WATER QUALITY

A Compendium of Working Water Quality Guidelines for British Columbia

N. K. Nagpal Ph.D. P.Ag.
L. W. Pommen M.Sc. P.Eng.
L. G. Swain P.Eng.

Water Management Branch
Environmental and Resource Management Department
Ministry of Environment, Lands and Parks (now called Ministry of Water, Land and Air Protection)

Updated: August 23, 2001

Table of Contents

Introduction

Compendium of Working Guidelines for 1998.

The following questions and answers will introduce you to the 1998 Compendium of Working Water Quality Guidelines for British Columbia. They will explain what the report is about and guide you through its use. This report is revised periodically to incorporate new information. The authors invite your comments and suggestion on any errors or omissions in the guidelines cited here.

What are water quality guidelines and why are they important?

Water quality guidelines are environmental benchmarks. They are safe levels of substances for the protection of a given water use, including drinking water, aquatic life, recreation and agriculture. They are developed in order that water quality data can be assessed and site-specific water quality objectives can be prepared. The Ministry of Environment, Lands and Parks (now called the Ministry

of Water, Land and Air Protection) has recently published, under a separate cover, a report on approved water quality guidelines: ***British Columbia Water Quality Guidelines (Criteria): 1998 Edition.***

It lists water quality guidelines for certain priority substances and has been approved by the executive for use in BC.

What are Working Guidelines and why do we have them?

The Working Guidelines Compendium brings together guidelines that have not yet been approved by the Province-hence, called the working guidelines. These guidelines were obtained from various Canadian (primarily the Canadian Council of the Ministers of the Environment or CCME), and other North American jurisdictions. These working guidelines provide benchmarks for those substances which have not yet been fully assessed and formally endorsed by the ministry. They will be reviewed by the ministry on a priority basis for their formal approval and use in British Columbia.

Who can use this report?

Traditionally, water quality professionals such as consultants have used this report. We are hoping that members of the public, especially those associated with local stewardship groups, will use this new user-friendly edition of the report to evaluate water quality data that they collect.

What are sediment quality guidelines and how should they be used?

Sediment guidelines are generally stated in two ways:

a. safe levels of substances which will protect aquatic life from adverse effects of toxic substances
b. levels which, if exceeded, will cause severe effects on aquatic life.

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.

What are site-specific water quality guidelines or objectives?

Site-specific water quality guidelines (or objectives) are a refinement of the province-wide guidelines. They are adapted to protect the most sensitive water use at a specific location, taking local circumstances into account. As suggested above, they have their basis in the water quality guidelines plus the site characteristics that may influence the toxic action of the substance of concern. The ministry recognizes that site-specific factors may necessitate modification of the ***Approved*** or the ***Working*** guidelines and suggests means to do this in a 1997 publication: ***Methods for Deriving Site-Specific Water Quality Objectives in British Columbia and Yukon.***

What is the difference between the British Columbia water quality guidelines (or criteria) and the Canadian Council of Ministers of the Environment or CCME guidelines?

The terms ***guidelines*** and ***criteria*** are synonymous; however, care must be exercised when numbers from BC and CCME are compared. In some instances, BC guidelines for a substance may be specified as two values: one to protect aquatic life from short-term, lethal effects (i.e., the maximum value or the acute criterion) and the other to protect it from long-term, sub-lethal effects (the 30-day average value or the chronic criterion). On the other hand, a CCME water quality

guideline is always specified as a single maximum value to protect aquatic life from all adverse effects. CCME guidelines and BC chronic guidelines are generally similar in value.

How do I find the guidelines for a substance in all these tables?

The substances are arranged in alphabetical order in Table 1 and Table 2. Substances in the water column are listed in Table 1 while substances in the bottom sediments are listed in Table 2. The last column in the Tables indicates the source of the guidelines.

Which water users are included in the tables?

There are six uses of water that require protection: aquatic life, wildlife, raw drinking water prior to treatment, recreation, irrigation and livestock watering. Values to protect drinking water and recreational water uses are mostly specified in the ***British Columbia Water Quality Guidelines (Criteria): 1998 Edition***.

How do I use the tables of values?

You determine for a waterbody the water uses that you want to ensure are protected. Knowing this, you go to the table for a substance and find the corresponding guideline for each use that you want to protect. Usually the lowest guideline associated with the uses that you want to protect will determine the level that must be met to ensure that all the uses are protected.

I have seen other references to similar reports issued by the ministry in the past. Are those reports still valid?

As indicated above, this report is revised periodically to incorporate new information. Sections from the earlier versions that are still useful have been included in this 1998 report. This 1998 version and the ***British Columbia Water Quality Guidelines (Criteria): 1998 Edition*** supersedes the following documents:

1. ***Preliminary Working Criteria for Water Quality***, October 1982.
2. ***Working Criteria for Water Quality***, April 1985.
3. ***Approved and Working Criteria for Water Quality***, April 1987, March 1989, May 1991, February 1994 and April 1995.

Which water quality guidelines have been developed by the ministry?

Water quality guidelines for the following substances have been approved:

Substance	
• Algae	• Nitrite
• Aluminum	• Nitrogen (nitrate, nitrite and ammonia)
• Ammonia	• Nutrients (phosphorus) and algae
• Benthic sedimentation	• Organic Carbon
• Carbon (organic)	• Oxygen (dissolved)
• Chlorine	• PAHs (polycyclic aromatic hydrocarbons)
• Chlorophenols	• Particulate matter (suspended solids and

- Coliforms
- Colour
- Copper
- Cyanide
- Dissolved Oxygen
- Ethylbenzene
- Fluoride
- Lead
- Manganese
- Mercury
- Methyl tertiary-butyl ether (MTBE)
- Microbiological indicators
- Molybdenum
- MTBE (methyl tertiary-butyl ether
- Nitrate
- turbidity)
- PCBs (polychlorinated biphenyls)
- pH
- Phosphorus
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Pressure (total gas pressure
- Selenium
- Silver
- Sulphate
- Suspended solids
- Temperature
- Toluene
- Total gas pressure
- Turbidity
- Zinc

Which water quality guidelines are currently being developed by the ministry?

Guidelines for the following substances are being developed or reviewed for possible formal approval by the ministry:

Substance
• Aluminum (update)
• Barium
• Beryllium
• Boron
• Cadmium
• Chlorate
• Chromium
• Diisopropanolamine (DIPA)
• Dioxins and furans
• Iron
• Sulfolane
• Xylene

What other tools does the ministry have to help one assess water quality?

In addition to the Guidelines, the ministry has developed several tools that can be used to assess water quality. For instance, the ***Principles*** document and the ***User's Guide***, (see below) outline the process that can be used to develop site-specific water quality objectives. The ***Status Report*** indicates the state of water quality for waterbodies in BC where data are available. The Ministry is

also developing manuals that will help in designing and implementing monitoring programs, and interpreting water quality data. Titles of the completed reports are listed below:

- *Principles for Preparing Water Quality Objectives in British Columbia. 1986*
- *Developing Water Quality Objectives in British Columbia — A User's Guide. 1996*
- *British Columbia Water Quality Status Report. 1996*
- *Lake and Stream Bottom Sediment Sampling Manual. 1994*
- *Biological Sampling Manual. 1994*
- *Ambient Fresh Water and Effluent Sampling Manual. 1994*
- *Guidelines for Designing and Implementing a Water Quality Program. 1997*
- *Guidelines for Interpreting Water Quality Data. 1997*
- *Methods for Deriving Site-Specific Objectives in British Columbia and Yukon, 1997*

