WATER QUALITY GUIDELINE SERIES

British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (August 2024)

Ministry of Water, Land and Resource Stewardship

Water Stewardship and Security Branch

No. WQG-08-01

BRITISH COLUMBIA

The Working Water Quality Guidelines are a collection of British Columbia (B.C.) Ministry of Environment and Climate Change Strategy water quality guidelines (WQGs) that are adopted from other environmental jurisdictions for the substances without approved WQGs. Working WQGs are developed to protect a variety of water values and uses: aquatic life, livestock watering, irrigation, and wildlife.

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Updates in the August 2024 version:

- Working water quality guidelines were added for 174 pesticides, 1,4-dioxane, chlorinated alkanes, endosulfan (short-term), hydrazine, PBDE-BDE99, PBDE-BDE100, petroleum hydrocarbons groups, siloxane-D4, strontium, TBBPA (tetrabromobisphenol A), triclocarban, uranium (acute maximum), vanadium (freshwater aquatic life), and vinyl chloride.
- Working water quality guidelines were updated for acrolein, alkalinity, chromium (Cr(VI); freshwater), endosulfan (long-term), imidacloprid, glyphosate, malathion (freshwater), quinoline, uranium (chronic long-term), vanadium (marine aquatic life), and thallium (freshwater).
- Working sediment and working wildlife dietary guidelines were added for tetrabromobisphenol A (TBBPA).

Updates in the February 2021 version:

- Sediment quality guideline was added for molybdenum.
- Water Quality guidelines for Perfluorooctane Sulfonate (PFOS), and Polybrominated Diphenyl Ethers (PBDE) including heptaBDE and octaBDE were corrected.
- Sediment quality guidelines for Benzo(g,h,i)perylene and Polychlorinated dibenzo-*p*-dioxins/dibenzo furans (PCDD/Fs) were corrected.

Updates in the July 2020 version:

- Water quality guidelines were added for the following 11 substances: Bisphenol A (BPA), Diazinon, Hexabromocyclododecane (HBCD), Perfluorooctane Sulfonate (PFOS), Permethrin, Polybrominated Diphenyl Ethers (PBDE) including triBDE, tetraBDE, pentaBDE, hexaBDE, heptaBDE, octaBDE and Triclosan.
- Sediment quality guidelines for Polychlorinated Biphenyls (PCBs) previously adopted from CCME (2001) were rescinded including Arochlor 1016, Arochlor 1248, Arochlor 1254, Arochlor 1260, and total PCBs.
- Sediment quality guidelines were added for the following 6 substances: Atrazine, Bisphenol A (BPA), Chlorpyrifos, Diazinon, Hexabromocyclododecane (HBCD), Polychlorinated Biphenyls (PCBs).
- Tissue residues guidelines were added for the following five substances: Polybrominated Diphenyl Ethers (PBDE) including triBDE, tetraBDE, pentaBDE, hexaBDE, and Perfluorooctane Sulfonate (PFOS).
- Wildlife dietary guidelines were added for the following 13 substances: Bisphenol A (BPA), DDT, Hexabromocyclododecane (HBCD), Polybrominated Diphenyl Ethers (PBDE) including triBDE, tetraBDE, pentaBDE, hexaBDE, heptaBDE, octaBDE, nonaBDE, decaBDE, Polychlorinated Biphenyls (PCBs), and Perfluorooctane Sulfonate (PFOS).

Introduction

This document presents BC's updated Working Water Quality Guidelines (WWQGs). These guidelines are revised periodically to incorporate new information and represent the best guidance the Ministry of Water, Land, and Resource Stewardship (WLRS) can provide, at the time of publication, for substances without approved water quality guidelines (WQGs). The 2024 edition supersedes all previous versions.

Many jurisdictions develop WQGs to protect water quality. BC's WQGs represent safe levels of substances that protect different water uses, including: drinking water, recreation, aquatic life, wildlife and agriculture. In BC, the definition of water quality includes sediment, and therefore WQG documents may include sediment quality values.

WQGs provide policy direction to those making decisions affecting water quality. Although WQGs do not have any direct legal standing, once approved, BC WQGs must be considered in any decision affecting water quality made within the Ministry of Environment and Climate Change Strategy (ENV). WQGs are used to assess water quality and may be used as the basis for determining the allowable limits in waste discharge authorizations. Exceeding a WQG does not imply that unacceptable risks exist, but rather that the potential for adverse effects may be increased and additional investigation may be required. BC's approved WQGs are located at: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines

Working water quality guidelines (WWQGs) can be used when there is no approved B.C. WQG for a substance. These guidelines are adopted from other jurisdictions or from the scientific literature and represent a best estimate for predicted no-effects concentration of a given substance. WWQGs include guidelines for sediment, tissue residue and wildlife diets.

Working Water Quality Guidelines (WWQGs)

The working WQGs (WWQGs) are listed alphabetically by substance in Table 1 and are classified by substance type (e.g., Metals, Herbicides, Organics etc.). WWQGs are derived to be protective of specific water values (e.g. AL, agriculture) and these are listed for each substance in the table. WWQG values are protective of chronic long-term exposures unless identified as a short-term maximum in the "Notes" column.

The averaging period for the long-term WWQG may differ depending upon the substance under investigation. A 5 samples in 30 days averaging period (5-in-30) provides a reasonable and practical duration to assess long-term effects. However, in some cases where concentrations fluctuate widely in nature, more than 5 samples may be necessary. In other situations where concentrations are uniform and rarely exceed the long-term WWQG, less frequent monitoring may be justified. In this case, failure of any individual sample to meet the long-term WWQG would serve as an alert signal to increase the monitoring. Notes and references for Table 1 are provided at the end of the table.

Working Sediment Quality Guidelines (WSQGs)

WSQGs substances are listed alphabetically in Table 2 are classified by substance type and may include values for both freshwater and marine aquatic life (AL). In addition, most of the WSQGs have two values:

- Lower WSQG – a concentration that will protect aquatic life from the adverse effects of a toxic substance in most situations (equivalent to CCME's Threshold Effect Level or Interim Sediment Quality Guidelines (TEL or ISQGs; CCME 2001)); and
- Upper WSQGs – a concentration that if exceeded will likely cause severe effects on AL (equivalent to CCME's Probable Effect Level (PEL; CCME [2001]).

The two values provide three ranges of concentrations to support sediment decision making (CCME 2001):

- Concentrations < Lower WSQG are rarely associated with adverse biological effects;
- Concentrations > Lower WSQG but < Upper WSQG are occasionally associated with adverse biological effects; and
- Concentrations > Upper WSQG are frequently associated with adverse biological effects.

These guidelines are not based on cause-effect studies, but on levels of toxic substances found in the sediment where biological effects have been measured. Caution should be exercised in the application of these guidelines. Further information on each WSQG can be found by referring to the reference. Notes and references for Table 2 are provided at the end of the table.

Working Tissue Residue Guidelines (WTRGs)

Tissue Residue Guidelines (TRGs) are intended to protect fish from direct adverse effects of bioaccumulative substances. Working TRG (WTRGs) are listed alphabetically in Table 3, classified by substance type, and apply to both freshwater and marine fish. WTRGs specify the concentration of substance in whole body fish tissue (wet weight) which is not expected to cause adverse effects to the fish. Notes and references for Table 3 are provided at the end of the table.

Working Wildlife Dietary Guidelines (WWDGs)

Wildlife Dietary Guidelines (WDGs) are concentrations of toxic substances in aquatic biota (whole body, wet weight) which are consumed by terrestrial and semi-aquatic wildlife. Working WDG (WWDGs) are listed alphabetically in Table 4 and are classified according to substance type. WWDGs specify the concentration of a substance in whole food (wet weight) which is not expected to cause adverse effects to the wildlife consumers. Notes and references for Table 4 are provided at the end of the table.

Table 1. Working Water Quality Guidelines. AL = Aquatic Life.

