CSR OMNIBUS UPDATING: Protocol Summary - Amendments to Schedule 5 Environmental Protection, Matrix Soil Standards

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Protocol Summary:

1. Repeal the existing CSR Schedule 5 and incorporate Schedule 5 listed substances into a new single schedule of consolidated soil standards further referred to as Schedule "X".

2. Where sufficient toxicological data is available for a substance, derive new omnibus updated Environmental Health Protection soil standards for all land uses in either:
    a. Schedule X Part 1 Matrix Soil Standards, or
    b. Schedule X Part 3 Environmental Protection Generic Numeric Soil Standards

3. Where sufficient toxicological data is available for a substance listed in Schedule X, Part 1, calculate in accordance with the original CSST, 1996 [1] protocol: livestock ingesting soil and fodder matrix soil standards.

4. Derive for emerging contaminants of concern, identified for omnibus updating, corresponding new environmental protection matrix soil standards.

Associated Omnibus Updating Documents

Details related to proposed changes to CSR Schedules 5 Environmental Protection Soil Standards are available in the ministry`s 2015 Omnibus Draft Discussion Documents:

a. CSR OMNIBUS UPDATING: Proposed Amendments to Schedule 5 Environmental Protection Standards [2]
b. CSR OMNIBUS STANDARDS UPDATING SUPPLEMENTAL CONSULTATION DOCUMENT: Proposal to Derive Two Levels of Wildlands Standards: Natural and Reverted [3]

Details related to the Ministry`s response/decisions on stakeholder comment received on the proposed omnibus updating changes to the CSR Schedule 5 Environmental Health Protection, matrix soil standards are available in 2015, Omnibus Updating of CSR Standards Draft Discussion Documents – Land Remediation Response to Stakeholder Comment. [4]

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

Adoption of High Density Residential Land Use

As more fully described in 2015, CSR OMNIBUS UPDATING: Proposed High Density Residential Soil Standards, [5] the High Density Residential Land Use (RL_{HDR}) soil invertebrate and plant matrix soil standard for a substance listed in Schedule X, Part 1 was set equal to the corresponding Commercial Land Use (CL) soil invertebrate and plant matrix soil standard derived for that substance.

Adoption of Natural Wildlands and Reverted Wildlands Land Use

For Wildlands (WL) land use, two discrete types of wildlands environmental health protection matrix standards are derived:

a. Natural Wildlands ($Wildlands_{Natural}$ or WL_N) : based on a 15^{th} percentile Effects Concentration (EC15) of environmental protection, and
b. Reverted Wildlands ($Wildlands_{Reverted}$ or WL_R) : based on a 25^{th} percentile Effects Concentration (EC25) of environmental protection.

Natural wildlands are unmanaged wildlands which are, and have always been, ecologically pristine, having never been used for a CSR Schedule 2 activity. Natural Wildlands standards are derived based on an EC15 level of ecological protection, using either the new omnibus updated:

a. Method 1 – Modified CSST, 1996 [1] Regression based method detailed below, or
b. where Method 1 cannot be used, the new proposed Method 2 – Simplified SABCS. 2009 [6, 7] Geometric Mean based method.

Reverted wildlands are lands that are, or had been, used for a CSR Schedule 2 activity and that have reverted to an unmanaged wildlands state as a result of: termination of schedule 2 activity, abandonment, neglect or any other reason. Reverted Wildlands standards are derived, based on an EC25 level of acceptable ecological protection, using either of the new omnibus Methods 1 or 2. The new $Wildland_{Reverted}$ matrix soil standard is equivalent to the environmental health protection matrix soil standards for: Agricultural, Parkland and Low Density Residential land uses.

Proposed New Derivation Methods – Details of Method 1 and 2

In establishing the standards, one of the following two derivation methods is used. Method 1 is the preferred method for all substances. Method 2 is used only in the case that the regression does not meet quality criteria.