Return to the Table of Contents

Tables

Table 1. Working Guidelines for the Water Column

Substance	Working Guidelines	References
Acrolein - livestock	µg/L, total 0.7, maximum	1
Aldicarb - fresh water aquatic life	µg/L, (aldicarb, aldicarb sulfoxide, aldicarb sulfone) 1, interim maximum	1 (app. 14)
Aldicarb - marine aquatic life	µg/L, (aldicarb, aldicarb sulfoxide, aldicarb sulfone) 0.15, interim maximum	1 (app. 14)
Aldicarb - livestock	µg/L, (aldicarb, aldicarb sulfoxide, aldicarb sulfone) 11, interim maximum	1 (app. 14)
Aldicarb - irrigation	µg/L, (aldicarb, aldicarb sulfoxide, aldicarb sulfone) 67.5, interim maximum to protect legumes 54.9, interim maximum, other non-target crops	1 (app. 14)
Aldrin + Dieldrin - fresh water aquatic life	µg/L, total 0.004, maximum	1
Alkalinity - food processing	mg/L, total CaCO3 30 to 250 (process dependent)	1
Alkalinity - industrial (process dependent)	mg/L, total CaCO3 0.5, iron and steel 125 to 150, chemical 130, tanning 50 to 75, textiles 1 to 1000, boilers 20 to 500, cooling 40 to 150, pulp and paper	1

Alkalinity - fresh water aquatic life	mg/L, total CaCO3 up to 10, highly sensitive to acid inputs 10 to 20, moderately sensitive over 20 low sensitivity refer to calcium regarding sensitivity to acid inputs, the more restrictive of calcium or alkalinity is applicable	2
Aniline - fresh water aquatic life	µg/L, total 2, maximum	1, (app. 13)
Antimony - fresh water aquatic life	µg/L, total 20, proposed Ontario guideline	4
Antimony - human health concerns	µg/L, total 14, human health protection (consumption of water + organisms) 4300 human health protection (consumption of organisms only)	3
Arsenic - fresh water aquatic life	µg/L, total 5, maximum	1 (app. 23)
Arsenic - marine aquatic life	µg/L, total 12, interim maximum	1 (app. 23)
Arsenic - livestock	µg/L, total 12, interim maximum	1 (app. 23)
Arsenic - irrigation	µg/L, total 100, maximum	1 (app. 23)
Atrazine - fresh water aquatic life	µg/L, Atrazine + metabolites 2 maximum	1 (app. 5)
Atrazine - marine aquatic life	µg/L, Atrazine + metabolites 10 maximum	7
Atrazine - irrigation	µg/L, Atrazine + metabolites 10 interim maximum	1 (app. 5)
Atrazine - livestock	µg/L, Atrazine + metabolites 60 interim maximum (same as old drinking water guideline)	1 (app. 5)
Barium - fresh water aquatic life	mg/L, total (under Ministry review) 1, 30-day average 5, maximum	8
Barium - marine aquatic life	mg/L, total (under Ministry review) 0.5, minimal risk 1, hazard	5 (p. 244)
Barium - marine aquatic life	mg/L, total (under Ministry review) 0.02, adverse effects on a bivalve	9
Benzene - fresh water aquatic life	µg/L, total 400, interim maximum	1 (1998)
Benzene - marine aquatic life	µg/L, total 100, interim maximum	1 (1998)
Benzene - livestock	µg/L, total 5, maximum	1 (1998)
Beryllium -fresh water aquatic life	µg/L, total 5.3, chronic criterion	10
Beryllium	µg/L, total	10

-fresh water aquatic life	0.068, risk level 1:100,000 water and fish ingestion criteria	
Beryllium -fresh water aquatic life	µg/L, total 0.0068, risk level 1:1,000,000 water and fish ingestion criteria	10
Beryllium - marine aquatic life	µg/L, total 100, minimal risk 1500, hazard	5 (p. 244)
Beryllium - livestock	µg/L, total 100, tentative maximum	1
Beryllium - irrigation	µg/L, total 100, maximum, continuous use, all soils	1
Beryllium - irrigation	µg/L, total 500, maximum, up to 20 years on fine-textured, neutral to alkaline soils	11 (p. 21) 12 (p. 41) 5 (p. 341)
Boron - livestock	mg/L, total (under Ministry review) 5, maximum	1
Boron - marine aquatic life	mg/L, total (under Ministry review) 5, maximum (normal seawater is 4.5	5
Boron - irrigation	mg/L, total (under Ministry review) 0.5 to 6.0, maximum, depends on the crop	1
Bromide - drinking water	µg/L 50, annual mean of monthly raw water samples for systems using ozonation less than 50 requires reduced bromate monitoring of treated water greater than 50 requires increased bromate monitoring of treated water	51 (1999)
Bromocil - fresh water aquatic life	µg/L, total 5, maximum	1 (1996)
Bromocil - livestock	µg/L, total 1100, proposed maximum	1 (1996)
Bromocil - irrigation	µg/L, total 0.6, proposed maximum (cereals, hay, pasture) 0.2, proposed maximum (other crops)	1 (1996)
Bromoxynl - fresh water aquatic life	µg/L, total 5, maximum	1 (app. 12)
Bromoxynl - livestock	µg/L, total 11, maximum for most sensitive animals	1 (app. 12)
Bromoxynl - irrigation	µg/L, total 0.35, maximum for most sensitive legume species	1 (app. 12)
Cadmium - fresh water aquatic life	µg/L, total (under Ministry review) cadmium = 10 exp (0.86[log {hardness}]-3.2) 0.01 at 30 mg/L CaCO3 0.03 at 90 mg/L CaCO3	1 (app. 21)

	0.05 at 150 mg/L CaCO3 0.06 at 210 mg/L CaCO3	
Cadmium - marine aquatic life	µg/L, total (under Ministry review) 0.1, maximum	1 (app. 21)
Cadmium - livestock	µg/L, total (under Ministry review) 80, maximum	1 (app. 21)
Cadmium - irrigation	µg/L, total (under Ministry review) 5, maximum	1 (app. 21)
Calcium - food processing	mg/L, dissolved 20 to 100 (process dependent)	1
Calcium - industrial (process dependent)	mg/L, dissolved 0.01, boilers 2 to 80, chemical 0 to 60, tanning 30 to 420, cooling 75, petroleum 20, pulp and paper	1
Calcium - fresh water aquatic life	mg/L, dissolved up to 4, highly sensitive to acid inputs 4 to 8, moderately sensitive over 8 low sensitivity refer to alkalinity the more restrictive of calcium or alkalinity applies	2
Calcium - livestock	mg/L, dissolved 1000, maximum less if high levels of other major ions present	1
Captan - fresh water aquatic life	µg/L, total 2.8, interim maximum	1 (app. 8)
Captan - livestock	µg/L, total 10, interim based on reproductive effects in rats	1 (app. 8)
Carbaryl - fresh water aquatic life	µg/L, total 0.2	1 (1996)
Carbaryl - marine aquatic life	µg/L, total 0.3, interim maximum	1 (1996)
Carbaryl - livestock	µg/L, total 1100, maximum	1 (1996)
Carbon tetrachloride - fresh water aquatic life	µg/L, total 13, interim maximum	1 (app. 10)
Carbon tetrachloride - livestock	µg/L, total 5, interim maximum	1 (app. 10)
Carbofuran - fresh water aquatic life	µg/L, total 1.8, maximum	1 (app. 5)