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
1,1,2,2-tetrachloroethene (tetrachloroethylene, perchlorethylene)	Chlorinated ethenes	Freshwater AL	110	µg/L		CCME (1993)
1,1,2-trichloroethene, trichloroethylene	Chlorinated ethenes	Freshwater AL	21	µg/L		CCME (1991)
1,1,2-trichloroethene, trichloroethylene	Chlorinated ethenes	Livestock watering	50	µg/L		CCME (1991)
1,2,3,4-tetrachlorobenzene	Chlorinated benzenes	Freshwater AL	1.8	µg/L		CCME (1997)
1,2,3-trichlorobenzene	Chlorinated benzenes	Freshwater AL	8	µg/L		CCME (1997)
1,2,4-trichlorobenzene	Chlorinated benzenes	Freshwater AL	24	µg/L		CCME (1997)
1,2,4-trichlorobenzene	Chlorinated benzenes	Marine AL	5.4	µg/L		CCME (1997)
1,2-dichlorobenzene	Chlorinated benzenes	Freshwater AL	0.7	µg/L		CCME (1997)
1,2-dichlorobenzene	Chlorinated benzenes	Marine AL	42	µg/L		CCME (1997)
1,2-dichloroethane	Chlorinated ethanes	Freshwater AL	100	µg/L		CCME (1991)
1,2-dichloroethane	Chlorinated ethanes	Livestock watering	5	µg/L		CCME (1991)
1,2-propylene glycol	Glycols	Freshwater AL	500	mg/L		CCME (1997)
1,3-dichlorobenzene	Chlorinated benzenes	Freshwater AL	150	µg/L		CCME (1997)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
1,4-dichlorobenzene	Chlorinated benzenes	Freshwater AL	26	µg/L		CCME (1997)
1,4-dioxane	Organics	Freshwater AL	20	mg/L		OME (1991)
Abamectin	Pesticides	Freshwater AL	0.0085	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2023a); US EPA (2013a)
Acephate	Pesticides	Freshwater AL	37.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019a); HC PMRA (2016a); HC PMRA (2004a)
Acetamiprid	Pesticides	Freshwater AL	0.037	µg a.i./L	Adapted from Raby *et al*. (2018)	Raby *et al.* (2018)
Acetochlor	Herbicides	Freshwater AL	0.143	µg/L	Adapted from US EPA ALB[9]	US EPA (2020a)
Acibenzolar-S-methyl	Pesticides	Freshwater AL	8.7	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010a)
Acifluorfen-sodium	Herbicides	Freshwater AL	25.2	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006a); US EPA (2010a)
Acrolein	Pesticide	Freshwater AL	0.35	µg/L	Adapted from HC PMRA [4]	HC PMRA (2016b); US EPA (2020b)
Aldicarb	Pesticides	Freshwater AL	1	µg/L		CCME (1993)
Aldicarb	Pesticides	Irrigation	54.9	µg/L		CCME (1993)
Aldicarb	Pesticides	Livestock	11	µg/L		CCME (1993)
Aldicarb	Pesticides	Marine AL	0.15	µg/L		CCME (1993)
Alkalinity (total $CaCO_3$)	Inorganics	Freshwater AL	<20 >20	mg/L $CaCO_3$	No Change 20 mg/L or 25% lower than background whichever is higher	USEPA (1986)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Ametoctradin	Pesticides	Freshwater AL	0.78	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011a)
Aniline (total)	Organics	Freshwater AL	2.2	µg/L		CCME (1993)
Antimony (III)	Metals	Marine AL	270	µg/L		ANZECC (2000b)
Atrazine	Pesticides	Freshwater AL	1.8	µg/L	Atrazine metabolites[5]	CCME (1989)
Atrazine	Pesticides	Irrigation	10	µg/L	Atrazine metabolites	CCME (1989)
Atrazine	Pesticides	Livestock	5	µg/L	Atrazine metabolites	CCME (1989)
Azoxystrobin	Pesticides	Freshwater AL	10	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007a)
Barium	Metals	Freshwater AL	1	mg/L		Haywood & Drinnin (1983)
Bensulide	Herbicides	Freshwater AL	5.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2003a); US EPA (2016a)
Bentazon	Herbicides	Freshwater AL	450	µg a.e./L	Adapted from HC PMRA [4]	HC PMRA (2007b); US EPA (2014a)
Benzovindiflupyr	Pesticides	Freshwater AL	0.18	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015a)
Beryllium	Metals	Freshwater AL	0.13	µg/L		ANZECC (2000a)
Beryllium	Metals	Marine AL	100	µg/L		NAS-NAE (1972)
Beryllium	Metals	Irrigation	100	µg/L		CCREM (1987)
Beryllium	Metals	Livestock	100	µg/L		CCREM (1987)
Bicyclopyrone	Herbicides	Freshwater AL	1.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015b)
Bifenazate	Pesticides	Freshwater AL	25	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006b)
Bisphenol A (BPA)	Organics	Freshwater AL	0.9	µg/L	See footnote #6	ECCC (2018)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Bisphenol A (BPA)	Organics	Marine AL	0.9	µg/L	See footnote #6	ECCC (2018)
Bixafen	Pesticides	Freshwater AL	2.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019b)
Boscalid	Pesticides	Freshwater AL	70	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004b)
Bromocil	Pesticides	Freshwater AL	5	µg/L		CCME (1997)
Bromocil	Pesticides	Irrigation	0.2	µg/L		CCME (1997)
Bromocil	Pesticides	Livestock	1.1	mg/L		CCME (1997)
Bromoform	Organics	See Chloromethanes				
Bromoxynil	Herbicides	Freshwater AL	5	µg/L		CCME (1993)
Bromoxynil	Herbicides	Irrigation	0.33	µg/L		CCME (1993)
Bromoxynil	Herbicides	Livestock	11	µg/L		CCME (1993)
Cadmium	Metals	Marine AL	0.12	µg/L		CCME (2014)
Cadmium	Metals	Irrigation	5.1	ug/L	Short-term maximum guideline	CCME (1996)
Cadmium	Metals	Livestock	80	µg/L	Short-term maximum guideline	CCME (1996)
Calcium (dissolved)	Metals	Livestock	1,000	mg/L		CCREM (1987)
Captan	Pesticides	Freshwater AL	1.3	µg/L		CCME (1991)
Captan	Pesticides	Livestock	13	µg/L		CCME (1991)
Carbaryl	Pesticides	Freshwater AL	0.2	µg a.i./L		CCME (2009)
Carbaryl	Pesticides	Livestock	1.1	mg/L		CCME (1997)
Carbaryl	Pesticides	Marine AL	0.29	µg a.i./L		CCME (2009)
Carbathiin / carboxin	Pesticides	Freshwater AL	37	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008a); US EPA (2022)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Carbofuran	Pesticides	Freshwater AL	1.8	µg/L		CCME (1989)
Carbofuran	Pesticides	Livestock	45	µg/L		CCME (1989)
Carbon tetrachloride	Halogenated methanes	See Chloromethanes				
Carfentrazone-ethyl	Herbicides	Freshwater AL	0.6	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011b)
Chlorantraniliprole	Pesticides	Freshwater AL	1.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008b)
Chlorinated alkanes - Long chain -LCCAs	Chlorinated organics	Freshwater AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorinated alkanes - Long chain -LCCAs	Chlorinated organics	Marine AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorinated alkanes - Medium chain - MCCAs	Chlorinated organics	Freshwater AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorinated alkanes - Medium chain - MCCAs	Chlorinated organics	Marine AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorinated alkanes -Short chain - SCCAs	Chlorinated organics	Freshwater AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorinated alkanes -Short chain - SCCAs	Chlorinated organics	Marine AL	1.2	µg/L	See footnote #7	ECCC (2016)
Chlorothalonil (2,4,5,6-tetrachloro-1,3-benzenecarbonitrile, Daconil)	Fungicides, Organochlorine	Freshwater AL	0.18	µg/L	Chlorothalonil + 4-hydroxy transformation product	CCME (1994)
Chlorothalonil (2,4,5,6-tetrachloro-1,3-benzenecarbonitrile, Daconil)	Fungicides, Organochlorine	Livestock watering	170	µg/L		CCME (1994)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Chlorothalonil (2,4,5,6-tetrachloro-1,3-benzenecarbonitrile, Daconil)	Fungicides, Organochlorine	Marine AL	0.36	µg/L	Chlorothalonil + 4-hydroxy transformation product	CCME (1994)
Chlorothalonil (2,4,5,6-tetrachloro-1,3-benzenecarbonitrile, Daconil)	Fungicides, Organochlorine	Irrigation	5.8	µg/L	All crops other than cereals, tame hays or pastures	CCME (1994)
Chlorpyrifos	Pesticides	Freshwater AL	0.002	µg a.i./L		CCME (2008a)
Chlorpyrifos	Pesticides	Livestock watering	24	µg/L		CCME (1997)
Chlorpyrifos	Pesticides	Marine AL	0.002	µg a.i./L		CCME (2008a)
Chlorsulfuron	Herbicides	Freshwater AL	0.035	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007c); US EPA (2012)
Chromium (Cr(III))	Metals	Freshwater AL	8.9	µg/L		CCME (1999)
Chromium (Cr(III))	Metals	Irrigation	4.9	µg/L		CCME (1997)
Chromium (Cr(III))	Metals	Livestock watering	50	µg/L		CCME (1997)
Chromium (Cr(III))	Metals	Marine AL	56	µg/L		CCME (1997)
Chromium (Cr(VI))	Metals	Freshwater AL	2.5	µg/L	See footnote #8	ECCC (2018)
Chromium (Cr(VI))	Metals	Irrigation	8	µg/L		CCME (1997)
Chromium (Cr(VI))	Metals	Livestock watering	50	µg/L		CCME (1997)
Chromium (Cr(VI))	Metals	Marine AL	1.5	µg/L		CCME (1997)
Clethodim	Herbicides	Freshwater AL	0.42	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016c)
Clodinafop propargyl	Herbicides	Freshwater AL	7	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2018a)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Clofentezine	Pesticides	Freshwater AL	3	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2013a);US EPA (2013b)
Clomazone	Herbicides	Freshwater AL	8.35	µg a.i./L	Adapted from US EPA ALB[9]	US EPA (2009a)
Clopyralid	Herbicides	Freshwater AL	690	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010b)
Cloransulam-methyl	Herbicides	Freshwater AL	0.39	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008c)
Clothianidin	Pesticides	Freshwater AL	0.028	µg a.i./L	Adapted from Raby *et al*. (2018)	Raby *et al.* (2018)
Cobalt	Metals	Irrigation	50	µg/L	Continuous or intermittent use on all soils	CCME (1999)
Cobalt	Metals	Livestock watering	1	mg/L		CCME (1987)
Conductivity (specific)	Physical	Irrigation	<0.7	mS/cm	For low tolerance crops[10]	CCREM (1987)
Conductivity (specific)	Physical	Irrigation	<1.2	mS/cm	For slightly tolerant crops[10]	CCREM (1987)
Conductivity (specific)	Physical	Irrigation	<2.2	mS/cm	For moderately tolerant crops[10]	CCREM (1987)
Conductivity (specific)	Physical	Irrigation	<3.6	mS/cm	For tolerant crops[10]	CCREM (1987)
Conductivity (specific)	Physical	Irrigation	<5	mS/cm	For very tolerant crop[10]	CCREM (1987)
Cyanazine	Pesticides	Freshwater AL	2	µg/L		CCME (1990)
Cyanazine	Pesticides	Irrigation	0.5	µg/L		CCME (1990)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Cyanazine	Pesticides	Livestock watering	10	µg/L		CCME (1990)
Cyantraniliprole	Pesticides	Freshwater AL	3.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2013b)
Cyazofamid	Pesticides	Freshwater AL	9.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016d)
Cyclaniliprole	Pesticides	Freshwater AL	5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017a)
Cypermethrin	Pesticides	Freshwater AL	0.00006	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2016e); US EPA (2016b)
Cyprodinil	Pesticides	Freshwater AL	4.1	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2017a)
