Protocol Details Related to Human and Environmental Health Protection, Soil to Water Pathway Matrix Soil Standards for the CSR Stage 10 Amendment

CSR Soil to Water matrix soil standards were derived using the CSST 1996 protocol [1] and the omnibus updated Groundwater Protection Model (GPM). Modifications to the Groundwater Protection Model, used for the CSR Stage 10 Amendment, made in consideration of stakeholder comments and other ministry considerations, are summarized as follows.
Changes to the Model to Incorporate New Science or Harmonization with other Protocols

1. The model was revised to:
   a. include an upgraded graphical user interface;
   b. provide greater transparency in parameter selection/input and substance properties; and,
   c. include updated model documentation and help file information (in progress).

2. The existing soil type used in the model was revised to:
   a. be more broadly representative of coarse-grained soil conditions in BC; and
   b. provide general agreement with the coarse-grained soil type, and corresponding average linear groundwater velocity, as provided in the CCME 2006 [5] soil protocol.

3. The US EPA SSG [6] distribution coefficient isotherms (soil pH-K\textsubscript{d} relationships) for inorganic substances were adopted for existing and new matrix substances, where available, with the exception of the following:
   a. existing distribution coefficients were retained for barium, chloride, copper, mercury and sodium;
   b. a literature-based isotherm was adopted for lead based on mean values provided in Sauvé et al, 2000 [7] and,
   c. as distribution coefficients were not available in US EPA SSG [6], distribution coefficients for cobalt, manganese, molybdenum and uranium were adopted from the US DOE RAIS database. [8]

4. The mixing equation was modified to the peer reviewed US EPA SSG [6] mixing model.


7. The US DOE RAIS database [8] was used for the selection of the following substance properties: solubility; soil organic carbon-water partitioning coefficient (K\textsubscript{oc}); and, dimensionless Henry’s Law constant (H’).

8. A new pH-dependent K\textsubscript{oc} isotherm for pentachlorophenol was adopted from US EPA SSG. [6]

9. A solubility constraint (50% of pure-phase solubility) was adopted for organic substances.
10. The background adjustment was revised to report either the background concentration or the calculated standard, whichever is greater.

11. The Hazardous Waste Regulation [13] leachate quality standards were removed as hazardous waste soil quality is assessed separately under the Contaminated Sites Regulation. [14]

12. The model was revised to include updated water use standards and calculation of soil to water protective AW standards for both freshwater and estuarine/marine AW water use standards.

13. The model defaults and input parameters for source dimensions, fraction of organic carbon, and bulk density were harmonized with the CCME, 2006 [5] model.

Consequential Changes to CSR Protocols

1. Update CSR Protocols 2 [15] and 13 [10] to improve the overall usability of the protocols. Also, as part of the update, ensure consistency with the new CSST model [1] based on the model changes identified above.


4. Under CSR Protocol 2, [15] retain the maximum allowed average linear groundwater velocity of 100 m/year and revise the minimum allowable velocity to 5 m/year.

Next Cycle Revisions

1. Evaluate other groundwater model related SABCS recommended changes [17] to the CSST Protocol, which although supported by the ministry, were deferred to future review due to time and resource constraints.

2. Evaluate the potential for web-hosting of the GPM.

3. Evaluate existing and potential new constraints/limits to ensure appropriate conservatism of the GPM.

4. Evaluate the consistency achieved by, and feasibility of, incorporating changes to the GPM to address dilution due to infiltration occurring downgradient from the contaminant source zone.
5. Evaluate incorporation of the Aquatic Life (AW) protective pathway transport assessment used in CCME, 2015 [18] for use in deriving matrix soil to groundwater standards for the protection of aquatic life (i.e. consider modification of the ten times AW dilution factor used in the GPM).

6. Evaluate incorporation of the CCME, 2015 [18] AW pathway transport assessment for use in setting the aquatic life protection water quality standards under the CSR.

7. For chlorinated solvents, undertake an evaluation of alternate approaches that may more effectively address concerns related to determination of whether biodegradation may occur and the concomitant potential for formation of toxic daughter products in groundwater.

8. For ionizing organic substances, consider incorporation of variable soil pH ranges where sufficient soil pH-Koc relationship data are available.

9. Evaluate the practicability of, and need to, develop soil standards based on porewater to protect soil invertebrates.

10. Evaluate the practicability of, and need to, develop soil to groundwater standards to protect phreatophyte and non-phreatophyte plants.

11. Evaluate the practicability of, and need to, develop soil standards based on groundwater contaminant transport to surface water for the purposes of protecting wildlife surface water ingestion (i.e. wildlife drinking watering pathway).

12. Undertake an updated literature review of models/approaches used in other jurisdictions for protection of water uses through setting/calculation of soil standards.

13. Review assumptions for the Dilution Attenuation Factor (DAF) value used in the model.

References