Carbofuran - livestock	µg/L, total 45, maximum	1 (app. 5)
Chlordane - fresh water aquatic life	µg/L, total 0.006, maximum	1
Chlordane - livestock	µg/L, total 7, maximum	1
Chloride - food processing	mg/L, dissolved 20 to 250 (process dependent)	1
Chloride - industrial (process dependent)	mg/L, dissolved 150, iron and steel 500 to 19000, cooling 250, tanning 200, petroleum 25 to 200, pulp and paper	1
Chloride - irrigation	mg/L, dissolved 100 to 700, depending on the crop	1
Chlorobenzenes - livestock hexachlorobenzene	µg/L, total 0.5, interim maximum	1 (1997)
Chlorobenzenes - marine aquatic life monochlorobenzene	µg/L, total 12, interim maximum	1 (1997)
Chlorobenzenes -marine aquatic life 1,2-dichlorobenzene	µg/L, total 42, interim maximum	1 (1997)
Chlorobenzenes - marine aquatic life 1,2,4-trichlorobenzene	µg/L, total 5.4, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life monochlorobenzene	µg/L, total 1.3, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,2-dichlorobenzene	µg/L, total 0.7, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,3-dichlorobenzene	µg/L, total 150, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,4-dichlorobenzene	µg/L, total 26, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,2,3-trichlorobenzene	µg/L, total 8, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,2,4-trichlorobenzene	µg/L, total 24, interim maximum	1 (1997)
Chlorobenzenes - fresh water aquatic life 1,2,3,4-tetrachlorobenzene	µg/L, total 1.8, interim maximum	1 (1997)
Chlorobenzenes	µg/L, total	1 (1997)

- fresh water aquatic life pentachlorobenzene	6, interim maximum	
Chloroform -aquatic life (trichloromethane)	µg/L, total trichloromethane 2, interim maximum	1 (app. 10)
4-chloro-2-methylphenoxy acetic acid MCPA - drinking water	µg/L, total 10, lifetime health advisory	15
4-chloro-2-methylphenoxy acetic acid MCPA - fresh water aquatic life	µg/L, total 2.6, maximum	1 (app. 18)
4-chloro-2-methylphenoxy acetic acid MCPA - marine aquatic life	µg/L, total 4.2, maximum	1 (app. 18)
4-chloro-2-methylphenoxy acetic acid MCPA - livestock	µg/L, total 25, maximum	1 (app. 18)
4-chloro-2-methylphenoxy acetic acid MCPA - irrigation	µg/L, total 0.16, cereals, hay and pastures 0.03, other crops	1 (app. 18)
Chlorothalonil - drinking water 2,4,5,6-tetrachloro-1,3 benzenedicarbonitrile	µg/L, total 200, health advisory	15
Chlorothalonil - fresh water aquatic life 2,4,5,6-tetrachloro-1,3 benzenedicarbonitrile	µg/L, total 0.2, chlorothalonil + 4-hydroxy transformation product	1 (app. 17)
Chlorothalonil - marine aquatic life 2,4,5,6-tetrachloro-1,3 benzenedicarbonitrile	µg/L, total 0.4, chlorothalonil + 4-hydroxy transformation product	1 (app. 17)
Chlorothalonil - livestock 2,4,5,6-tetrachloro-1,3 benzenedicarbonitrile	µg/L, total 170, maximum	1 (app. 17)
Chlorothalonil - irrigation 2,4,5,6-tetrachloro-1,3 benzenedicarbonitrile	µg/L, total 5.8, maximum	1 (app. 17)
Chlorpyrifos - fresh water aquatic life	µg/L, total 0.0035, maximum	1 (1996)
Chlorpyrifos - marine aquatic life	µg/L, total 0.002, interim maximum	1 (1996)
Chlorpyrifos - livestock	µg/L, total 24, maximum	1 (1996)
Chromium - fresh water aquatic life	µg/L, total 1, maximum, Cr(VI)	1 (1997)

	9, maximum, Cr(III)	
Chromium - marine aquatic life	µg/L, total 1.5, maximum, Cr(VI) 56, maximum, Cr(III)	1 (1997)
Chromium - livestock	µg/L, total 50, Cr(VI) 50, Cr(III)	1
Chromium - irrigation	µg/L, total 8, Cr(VI) 5, Cr(III)	1
Cobalt - fresh water aquatic life	µg/L, total 0.9, maximum (Ontario water quality objective)	16
Cobalt - livestock	µg/L, total 1000, maximum	1
Cobalt - irrigation	µg/L, total 50, maximum (continuous use on all soils) 5000, maximum (for up to 20-year use on fine-textured neutral to alkaline soils)	1
Colour - industrial	true colour, process dependent 5, textiles and tanning 5 to 20, chemicals 25 to 100, pulp and paper	1
Conductivity (specific) - livestock	µS/cm, (see also filterable residue and salinity) 1400 to 4200, maximum, species dependent	1
Conductivity (specific) - irrigation	µS/cm, (see also filterable residue and salinity) 700 to 5000, soil and crop dependent	1
Conductivity (specific) - industrial	µS/cm, (see also filterable residue and salinity) 0.7 to 8000, boilers, process dependent 140 to 4000, cooling, process dependent	1
Cyanazine - fresh water aquatic life	µg/L, total 2, maximum	1 (app. 6)
Cyanazine - irrigation	µg/L, total 0.5, interim maximum	1 (app. 6)
Cyanazine - livestock	µg/L, total 10, maximum (same as drinking water)	1 (app. 6)
2,4-D - fresh water aquatic life	µg/L, total (2,4-dichlorophenoxyacetic acid) 4, maximum (ester formulation)	1
2,4-D - livestock	µg/L, total (2,4-dichlorophenoxyacetic acid) 100, maximum	1
DDT + metabolites -fresh water aquatic life	µg/L, total (dichlorodiphenyltrichoroethane) 0.001, maximum	1
DDT + metabolites	µg/L, total (dichlorodiphenyltrichoroethane)	1

-livestock	30, maximum	
Dehydroabietic Acid (the major resin acid) - fresh water aquatic life	µg/L, total 1 at pH 5.0 2 at pH 5.5 2 at pH 6.0 4 at pH 6.5 8 at pH 7.0 12 at pH 7.5 13 at pH 8.0 14 at pH 8.5 14 at pH 9.0	49
Deltamethrin -fresh water aquatic life	µg/L, total 0.0004, maximum	1 (1996)
Deltamethrin -livestock	µg/L, total 2.5, maximum	1 (1996)
Diazinon - fresh water aquatic life	µg/L, total 0.003, average 0.1, maximum	18
Diazinon - livestock	µg/L, total 14, maximum	1
Dibutylphthalate (DBP) Phthalate ester - fresh water aquatic life	µg/L, total 19, interim maximum	1 (app. 13)
Dicamba - fresh water aquatic life	µg/L, total 10, maximum	1 (app. 12)
Dicamba - livestock	µg/L, total 122, maximum	1 (app. 12)
Dicamba - irrigation	µg/L, total 0.006, interim maximum	1 (app. 12)
1,2-dichloroethane - fresh water aquatic life	µg/L, total 100, interim maximum, protection and maintenance	1 (app. 7)
1,2-dichloroethane - livestock	µg/L, total 5, interim maximum (same as drinking water)	1 (app. 7)
2,4-dichlorophenoxy acetic acid - fresh water aquatic life	µg/L, total 2,4-D acid 4, maximum (ester formulation)	1
2,4-dichlorophenoxy acetic acid - livestock	µg/L, total 2,4-D acid 100, maximum	1
Dichlorodiphenyl trichoroethane - fresh water aquatic life	µg/L, total DDT + metabolites 0.001, maximum	1
Dichlorodiphenyl trichoroethane - livestock	µg/L, total DDT + metabolites 30, maximum	1
Diclofop-methyl - fresh water aquatic life	µg/L, total 6.1, maximum	1 (app. 12)
Diclofop-methyl - livestock	µg/L, total 9, interim maximum	1 (app. 12)
Diclofop-methyl - irrigation	µg/L, total 0.18, maximum	1 (app. 12)

