

Update on the CSST

May 29 2008

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Overview

- 1996 - Contaminated Sites Soils Task group (CSST)
- 2005 - Scientific Review of British Columbia CSST Soil Standards Derivation Protocol (Golder)
- 2006 Update: Contaminated Sites Soils Task group (CSST) Protocols for the Derivation of Soil Matrix Standards (Schedule 5) (UMA)
- 2007-2008 - SAB CSST Task Group working with UMA|AECOM to update draft 2006 CSST update
- 2009 SAB CSST Task Group reviewing the update.

CSST 1996

- CSST (1996) still in effect
- CSST (1996) Protocols were developed over a decade ago (from ~1994 to 1996) to provide the policies and technical basis for the establishment of “soil matrix standards”, included as Schedule 5 within the BC Contaminated Sites Regulation.

2005 - Scientific Review of British Columbia CSST Soil Standards Derivation Protocol (Golder)

- Is the current CSST protocol scientifically sound? Have there been significant scientific developments in the last decade that should be incorporated into the CSST protocol?
- To the extent that the CSST protocol (or its associated default toxicological and/or hydrogeological parameter values) may not be scientifically sound or up-to-date, how should the protocol or the default parameter values of the protocol be revised or replaced?
- Are there exposure scenarios that are not adequately addressed by the CSST protocol? If so, how should these exposure scenarios be addressed?

2005 - Scientific Review of British Columbia CSST Soil Standards Derivation Protocol (Golder)

The review made recommendations for changes in:

- Human health exposure routes to be included in standards derivation
- Reconsideration of default parameters used for the soil standards for human (such as soil allocation factor)
- Method used to derive soil invert-plant standards
- Propose methods to derive standards to address wildlife exposure to soil-derived contaminants (if appropriate)
- Groundwater mediated standards particularly the groundwater model used to assess these pathways.

2005 - Scientific Review of British Columbia CSST Soil Standards Derivation Protocol (Golder)

- Propose defined exposure scenarios and derivation protocols for deriving new soil standards, if appropriate, for Wild Lands and for High-Density Urban Residential - ongoing work being conducted by Frank Gobas and Ray Copes.
- Propose methods to derive standards to address human exposure to soil- or groundwater-derived contaminants in indoor air via soil vapour intrusion into buildings - BC now has Schedule II Generic Numeric Vapour Standards

2008 Update: Contaminated Sites Soils Taskgroup (CSST) Protocols for the Derivation of Soil Matrix Standards (Schedule 5) (UMA)

- Focused on development of Schedule 5 Soil Matrix Stds, not Schedule 4, 6, 9, 10 standards.
- Will add two new land uses:
 - Wildlands (WL)
 - High Density Urban (HDU)

 - They will not be incorporated into the 2008 revision recommendations to the BC MOE
- Harmonization with CCME was felt to be important, where this was not contrary to important policy decisions
- Implicitly sets policy for risk-based standards approach

CSST To-date

- Draft CSST document (March 2006); not in use by MoE
- Further development planned
- For 2007/8, MoE provided funding to SAB to complete update of CSST
- MoE provided comments on the 2006 Draft CSST
- Review of Draft CSST documents presently underway, completion in 2009

CSST Development

- UMA/AECOM developed CSST update working with SAB CSST Task Group Over the last 2 years:
 - Volume I: SABCS (2008) Recommended Revisions to CSST (1996) Procedures for the Derivation of Soil Quality Matrix Standards for Contaminated Sites.
 - Volume II: SABCS (2008) Recommendations Related to Revision of the CSST (1996) Policy Decision Summary
 - Volume III: Summary of Review Comments and Accessory Items - SABCS (2008) Recommended Revisions to CSST (1996) Procedures for the Derivation of Soil Quality Matrix Standards for Contaminated Sites
 - The above documents are currently undergoing review

CSST Development

Some Guiding Principles

- CSST Protocols provide a foundation for SLRA, DERA, and HHRA.
- Harmonize with CCME if adequately pragmatic to allow calculation of soil standards for a sufficiently large number of Contaminants of Concern (CoC)
- CSST revisions from SAB to reflect pragmatic procedures in face of best available science. Ministry of Environment may pose further 'policy' decisions on the resulting products, following completion by SAB.

