

UPDATING CSR ENVIRONMENTAL HEALTH PROTECTIVE MATRIX SOIL QUALITY STANDARDS

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Ministry of
Environment

CSR ENVIRONMENTAL HEALTH PROTECTION STANDARDS

CSR Matrix Environmental Health Protection Standards

Schedule 5 Matrix Environment Health standards include:

- **Soil Invertebrate and Plants standard** – (mandatorily applicable)
- Soil to Groundwater standards to protect:
 - Aquatic Life (freshwater & marine)
 - Livestock watering
 - Irrigation, and for,
- Agricultural lands:
 - Livestock soil ingestion standards and
 - Microbial Function standards



CSR ENVIRONMENTAL HEALTH STANDARDS – WHY UPDATE ?

CSR Matrix Soil Invertebrate and Plants Standard - History

- Schedule 5 matrix Soil Invertebrate and Plant standards were derived in accordance with 1996 CSST Protocol
 - most are based on 1995/96 CCME soil invertebrate and plant toxicity data
 - CCME toxicity database has expanded since 1996 – new substances and more studies
- The 2008 CSR Stage 6 amendment added Wildlands soil standards in recognition of need to regulate contaminated sites located in wildlands (e.g. pulp mills, minesites, oil and gas sites, etc.)
- CSR current Wildlands standards use PL/AL standards as “surrogates” for purpose-derived WL standards
- CSST Protocol did not envision need for Wildlands (WL) standards
- Ministry proposes to revise CSST Protocol to allow derivation of true Wildlands soil standards

ENVIRONMENTAL HEALTH STANDARDS – SUBSTANCES TO UPDATE

Substance	Sch 4 listed	Sch 5 listed	Substance	Sch 4 listed	Sch 5 listed
Arsenic		x	Antimony	x	
Barium		x	Anthracene		
Benzene		x	Beryllium	x	
Benzo[a]pyrene		x	chlorobenzenes	x	
cadmium		x	cobalt	x	
chromium		x	cyanide	x	
copper		x	lindane (HCB)	x	
di-isopropanolamine			endosulfan		
DDT		x	ethylbenzene		x
fluoranthene			ethylene glycol		x
lead		x	molybdenum	x	
mercury		x	PCDD/PCDF		x
naphthalene	x		PCP		x
nickel	x		selenium	x	
nonchlorophenols			TCE		x
nonylphenol			thallium	x	
PFOS			toluene		x
phenol	x		vanadium	x	
PERC		x	xylene		x
sulfolane					
uranium					
zinc		x			

Data sufficient to derive soil invertebrate and plants matrix standards

Data sufficient to derive soil invertebrate and plants matrix standards

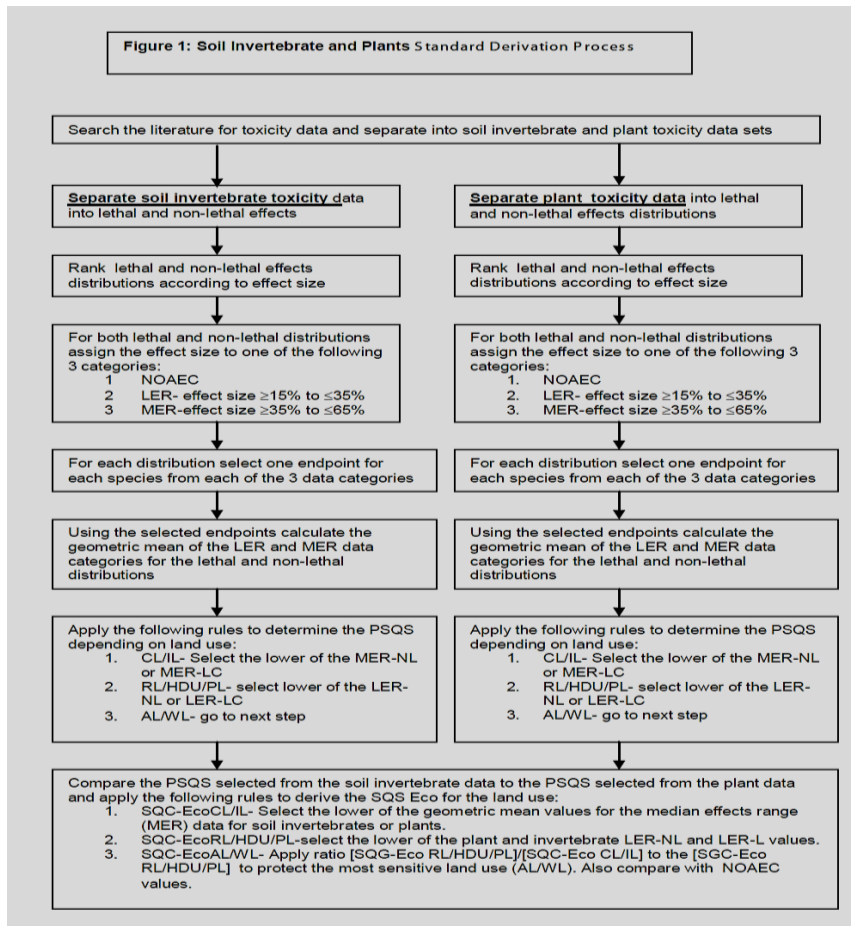
CSST PROTOCOL – SOIL INVERTEBRATE & PLANTS STANDARD

1996 CSST Protocol Derivation/Criteria

- For each CSR Schedule 5 substance, the available CCME Soil Invertebrate and Plant toxicity data for the substance was divided into 2 groups:
 - Non-lethal,
 - Lethal
- Regression lines were then fitted to each group, and the EC 50 (non-lethal) and LC 20 (lethal) values were determined
- **For AL/PL/RL** the Soil Invertebrate and plant EH standard is the **lesser of the EC50 or LC 20 value** determined for the substance
- **For CL/IL** the Soil Invertebrate and plant EH standard is the **greater of the EC50 or LC20 value** determined for the substance