Cyromazine	Pesticides	Freshwater AL	6.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020a)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	1	µg/L	Short-term maximum at pH 5.0	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	2	µg/L	Short-term maximum at pH 5.5	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	2	µg/L	Short-term maximum at pH 6.0	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	4	µg/L	Short-term maximum at pH 6.5	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	8	µg/L	Short-term maximum at pH 7.0	Environment Ontario (1988)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	12	µg/L	Short-term maximum at pH 7.5	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	13	µg/L	Short-term maximum at pH 8.0	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	14	µg/L	Short-term maximum at pH 8.5	Environment Ontario (1988)
Dehydroabietic acid (DHA)	Resin acids	Freshwater AL	14	µg/L	Short-term maximum at pH 9.0	Environment Ontario (1988)
Deltamethrin	Pesticides	Freshwater AL	0.0004	µg/L		CCME (1997)
Deltamethrin	Pesticides	Livestock watering	2.5	µg/L		CCME (1997)
Di-(2-ethylhexyl) phthalate (DEHP)	Phthalate esters	Freshwater AL	16	µg/L		CCME (1993)
Diazinon	Pesticide	Freshwater AL	0.0043	µg/L	See footnote #11	Efroymson *et al.* (1997)
Dibutyl phthalate (DBP, di-*n*-butylphthalate)	Phthalate esters	Freshwater AL	19	µg/L		CCME (1993)
Dicamba	Organic Pesticides; Aromatic carboxylic acid	Freshwater AL	10	µg/L		CCME (1993)
Dicamba	Organic Pesticides; Aromatic carboxylic acid	Irrigation	0.006	µg/L		CCME (1993)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Dicamba	Organic Pesticides; Aromatic carboxylic acid	Livestock watering	122	µg/L		CCME (1993)
Dichlorobromomethane	Halogenated methanes	Livestock watering	100	µg/L		CCME (1992)
Dichloromethane (methylene chloride)	Halogenated methanes	Freshwater AL	98.1	µg/L		CCME (1992)
Dichloromethane (methylene chloride)	Halogenated methanes	Livestock watering	50	µg/L		CCME (1992)
Dichlorophenoxyacetic acid (2,4-D)	Herbicides	Freshwater AL	4	µg/L		CCME (1999)
Dichlorophenoxyacetic acid (2,4-D)	Herbicides	Livestock watering	100	µg/L		CCME (1999)
Dichlorprop-p	Herbicides	Freshwater AL	2000	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2013c)
Dichlorvos (DDVP)	Pesticides	Freshwater AL	0.0029	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017b); US EPA (2020c)
Diclofop-methyl	Pesticides	Freshwater AL	6.1	µg/L		CCME (1993)
Diclofop-methyl	Pesticides	Irrigation	0.18	µg/L		CCME (1993)
Diclofop-methyl	Pesticides	Livestock watering	9	µg/L		CCME (1993)
Didecyl dimethyl ammonium chloride (DDAC)	Pesticides	Freshwater AL	1.5	µg/L		CCME (1999)
Difenoconazole	Pesticides	Freshwater AL	1.4	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015c); HC PMRA (2011c)
Diflubenzuron	Pesticides	Freshwater AL	0.000025	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004c); US EPA (2009b)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Diflufenzopyr	Herbicides	Freshwater AL	1.7	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017c)
Dimethenamid-P	Herbicides	Freshwater AL	0.9	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2009a)
Dimethoate	Pesticides	Freshwater AL	6.2	µg/L		CCME (1993)
Dimethoate	Pesticides	Livestock watering	3	µg/L		CCME (1993)
Dimethomorph	Pesticides	Freshwater AL	28	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019c)
Di-n-butyl tin (total)	Organotin compounds	Freshwater AL	0.08	µg/L		Ontario MOEE (1994)
Dinoseb	Pesticides	Freshwater AL	0.05	µg/L		CCME (1992)
Dinoseb	Pesticides	Irrigation	16	µg/L		CCME (1992)
Dinoseb	Pesticides	Irrigation	46	µg/L	Cereals and hay	CCME (1999)
Dinoseb	Pesticides	Irrigation	93	µg/L	Legumes	CCME (1999)
Dinoseb	Pesticides	Livestock watering	150	µg/L		CCME (1992)
Diquat	Herbicides	Freshwater AL	0.075	µg /L cation	Adapted from HC PMRA [4]	HC PMRA (2008d); US EPA (2009c)
Dithiopyr	Herbicides	Freshwater AL	0.61	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2009b); US EPA (2020d)
Diuron	Herbicides	Freshwater AL	0.013	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2020e)
Dodine	Pesticides	Freshwater AL	0.016	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008e); US EPA (2021a)
Endosulfan	Pesticides	Freshwater AL	0.0015	µg a.i./L	see footnote #12	CCME (2010)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Endosulfan	Pesticides	Freshwater AL	0.03	µg a.i./L	short-term maximum; see footnote #12	CCME (2010)
Endosulfan	Pesticides	Marine AL	0.001	µg a.i./L	see footnote #13	CCME (2010)
Endosulfan	Pesticides	Marine AL	0.015	µg a.i./L	short-term maximum; see footnote #13	CCME (2010)
EPTC / S-ethyl dipropylthiocarbamate	Herbicides	Freshwater AL	13	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2007d); US EPA (2017b)
Ethaboxam	Pesticides	Freshwater AL	8.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014a)
Ethametsulfuron methyl	Herbicides	Freshwater AL	0.005	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008f)
Ethephon	Organophosphonate plant growth regulator	Freshwater AL	250	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2018b); US EPA (2015a)
Ethofumesate	Herbicides	Freshwater AL	100	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007e); US EPA (2020f)
Ethylene glycol	Glycols	Freshwater AL	192	mg/L		CCME (1997)
Famoxadone	Pesticides	Freshwater AL	0.043	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2003b)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Fenamidone	Pesticides	Freshwater AL	2.4	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2007f); HC PMRA (2003c); US EPA (2019a)
Fenbuconazole	Pesticides	Freshwater AL	13	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2005a)
Fenhexamid	Pesticides	Freshwater AL	50.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020b); HC PMRA (2003d)
Fenoxaprop-P-ethyl	Herbicides	Freshwater AL	22	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011d); US EPA (2014b)
Fenpropathrin	Pesticides	Freshwater AL	0.00078	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020c); US EPA (2011a)
Flazasulfuron	Herbicides	Freshwater AL	0.004	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2018c)
Flonicamid	Pesticides	Freshwater AL	1003	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010c)
Florasulam	Herbicides	Freshwater AL	0.31	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004d)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Fluazifop-p-butyl	Herbicides	Freshwater AL	33.8	µg a.e./L	Adapted from HC PMRA [4]	HC PMRA (2011e); US EPA (2014c)
Fluazinam	Pesticides	Freshwater AL	0.35	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017d); HC PMRA (2003e)
Flucarbazone	Herbicides	Freshwater AL	1.2	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2022a); HC PMRA (2000)
Fludioxonil	Pesticides	Freshwater AL	9.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006c); US EPA (2017c)
Fluensulfone	Pesticides	Freshwater AL	1.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017e)
Flufenacet	Herbicides	Freshwater AL	0.145	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021a); HC PMRA (2003f)
Flumetsulam	Herbicides	Freshwater AL	0.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014b)
Fluopicolide	Pesticides	Freshwater AL	20	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011f)
Fluopyram	Pesticides	Freshwater AL	67.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014c)
Fluoxastrobin	Pesticides	Freshwater AL	21.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012a)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Flupyradifurone	Pesticides	Freshwater AL	5.25	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014d)
Fluroxypyr-meptyl	Herbicides	Freshwater AL	3.7	µg a.e./L	Adapted from HC PMRA [4]	HC PMRA (2017f); HC PMRA (2012b); US EPA (2014d)
Flutriafol	Pesticides	Freshwater AL	6.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014e)
Fluxapyroxad	Pesticides	Freshwater AL	11	µg a.i./L	Adapted from US EPA ALB[9]	US EPA (2013c)
Fomesafen	Herbicides	Freshwater AL	9.2	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2018d)
Foramsulfuron	Herbicides	Freshwater AL	0.17	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2003g); HC PMRA (2008g)
Fosetyl-Al	Pesticides	Freshwater AL	53.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2023b); HC PMRA (2017g)
Glufosinate-ammonium	Herbicides	Freshwater AL	7.2	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2013d)
Glyphosate	Herbicides	Freshwater AL	400	µg a.i./L	see footnote #14	CCME (2012)
Glyphosate	Herbicides	Freshwater AL	13500	µg a.i./L	short-term maximum; see footnote #14	CCME (2012)
Glyphosate	Herbicides	Livestock watering	280	µg/L		CCREM (1987)
Halauxifen-methyl	Herbicides	Freshwater AL	0.0149	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014f)
Halosulfuron-methyl	Herbicides	Freshwater AL	0.0038	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014g)
Hexabromocyclododecane (HBCD)	Organics	Freshwater AL	0.56	µg/L		ECCC (2016)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Hexabromocyclododecane (HBCD)	Organics	Marine AL	0.56	µg/L		ECCC (2016)
Hexachlorobenzene	Chlorinated benzenes	Livestock	0.52	µg/L		CCREM (1987)
Hexachlorobutadiene (HCBD)	Organics	Freshwater AL	1.3	µg/L		CCME (1999)
Hexachlorocyclohexane (Lindane)	Pesticides	Freshwater AL	0.01	µg/L		CCREM (1987)
Hexachlorocyclohexane (Lindane)	Pesticides	Livestock watering	4	µg/L		CCREM (1987)
Hexazinone	Herbicides	Freshwater AL	0.7	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019d); HC PMRA (2007g); US EPA (2015b)
Hydrazine	Inorganic	Freshwater AL	2.6	µg/L		ECCC (2013)
Hydrazine	Inorganic	Marine AL	0.2	µg/L		ECCC (2013)
Imazamethabenz-methyl	Herbicides	Freshwater AL	7.28	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008h)
Imazapyr	Herbicides	Freshwater AL	1.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020d); HC PMRA (2011g)
Imazethapyr	Herbicides	Freshwater AL	1.01	µg a.e./L	Adapted from HC PMRA [4]	HC PMRA (2010d)
Imidacloprid	Pesticides	Marine AL	0.65	µg a.i./L		CCME (2007)
Imidacloprid	Pesticides	Freshwater AL	0.013	µg a.i./L	Adapted from Raby *et al*. (2018)	Raby *et al.* (2018)
Inpyrfluxam	Pesticides	Freshwater AL	0.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020e)