CSST Development

Some Guiding Principles

- Current efforts should not consider derivation of Schedule 6, 9, 10, or 11 standards. While it is desirable to develop a unified protocols document to address all media and exposure routes in the future, this is not expected at this time.
- CSST Protocols update will not incorporate wildlands or high density urban land use setting, deliberations on which are happening in parallel with this project.
- CSST Protocols associated with groundwater mediated exposure routes will simply refer to the MoE groundwater model, the particulars of which will be dealt with by other entities within MoE, whose deliberations will likely not be complete prior to completion of this SAB project.

CSST Development

- Changes to the CSST recommended by the SAB reflect the influences of
 - Best available science
 - Availability of data to derive standards
 - BCMOE Policy

Update to CSST

- The Review will consider and recommend a deemed necessary changes in four areas:
 - Human Health – Soils
 - Groundwater mediated exposure routes:
 - Eco- Soil Contact
 - Eco- mammalian and avian

Update to CSST

Human Health – Soils :

Major Decisions – Human Health

Multimedia exposure estimates:

- CSST 1996 and CCME 2006/CSST 2008 very similar:
- Consider background exposures (EDI) to Contaminant of Concern (CoC) only if sufficient data of relevance to BC.
- Otherwise, need to account for background exposures using Soil Allocation Factor (SAF) approach, per CSST 1996.

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

- Most important exposure pathway, and the one mandatory pathway for assessment is soil ingestion.
- Soil ingestion pathway is assigned an SAF of 0.2 unless there is adequate,
- generalizable scientific knowledge for the CoC to assign an alternate set of SAFs to the different exposure routes.

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Should BC Environment support a multi-media approach to HH soil quality standard derivation and by inference support Health Canada's "no appreciable risk" concept?

- ***The SABCS approves the concept of consideration of an EDI as used in CSST 1996. The SABCS notes a paucity of efforts by MoE and Health Canada to assess EDIs for substances commonly found at contaminated sites. Instead an apportionment equation that results in a 400% level of conservatism is applied.]***
- **The SABCS therefore encourages a high priority assessment of EDIs given that a default soil allocation factor of 0.2 is otherwise implied. The SABCS considers that the use of the 0.2 soil allocation factor is a matter of policy that should be replaced by a science-based effort to evaluate EDIs to the greatest extent possible.**

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Should BC Environment support HH derivation based primarily on "direct soil ingestion"?

- The SABCS recommends that for the development of the generic soil standards, both soil ingestion and skin contact should be assessed separately. Although the SABCS agrees that upon human exposure to soil, “direct soil ingestion” is likely the most important human health pathway, the SABCS recommends separate concurrent assessments of dermal exposures.
- The derivation of separate soil intake standards would account for differences in the mechanisms of toxicity for different exposure routes, different absorption factors and different TRVs, if available.

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Should BC Environment support HH criteria derivation based on lifetime exposure as a first principle?

- For life expectancy, the SABCS notes a Health Canada (2007 Draft) Preliminary Quantitative Risk Assessment guidance document, that suggests a life expectancy of 80 years. The SABCS also notes Health Canada's recommendation: "if cancer risks are estimated for adults only, the 60-year duration of adulthood (20 to 80 years, inclusive) should be used; if cancer risks are estimated on the basis of lifetime average daily intake, then average life expectancy of 80 years should be used ."
- Proposed recommendation would seem to conflict with CSST 96 science policy to establish soil standards for "reasonably maximally exposed" individual

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

- Human exposure assumptions (body weight, soil ingestion rates, surface area, etc.) differ slightly between CSST (1996) and Health Canada (2007), and appreciably between USEPA RAGS or for Region 9 PRG development. Recommend adopting Health Canada (2007) pending more detailed review.