Di-(2-ethylhexyl)phthalate (DEHP) Phthalate ester - fresh water aquatic life	µg/L, total 16, interim maximum	1 (app. 13)
Dimethoate - fresh water aquatic life	µg/L, total 6.2, interim maximum	1 (app. 14)
Dimethoate - livestock	µg/L, total 3, interim maximum	1 (app. 14)
Di-n-butyl tin - fresh water aquatic life	µg/L, total 0.08, Ontario objective	31
Dinoseb - fresh water aquatic life	µg/L, total 0.05, maximum	1 (app. 11)
Dinoseb - livestock	µg/L, total 150, maximum, protects lactating dairy cows	1 (app. 11)
Dinoseb - irrigation	µg/L, total 93, maximum for legumes 46, maximum for cereals and hay 16, maximum for all other crops	1 (app. 11)
Dissolved Solids (residue, filterable) - food processing	mg/L, total dissolved 50 to 850, process dependent	1
Dissolved Solids (residue, filterable) - livestock	mg/L, total dissolved 1000, maximum, sensitive species 3000, maximum, other species	1
Dissolved Solids (residue, filterable) - irrigation	mg/L, total dissolved 500 to 3500, maximum, crop and soil dependent	1
Dissolved Solids (residue, filterable) - industrial	mg/L, total dissolved, process dependent 0.5, boilers 100, textiles 750, petroleum 1000, iron and steel 200, chemical 200 to 500, pulp and paper 500 to 35000, cooling	1
Endosulfan - fresh water aquatic life	µg/L, total 0.02, maximum	1
Endrin - fresh water aquatic life	µg/L, total 0.0023, maximum	1
Endrin - livestock	µg/L, total 0.2, maximum	1
Ethylene glycol - fresh water aquatic life	mg/L, total 192, interim maximum	1 (March 97)
Floatable Solids - industrial	mg/L, total 0, iron and steel	1
Glyphosate - fresh water aquatic life	µg/L, total 65, interim maximum	1 (app. 5)
Glyphosate - livestock	µg/L, total 280, maximum, same as drinking water	1 (app. 5)
Hardness	µg/L, total dissolved	1

- food processing	10 to 250, process dependent	
Hardness - industrial process dependent	µg/L, total dissolved 0.07 to 1, boilers 0 to 150, tanning 8 to 55, textiles 0.1 to 100, iron and steel 130 to 6250, cooling low to 350, chemical 350, petroleum 100, pulp and paper	1
Heptachlor - fresh water aquatic life	µg/L, heptachlor + heptachlor epoxide 0.01, maximum	1
Heptachlor - livestock	µg/L, heptachlor + heptachlor epoxide 3, maximum	1
Hexachloro-1,3-butadiene - fresh water aquatic life	µg/L, total 0.1, maximum	1
Hexachlorocyclohexane	see Lindane	—
Iron - food processing	mg/L, total, under Ministry review 0.1 to 1, process dependent	1
Iron - fresh water aquatic life	mg/L, total, under Ministry review 0.3, maximum	1
Iron - marine aquatic life	mg/L, total, under Ministry review 0.05, minimal risk 0.3, hazardous	5 (p. 249)
Iron - irrigation	mg/L, total, under Ministry review 5, maximum, continuous use on all soils	5 (p. 343)
Iron - irrigation	mg/L, total, under Ministry review 20, maximum, 20-years use on alkaline to neutral fine-textured soils	1
Iron - industrial process dependent	mg/L, total, under Ministry review 0.01 to 1, boilers 0.02 to 0.1, chemical 1, petroleum 0.05 to 0.1, textiles 0.1 to 1, pulp and paper 0.1 to 50, tanning 0.5, make-up water for recirculating cooling	1
Lead - fresh water aquatic life tetra-ethyl lead	µg/L, total organic 0.0007, maximum, Ontario objective	19
Lead - fresh water aquatic life tri-ethyl lead	µg/L, total organic 0.4, maximum, Ontario objective	19
Lead - fresh water aquatic life tetra-methyl lead	µg/L, total organic 0.006, maximum, Ontario objective	19
Lindane - fresh water aquatic life hexachlorocyclohexane	µg/L, total 0.01, maximum	1
Lindane - livestock	µg/L, total 4, maximum	1

hexachlorocyclohexane		
Linuron - fresh water aquatic life	µg/L, total 7, maximum	1 (app. 19)
Linuron - irrigation	µg/L, total 3.3, maximum, cereals, hay, pastures 0.071, interim maximum, other crops	1 (app. 19)
Lithium - fresh water aquatic life	mg/L, total 5, maximum	20 (p. 72)
Lithium - irrigation	mg/L, total 2.5, maximum, continuous use on all soils (this may be too high for cereals since 1 mg/L suppressed barley growth)	1, 5
Magnesium - food processing	mg/L, total 10 to 30, process dependent	1
Magnesium - industrial	mg/L, total, process dependent 0.01, boilers 2 to 35, chemicals 12, pulp and paper 25, petroleum	1
Malathion - fresh water aquatic life - marine aquatic life	µg/L, total 0.1, maximum	10
Manganese - food processing	µg/L, total, under Ministry review 30 to 200, process dependent	1
Manganese - marine aquatic life	µg/L, total, under Ministry review 100, to protect consumers of shellfish	10
Manganese - irrigation	µg/L, total, under Ministry review 200, maximum, continuous use on all soils 10000, maximum for up to 20 years on neutral to alkaline fine-textured soils	1
Manganese - industrial	µg/L, total, under Ministry review 10, boilers 10 to 50, textiles 100 to 500, pulp and paper 10 to 200, tanning 20 to 100, chemical 20 to 50, cooling water	1
MCPA 4-chloro-2-methylphenoxy acetic acid - drinking water	µg/L, total 10, lifetime health advisory	15
MCPA 4-chloro-2-methylphenoxy acetic acid - fresh water aquatic life	µg/L, total 2.6, maximum	1 (app. 18)
MCPA 4-chloro-2-methylphenoxy acetic acid	µg/L, total 4.2, maximum	1 (app. 18)

- marine aquatic life		
MCPA 4-chloro-2-methylphenoxy acetic acid - livestock	µg/L, total 25, maximum	1 (app. 18)
MCPA 4-chloro-2-methylphenoxy acetic acid - irrigation	µg/L, total 0.16, cereals, hay and pastures 0.03, other crops	1 (app. 18)
Methylene Chloride - drinking water	µg/L, total 50, maximum	1 (app. 10)
Methylene Chloride - fresh water aquatic life	µg/L, total 98, interim maximum	1 (app. 10)
Methylene Chloride - livestock	µg/L, total 50, interim maximum	1 (app. 10)
Metolachlor - fresh water aquatic life	µg/L, total 8, interim maximum	1 (app. 8)
Metolachlor - irrigation	µg/L, total 28, interim maximum, crops	1 (app. 8)
Metolachlor - livestock	µg/L, total 50, interim maximum, same as drinking water	1 (app. 8)
Metribuzin - fresh water aquatic life	µg/L, total 1, interim maximum	1 (app. 6)
Metribuzin - irrigation	µg/L, total 0.5, interim maximum, non-target crop species	1 (app. 6)
Metribuzin - livestock	µg/L, total 80, interim maximum, same as drinking water	1 (app. 6)
Nickel - fresh water aquatic life	µg/L, total 25, maximum at hardness of 0 to 60 mg/L as CaCO3 65, maximum at hardness of 60 to 120 mg/L as CaCO3 110, maximum at hardness of 120 to 180 mg/L as CaCO3 150, maximum at hardness greater than 180 mg/L as CaCO3	1
Nickel - marine aquatic life	µg/L, total 8.3, 4-day average 75, 1-hour average	10
Nickle	µg/L, total	1