Iodosulfuron-methyl-sodium	Herbicides	Freshwater AL	0.07	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2008i); HC PMRA (2004e); US EPA (2013e)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
IPBC (3-Iodo-2-propynlbutylcarbamate)	Pesticides	Freshwater AL	1.9	µg/L		CCME (1999)
Ipconazole	Pesticides	Freshwater AL	0.030	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011h); US EPA (2020g)
Iprodione	Pesticides	Freshwater AL	4.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016f)
Isofetamid	Pesticides	Freshwater AL	43	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014h); US EPA (2013f)
Isoxaben	Herbicides	Freshwater AL	1.0	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014i); US EPA (2014e)
Isoxaflutole	Herbicides	Freshwater AL	0.32	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021b)
Kresoxim-methyl	Pesticides	Freshwater AL	2.9	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020f)
Lead - Tetra-ethyl lead	Metals, Organic	Freshwater AL	0.0007	µg/L		Ontario MOEE (1994)
Lead - Tetra-methyl lead	Metals, Organic	Freshwater AL	0.006	µg/L		Ontario MOEE (1994)
Linuron	Pesticides	Freshwater AL	7	µg/L		CCME (1995)
Linuron	Pesticides	Irrigation	3.3	µg/L	Cereals, hay and pastures	CCME (1999)
Linuron	Pesticides	Irrigation	0.071	µg/L	(e.g., tomato)	CCME (1995)
Lithium	Metals	Irrigation	2.5	mg/L	See footnote #15	CCREM (1987)
Lithium	Metals	Irrigation	0.75	mg/L	Citrus	CCREM (1987)
Malathion	Pesticides	Freshwater AL	0.03	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010e)
Malathion	Pesticides	Marine AL	0.1	µg/L		US EPA (1986)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Maleic Hydrazide	Herbicides	Freshwater AL	4,800	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008j); US EPA (2014f)
Mandestrobin	Pesticides	Freshwater AL	6.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016g)
Mandipropamid	Pesticides	Freshwater AL	38	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2009c); US EPA (2019b)
Manganese	Metals	Marine AL	100	µg/L	To protect consumers of shellfish	US EPA (1986)
Manganese	Metals	Irrigation	200	µg/L		CCREM (1987)
MCPB	Herbicides	Freshwater AL	21	µg a.e./L	Adapted from HC PMRA [4]	HC PMRA (2011i)
Mecoprop-P (MCPP-P)	Herbicides	Freshwater AL	0.8	µg/L		Kroll *et al*. (2023)
Mefentrifluconazole	Pesticides	Freshwater AL	4.57	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019e)
Mesosulfuron-methyl	Herbicides	Freshwater AL	0.064	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010f)
Mesotrione	Herbicides	Freshwater AL	1	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2005b)
Metalaxyl	Pesticides	Freshwater AL	600	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007h); US EPA (2016c)
Metconazole	Pesticides	Freshwater AL	0.97	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011j)
Methamidophos	Pesticides	Freshwater AL	0.225	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2007i); US EPA (2008)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Methlychlorophenoxyacetic acid (4-chloro-2-methylphenoxy acetic acid) (MCPA)	Herbicides	Freshwater AL	2.6	µg/L		CCME (1995)
Methlychlorophenoxyacetic acid (4-chloro-2-methylphenoxy acetic acid) (MCPA)	Herbicides	Irrigation	0.025	µg/L		CCME (1995)
Methlychlorophenoxyacetic acid (4-chloro-2-methylphenoxy acetic acid) (MCPA)	Herbicides	Livestock watering	25	µg/L		CCME (1995)
Methlychlorophenoxyacetic acid (4-chloro-2-methylphenoxy acetic acid) (MCPA)	Herbicides	Marine AL	4.2	µg/L		CCME (1995)
Methomyl	Pesticides	Freshwater AL	0.13	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016h)
Methoxyfenozide	Pesticides	Freshwater AL	0.65	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004f)
Metolachlor	Pesticides	Freshwater AL	7.8	µg/L		CCME (1991)
Metolachlor	Pesticides	Irrigation	28	µg/L		CCME (1991)
Metolachlor	Pesticides	Livestock watering	50	µg/L		CCME (1991)
Metrafenone	Pesticides	Freshwater AL	41	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011k)
Metribuzin	Pesticides	Freshwater AL	1	µg/L		CCME (1990)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Metribuzin	Pesticides	Irrigation	0.5	µg/L		CCME (1990)
Metribuzin	Pesticides	Livestock watering	80	µg/L		CCME (1990)
Metsulfuron methyl	Herbicides	Freshwater AL	0.007	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008k)
MGK-264 (N-octyl bicycloheptene dicarboximide)	Pesticides	Freshwater AL	0.8	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2016d)
Monochlorobenzene	Chlorinated benzenes	Freshwater AL	1.3	µg/L		CCME (1997)
Monochlorobenzene	Chlorinated benzenes	Marine AL	25	µg/L		CCME (1997)
Myclobutanil	Pesticides	Freshwater AL	17.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010g); US EPA (2015c)
Napropamide	Herbicides	Freshwater AL	35	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2021b)
Nickel	Metals	Irrigation	200	µg/L		CCREM (1987)
Nickel	Metals	Livestock watering	1	mg/L		CCREM (1987)
Nickel	Metals	Marine AL	8.3	µg/L		US EPA (1986)
Nicosulfuron	Herbicides	Freshwater AL	2.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008l)
Nonylphenol and its ethoxylates	Organics	Freshwater AL	1	µg/L	See footnote #16	CCME (2002)
Nonylphenol and its ethoxylates	Organics	Marine AL	0.7	µg/L	See footnote #16	CCME (2002)
Oxadiazon	Herbicides	Freshwater AL	0.44	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2020h)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Oxamyl	Pesticides	Freshwater AL	13.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007j); US EPA (2010b)
Oxathiapiprolin	Pesticides	Freshwater AL	34.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015d)
Oxyfluorfen	Herbicides	Freshwater AL	0.022	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006d); HC PMRA (2005c); US EPA (2019c)
Paraquat	Herbicides	Freshwater AL	0.040	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015e); US EPA (2019d)
Pendimethalin	Herbicides	Freshwater AL	1.25	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007k); US EPA (2017d)
Penflufen	Pesticides	Freshwater AL	4.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012c)
Pentachlorobenzene	Chlorinated benzenes	Freshwater AL	6	µg/L		CCME (1997)
Penthiopyrad	Pesticides	Freshwater AL	15	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014j); HC PMRA (2011l); US EPA (2011b)
Perfluorooctane Sulfonate (PFOS)	Organics	Freshwater AL	3.4	µg/L	See footnote #17	ECCC (2018)
Permethrin	Pesticides	Freshwater AL	0.004	µg/L		CCME (2006)
Permethrin	Pesticides	Marine AL	0.001	µg/L		CCME (2006)
Pethoxamid	Herbicides	Freshwater AL	0.17	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019f)
Petroleum hydrocarbons (PHC)-F1 - Aliphatics $C_6 – C_8$	Organics	Freshwater AL	46.5	µg /L		CCME (2008b)
Petroleum hydrocarbons (PHC) - F1-Aliphatics $C_{>8} – C_{10}$	Organics	Freshwater AL	7.6	µg /L		CCME (2008b)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Petroleum hydrocarbons (PHC) - F1 -Aromatics $C_{>8} – C_{10}$	Organics	Freshwater AL	140	µg /L	See footnote #18	CCME (2008b)
Petroleum hydrocarbons (PHC) - F2 -Aliphatics $C_{>10} – C_{12}$	Organics	Freshwater AL	1.18	µg /L		CCME (2008b)
Petroleum hydrocarbons (PHC) - F2 -Aliphatics $C_{>12} – C_{16}$	Organics	Freshwater AL	0.074	µg /L		CCME (2008b)
Petroleum hydrocarbons (PHC) - Aromatics $C_{>10} – C_{12}$	Organics	Freshwater AL	96	µg /L		CCME (2008b)
Petroleum hydrocarbons (PHC) F2 -Aromatics $C_{>12} – C_{16}$	Organics	Freshwater AL	55.4	µg /L		CCME (2008b)
Phorate	Pesticides	Freshwater AL	0.07	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2003h); US EPA (2020i)
Picloram	Pesticides	Freshwater AL	29	µg/L		CCME (1990)
Picloram	Pesticides	Livestock watering	190	µg/L		CCME (1990)
Picolinafen	Herbicides	Freshwater AL	0.034	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2005d)
Picoxystrobin	Pesticides	Freshwater AL	4	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012d)
Pinoxaden	Herbicides	Freshwater AL	1.1	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006e)
Piperonyl butoxide	Pesticides	Freshwater AL	9.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2023c); HC PMRA (2020g)
Polybrominated Diphenyl Ethers (PBDE) (triBDE)	Organics	Marine AL	0.046	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (triBDE)	Organics	Freshwater AL	0.046	µg/L		ECCC (2013)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Polybrominated Diphenyl Ethers (PBDE) (tetraBDE)	Organics	Marine AL	0.024	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (tetraBDE)	Organics	Freshwater AL	0.024	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)	Organics	Freshwater AL	0.0002	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)	Organics	Marine AL	0.0002	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (hexaBDE)	Organics	Marine AL	0.12	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (hexaBDE)	Organics	Freshwater AL	0.12	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (heptaBDE)	Organics	Freshwater AL	0.017	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (heptaBDE)	Organics	Marine AL	0.017	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (octaBDE)	Organics	Marine AL	0.017	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (octaBDE)	Organics	Freshwater AL	0.017	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)-BDE99	Organics	Freshwater AL	0.004	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)-BDE-99	Organics	Marine AL	0.004	µg/L		ECCC (2013)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE) BDE-100	Organics	Freshwater AL	0.0002	µg/L		ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE) BDE-100	Organics	Marine AL	0.0002	µg/L		ECCC (2013)
Prometryn	Herbicides	Freshwater AL	0.104	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007l); US EPA (2013g)
Propiconazole	Pesticides	Freshwater AL	9.3	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2011m)
Propoxycarbazone-sodium	Herbicides	Freshwater AL	0.64	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016i)
Propyzamide	Herbicides	Freshwater AL	112	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008m); US EPA (2015d)
Prosulfuron	Herbicides	Freshwater AL	0.126	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015f)