Method 1 – Modified CSST, 1996 [1] Method (Preferred) – Substance specific linear regression based Effects Concentrations estimates are calculated using geometric means of quartile or quintile data bins of combined EC (non-lethal) and LC (lethal) toxicity data as follows:

1. All available toxicity data for a substance is compiled and assessed for acceptability against data quality assurance/quality control criteria and data bias checks.

2. No Observed Effect Concentration (NOEC) data lacking an associated percent effect are binned in the first quartile (or quintile) data bin.

3. All data are combined into a single data set comprising non-lethal Effect Concentration (EC) and Lethal Effect Concentration (LC) data.

4. Calculate a linear regression line for the resulting combined EC and LC effects substance specific distribution based on quartile geometric means for the following classes:
    a. 1^{st} quartile – EC and LC effects in the range of 0% to 24% (inclusive)
    b. 2^{nd} quartile – EC and LC effects in the range of 25% to 49% (inclusive)

c. 3rd quartile – EC and LC effects in the range of 50% to 74% (inclusive)
d. 4th quartile – EC and LC effects in the range of 75% to 100% (inclusive)

5. If the quartile regression returns an regression correlation coefficient, $r^2 \geq 0.75$, calculate from the regression line, land use soil invertebrate and plants soil standards as follows:
   a. WL_N: standard is the predicted 15th percentile concentration
   b. WL_R /AL/RL_{LDR}/PL: standard is the predicted 25th percentile concentration
   c. RL_{HDR} /CL/IL: standard is the predicted 50th percentile concentration

6. If the quartile regression does not meet data quality criteria, e.g. returns an $r^2 < 0.75$, recalculate the regression using quintile data bins:
   a. 1st quintile – EC and LC effects in the range of 0% to 19% (inclusive)
   b. 2nd quintile – EC and LC effects in the range of 20% to 39% (inclusive)
   c. 3rd quartile – EC and LC effects in the range of 40% to 59% (inclusive)
   d. 4th quartile – EC and LC effects in the range of 60% to 79% (inclusive)
   e. 5th quintile – EC and LC effects in the range of 80% to 100% (inclusive)

7. If the quintile regression returns an $r^2 \geq 0.75$, calculate from the regression line, land use soil invertebrate and plants soil standards as follows:
   a. WL_N: standard is the predicted 15th percentile concentration
   b. WL_R /AL/RL_{LDR}/PL: standard is the predicted 25th percentile concentration
   c. RL_{HDR}/CL/IL: standard is the predicted 50th percentile concentration

8. If the quintile regression does not meet data quality criteria, e.g. returns an $r^2 < 0.75$, do not use Method 1. Instead use Method 2 to derive the standard.

Method 2 – Simplified SABCS, 2009 [6, 7] Method (Alternate) –Calculate substance specific Effects Concentrations estimates using geometric means of combined EC and LC data available for the substance as follows:

1. All available toxicity data for a substance is compiled and assessed for acceptability against data quality assurance/quality control criteria and data bias checks.

2. No Observed Effect Concentration data lacking an associated percent effect are discarded.

3. All data are combined into a single data set comprising non-lethal Effect Concentration (EC) and Lethal Effect Concentration (LC) data.

4. Calculate geometric means for the following data sub-sets:
   a. Low Effect Range (LER): set the 25th percentile estimate equal to the geometric mean of the 15% – 34% effect range of data (inclusive)
   b. Moderate Effects Range (MER): set the 50th percentile estimate equal to the geometric mean of 35% – 65% effect range of data (inclusive)

5. Derive land use soil invertebrate and plants standards as follows:

a. WL_N: standard is the LER/ wildlands divisor[1]
b. WL_R /AL/RL_{LDR}/PL: standard is the LER
c. RL_{HDR}/CL/IL: standard is the MER

6. In the circumstance that new omnibus environmental health protective matrix soil standards cannot be derived using either Method 1 or Method 2, the original existing CSR Schedule 5 matrix soil standards and Schedule 4 generic soil standards will be retained, with an option to adopt an acceptable standard from another jurisdiction. In the case that original existing CSR Schedule 5 and Schedule 4 soil standards are retained, the WL_N standard will be derived by dividing the existing CSR Schedule PL standard by the wildlands divisor; and the WL_R standard will be set equal to the existing PL standard.