- livestock	1000, maximum	
Nickle - irrigation	µg/L, total 200, maximum, continuous use on all soils 2000 maximum, 20-year use on neutral to alkaline fine-textured soils	1
Oil and Grease - fresh water aquatic life	mg/L, total the surface water should be virtually free of petroleum, animal or vegetable oils	22
Oil and Grease - industrial	mg/L, total, process dependent 0, iron and steel 0.2 to 1, boilers	1
pH - industrial	pH, process dependent 2.5 to 10.5, textiles 7 to 10.5, boilers 6 to 9, petroleum 6 to 8, tanning 5 to 8.3, cooling 5 to 8.7, chemical 5 to 9, iron and steel 6 to 8, pulp and paper	1
Phenols - aquatic life	µg/L, total 300, to prevent taste and odour problems in flesh of food organisms	3
Phthalate esters (DBP) Dibutylphthalate - fresh water aquatic life	µg/L, total 19, interim maximum	1 (app. 13)
Phthalate esters (DEHP) Di-(2-ethylhexyl)phthalate - fresh water aquatic life	µg/L, total 16, interim maximum	1 (app. 13)
Picloram - fresh water aquatic life	µg/L, total 29, interim maximum	1 (app. 6)
Picloram - irrigation	µg/L, total less than 0.5, interim maximum, seedling crops	23
Picloram - livestock	µg/L, total 190, interim maximum, same as drinking water	1 (app. 6)
Potassium	mg/L, total dissolved 20, dairy sanitation	20
1,2-propylene glycol - fresh water aquatic life	mg/L, total 500, interim maximum	1 (March 97)
Residue, filterable (dissolved solids) - food processing	mg/L, total dissolved 50 to 850, process dependent	1
Residue, filterable (dissolved solids) - livestock	mg/L, total dissolved 1000, maximum, sensitive species 3000, maximum, other species	1
Residue, filterable (dissolved	mg/L, total dissolved	1

solids) - irrigation	500 to 3500, maximum, crop and soil dependent	
Residue, filterable (dissolved solids) - industrial	mg/L, total dissolved, process dependent 0.5, boilers 100, textiles 750, petroleum 1000, iron and steel 200, chemical 200 to 500, pulp and paper 500 to 35000, cooling	1
Residue, filterable (suspended solids) - food processing	mg/L, total 0 to 500	1
Residue, filterable (suspended solids) - industrial	mg/L, total, process dependent 0.05, boilers 5, textiles 10, petroleum 0 to 25, iron and steel 5 to 10, chemical 10, pulp and paper 100 to 5000, cooling	1
Resin Acids dehydroabietic acid - fresh water aquatic life	µg/L, total 1 at pH 5.0 2 at pH 5.5 2 at pH 6.0 4 at pH 6.5 8 at pH 7.0 12 at pH 7.5 13 at pH 8.0 14 at pH 8.5 14 at pH 9.0	49
Resin Acids (total) abietic acid neoabietic acid pimaric acid isopimaric acid sandaracopimaric acid - fresh water aquatic lifeneoabietic	µg/L, total 1 at pH 5.0 3 at pH 5.5 4 at pH 6.0 9 at pH 6.5 25 at pH 7.0 45 at pH 7.5 52 at pH 8.0 60 at pH 8.5 62 at pH 9.0	49
Salinity - fresh water aquatic life - terrestrial wildlife	g/L of NaCl or equivalent (the sea is about 35 g/L or 3.5%) 1.5, maximum	24 (p.32)
Salinity - marine aquatic life - estuarine aquatic life	g/L of NaCl or equivalent (the sea is about 35 g/L or 3.5%) + or - 10%, maximum change	24 (p.68)
Salinity - marine aquatic life - estuarine aquatic life - estuarine wildlife	g/L of NaCl or equivalent (the sea is about 35 g/L or 3.5%) 6, maximum for waterfowl marshes to protect vegetation For natural communities the maximum	24 (p.53)

	24-hour change should not exceed 1 if natural salinity is 0 to 3.5 2 if natural salinity is 3.5 to 13.5 4 if natural salinity is 13.5 to 35	
Salinity - recreation	g/L of NaCl or equivalent (the sea is about 35 g/L or 3.5%) 9, ideal 5 to 20, acceptable range this is isotonic to blood and tears	24 (p.18)
Settleable Solids - industrial	mg/L, total 0 to 100, iron and steel	1
Silica - food processing	mg/L, total 0 to 50, process dependent	1
Silica - industrial	mg/L, total, process dependent 0.01 to 150, boilers 25 to 200, cooling 20 to 100, pulp and paper 25, textiles	1
Simazine - fresh water aquatic life	µg/L, total 10, interim maximum	1 (app. 8)
Simazine - irrigation	µg/L, total 0.5, interim maximum protection of non-target crops	1 (app. 8)
Simazine - livestock	µg/L, total 10, interim maximum same as drinking water	1 (app. 8)
Sodium - irrigation	mg/L, dissolved crop, soil and water regime dependent	1
Solids, Floatable - industrial	mg/L, total 0, iron and steel	1
Solids, Settleable - industrial	mg/L, total 0 to 100, iron and steel	1
Solids, Suspended (residue, non-filterable) - food processing	mg/L, total 0 to 500	1
Solids, Suspended (residue, non-filterable) - industrial	mg/L, total, process dependent 0.05, boilers 5, textiles 10, petroleum 0 to 25, iron and steel 5 to 10, chemical 10, pulp and paper 100 to 5000, cooling	1
Sulphate - livestock	mg/L, dissolved, under Ministry review 1000, maximum	1
Sulphate - industrial	mg/L, dissolved, under Ministry review process dependent 175 to 200, iron and steel	1

	250, tanning 200 to 2700, cooling	
Sulphide - food processing	µg/L, as H2S 200, detected by smell in air at 2 ppb and in water at 0.025 to 0.25 µg/L	1
Sulphide - industrial	µg/L, as total sulphide 5000, cooling water	1
Sulphide - fresh water aquatic life - marine aquatic life	µg/L, as H2S 2, detected by smell in air at 2 ppb and in water at 0.025 to 0.25 µg/L	11 (p. 213) 12, 15
Surfactant, LAS - drinking water	µg/L, total 500	5 (p. 67)
Surfactant, LAS - fresh water aquatic life	µg/L, total 200	5 (p. 191)
Suspended Solids (residue, non-filterable) - food processing	mg/L, total 0 to 500	1
Suspended Solids (residue, non-filterable) - industrial	mg/L, total, process dependent 0.05, boilers 5, textiles 10, petroleum 0 to 25, iron and steel 5 to 10, chemical 10, pulp and paper 100 to 5000, cooling	1
Tannins and Lignins - drinking water	µg/L, total 400, taste and odour threshold	27
Tebuthiuron 1-(5-tert-butyl-1,3,4-thiadiazol-2-yl)-1,3-dimethylurea - drinking water	µg/L, total 490, lifetime health advisory	15
Tebuthiuron 1-(5-tert-butyl-1,3,4-thiadiazol-2-yl)-1,3-dimethylurea - fresh water aquatic life	µg/L, total 1.6, maximum	1 (app. 19)
Tebuthiuron 1-(5-tert-butyl-1,3,4-thiadiazol-2-yl)-1,3-dimethylurea - livestock	µg/L, total 130, maximum	1 (app. 19)
Tebuthiuron 1-(5-tert-butyl-1,3,4-thiadiazol-2-yl)-1,3-dimethylurea - irrigation	µg/L, total 0.27, for cereals, hay and pasture	1 (app. 19)
Tetrachloroethylene - fresh water aquatic life	µg/L, total 110, interim maximum	1 (app. 13)
Thallium - drinking water	µg/L, total 2, maximum 0.5, maximum contaminant level goal	29
Thallium - fresh water aquatic life	µg/L, total 1.7, human health, consumption of water + organism 6.3, human health, consumption of	29