Pydiflumetofen	Pesticides	Freshwater AL	21	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010h)
Pymetrozine	Pesticides	Freshwater AL	8.37	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021c); HC PMRA (2002); US EPA (2013h)
Pyraclostrobin	Pesticides	Freshwater AL	0.16	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008n)
Pyraflufen-ethyl	Herbicides	Freshwater AL	0.032	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016j; HC PMRA (2014k)
Pyrasulfotole	Herbicides	Freshwater AL	2.8	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007m)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Pyrethrins	Pesticides	Freshwater AL	0.020	µg a.i./L	Adapted from US EPA ALB[9]	HC PMRA (2023d); HC PMRA (2020h); US EPA (2016e)
Pyridaben	Pesticides	Freshwater AL	0.022	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016k)
Pyrimethanil	Pesticides	Freshwater AL	39	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006f)
Pyriofenone	Pesticides	Freshwater AL	6.2	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016l)
Pyroxasulfone	Herbicides	Freshwater AL	0.032	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012e)
Pyroxsulam	Herbicides	Freshwater AL	0.258	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010i)
Quinoline	Aromatic hydrocarbons (PAHs)	Freshwater AL	50	µg/L	See footnote #19	ECCC (2020)
Quinoxyfen	Pesticides	Freshwater AL	6.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2018e); HC PMRA (2013d)
Quizalofop-P-ethyl	Herbicide	Freshwater AL	2.1	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2022b); US EPA (2013i)
Resin acids (total)	Organics	Freshwater AL	1	µg/L	Short-term maximum at pH 5.0[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	3	µg/L	Short-term maximum at pH 5.5[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	4	µg/L	Short-term maximum at pH 6.01[20]	Environment Ontario (1988)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Resin acids (total)	Organics	Freshwater AL	9	µg/L	Short-term maximum at pH 6.5[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	25	µg/L	Short-term maximum at pH 7.0[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	45	µg/L	Short-term maximum at pH 7.5[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	52	µg/L	Short-term maximum at pH 8.0[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	60	µg/L	Short-term maximum at pH 8.5[20]	Environment Ontario (1988)
Resin acids (total)	Organics	Freshwater AL	62	µg/L	Short-term maximum at pH 9.0[20]	Environment Ontario (1988)
Rimsulfuron	Herbicides	Freshwater AL	0.46	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008o)
Saflufenacil	Herbicides	Freshwater AL	4.2	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2009d)
Salinity	Inorganics	Estuarine aquatic life	± 10%		± 10% change in concentration (NaCl or equivalent)[21]	DoE (1972)
Sedaxane	Pesticides	Freshwater AL	31	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012f)
Sethoxydim	Herbicides	Freshwater AL	21	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007n); US EPA (2015e)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Siloxane-D4	Organics	Freshwater AL	0.20	µg/L		ECCC (2022)
Simazine	Herbicides	Freshwater AL	10	µg/L		CCME (1991)
Simazine	Herbicides	Irrigation	0.5	µg/L		CCME (1991)
Simazine	Herbicides	Livestock watering	10	µg/L		CCME (1991)
Spinetoram	Insecticide	Freshwater AL	0.031	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012); HC PMRA (2008p)
Spinosad	Insecticide	Freshwater AL	0.31	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015g); HC PMRA (2001a); US EPA (2016f)
Spirodiclofen	Pesticides	Freshwater AL	0.65	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2006g)
Spiromesifen	Pesticides	Freshwater AL	0.13	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2007o)
Spirotetramat	Pesticides	Freshwater AL	50	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008q)
Spiroxamine	Pesticides	Freshwater AL	0.090	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015h)
Strontium (dissolved)	Metal	Freshwater AL	1,250	µg/L	See footnote #22	ECCC (2020)
Styrene	Organic, Monocyclic aromatic compounds	Freshwater AL	72	µg/L		CCME (1999)
Sulfentrazone	Herbicides	Freshwater AL	2.90	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010j)
Sulfoxaflor	Pesticides	Freshwater AL	22.7	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2015i); US EPA (2013j)
Sulphate (dissolved)	Inorganic	Livestock watering	1,000	mg/L		CCME (1987)
Sulphide (as unionized H2S)	Inorganic	Freshwater AL	2	µg/L	See footnote #23	US EPA (1976) (p. 410)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Surfactant – Alcohol ethoxylated sulphate (AES)	Organics	Freshwater AL	340	µg/L	99% level of protection	ANZECC (2000a)
Surfactant – Alcohol ethoxylated surfactants (AE)	Organics	Freshwater AL	50	µg/L	99% level of protection	ANZECC (2000a)
Surfactant – Linear alkylbenzene sulphonates (LAS)	Organics	Freshwater AL	65	µg/L	99% level of protection	ANZECC (2000a)
Surfactant –alcohol ethoxylate homologue C13.7 EO5	Organics	Freshwater AL	35	µg/L	See footnote #24	ECCC 2013
TBBPA (Tetrabromobisphenol A)	Organics	Freshwater AL	3.1	µg/L		ECCC (2016)
TBBPA (Tetrabromobisphenol A)	Organics	Marine AL	3.1	µg/L		ECCC (2016)
TCMTB [2-(thiocyanomethylthio) benzothiazole]	Pesticides	Freshwater AL	0.11	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2016m)
Tebuconazole	Pesticides	Freshwater AL	6.0	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021d)
Tebufenozide	Pesticides	Freshwater AL	4.9	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021e); HC PMRA (2019g)
Tebuthiuron	Herbicides	Freshwater AL	1.6	µg/L		CCME (1995)
Tebuthiuron	Herbicides	Irrigation	0.27	µg/L	Cereals, hay and pastures	CCME (1995)
Tebuthiuron	Herbicides	Livestock watering	130	µg/L		CCME (1995)
Tembotrione	Herbicides	Freshwater AL	0.52	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012h)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Tepraloxydim	Herbicides	Freshwater AL	370	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004g)
Tetrachloromethane (carbon tetrachloride)	Halogenated methanes	Freshwater AL	13.3	µg/L		CCME (1992)
Tetrachloromethane (carbon tetrachloride)	Halogenated methanes	Livestock Organic watering	5	µg/L		CCME (1992)
Tetraconazole	Pesticides	Freshwater AL	27.0	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2012i)
Tetraniliprole	Pesticides	Freshwater AL	0.176	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2019h)
Thallium	Metals	Freshwater AL	0.03	µg/L		ANZECC (2000a)
Thiacloprid	Pesticides	Freshwater AL	0.0026	µg a.i./L	Adapted from Raby *et al*. (2018)	Raby *et al.* (2018)
Thiamethoxam	Pesticides	Freshwater AL	0.15	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021f); HC PMRA (2007p)
Thiencarbazone-methyl	Herbicides	Freshwater AL	0.034	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2010k)
Thifensulfuron methyl	Herbicides	Freshwater AL	0.25	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2008r)
Tin, Tributyltin	Organotin compounds	Freshwater AL	0.008	µg/L		CCME (1992)
Tin, Tributyltin	Organotin compounds	Livestock watering	250	µg/L		CCME (1992)
Tin, Tributyltin	Organotin compounds	Marine AL	0.001	µg/L		CCME (1992)
Tin, Tricyclohexyltin	Organotin compounds	Livestock watering	250	µg/L		CCME (1992)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Tin, Triethyltin	Organotin compounds	Freshwater AL	0.4	µg/L		Ontario MOEE (1994)
Tin, Triphenyltin	Organotin compounds	Freshwater AL	0.022	µg/L		CCME (1992)
Tin, Triphenyltin	Organotin compounds	Livestock watering	820	µg/L		CCME (1992)
Tioxazafen	Pesticides	Freshwater AL	3.0	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017h)
Tolpyralate	Herbicides	Freshwater AL	0.590	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2017i)
Total dissolved solids (filterable residue)	Inorganics	Livestock watering	1,000-3,000	mg/L	Species dependent - see Table 4-13 in CCREM 1987	CCREM (1987)
Total dissolved solids (filterable residue)	Physical	Irrigation	<500	mg/L	For low tolerance crops[10]	CCREM (1987)
Total dissolved solids (filterable residue)	Physical	Irrigation	<800	mg/L	For slightly tolerant crops[10]	CCREM (1987)
Total dissolved solids (filterable residue)	Physical	Irrigation	<1500	mg/L	For moderately tolerant crops[10]	CCREM (1987)
Total dissolved solids (filterable residue)	Physical	Irrigation	<2500	mg/L	For tolerant crops[10]	CCREM (1987)
Total dissolved solids (filterable residue)	Physical	Irrigation	<3500	mg/L	For very tolerant crops[10]	CCREM (1987)
Tralkoxydim	Herbicides	Freshwater AL	100	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2009e)
Triallate	Pesticides	Freshwater AL	0.24	µg/L		CCME (1992)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Triallate	Pesticides	Livestock watering	230	µg/L		CCME (1992)
Tribenuron methyl	Herbicides	Freshwater AL	0.1	µg a.i./L	Adapted from HC PMRA [4]	US EPA (2011c)
Tribromomethane (bromoform)	Halogenated methanes	Livestock watering	100	µg/L		CCME (1992)
Trichlorfon	Pesticides	Freshwater AL	0.009	µg a.i./L		CCME (2012)
Trichloromethane (chloroform)	Halogenated methanes	Freshwater AL	1.8	µg/L		CCME (1992)
Trichloromethane (chloroform)	Halogenated methanes	Livestock watering	100	µg/L		CCME (1992)
Triclocarban	Chlorinated organics	Freshwater AL	0.05	µg/L	See footnote #26	ECCC (2024)
Triclopyr	Herbicides	Freshwater AL	13	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004h); US EPA (2019e)
Triclosan	Organics	Freshwater AL	0.12	µg/L	See footnote #27	ECCC (2017)
Trifloxystrobin	Pesticides	Freshwater AL	1.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2004i)
Trifluralin	Herbicides	Freshwater AL	0.2	µg/L		CCME (1993)
Trifluralin	Herbicides	Livestock watering	45	µg/L		CCME (1992)
Triflusulfuron-methyl	Herbicides	Freshwater AL	0.203	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2014l); HC PMRA (1999)
Trinexapac-ethyl	Herbicides	Freshwater AL	19	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2020i); US EPA (2013k)
Triticonazole	Pesticides	Freshwater AL	10.5	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2021g; US EPA (2019f)
Uranium	Metals	Freshwater AL	7.5	µg/L	See footnote #28	CCME (2011)

