Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

SUMMARY TABLES

Table 1. Canadian soil quality guidelines (mg·kg^{-1}).

Substance	Year revised/ released[a]	Land use			
		Agricultural	Residential/ parkland	Commercial	Industrial
Arsenic (inorganic)	1997	12[b]	12[b]	12[b]	12[b]
Barium	1999	750[c]	500[c]	2000[c]	2000[c]
Benzene	1997	0.05[d]	0.5[d]	5[d]	5[d]
Benzo*(a)*pyrene	1997	0.1[e]	0.7[f]	0.7[f]	0.7[f]
Cadmium	1999	1.4[b]	10[g]	22[b]	22[b]
Chromium					
Total chromium	1997	64[b]	64[b]	87[b]	87[b]
Hexavalent chromium (VI)	1999	0.4[h]	0.4[h]	1.4[h]	1.4[h]
Copper	1999	63[b]	63[b]	91[b]	91[b]
Cyanide (free)	1997	0.9[b]	0.9[b]	8.0[b]	8.0[b]
DDT (total)	1999	0.7[i]	0.7[i]	12[i, j]	12[i, j]
Ethylbenzene	1997	0.1[d]	1.2[h]	20[h]	20[h]
Ethylene glycol	1999	960[k]	960[k]	960[k]	960[k]
Lead	1999	70[b]	140[b]	260[b]	600[b]
Mercury (inorganic)	1999	6.6[b]	6.6[b]	24[b]	50[b]
Naphthalene	1997	0.1[d]	0.6[h]	22[h]	22[h]
Nickel	1999	50[l]	50[l]	50[l]	50[l]
Pentachlorophenol	1997	7.6[b]	7.6[b]	7.6[b]	7.6[b]
Phenol	1997	3.8[b]	3.8[b]	3.8[b]	3.8[b]
Polychlorinated biphenyls (PCBs)	1999	0.5[m]	1.3[l]	33[l, j]	33[l, j]
Tetrachloroethylene	1997	0.1[e]	0.2[f]	0.5[f]	0.6[f]
Thallium	1999	1[n]	1[o]	1[o]	1[o]
Toluene	1997	0.1[e]	0.8[f]	0.8[f]	0.8[f]
Trichloroethylene	1997	0.1[d]	3[h]	31[h]	31[h]
Vanadium	1997	130[l]	130[l]	130[i]	130[i]
Xylene	1997	0.1[e]	1[f]	17[f]	20[f]
Zinc	1999	200[l]	200[l]	360[l]	360[l]

Notes: SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

[a]Guidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines revised/released in 1999 are published here for the first time (see Table 2).

[b]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated de novo guideline for this land use, derived in accordance with the soil protocol (CCME 1996). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[c]Data are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E , or a provisional SQG_E. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[d]Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[e]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[f]Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than corresponding interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[g]The soil–plant–human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g., adopt the agricultural guideline as objective). The off-site migration check should be recalculated accordingly.

[h]Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[i]Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_E becomes the soil quality guideline.

[j]In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary, or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.

[k]Data are sufficient and adequate to calculate only a provisional SQG_E.

[l]Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[m]Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[n]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E . The provisional SQG_{HH} is equal to the SQG_E and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[o]Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E . The provisional SQG_{HH} is less than the SQG_E and thus becomes the soil quality guideline for this land use.

References

CCME (Canadian Council of Ministers of the Environment). 1991. Interim Canadian environmental quality criteria for contaminated sites. CCME, Winnipeg.

———. 1996. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [A summary of the protocol appears in Canadian environmental quality guidelines, Chapter 7, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

———. 1997. Recommended Canadian soil quality guidelines. CCME, Winnipeg.

Table 2. Historical record of interim remediation criteria for soil and soil quality guidelines ($mg \cdot kg^{-1}$).