	organism only	
Thallium - fresh water aquatic life	µg/L, total 0.3, water quality objective for Ontario	30
Tin, Organic Di-n-butyl tin - fresh water aquatic life	µg/L, total 0.08, Ontario objective	31
Tin, Organic Tributyl tin - fresh water aquatic life	µg/L, total 0.008, interim maximum	1 (app. 10)
Tin, Organic Tributyl tin - marine aquatic life	µg/L, total 0.001, interim maximum	1 (app. 10)
Tin, Organic Tributyl tin - livestock	µg/L, total 250, maximum, especially dairy cattle	1 (app. 10)
Tin, Organic Tricyclohexyl tin - livestock	µg/L, total 250, interim maximum, especially dairy cattle	1 (app. 10)
Tin, Organic Triethyl tin - fresh water aquatic life	µg/L, total 0.4, Ontario objective	31
Tin, Organic Triphenyl tin - fresh water aquatic life	µg/L, total 0.02, interim maximum	1 (app. 10)
Tin, Organic Triphenyl tin - marine aquatic life	µg/L, total 96-hour LC50 = 34 to 48.9	1 (app. 10)
Tin, Organic Triphenyl tin - livestock	µg/L, total 800, maximum, especially dairy cattle	1 (app. 10)
Titanium - drinking water	µg/L, total 100, maximum	20
Titanium - fresh water aquatic life	µg/L, total 100, maximum	20
Toluene - recreation and aesthetics	µg/L, total, under Ministry review 24, interim maximum, based on drinking water	1 (app. 20)
Toxaphene - fresh water aquatic life	µg/L, total 0.008	1
Toxaphene - livestock	µg/L, total 5, maximum	1
Triallate - fresh water aquatic life	µg/L, total 0.24, interim maximum	1 (app. 11)
Triallate - livestock	µg/L, total 230, interim maximum, same as drinking water	1 (app. 11)
Tributyl tin - fresh water aquatic life	µg/L, total 0.008, interim maximum	1 (app. 10)
Tributyl tin	µg/L, total	1 (app. 10)

- marine aquatic life	0.001, interim maximum	
Tributyl tin - livestock	µg/L, total 250, maximum, especially dairy cattle	1 (app. 10)
1,1,1-trichloroethane - drinking water	µg/L, total 200, maximum acceptable concentration	10, 32
1,1,1-trichloroethane - fresh water aquatic life	mg/L, total 11.1, 96-hour EC50 for P. promelas (loss of equilibrium, narcosis, etc.)	1 (app. 7)
Trichloroethylene - fresh water aquatic life	µg/L, total 20, maximum	1 (app. 7)
Trichloroethylene - livestock	µg/L, total 50, interim maximum, same as drinking water	1 (app. 7)
Trichloromethane - aquatic life (chloroform)	µg/L, total 2, interim maximum	1 (app. 10)
Tricyclohexyl tin - livestock	µg/L, total 250, interim maximum, especially dairy cattle	1 (app. 10)
Triethyl tin - fresh water aquatic life	µg/L, total 0.4, Ontario objective	31
Trifluralin - fresh water aquatic life	µg/L, total 0.1, maximum	1 (app. 11)
Trifluralin - livestock	µg/L, total 45, interim, same as drinking water	1 (app. 11)
Triphenyl tin - fresh water aquatic life	µg/L, total 0.02, interim maximum	1 (app. 10)
Triphenyl tin - marine aquatic life	µg/L, total 96-hour LC50 = 34 to 48.9	1 (app. 10)
Triphenyl tin - livestock	µg/L, total 800, maximum, especially dairy cattle	1 (app. 10)
Turbidity - food processing	NTU, process dependent 1 to 10	1
Turbidity - industrial	NTU, process dependent 0, tanning 0.3 to 15, textiles 10 to 100, pulp and paper 1 to 2, chemical	1
Uranium - fresh water aquatic life	µg/L, total 300, maximum	33
Uranium - marine aquatic life	µg/L, total 100, minimal risk 500, hazardous	5 (p. 257)
Uranium - livestock	µg/L, total 200, maximum	1
Uranium - irrigation	µg/L, total 10, maximum, continuous or intermittent use on all soils 100, maximum for up to 20-years use on fine-textured soils with pH greater than or equal to 7	1

Vanadium - drinking water	mg/L, total 0.1	20
Vanadium - marine aquatic life	mg/L, total 10, the 96-h LC50 for some fish	23 (p. 46)
Vanadium - livestock	mg/L, total 0.1, maximum	1
Vanadium - irrigation	mg/L, total 0.1, maximum, continuous use on all soils 1, maximum for 20-year use on fine-textured soils with pH less than or equal to 7	1
Zinc - industrial	mg/L, total 0.01, boilers	1

1. Colour — One TCU (true colour unit) is theoretically equal to 2 TAC (total absorbence colour) unit, but correlation between the two methods is poor.

2. Conductivity — Livestock and Irrigation values are derived from reference #1 assuming 1 mg/L filterable residue is about equal to 1.4 µS/cm.

3. Iron — Dissolved iron and iron precipitates are the important forms to consider. Total iron is often high due to iron content of suspended sediment and this is not important.

4. Manganese — Dissolved manganese and manganese precipitates are the important forms to consider. Total manganese is often high due to manganese content of suspended sediment and thus is not important.

5. Nickel — For fresh water aquatic life nickel was lethal (7-day test) to C. dubia at 7 µg/L (hardness = 40 mg/L $CaCO_3$) and 15 µg/L (hardness = 177 mg/L $CaCO_3$). See reference 21.

6. Resin Acids — Total resin acids include abietic acid, neoabietic acid, pimaric acid, isopimaric acid, and sandaracopimaric acid but not dehydroabietic acid.

7. Sulphide — Total sulphide = dissolved H_2S + HS + acid-soluble metal sulphides present in suspended matter. Dissolved sulphide is that remaining after suspended solids have been removed after flocculation or settling. In aquatic environments, H_2S and HS are in equilibrium as H_2S = H+ + HS-. The un-ionized H_2S can be calculated from dissolved sulphide, the sample pH and the ionization constant (which is dependent on the sample water temperature) of H_2S.

