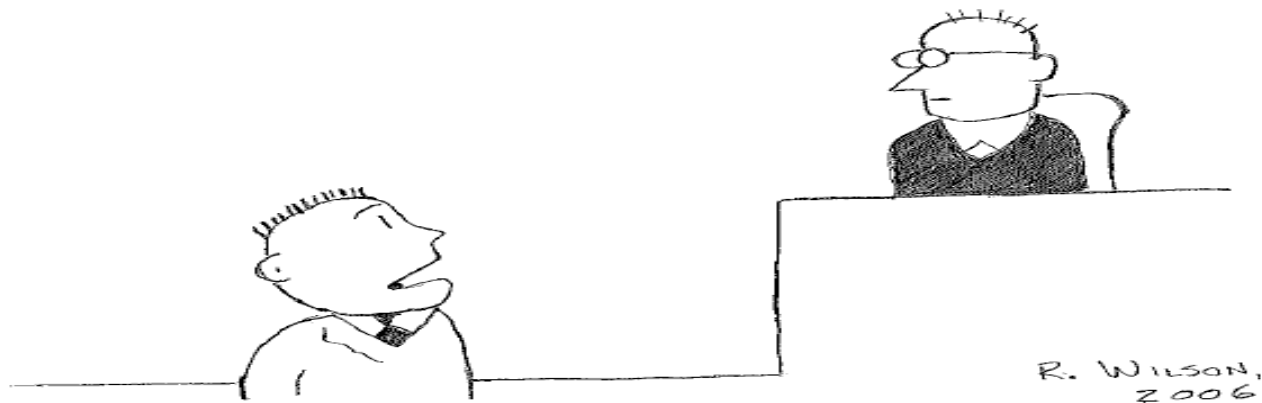
- Thus, it is generally not advisable to multiply a chronic TRV by “10” (for example) to estimate a short-term TRV without full consideration of all factors

Considerations in Short-Term Exposure Assessment

- Amortization of exposure should not underestimate the potential for exceeding threshold effects and mathematical amortization needs to be carefully justified.
- This concept can be illustrated as follows:

365 ug/kg/day for 1 day \neq 1 ug/kg/day for 365 days

Example of Incorrect Exposure Amortization



“So you see, your Honour, given that this was the first time that I drank all year, the 12 drinks that I consumed on the night of September 29 were actually equivalent to about 0.033 drinks per day when amortized evenly over the entire year. As a result, I could not have been impaired and the DUI charge should be thrown out.”

Considerations in Short-Term Exposure Assessment

- Key Issues:
 - Most exposures for comparison to chronic TDI's should not be amortized over a period greater than one week
 - Exceptions may include chlorinated dioxins and methylmercury whereby TDIs are also used for evaluation of monthly exposures
 - Some TDIs are based on developmental endpoints (i.e., effects on the fetus) (e.g., xylenes, chlorinated dioxins, methylmercury)
 - Spreading out the exposure may not be protective of health effects on the developing fetus

Considerations in Short-Term Risk Characterization

- Risks from acute soil ingestion are most likely to be a concern at:
 - Sites with chemicals that are acutely potent **and** present in soils where toddlers may gain access
- Risks from subchronic exposure are most likely to be a concern at:
 - Sites where large amortization factors may have been used in the HHRA of chronic effects (e.g., seasonally used sites, evaluation of construction workers, etc.)

Considerations in Short-Term Risk Characterization

- When sufficient information is available to estimate short-term risks, Hazard Quotients can be calculated similar to those for chronic risks
 - in most cases, if the short term HQ is ≤ 1 , then no short term risk is likely

Key Conclusions

- 1) Assessment of short-term exposures is difficult to completed because of:
 - paucity of acute and subchronic TRVs, exposure parameters and acceptable risk levels.
- 2) Potential short-term risks should not be ignored
- 3) Exposure amortization is acceptable, with consideration of toxicological endpoints (e.g., developmental toxicants)