

Considerations in Human Health Risk Assessment of Drinking Water

Ross Wilson, M.Sc., DABT

Introduction

- Human health risk assessment of drinking water is a tool for use under the CSR
- Similar to other media, risk-based standards can be obtained for groundwater that is used for drinking water purposes
- Nevertheless, risk assessors should be aware of various potential issues that should be considered in a drinking water HHRA

Key Differences Between HHRA of Soil vs Drinking Water

Soil

- Often exposure potential is reduced due to depth or coverage by building/pavement
- Chemicals may sometimes show reduced bioavailability
- Lots of precedent
- Uptake into garden produce hard to estimate

Drinking Water

- Goal is to determine if the drinking water source is acceptable, no adjustment in exposure potential
- Little ability to adjust the bioavailability potential (no protocols)
- Not as much precedent
- Uptake into garden produce is hard to estimate

Exposure Pathways

- Exposure pathways that would seem to be required would include:
 - Direct ingestion (1.5 L/d for adult often used)
 - Dermal contact while bathing (through use of permeability constants)
 - Inhalation while showering (particularly with chlorinated VOCs)
- Other exposure pathways are less clear:
 - Watering gardens and then consuming produce?
 - Other domestic uses?

Question 1

- Does the group have any past experience on the type of exposure pathways that they consider for drinking water?
- Is it a site-dependent?
- When can gardens be ignored?
- When can vapour inhalation during showering be ignored with volatiles?

Acceptable Risk

- CSR indicates
 - $HQ \leq 1$
 - $ILCR < 1 \times 10^{-5}$
- Most drinking water guidelines are based on HQ values between 0.1 and 0.2
- So there is some leeway...
- HQ of 1 for some chemicals in drinking water could result in elevated concentrations as acceptable under the CSR:
 - 50 ug/L of lead in drinking water would likely result in a $HQ < 1$
 - 1000 mg/L of sodium in drinking water would likely result in a $HQ < 1$

Acceptable Risk

- To use the following values,
 - $HQ \leq 1$
 - $ILCR < 1 \times 10^{-5}$

MoE has indicated that all exposure pathways must be considered

- However, if a metal is in groundwater and the only use is drinking water then the entire HQ of 1 could come from water:

“If $HI < 1.0$ where $HI = \text{sum of HQ for air (0.0)} + \text{HQ for soil (0.0)} + \text{HQ for water (1.0)} + \text{HQ for food (0.0)} + \text{HQ for consumer products (0.0)}$ ”

Acceptable Risk

- In development of the interim drinking water standards for iron and manganese, MoE has mainly indicated that aesthetic values do not require consideration

Acceptable Risk

- Nevertheless, the sensitivity analysis should likely ensure that it is clear that drinking water guidelines and/or aesthetic endpoints have been exceeded

Question 2

- What are the experiences with acceptable risk levels?
- Any concerns regarding HQ values that are less than 1 but greater than 0.2?
- Any concerns regarding aesthetic standards?

Does Groundwater Conc Equal the Tap Water Conc?

- Can the HHRA can be based on what is coming out of the tap?
 - Probably but it would be necessary to ensure that this is always the case

Question 3

- Has the group had any experiences where tap water concentrations are less than groundwater in a manner that could be considered in a HHRA?

Situations where HHRA is not likely to be useful or at least difficult

- Arsenic (however, do not need to better than background or standards)
- Chloroform
- Benzene

Situations where HHRA is likely to be useful

- Chemicals that the Health Canada drinking water guidelines are based on outdated TRVs
 - Barium
 - Chromium
- Chemicals that are not volatile and their drinking water concentrations result in HQ >0.2 but less than 1 (relatively narrow range)

Site Investigation Requirements

- It would seem that DSI level information should suffice
- May need to focus HHRA on maximum concentrations
- Other thoughts?

Other Issues

- Irrigation
 - Models?
 - Comparison to irrigation standards
- Livestock watering
 - Models
- Age groups requiring evaluation

Conclusions

- HHRA may not be able to assist many drinking water exceedences (i.e., a drinking water standard exceedence can be a serious issue if people are really drinking the water)
- It will be an interesting time as we learn the “dos and don’ts” of drinking water HHRA
 - Much of the guidance is already available in MoE, Health Canada and US EPA documents
- MoE has repeatedly indicated that they are available for consultation (preferably by email)