8. X. (app. y) in the references refers to appendix y in reference X.

Return to the Table of Contents

Table 2. Working Guidelines for the Sediments

Substance	Working Guidelines (dry-weight basis)	References
Aldrin - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.002 lowest effect level based on SLC 0.08 severe effect level based on SLC	36
Aldrin - marine	µg/g 0.005 EPA chronic marine EqP threshold 0.0001 significantly toxic to R. abronius based on CoA	38
Arsenic (total) - freshwater	µg/g 5.9 ISQG 17 PEL	35
Arsenic (total - marine	µg/g 7.2 ISQG 42 PEL	35
Benzene hexachloride	This is a conserved misleading name for Hexachlorocyclohexane, it is not an aromatic compound. This is not the same compound as Hexachlorobenzene.	—
Benzene hexachloride-total BHC-total Hexachlorocyclohexane see also Lindane (gamma isomer) - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.003 lowest effect level based on SLC 0.12 severe effect level based on SLC	36
Benzene hexachloride-alpha BHC-alpha Hexachlorocyclohexane see also Lindane (gamma isomer) - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.006 lowest effect level based on SLC 0.10 severe effect level based on SLC	36
Benzene hexachloride-beta BHC-beta Hexachlorocyclohexane see also Lindane (gamma isomer) - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.005 lowest effect level based on SLC 0.21 severe effect level based on SLC	36
Bis (2-ethylhexyl) phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.47 no adverse effect on biota 0.78 minor adverse effects	37
Butyl benzyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.049 no adverse effect on biota 0.64 minor adverse effects	37
Cadmium (total) - freshwater	µg/g 0.60 interim TEL	35

	3.5 PEL	
Cadmium (total) - marine	µg/g 0.68 interim TEL 4.2 PEL	35
Chlordane (total) - freshwater	µg/g 0.005 ISQG 0.009 PEL	35
Chlordane (total) - marine	µg/g 0.002 ISQG 0.005 PEL	35
Chromium (total) - freshwater	µg/g 37 ISQG 90 PEL	35
Chromium (total) - marine	µg/g 52 ISQG 160 PEL	35
Copper (total) - freshwater	µg/g 36 ISQG 197 PEL	35
Copper (total) - marine	µg/g 19 ISQG 108 PEL	35
Dibenzofuran - marine	µg/g, (when sediment contains 1% organic carbon) 0.15 no adverse effect on biota 0.58 minor adverse effects	37
1,2-Dichlorobenzene	µg/g, (sediment containing 1% organic carbon) 0.023 no adverse effects on biota	37
1,4-Dichlorobenzene	µg/g, (when sediment contains 1% organic carbon) 0.031 no adverse effects on biota 0.09 minor adverse effects	37
Dichloro diphenyl dichloroethane 1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethane - freshwater p,p'-DDD	µg/g 0.004 ISQG 0.007 PEL	35
Dichloro diphenyl dichloroethane 1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethane - marine p,p'-DDD	µg/g 0.001 ISQG 0.008 PEL	35
Dichloro diphenyl dichloroethene 1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethene - freshwater p,p'-DDE	µg/g 0.001 ISQG 0.007 PEL	35
Dichloro diphenyl dichloroethene	µg/g 0.002 ISQG	35

1,1-Dichloro 2,2-bis (p-chloro-phenyl) ethene - marine p,p'-DDE	0.374 PEL	
Dichloro diphenyl trichloroethane 1,1,1-Trichloro 2,2-bis (p-chloro-phenyl) ethane - freshwater total DDT	µg/g 0.007 ISQG 4.45 PEL	35
Dichloro diphenyl trichloroethane 1,1,1-Trichloro 2,2-bis (p-chloro-phenyl) ethane - marine total DDT	µg/g 0.004 ISQG 0.052 PEL	35
Dichloro diphenyl trichloroethane 1,1,1-Trichloro 2,2-bis (p-chloro-phenyl) ethane - marine p,p'-DDT	µg/g 0.001 ISQG 0.005 PEL	35
Dieldrin - freshwater	µg/g 0.003 ISQG 0.007 PEL	35
Dieldrin - marine	µg/g 0.0007 ISQG 0.004 PEL	35
Diethyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.61 no adverse effect on biota 1.10 minor adverse effects	37
Diethyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.61 lowest AET benthic community composition	39
Dimetyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.53 no adverse effects on biota	37
Di-n-butyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 2.2 no adverse effect on biota 17 minor adverse effects	37
Di-N-octyl phthalate - marine	µg/g, (when sediment contains 1% organic carbon) 0.58 no adverse effects on biota 45 minor adverse effects	37
Endrin - freshwater	µg/g 0.003 ISQG 0.062 PEL	35
Endrin - marine	µg/g 0.00002 effects range low based on NSTPA 0.045 effects range median based on NSTPA	38

Endrin - marine	µg/g, (when sediment contains 1% organic carbon) 0.0073 proposed EPA.criteria (may not protect locally sensitive species)	40
Heptachlor - freshwater	µg/g 0.0003 no effects threshold based on BA 0.0003 minimal effects threshold based on SLC	41
Heptachlor - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.01 toxic effects threshold based on SLC	41
Heptachlor - marine	µg/g 0.00004 99th percentile chronic permissible level 0.00006 95th percentile chronic permissible level	38
Heptachlor epoxide - freshwater	µg/g 0.0006 ISQG 0.003 PEL	35
Hexachlorobenzene - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.01 no effect level based on EqP 0.02 lowest effect level based on SLC 0.24 severe effect level	36
Hexachlorobenzene - marine	µg/g, (when sediment contains 1% organic carbon) 0.0038 no adverse effects on biota 0.023 minor adverse effects	37
Hexachlorobenzene - marine	µg/g 0.23 maximum level for drege disposal based on AET	43
Hexachlorobutadiene - marine	µg/g, (when sediment contains 1% organic carbon) 0.039 no adverse effects on biota 0.062 minor adverse effects	37
Hexachlorocyclohexane	see Benzene hexachloride (a conserved misleading name) see Lindane (gamma isomer only)	—
Iron (total) - freshwater	µg/g 21,200 (about 2%) lowest effect level based on SLC 43,766 (about 4%) severe effects level based on SLC	44
Lead (total) - freshwater	µg/g 35 ISQG 91 PEL	35
Lead (total) - marine	µg/g 30 ISQG 112 PEL	35
Lindane-gamma BHC - freshwater	µg/g 0.0009 ISQG	35

	0.001 PEL	
Lindane-gamma BHC - marine	µg/g 0.0003 ISQG 0.001 PEL	35
Mercury (total) - freshwater	µg/g 0.174 ISQG 0.486 PEL	35, 45
Mercury (total) - marine	µg/g 0.130 ISQG 0.70 PEL	35, 45
Mirex - freshwater	µg/g, (when sediment contains 1% organic carbon) 0.007 lowest effect level based on SLC 1.30 severe effect level based on SLC	36
Nickel (total) - freshwater	µg/g 16 lowest effect level based on SLC 75 severe effect level based on SLC	44
Nickel (total) - marine	µg/g 30 effects range low based on NSTPA 50 effects range median based on NSTPA	38
N-Nitrosodiphenylamine - marine	µg/g, (when sediment contains 1% organic carbon) 0.11 no adverse effect on biota	37
Polychlorinated Biphenyls (PCBs) - freshwater total PCBs	µg/g, (when sediment contains 1% organic carbon) 0.02 no effect level, approved provincial guideline	46
Polychlorinated Biphenyls (PCBs) - freshwater total PCBs	µg/g 0.034 ISQG 0.277 PEL	35
Polychlorinated Biphenyls (PCBs) - freshwater Arochlor 1254	µg/g 0.060 ISQG	35
Polychlorinated Biphenyls (PCBs) - freshwater Arochlor 1254	µg/g, (when sediment contains 1% organic carbon) 0.34 severe effect level based on SLC 90th percentile	36
Polychlorinated Biphenyls (PCBs) - freshwater Arochlor 1016	µg/g, (when sediment contains 1% organic carbon) 0.007 lowest effect level based on SLC 10th percentile 0.53 severe effect level based on SLC 90th percentile	36
Polychlorinated Biphenyls (PCBs) - freshwater Arochlor 1248	µg/g, (when sediment contains 1% organic carbon) 0.03 lowest effect level based on SLC 10th percentile 1.50 severe effect level based on SLC 90th	36