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Chemical	CSR Standard (mg/kg)	CSST 2008 Method (mg/kg)	EPA Method- with EPA default values (mg/kg)	EPA Method with CSST default values (mg/kg)	EPA Method with possible SABCS default values (mg/kg)
Arsenic	100 (adjusted to background levels)	23	4.3	10	14
DDT	15	103	19	44	60
Penta-chlorophenol	100	292	53	126	171
Tetrachloro-ethylene	1000	673	123	290	394

Comparison of methods for assessing soil-screening values for carcinogens:

Update to CSST

Human Health – Soils :

- Comparison of methods for assessing soil-screening values for carcinogens:
- “CSST Method” is as per CSST Volume I most recent draft
- “EPA Method with EPA default values”. This method (which is used for Schedule 10) amortizes exposures at 0-6 years and at 6-30 years. Soil ingestion quantities are assumed to be much higher than CSST assumptions.
- “EPA Method with CSST default values”. The EPA amortization procedure is used for two different age groups. The CSST soil ingestion quantities are used. As noted in the table for calculation of “age adjusted soil ingestion factors”, the second age group is assumed to be exposed from ages 6 to 80.
- “EPA Method with possible SABCS default values” uses the EPA amortization procedure. The CSST soil ingestion quantities are used. As noted in the table for calculation of “age adjusted soil ingestion factors”, the second age group is assumed to be exposed from ages 6 to 30.

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Should BC Environment specify human health protective soil-ingestion standards for industrial sites or leave the issue of the development of such standards at these sites to the WCB?:

- SABCS 2008 Review: *The SABCS recommends derivation of soil quality matrix standards for “intake of contaminated soils” for industrial lands.*

Update to CSST

Human Health – Soils :

Major Decisions – Human Health continued

Should BC Environment support the "CCME protocol" PSQCHH formula proposed by SCEQCCS for non-carcinogenic substances?

- SABCS (2008) recommends the following approach:
- 1. If a scientifically defensible EDI can be determined which takes into account the contribution from all potentially contaminated environmental media, then no further correction via the SAF is required.
- 2. Alternatively, if insufficient data are available to determine an EDI with confidence, then no correction for EDI would be applied, but an SAF would be used, and would have the value $1/n$, where n is the number of environmental media in which the contaminant in question could be expected to be present in potentially significant concentrations.

Update to CSST

Human Health – Soils :

Additional Recommendations:

- Children are removed as the sensitive receptor on commercial lands.
- Modification of exposure duration for residents to represent 95 percentile
- Modification of exposure duration for workers at commercial/industrial sites to be 25 years versus the 52 or 60 years, based on Statistics Canada data and US reviews.
- The basis of exposure durations for all scenarios should be explicitly defined
- There should be emphasis on calculation of EDIs. The literature shows several EDI calculations and an abundance of supporting data to calculate EDIs.
- The US EPA model should be used to determine standards for carcinogens in soils within residential, urban parkland and agricultural properties. Child and adult exposures would be considered.
- Human health soil standards are to consider ingestion and skin contact. Dust inhalation is assumed to be negligible based on Health Canada's assessment (but should be considered on a site specific basis if dust is evident). If you feel otherwise I can incorporate the dust inhalation component into the soil standard calculations.



Update to CSST

Groundwater mediated exposure routes:

- CSST Protocols associated with groundwater mediated exposure routes will simply refer to the MoE groundwater model, the particulars of which will be dealt with by other entities within MoE, whose deliberations will likely not be complete prior to completion of this SAB project.

Update to CSST

Ecological Health – Soils :

Major Decisions – Ecological Health continued

Should BC Environment support critical receptors identified in Table 1 of the CCME draft Protocol document as suitable predictive sentinel species to encompass the prescribed "scope" of Ecological function present at identified land use sites?

SABCS 2008 recommends consideration of vertebrate wildlife as ecological receptors on agricultural lands and wildlands. SABCS recommends inclusion of foraging wildlife as receptors on these land

Contaminant exposure pathways through soil and plant ingestion are possible for vertebrate wildlife on these land uses especially for herbivores and omnivores. Particular attention must also be given to those substances that persist in the environment (i.e. DDT, PCB) and have a strong tendency to bioaccumulate and / or biomagnify up the food chain. (agricultural lands and wildlands).