Substance[1]	Class	Water Value	Long-term WWQG[2]	Units[3]	Notes	Reference
Uranium	Metals	Freshwater AL	16.5	µg/L	See footnote #28 - short term acute	CCME (2011)
Uranium	Metals	Irrigation	10	µg/L		CCREM (1987)
Uranium	Metals	Livestock watering	200	µg/L		CCREM (1987)
Vanadium	Metals	Freshwater AL	60	µg/L	See footnote #29	ECCC(2016)
Vanadium	Metals	Marine AL	5	µg/L		ECCC(2016)
Vanadium	Metals	Irrigation	100	µg/L		CCREM (1987)
Vanadium	Metals	Livestock watering	100	µg/L		CCREM (1987)
Vinyl chloride	Organics	Freshwater AL	625	µg/L	Adapted from Nam and An (2010)	Nam and An (2010)
Zoxamide	Pesticides	Freshwater AL	1.74	µg a.i./L	Adapted from HC PMRA [4]	HC PMRA (2022c); HC PMRA (2001b)

Notes

1. WWQG are given for total substance concentrations unless otherwise noted.
2. Values are for long-term chronic concentrations unless otherwise noted.
3. Note that a.i. = active ingredient and a.e. = acid equivalent.
4. The aquatic life reference values (ALRVs) for the most sensitive taxa by the Health Canada (HC) Pest Management Regulatory Agency (PMRA) were adapted using assessment factors (AF) to account for uncertainty and meet the protection goals of the BC water quality guidelines (BC WQG). The assessment factor was calculated following the approach suggested by Okonski *et al*. (2021).
5. New evidence presented in Tillitt *et al.* (2010) suggests a more conservative value may be needed.
6. An assessment factor of 4 was applied to the HC_5 of 3.5 µg/L derived by ECCC for Bisphenol A (BPA).
7. An assessment factor of 2 was applied to the HC_5 of 2.4 µg/L derived by ECCC for chlorinated alkanes.
8. An assessment factor of 2 was applied to the HC_5 of 5 µg/L derived by ECCC for hexavalent chromium in freshwater.

9. The aquatic life benchmarks (ALBs) for the most sensitive taxa by the US Environmental Protection Agency (EPA) were adapted using assessment factors (AF) to account for uncertainty and meet the protection goals of the BC water quality guidelines (BC WQG). The assessment factor was calculated following the approach suggested by Okonski *et al*. (2021).
10. Low tolerance crops: strawberry, raspberry, bean, carrot; slightly tolerant crops: all other fruits and berries, onions, parsnip, radish, pea, pumpkin, lettuce, pepper, muskmelon, sweet potato, sweet corn, potato, celery, cabbage kohlrabi, cauliflower, cowpea, broadbean, flax, sunflower, corn, clover; moderately tolerant crops: spinach, cantaloupe, cucumber, tomato, squash, brussel sprout, broccoli, turnip, brome, alfalfa, big trefoil, beardless, wildrye, vetch timothy, crested wheatgrass; tolerant crops: beet, zucchini, canola, sorghum, oat hay, wheat hay, brume, tall fascue, sweet clover, perennial ryegrass; very tolerant crops: asparagus, soybean, safflower, oats, rye wheat, sugar beet, barley, barley hay, tall wheatgrass (Source: Table 4-7 CCREM 1987).
11. An assessment factor of 10 was applied to the guideline derived by Efroymson *et al*. (1997) for diazinon.
12. An assessment factors of 2 was applied to the short-term and long-term HC_5s derived by CCME for Endosulfan in freshwater.
13. An assessment factors of 6 was applied to the short-term HC_5 and a factor of 2 to the long-term WQG derived by the CCME for Endosulfan in marine waters.
14. An assessment factors of 2 was applied to both the long-term and the short-term HC_5s, derived by the CCME for Glyphosate.
15. May not be protective of barley and other cereal crops; 1.0 mg/L lithium suggested for cereal crops.
16. WWQG is for the total concentration of nonylphenols and nonylphenol ethoxylates which is calculated as the concentration of the mixture of nonylphenolic compounds expressed as the toxic equivalent of nonylphenolic compounds. See CCME (2002) for more information.
17. An assessment factor of 2 was applied to the HC_5 of 6.8 µg/L derived by ECCC for Perfluorooctane Sulfonate (PFOS) in freshwater.
18. In assessing aromatics hydrocarbons, BTEX (benzene, toluene, ethylbenzene and xylene) are to be tested separately and compared to their own BC approved WQGs.
19. An assessment factor of 3 was applied to the HC_5 of 150 µg/L derived by ECCC for quinoline in freshwater.
20. Resin Acids — Total resin acids include abietic acid, neoabietic acid, pimaric acid, isopimaric acid, and sandaracopimaric acid but not dehydroabietic acid.
21. 24-hour change in salinity should not exceed 1 ‰ if natural salinity is 0 to 3.5 ‰; 2 ‰ if natural salinity is 3.5 to 13.5 ‰; and 4 ‰ if natural salinity is 13.5 to 35 ‰ (US EPA 1976).
22. An assessment factor of 2 was applied to the HC_5 of 2,500 µg/L derived by ECCC for dissolved strontium. Given that dissolved strontium concentrations are approximately equivalent to total strontium concentrations, this guideline can be compared to total strontium concentrations when dissolved strontium concentrations are unavailable (ECCC 2020).
23. Sulphide. In aquatic environments H_2S and HS are in equilibrium as $H_2S \leftrightharpoons H^+ + HS^-$. Therefore, the un-ionized H_2S can be calculated from dissolved sulphide concentration [S^{2-}], pH, and the dissociation constant (pK) which is dependent on the sample water temperature. Ionic

strength or salinity can be used to select an accurate pK. Look-up tables to select the pK can be found in USEPA (1983; page 11 here). The formula to calculate [H_2S] given a total dissolved sulphide concentration [S^{2-}] is as follows (where both [H_2S] and [S^{2-}] are in mg/L):

$$[H_2\,S] = [S^{2-}]\left[\frac{1}{(1+(10^{(pH-pK)})}\right]$$

24. An assessment factor of 2 was applied to the HC_5 of 70 µg/L derived by ECCC (2013) for the average homologue distribution of AEs in freshwater (based on Canadian municipal wastewater effluent as $C_{13.7}EO_5$).
25. 30-day average, site-specific objective for the lower Columbia River, BC (MacDonald Environmental Sciences 1997).
26. An assessment factor of 3 was applied to the HC_5 of 0.15 µg/L derived by ECCC (2024) for Triclocarban.
27. An assessment factor of 4 was applied to the HC_5 of 0.47 µg/L derived by ECCC for Triclosan.
28. Assessment factor of 2 was applied to chronic and acute HC_5 of 15 and 33 µg/L derived by CCME for uranium in freshwater.
29. Assessment factor of 2 was applied to the HC_5 of 120 µg/L derived by ECCC for vanadium in freshwater.