Substance	Year released[a]	Land use			
		Agricultural	Residential/ parkland	Commercial	Industrial
General Parameters					
Conductivity [dS/m]	1991	2	2	4	4
pH	1991	6 to 8	6 to 8	6 to 8	6 to 8
Sodium adsorption ratio	1991	5	5	12	12
Inorganic Parameters					
Antimony	1991	20	20	40	40
Arsenic (inorganic)	1997	12	12	12	12
Barium	1999	750	500	2000	2000
Beryllium	1991	4	4	8	8
Boron (hot water soluble)	1991	2	—	—	—
Cadmium	1997	1.4	10	27	27
Cadmium	1999	1.4	10	22	22
Chromium					
Total chromium	1997	64	64	87	87
Hexavalent chromium (VI)	1991	8	8	—	—
Hexavalent chromium (VI)	1999	0.4	0.4	1.4	1.4
Cobalt	1991	40	50	300	300
Copper	1997	63	63	100	100
Copper	1999	63	63	91	91
Cyanide (free)	1997	0.9	0.9	8.0	8.0
Fluoride (total)	1991	200	400	2000	2000
Lead	1997	70	140	260	400
Lead	1999	70	140	260	600
Mercury (inorganic)	1997	6.6	6.6	24	30
Mercury (inorganic)	1999	6.6	6.6	24	50
Molybdenum	1991	5	10	40	40
Nickel	1991	150	100	500	500
Nickel	1999	50	50	50	50
Selenium	1991	2	3	10	10
Silver	1991	20	20	40	40
Sulphur (elemental)	1991	500	—	—	—
Thallium	1999	1	1	1	1
Tin	1991	5	50	300	300
Vanadium	1997	130	130	130	130
Zinc	1997	200	200	380	380
Zinc (erratum)	1997	200	200	360[b]	360[b]
Zinc	1999	200	200	360	360

Continued.

Table 2. Continued.

Substance	Year released[a]	Land use			
		Agricultural	Residential/ parkland	Commercial	Industrial
Monocyclic Aromatic Hydrocarbons					
Benzene	1997	0.05	0.5	5	5
Chlorobenzene	1991	0.1	1	10	10
1,2-Dichlorobenzene	1991	0.1	1	10	10
1,3-Dichlorobenzene	1991	0.1	1	10	10
1,4-Dichlorobenzene	1991	0.1	1	10	10
Ethylbenzene	1997	0.1	1.2	20	20
Styrene	1991	0.1	5	50	50
Toluene	1997	0.1	0.8	0.8	0.8
Xylene	1997	0.1	1	17	20
Phenolic Compounds					
Chlorophenols[c] (each)	1991	0.05	0.5	5	5
Nonchlorinated[d] (each)	1991	0.1	1	10	10
Pentachlorophenol	1997	7.6	7.6	7.6	7.6
Phenol	1997	3.8	3.8	3.8	3.8
Polycyclic Aromatic Hydrocarbons (PAHs)					
Benzo*(a)*anthracene	1991	0.1	1	10	10
Benzo*(b)*fluoranthene	1991	0.1	1	10	10
Benzo*(k)*fluoranthene	1991	0.1	1	10	10
Benzo*(a)*pyrene	1997	0.1	0.7	0.7	0.7
Dibenz*(a,h)*anthracene	1991	0.1	1	10	10
Indeno(1,2,3-c,d)pyrene	1991	0.1	1	10	10
Naphthalene	1997	0.1	0.6	22	22
Phenanthrene	1991	0.1	5	50	50
Pyrene	1991	0.1	10	100	100
Chlorinated Hydrocarbons					
Chlorinated aliphatics[e] (each)	1991	0.1	5	50	50
Chlorobenzenes[f] (each)	1991	0.05	2	10	10
DDT (total)	1999	0.7	0.7	12	12
Hexachlorobenzene	1991	0.05	2	10	10
Hexachlorocyclohexane	1991	0.01	—	—	—
PCDDs and PCDFs[g] (dioxins and furans)	1991	0.00001	0.001	—	—
Polychlorinated biphenyls (PCBs)	1999	0.5	1.3	33	33
Tetrachloroethylene	1997	0.1	0.2	0.5	0.6
Trichloroethylene	1997	0.1	3	31	31

Continued.