Update to CSST

Ecological Health – Soils :

Major Decisions – Ecological Health continued

Should BC Environment support the 1)direct contact, 2)food ingestion, and 3)soil ingestion exposure paths or simplify to only a single pathway (i.e. direct soil contact)?

For all land uses the direct soil contact pathway should continue to be applied to be protective of soil invertebrates and plants. SABCS 2008 also recommends derivation of separate soil invertebrate and plant standards,

SABCS 2008 recommends the inclusion of vertebrate wildlife as receptors of concern where there is potential for exposure to contaminated soil and plants through foraging activities on agricultural lands and wildlands.

SABCS 2008 also recommends the adoption of an indirect soil pathway to be applied to vertebrate wildlife, in particular secondary and tertiary consumers that may be exposed to soil contaminants through food web trophic transfers. This pathway would only apply if bioaccumulative substances are suspected to be present on agricultural lands, or on wildlands.

Update to CSST

Ecological Health – Soils :

Major Decisions – Ecological Health continued

Should BC Environment support preferred order for SQC_{sc} - TEC derivation? :

1. Weight of evidence method,
2. LOEC extrapolation method, and
3. Median effects extrapolation method

The CSST (1996) method was also revisited in 2008, and an alternate set of methods is nominated that overcomes some of the technical limitations of CCME, 1996, CSST 1996, and CCME 2006.

Update to CSST

Ecological Health – Soils :

Major Decisions – Ecological Health continued

Should BC Environment support preferred order for SQC_{sc} - TEC derivation? :

Two procedures for derivation being **SQC_{sc} - TEC** considered

Procedure 1 dates back to 1996 (CCME 1996) regulatory guidelines for contaminated sites, and is essentially a linear regression approach with interpolated values associated with specific effects sizes (e.g., EC20 or LC50).

Procedure 2 reflects updated guidance, and uses geometric means of grouped data within specific ranges of effects sizes to identify thresholds. Regardless, both methods require a representative dataset in order to provide reasonably sound estimates of thresholds.

Update to CSST

Eco- Soil Contact:

Current MoE approach

1. Consider all appropriate invertebrate and plant toxicity data from CCME "Substance Assessment" documents.
2. Separate data into discrete lethal and non-lethal effect distributions
3. Calculate median effects concentrations for lethal and non-lethal distributions
4. Fit linear regression lines to lethal and non-lethal median distributions. If lethal or non-lethal regression correlation coefficient < 0.25 use "Empirical Exception" rule¹.
5. Determine regression intercepts for EC50-NL and LC20 and apply appropriate level of protection rule for:
 - A/R/P - lesser of EC50-NL or LC20
 - C/I - greater of EC50-NL or LC20

Update to CSST

Eco- Soil Contact:

CSST 2006 Approach

Plant toxicity and soil invertebrate toxicity respectively data for the substance of interest are collated from CCME compilations, other databases and compilations, and through an independent search of the open scientific literature. Following an initial review, data gaps are identified and the need for development of new plant toxicity data evaluated.

The collated data are then divided into three major categories:

- **NO(A)EC data**
- **Lower Effects Range (LER) data; i.e., effects size relative to the control or reference condition in the range of approx. 5% to 35%. The intent is to standardize responses near the 20% effects level;**
- **Mid-Effects Range (MER) data; i.e.; i.e., effects size relative to the control or reference condition in the range of > 35% to <65%. The intent is to standardize responses near the median effects range to the extent possible.**



Update to CSST

Eco- Soil Thresholds:

A concern with Procedure 1 is that the guidance recommends pooling both invertebrate and plant data.

Procedure 2 recognizes that invertebrate data are often more sensitive as well as typically under-represented in soil toxicity data sets. Therefore, Procedure 2 recommends calculating separate thresholds for invertebrate and plant data.



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- Questions & comments?