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Table 2. Working Sediment Quality Guidelines (WSQGs)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
1,2,4-Trichlorobenzene	Organics	Marine AL	0.0081[2]	0.018[2]		Washington State DoE (2013)
1,2-Dichlorobenzene	Organics	Marine AL	0.023[2]	N/A		Washington State DoE (2013)
1,4-Dichlorobenzene	Organics	Marine AL	0.031[2]	0.09[2]		Washington State DoE (2013)
2-methylnaphthalene	PAHs	Freshwater AL	0.0202	0.201	Lower = ISQG; Upper = PEL	CCME (1998)
2-methylnaphthalene	PAHs	Marine AL	0.02	0.202	Lower = ISQG; Upper = PEL	CCME (1998)
Acenaphthene	PAHs	Freshwater & marine AL	0.00671	0.0889	Lower = ISQG; Upper = PEL	CCME (1998)
Acenaphthylene	PAHs	Freshwater & marine AL	0.00587	0.128	Lower = ISQG; Upper = PEL	CCME (1998)
Aldrin	Pesticides	Freshwater AL	0.002[2]	0.08[2]	Based on SLC; upper SWQG is for severe effects	Jaagumagi (1993a)
Aldrin	Pesticides	Marine AL	0.005	N/A	EPA chronic marine EqP threshold; 0.0001 significantly toxic to R. abronius based on CoA	Long and Morgan (1990)
Anthracene	PAHs	Freshwater & marine AL	0.0469	0.245	Lower = ISQG; Upper = PEL	CCME (1998)
Arsenic (total)	Metalloids	Marine AL	7.24	42	Lower = ISQG; Upper = PEL	CCME (1998)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Arsenic (total)	Metalloids	Freshwater AL	5.9	17	Lower = ISQG; Upper = PEL	CCME (1998)
Atrazine	Pesticides	Freshwater AL	0.0066	N/A		USEPA (2006)
Benzo(a)anthracene	PAHs	Freshwater AL	0.0317	0.385	Lower = ISQG; Upper = PEL	CCME (1998)
Benzo(a)anthracene	PAHs	Marine AL	0.0748	0.693	Lower = ISQG; Upper = PEL	CCME (1998)
Benzo(a)pyrene	PAHs	Freshwater AL	0.0319	0.782	Lower = ISQG; Upper = PEL	CCME (1998)
Benzo(a)pyrene	PAHs	Marine AL	0.0888	0.763	Lower = ISQG; Upper = PEL	CCME (1998)
Benzo(g,h,i)perylene	PAHs	Freshwater AL	0.17	0.32[2]	Based on SLC	Ontario MOEE (1993)
Benzo(g,h,i)perylene	PAHs	Marine AL	0.31[2]	0.78[2]		Washington State DoE (2013)
Benzo(k)fluoranthene	PAHs	Freshwater AL	0.24	13.4[2]		Ontario MOEE (1993)
Benzofluoranthene	PAHs	Freshwater AL	0.3	N/A	Based on BA method	EC and QC MoE (1992)
Benzofluroanthenes (all)	PAHs	Marine AL	2.3[2]	4.5[2]		CCME (1998)
Bis (2-ethylhexyl) phthalate (DEHP)	Phthalate esters	Marine AL	0.47[2]	0.78[2]		Washington State DoE (2013)
Bisphenol A (BPA)	Pesticides	Freshwater AL	0.06[2 & 3]	N/A		ECCC (2018)
Bisphenol A (BPA)	Pesticides	Marine AL	0.06[2 & 3]	N/A		ECCC (2018)
Butyl benzyl phthalate	Phthalate esters	Marine AL	0.049[2]	0.64[2]		Washington State DoE (2013)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Cadmium (total)	Metals	Freshwater AL	0.6	3.5	Lower = ISQG; Upper = PEL	CCME (1997)
Cadmium (total)	Metals	Marine AL	0.7	4.2	Lower = ISQG; Upper = PEL	CCME (1997)
Chlordane (total)	Metals	Freshwater AL	0.0045	0.00887	Lower = ISQG; Upper = PEL	CCME (1998)
Chlordane (total)	Metals	Marine AL	0.00226	0.00479	Lower = ISQG; Upper = PEL	CCME (1998)
Chlorpyrifos	Pesticides	Freshwater AL	0.012	0.063	Lower = ISQG; Upper = PEL	NYSDEC (2013)
Chlorpyrifos	Pesticides	Marine AL	0.008	0.017	Lower = ISQG; Upper = PEL	NYSDEC (2013)
Chromium (total)	Metals	Freshwater AL	37.3	90	Lower = ISQG; Upper = PEL	CCME (1998)
Chromium (total)	Metals	Marine AL	52.3	160	Lower = ISQG; Upper = PEL	CCME (1998)
Chrysene	PAHs	Freshwater AL	0.0571	0.862	Lower = ISQG; Upper = PEL	CCME (1998)
Chrysene	PAHs	Marine AL	0.108	0.846	Lower = ISQG; Upper = PEL	CCME (1998)
Copper (total)	Metals	Freshwater AL	35.7	197	Lower = ISQG; Upper = PEL	CCME (1998)
Copper (total)	Metals	Marine AL	18.7	108	Lower = ISQG; Upper = PEL	CCME (1998)
Diazinon	Pesticides	Freshwater AL	0.0024	N/A		USEPA (2006)
Dibenzo(a,h) anthracene	PAHs	Freshwater & marine AL	0.00622	0.135	Lower = ISQG; Upper = PEL	CCME (1998)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Dibenzofuran	Organics	Marine AL	0.15[2]	0.58[2]		Washington State DoE (2013)
Dichloro diphenyl dichloroethane (1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethane) p,p'-DDD	Pesticides	Freshwater AL	0.00354	0.00851	Lower = ISQG; Upper = PEL	CCME (1998)
Dichloro diphenyl dichloroethane (1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethane) p,p'-DDD	Pesticides	Marine AL	0.00122	0.00781	Lower = ISQG; Upper = PEL	CCME (1998)
Dichloro diphenyl dichloroethene (1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethene) p,p'-DDE	Pesticides	Freshwater AL	0.00142	0.00675	Lower = ISQG; Upper = PEL	CCME (1998)
Dichloro diphenyl dichloroethene (1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethene) p,p'-DDE	Pesticides	Marine AL	0.00207	0.374	Lower = ISQG; Upper = PEL	CCME (1998)
Dichloro diphenyl trichloroethane (1,1,1-Trichloro 2,2-bis (p-chloro-phenyl) ethane, total DDT)	Pesticides	Freshwater & marine AL	0.00119	0.00477	Lower = ISQG; Upper = PEL	CCME (1998)
Dieldrin	Pesticides	Freshwater AL	0.00285	0.00667	Lower = ISQG; Upper = PEL	CCME (1998)
Dieldrin	Pesticides	Marine AL	0.00071	0.0043	Lower = ISQG; Upper = PEL	CCME (1998)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Diethyl phthalate	Phthalate esters	Marine AL	0.61[2]	1.10[2]	When sediment contains 1% organic carbon	Washington State DoE (2013)
Dimethyl phthalate	Phthalate esters	Marine AL	0.53[2]	0.53[2]	Same value is given in reference	Washington State DoE (2013)
Di-n-butyl phthalate	Phthalate esters	Marine AL	2.2[2]	17[2]		Washington State DoE (2013)
Di-n-octyl phthalate	Phthalate esters	Marine AL	0.58[2]	45[2]		Washington State DoE (2013)
Endrin	Pesticides	Freshwater & marine AL	0.00267	0.0624	Lower = ISQG; Upper = PEL	CCME (1998)
Fluoranthene	PAHs	Freshwater AL	0.111	2.355	Lower = ISQG; Upper = PEL	CCME (1998)
Fluoranthene	PAHs	Marine AL	0.113	1.494	Lower = ISQG; Upper = PEL	CCME (1998)
Fluorene	PAHs	Freshwater & marine AL	0.0212	0.144	Lower = ISQG; Upper = PEL	CCME (1998)
Heptachlor (Heptachlor epoxide)	Pesticides	Freshwater & marine AL	0.0006	0.00274	Lower = ISQG; Upper = PEL	CCME (1998)
Hexabromocyclododecane (HBCD)	Organics	Freshwater AL	1.6	N/A		ECCC (2016a)
Hexabromocyclododecane (HBCD)	Organics	Marine AL	1.6	N/A		ECCC (2016a)
Hexachlorobenzene	Fungicides	Freshwater AL	0.01[2]	0.24[2]	Lower SWQG based on EqP	Jaagumagi (1993a)
Hexachlorobenzene	Fungicides	Marine AL	0.0038[2]	0.023[2]	0.23 µg/g maximum level for dredge disposal based on AET	Washington State DoE (2013)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Hexachlorobutadiene	Organics	Marine AL	0.039[2]	0.062[2]		Washington State DoE (2013)
Hexachlorocyclohexane - alpha (Benzene hexachloride-alpha; alpha-HCH)	Organics	Freshwater AL	0.006[2]	0.10[2]	Effect levels based on SLC	Jaagumagi (1993a)
Hexachlorocyclohexane - beta (Benzene hexachloride-beta; beta-HCH)	Organics	Freshwater AL	0.005[2]	0.21[2]	Effect levels based on SLC	Jaagumagi (1993a)
Hexachlorocyclohexane - total (Benzene hexachloride-total; BHC)	Organics	Freshwater AL	0.003[2]	0.12[2]	Effect levels based on SLC	Jaagumagi (1993a)
Hexachlorocyclohexane (Lindane-gamma BHC)	Pesticides	Freshwater AL	0.00094	0.00138	Lower = ISQG; Upper = PEL	CCME (1998)
Hexachlorocyclohexane (Lindane-gamma BHC)	Pesticides	Marine AL	0.00032	0.00099	Lower = ISQG; Upper = PEL	CCME (1998)
Indeno (1,2,3,c,d) pyrene	PAHs	Freshwater AL	0.2	3.2[2]	Effect levels based on SLC	Ontario MOEE (1993)
Indeno (1,2,3,c,d) pyrene	PAHs	Marine AL	0.34[2]	0.88[2]		Washington State DoE (2013)
Iron (total)	Metals	Freshwater AL	21,200 (about 2%)	43,766 (about 4%)	Effect levels based on SLC	Jaagumagi (1993b)
Lead (total)	Metals	Freshwater AL	35	91.3	Lower = ISQG; Upper = PEL	CCME (1998)
Lead (total)	Metals	Marine AL	30.2	112	Lower = ISQG; Upper = PEL	CCME (1998)
Manganese (total)	Metals	Freshwater AL	460	1100	Effect levels based on SLC	Jaagumagi (1993b)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Mercury (total)	Metals	Freshwater AL	0.17	0.486	Lower = ISQG; Upper = PEL	CCME (1997)
Mercury (total)	Metals	Marine AL	0.13	0.7	Lower = ISQG; Upper = PEL	CCME (1997)
Mirex	Pesticides	Freshwater AL	0.007[2]	1.3[2]	Effect levels based on SLC	Jaagumagi (1993a)
Molybdenum	Metals	Freshwater AL	25	23000	Lower=MPC; Upper=SRC	Verbruggen et al. 2001
Naphthalene	PAHs	Freshwater & marine AL	0.0346	0.391	Lower = ISQG; Upper = PEL	CCME (1998)
Nickel (total)	Metals	Freshwater AL	16	75	Effect levels based on SLC	Jaagumagi (1993b)
Nickel (total)	Metals	Marine AL	30	50	Effect levels based on NSTPA	Long and Morgan (1990)
N-Nitrosodiphenylamine	Organics	Marine AL	0.11[2]	0.11[2]	Same value is given in reference	Washington State DoE (2013)
Nonylphenol and its ethoxylates	Organics	Freshwater AL	1.4[2]	N/A	ISQG using equilibrium partitioning approach, expressed on a toxic equivalency basis using NP toxic equivalency factors. See reference.	CCME (2002)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Nonylphenol and its ethoxylates	Organics	Marine AL	1.0[2]	N/A	ISQG using equilibrium partitioning approach, expressed on a toxic equivalency basis using NP toxic equivalency factors. See reference.	CCME (2002)
Phenanthrene	PAHs	Freshwater AL	0.0419	0.515	Lower = ISQG; Upper = PEL	CCME (1998)
Phenanthrene	PAHs	Marine AL	0.0867	0.544	Lower = ISQG; Upper = PEL	CCME (1998)
Polybrominated diphenyl ethers (PBDE) (total)	Organics	Marine AL	0.001	N/A		Alava et al. (2016)
Polychlorinated Biphenyls (PCBs) (total PCBs)	Organics	Marine AL	0.0000037	N/A		Alava et al. (2012)
Polychlorinated dibenzo-*p*-dioxins/dibenzo furans (PCDD/Fs)	Organics	Freshwater & marine AL	0.00000085	0.0000215	Upper SWQG is provisional maximum expressed on a toxic equivalency basis using toxic equivalent factors for fish. See reference.	CCME (2001)
Polycyclic Aromatic Hydrocarbon (PAH) Benzo(g,h,i)perylene	PAHs	Freshwater AL	0.17	3.2[2]	Effect levels based on SLC	Ontario MOEE (1993)
Polycyclic Aromatic Hydrocarbons (PAHs) HPAH higher molecular weight	PAHs	Freshwater AL	1	N/A	Based on BA method	EC and QC MoE (1992)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Polycyclic Aromatic Hydrocarbons (PAHs) HPAH higher molecular weight	PAHs	Marine AL	9.6[2]	53[2]		Washington State DoE (2013)
Polycyclic Aromatic Hydrocarbons (PAHs) LPAH lower molecular weight	PAHs	Freshwater AL	0.1		Based on BA method	EC and QC MoE (1992)
Polycyclic Aromatic Hydrocarbons (PAHs) LPAH lower molecular weight	PAHs	Marine AL	3.7[2]	7.8[2]		Washington State DoE (2013)
Polycyclic Aromatic Hydrocarbons (PAHs) total	PAHs	Freshwater AL	4	35	Based on NSTPA, 100 µg/g shows severe effects (Persuad et al. 1993)	Long and Morgan (1990)
Pyrene	PAHs	Freshwater AL	0.053	0.875	Lower = ISQG; Upper = PEL	CCME (1998)
Pyrene	PAHs	Marine AL	0.153	1.398	Lower = ISQG; Upper = PEL	CCME (1998)
Silver (total)	Metals	Freshwater AL	0.5	N/A	Ontario sediment guideline	Ontario MOEE (1993)
Silver (total)	Metals	Marine AL	1	2.2	Based on NSTPA	Long and Morgan (1990)
TBBPA (Tetrabromobisphenol A)	Organic	Freshwater AL	0.6			ECCC (2016b)
TBBPA (Tetrabromobisphenol A)	Organic	Marine AL	0.6			ECCC (2016b)
Toxaphene	Pesticides	Freshwater & marine AL	0.0001[2]	N/A	ISQG	CCME (2002)