[CSST 1996 As derivation](#)

SABCS RECOMMENDED REVISION OF CSST DERIVATION



2009 SABCS Proposed Derivation

- Very labour intensive/complicated
- Often unworkable for typical small toxicity datasets available
- Discards low (< 35% effect) and high (> 65% effect) data
- Does not consider the slope of the dose : response curve for the substance
- Usually produces more stringent standards compared to CSST regression method

SABCS RECOMMENDED REVISION OF CSST DERIVATION

2009 SABCS Proposed Derivation Process

- Splint plant and invertebrate data into 2 groups
- Then split plant and invert groups into 2 further subgroups (NL and L - i.e. 4 subgroups)
- For each subgroup identify 2 median effects range values
 - Lower Effects Range (LER) : 15 – 35% effects response range
 - Moderate Effects Range (MER) : 35 – 65% effects response range
- Results in 8 critical value estimates:

Plant LER _{NL}	Plant LER _L
Invertebrate LER _{NL}	Invertebrate LER _L
Plant MER _{NL}	Plant MER _{NL}
Invertebrate MER _{NL}	Invertebrate MER _{NL}

SABCS RECOMMENDED REVISION OF CSST DERIVATION

2009 SABCS Proposed Derivation Process

- Then recombine the 2 plant and invert LER_{NL} estimates by setting a single LER_{NL} as the lesser of the 2 plant and invert LER_{NL}
- Then recombine the 2 plant and invert LER_L estimates by setting a single LER_L as the lesser of the 2 plant and invert LER_L
- Then recombine the 2 plant and invert MER_{NL} estimates by setting a single MER_{NL} as the lesser of the 2 plant and invert MER_{NL}
- Then recombine the 2 plant and invert MER_L estimates by setting a single MER_L as the lesser of the 2 plant and invert MER_L
- Results in 4 critical values

Combined lowest LER_{NL}	Combined lowest LER_L
Combined lowest MER_{NL}	Combined lowest MER_L

SABCS RECOMMENDED REVISION OF CSST DERIVATION

2009 SABCS Proposed Derivation Process

- Finally, set the soil invertebrate and plants standards as follows:
 - For **AL, PL and RL** the standard is the **lessor** of the above determined LER_{NL} and LER_L values
 - For **CL and IL** the standard is the **lessor** of the above determined MER_{NL} and MER_L values
 - For **WL** set the standard as **PL times the ratio of PL, RL to CL, IL**:

$$WL = PL \times \frac{AL, PL, RL}{CL, IL}$$

AL, PL, RL = 50	$WL = PL \times \frac{AL, PL, RL}{CL, IL}$	$WL = 50 \times \frac{50}{100} = 25$
CL, IL = 100		

MINISTRY PROPOSED 2015 REVISED DERIVATION

Method 1 Preferred - (Modified 1996 CSST Method)

- Check and cull where necessary to meet quality criteria, updated soil invertebrate and plants ECx and LCx data for existing Sch 5 and where sufficient data exists, Sch 4 substances.
- Combine all data into a single dataset and calculate geometric means for the following distribution quartiles (i.e. 4 “bins”):

Bin	Quartile	Effects Range
1	1st Quartile	0 – 24 %
2	2ndt Quartile	25 – 49%
3	3rd Quartile	50 – 74%
4	4th Quartile	75 – 100%

MINISTRY PROPOSED EH DERIVATION/CRITERIA

Method 1 Preferred

- Fit regression line through binned data
- If R^2 value of the regression line is > 0.75 use the regression to derive the soil invertebrate and plants standard for the substance as follows:
 - **AL, PL, RL_{LDR}** standard is **predicted 25% effects value**
 - RL_{HDR} standard is set to $\frac{1}{2}$ CL value (as per High Density Residential proposal paper)
 - **CL, IL** standard is **predicted 50% effects value**
 - **WL** standard is **predicted 15% effects value**
- If R^2 value of the regression line is < 0.75 use Method 2 Alternate

[2015 As Proposed Derivation \(Method 1\)](#)

MINISTRY PROPOSED EH DERIVATION/CRITERIA

Method 2 Alternate - (Modified 2009 SABCS Proposed Method)

- Check and cull where necessary to meet quality criteria, updated soil invertebrate and plants ECx and LCx data for existing Sch 5 and where sufficient data exists, Sch 4 substances.
- Combine all data into a single dataset and calculate geometric means for the following 2 distribution ranges (i.e. 2 “bins”):

Bin	Effects Range
1 (LER)	10 – 35 %
2 (MER)	40 – 65%

MINISTRY PROPOSED EH DERIVATION/CRITERIA

Method 2 Alternate

- Derive the EH soil invertebrate and plants standards for the substance as follows:
 - **AL, PL, RL_{LDR}** standard is **LER value**
 - **RL_{HDR}** standard is set to $\frac{1}{2}$ CL value (as per High Density Residential proposal paper)
 - **CL, IL** standard is **MER value**
 - **WL** standard is set to **PL value/1.5** (less stringent WL standard) or,
PL value/2 (more stringent WL standard)

QUESTIONS ?

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