Next Cycle Revisions

For a future cycle of updating the Environmental Health Protection, Schedule X, Part 1 Matrix and Part 3 Generic soil standards, consider:

1. Conduct a dedicated literature review for new eco-toxicity information, to include review of new eco-toxicity data as vetted by other jurisdictions and data obtained directly from the scientific literature.

2. Review wildlife species soil and food ingestion rate data for application in updating future wildlands and agricultural land use standards.

3. Assess soil invertebrate and plant bioavailability of substances from soil,

4. Assess soil invertebrate and plant bioaccumulation and trophic transfer of bioaccumulative substances from soil, and

5. Determine if the "state of the science" has advanced to the point where it is possible to derive soil standards to protect terrestrial vertebrates.[2]

[1] The wildlands divisor is a value derived empirically from the relationship of derived PL and WL values from Method 1. The wildlands divisor is intended to provide an estimate of the 15% level of protection for WL standards.

[2] The SABCS, 2009 [6, 7] noted that other agencies (e.g. CCME, 2006 [8] and US EPA, 2005 [9]) have developed guidelines to protect terrestrial vertebrate receptors. The SABCS concluded that the guidelines produced "would be protective at a very conservative end of the exposure and effects species distribution"… "However, the SABCS is of the opinion that additional databases and further development and clarification of existing models are required before procedures (in regard to developing soil standards to protect terrestrial vertebrates) can be recommended."

References

1. British Columbia. (1996). *Overview of Contaminated Sites Soil Task Group (CSST) Procedures for the Derivation of Soil Quality Matrix Standards for Contaminated Sites.* Ministry of Environment. Victoria, British Columbia. January 31, 1996.

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3. BC Ministry of Environment. (2015). *CSR Omnibus Standards Updating Supplemental Consultation Document – Proposal to Derive Wildlands Soil Quality Standards for use under the Contaminated Sites Regulation based on Two Tiers of Environmental Protection.* Authors Remi Odense/Glyn Fox: Environmental Emergencies & Land Remediation Branch. Victoria, British Columbia, December, 2015.

4. British Columbia. (2015). *Omnibus Updating of CSR Standards Draft Discussion Documents – Land Remediation Response to Stakeholder Comment.* Ministry of Environment. November, 2015

5. BC Ministry of Environment. (2015). *CSR OMNIBUS UPDATING: Proposed High Density Residential Soil Standards. Draft Proposal Paper: For Stakeholder Consultation.* Authors: Peter Kickham/Glyn Fox. Environmental Emergencies & Land Remediation Branch. Victoria, B.C., June, 2015.

6. SABCS. (2009). *Report on: Review of CSST (1996) Soil Matrix Derivation Approach and Related Policy Decisions. Volume I: SABCS Review and Recommendations for Revision of the Soil Quality Matrix Standards for Contaminated Sites.* A Report Submitted to the B.C. Ministry of Environment. Prepared by: Science Advisory Board for Contaminated Sites in British Columbia (SABCS), Victoria, British Columbia, November, 2009.

7. SABCS. (2009). *Report on: Review of CSST (1996) Soil Matrix Derivation Approach and Related Policy Decisions. Volume II: SABCS Review and Recommendations for Revision of the Soil Quality Matrix Standards for Contaminated Sites.* A Report Submitted to the B.C. Ministry of Environment. Prepared by: Science Advisory Board for Contaminated Sites in British Columbia (SABCS), Victoria, British Columbia, November, 2009.

8. CCME. (2006). *A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines.* Canadian Counil of Ministers of the Environment. Winnipeg, Manitoba. 2006.

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