Substance	Group	Water Value	Lower SWQG (µg/g dry weight)	Upper SWQG (µg/g dry weight)	Notes[1]	Reference
Zinc (total)	Metals	Freshwater AL	123	315	Lower = ISQG; Upper = PEL	CCME (1998)
Zinc (total)	Metals	Marine AL	124	271	Lower = ISQG; Upper = PEL	CCME (1998)

[1]Acronyms:
AET = Apparent Effects Threshold
BA = Background Approach
CoA = Co-Occurrence analysis
EqP = Equilibrium Partitioning
ISQG = Interim Sediment Quality Guideline
MPC=Maximum permissible Concentration
NSTPA = National Status and Trends Program Approach
PEL = Probable Effect Level
SLC = Screening Level Concentration
SRC=Serious Risk Concentration

[2]Concentrations are expressed as µg/g sediment containing 1% organic carbon. A guideline expressed as µg/g is based on the sediment as a whole and does not require adjustment for organic carbon content. Adjustments to guidelines are required when they are expressed in terms of the sediment containing 1% organic carbon. For sediments with organic carbon other than 1%, an adjustment in guidelines should be made by multiplying the guideline by the % organic carbon content of the sediment.

[3] This SQG is based on the water column guideline which is adapted by application of an assessment factor of 4. Therefore, the tissue guideline recommended by ECCC, 2018 is divided by a factor of 4 to reflect the application of assessment factor to the water column guideline.

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Table 1. Working tissue residue guidelines (WTRGs).

Substance	Class	Water use	Long-term WWQG	Unit	Reference
Polybrominated Diphenyl Ethers (PBDE) (triBDE)	Organics	AL-fish tissue	120	µg/kg ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (tetraBDE)	Organics	AL-fish tissue	88	µg/kg ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)	Organics	AL-fish tissue	1	µg/kg ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (hexaBDE)	Organics	AL-fish tissue	420	µg/kg ww	ECCC (2013)
Perfluorooctane Sulfonate (PFOS)	Organics	AL-fish tissue	4,700[1]	µg/kg ww	ECCC (2018)

[1]: An assessment factor of 2 was applied to the ECCC 2018 tissue guideline.

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Table 4. Working wildlife dietary guidelines (WWDGs).

Substance	Class	Long-term WWQG	Unit	Reference
Bisphenol A (BPA)	Organics	110	µg/kg food ww	ECCC (2018a)
DDT	Pesticides	14	µg/kg food ww	CCME (1997)
Hexabromocyclododecane (HBCD)	Organics	40,000	µg/kg food ww	ECCC (2016a)
Polybrominated Diphenyl Ethers (PBDE) (tetraBDE)	Organics	44	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (pentaBDE)	Organics	3	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (hexaBDE)	Organics	4	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (heptaBDE)	Organics	64	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (octaBDE)	Organics	63	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (nonaBDE)	Organics	78	µg/kg food ww	ECCC (2013)
Polybrominated Diphenyl Ethers (PBDE) (decaBDE)	Organics	9	µg/kg food ww	ECCC (2013)
Polychlorinated Biphenyls (total PCBs)	Organics	0.29	µg/kg food ww	Alava et al. (2012)
Perfluorooctane Sulfonate (PFOS)	Organics	4.6	µg/kg food ww	ECCC (2018b)
(TBBPA (Tetrabromobisphenol A)	Organics	20,000	µg/kg food ww	ECCC (2016b)

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