Table 2. Continued.

Substance	Year released[a]	Land use: Agricultural	Residential/ parkland	Commercial	Industrial
Miscellaneous Organic Parameters					
Ethylene glycol	1997	97	97	410	410
Ethylene glycol (erratum)	1997	103[h]	103[h]	428[h]	428[h]
Ethylene glycol	1999	960	960	960	960
Nonchlorinated aliphatics (each)	1991	0.3	—	—	—
Phthalic acid esters (each)	1991	30	—	—	—
Quinoline	1991	0.1	—	—	—
Thiophene	1991	0.1	—	—	—

Notes:

All values are in milligrams per kilogram dry weight unless otherwise stated.

Interim criteria should only be used when soil quality guidelines based on the CCME soil protocol (CCME 1991) have not yet been developed for a given chemical. Also, because the interim remediation criteria were not developed using the soil protocol and its integral checks, they cannot be modified through the site-specific remediation objective procedure.

— = Value not established.

[a]Guidelines released in 1991 were published in "Interim Canadian Environmental Quality Criteria for Contaminated Sites" (CCME 1991). Guidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines released in 1999 are published here for the first time. The 1999 guidelines supersede the 1997 guidelines.

[b]An erratum with this change was issued in 1997 to the supporting document for this substance (Environment Canada 1996a).

[c]Chlorophenols include
chlorophenol isomers (ortho, meta, para)
dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,4- 3,4,5-)
tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)
pentachlorophenol

[d]Nonchlorinated phenolic compounds include
2,4-dimethylphenol
2,4-dinitrophenol
2-methyl 4,6-dinitrophenol
nitrophenol (2-,4-)
phenol
cresol

[e]Aliphatic chlorinated hydrocarbons include
chloroform
dichloroethane (1,1- 1,2-), dichloroethene (1,1- 1,2-)
dichloromethane
1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
1,1,2,2-tetrachloroethane, tetrachloroethene
carbon tetrachloride
trichloroethane (1,1,1- 1,1,2-), trichloroethene

[f]Chlorobenzenes include
all trichlorobenzene isomers
all tetrachlorobenzene isomers
pentachlorobenzene

[g]PCDDs and PCDFs expressed in 2,3,7,8-TCDD equivalents. NATO International Toxicity Equivalency Factors (I-TEFs) for congeners and isomers of PCDDs and PCDFs are as follows:

Congener	TEF
2,3,7,8-T_4 CDD	1.0
1,2,3,7,8-P_5 CDD	0.5
1,2,3,4,7,8-H_6 CDD	0.1
1,2,3,7,8,9-H_6 CDD	0.1
1,2,3,6,7,8-H_6 CDD	0.1
1,2,3,4,6,7,8-H_7 CDD	0.1
O_8 CDD	0.001
2,3,7,8-T_4 CDF	0.1
2,3,4,7,8-P_5 CDF	0.5
1,2,3,7,8-P_5 CDF	0.05
1,2,3,4,7,8-H_6 CDF	0.1
1,2,3,4,7,8,9-H_6 CDF	0.1
1,2,3,6,7,8-H_6 CDF	0.1
2,3,4,6,7,8- H_6 CDF	0.1
1,2,3,4,6,7,8-H_7 CDF	0.1
1,2,3,4,7,8,9-H_7 CDF	0.01
O_8 CDF	0.001

[h]An erratum with this change was issued in 1997 to the supporting document for this substance (Environment Canada 1996b).

References

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Reference listing:

Canadian Council of Ministers of the Environment. 2001. Canadian soil quality guidelines for the protection of environmental and human health: Summary tables. Updated. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

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