	percentile	
Polychlorinated Biphenyls (PCBs) - freshwater Arochlor 1260	µg/g, (when sediment contains 1% organic carbon) 0.005 lowest effect level based on SLC 10th percentile 0.24 severe effect level based on SLC 90th percentile	36
Polychlorinated Biphenyls (PCBs) - marine total PCBs	µg/g, (when sediment contains 1% organic carbon) 0.02 no effect level, approved provincial guideline	46
Polychlorinated Biphenyls (PCBs) - marine total PCBs	µg/g 0.022 ISQG 0.189 PEL	35
Polychlorinated Biphenyls (PCBs) - marine Arochlor 1254	µg/g 0.063 ISQG 0.709 PEL	35
Polycyclic Aromatic Hydrocarbons (PAHs) total - freshwater	µg/g 4 effects range low based on NSTPA 35 effects range medium	38
Polycyclic Aromatic Hydrocarbons (PAHs) total - freshwater	µg/g, (when sediment contains 1% organic carbon) 100 severe effect level	50
Polycyclic Aromatic Hydrocarbons (PAHs) LPAH lower molecular weight - freshwater	µg/g 0.1 no effects threshold based on BA	41
Polycyclic Aromatic Hydrocarbons (PAHs) HPAH higher molecular weight - freshwater	µg/g 1.0 no effects threshold based on BA	41
Polycyclic Aromatic Hydrocarbon (PAH) Acenaphthene - freshwater	µg/g 0.007 ISQG 0.089 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Acenaphthylene - freshwater	µg/g 0.006 ISQG 0.128 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Anthracene - freshwater	µg/g 0.047 ISQG 0.245 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Benzo(a) anthracene - freshwater	µg/g 0.032 ISQG 0.385 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Benzofluoranthene - freshwater	µg/g 0.3 no effect threshold based on BA	41

Polycyclic Aromatic Hydrocarbon (PAH) Benzo(k) fluoranthene - freshwater	µg/g 0.24 lowest effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Benzo(k) fluoranthene - freshwater	µg/g, (when sediment contains 1% organic carbon) 13.4 severe effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - freshwater	µg/g 0.1 no effect threshold based on BA	41
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - freshwater	µg/g 0.17 lowest effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - freshwater	µg/g, (when sediment contains 1% organic carbon) 3.2 severe effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Benzo(a) pyrene - freshwater	µg/g 0.032 ISQG 0.782 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Chrysene - freshwater	µg/g 0.057 ISQG 0.862 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Dibenzo (a,h) anthracene - freshwater	µg/g 0.006 ISQG 0.135 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Fluoranthene - freshwater	µg/g 0.111 ISQG 2.355 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Fluorene - freshwater	µg/g 0.021 ISQG 0.144 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Indeno (1,2,3,c,d) pyrene - freshwater	µg/g 0.07 no effect threshold based on BA	41
Polycyclic Aromatic Hydrocarbon (PAH) Indeno (1,2,3,c,d) pyrene - freshwater	µg/g 0.2 lowest effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Indeno (1,2,3,c,d) pyrene - freshwater	µg/g, (when sediment contains 1% organic carbon) 3.2 severe effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH)	µg/g 0.020 ISQG	35

2-methylnaphthalene - freshwater	0.201 PEL	
Polycyclic Aromatic Hydrocarbon (PAH) Naphthalene - freshwater	µg/g 0.035 ISQG 0.391 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Phenanthrene - freshwater	µg/g 0.042 ISQG 0.515 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Pyrene - freshwater	µg/g 0.053 ISQG 0.875 PEL	35
Polycyclic Aromatic Hydrocarbons (PAHs) LPAH lower molecular weight - marine	µg/g, (when sediment contains 1% organic carbon) 3.7 no adverse effects on biota 7.8 minor adverse effects on biota	37
Polycyclic Aromatic Hydrocarbons (PAHs) HPAH higher molecular weight - marine	µg/g, (when sediment contains 1% organic carbon) 9.6 no adverse effects on biota 53 minor adverse effects on biota	37
Polycyclic Aromatic Hydrocarbon (PAH) Acenaphthene - marine	µg/g 0.007 ISQG 0.089 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Acenaphthylene - marine	µg/g 0.006 ISQG 0.128 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Anthracene - marine	µg/g 0.047 ISQG 0.245 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Benzo(a) anthracene - marine	µg/g 0.075 ISQG 0.693 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Benzofluroanthenes (all) - marine	µg/g, (when sediment contains 1% organic carbon) 2.3 no adverse effect on biota 4.5 minor adverse effects on biota	37
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - marine	µg/g, (when sediment contains 1% organic carbon) 0.31 no adverse effect on biota 0.78 minor adverse effects on biota	37
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - marine	µg/g 0.17 lowest effect level based on SLC	50
Polycyclic Aromatic Hydrocarbon (PAH) Benzo (g,h,i)perylene - marine	µg/g, (when sediment contains 1% organic carbon) 3.2 severe effect level based on SLC	50

Polycyclic Aromatic Hydrocarbon (PAH) Benzo(a) pyrene - marine	µg/g 0.089 ISQG 0.763 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Chrysene - marine	µg/g 0.108 ISQG 0.846 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Dibenzo (a,h) anthracene - marine	µg/g 0.006 ISQG 0.135 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Fluoranthene - marine	µg/g 0.113 ISQG 1.494 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Fluorene - marine	µg/g 0.021 ISQG 0.144 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Indeno (1,2,3,c,d) pyrene - marine	µg/g, (when sediment contains 1% organic carbon) 0.34 no adverse effect on biota 0.88 minor adverse effect on biota	37
Polycyclic Aromatic Hydrocarbon (PAH) 2-methylnaphthalene - marine	µg/g 0.020 ISQG 0.201 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Naphthalene - marine	µg/g 0.035 ISQG 0.391 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Phenanthrene - marine	µg/g 0.087 ISQG 0.544 PEL	35
Polycyclic Aromatic Hydrocarbon (PAH) Pyrene - marine	µg/g 0.153 ISQG 1.398 PEL	35
Selenium (total) -freshwater	µg/g 5	48 (p. 3)
Silver (total - freshwater	µg/g 0.5 Ontario sediment quality guideline	47
Silver (total) - marine	µg/g 1.0 effects range low based on NSTPA 2.2 effects range median based on NSTPA	38
1,2,4-Trichlorobenzene - marine	µg/g, (when sediment contains 1% organic carbon) 0.0081 no adverse effects on biota 0.018 minor adverse effects 0.064 maximum level for dredge disposal	37
Zinc (total) - freshwater	µg/g 123 ISQG 315 PEL	35

Zinc (total) - marine	µg/g 124 ISQG 271 PEL	35

1. Concentrations are expressed as µg/g or 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.

2. SLC = Screening Level Concentration

3. CoA = Co-Occurrence analyses

4. AET = Apparent Effects Threshold

5. EqP = Equilibrium Partitioning

6. NSTPA = National Status and Trends Program Approach

7. BA = Background Approach

8. PEL = Probable Effect Level

9. ISQG = Interim Sediment Quality Guideline

10. EPA = United States Environmental Protection Agency

Return to the Table of Contents

References

1. Canadian Council of Resource and Environment Ministers, March 1987. Canadian Water Quality Guidelines.

2. Swain, L. G. 1987. Second report on chemical sensitivity of BC lakes to acidic inputs. Water Management Branch, Ministry of Environment, Victoria, BC. 31p.

3. National Recommended Water Quality Guidelines; Notice; Republication. Federal Register Vol 63, No. 237, Part IV. EPA. December 10, 1998.

4. Fletcher, T., G. L. Stephenson, J. Wang, C. D. Wren and B. W. Muncaster. 1996. Scientific criteria document for the development of a provincial water quality guideline for antimony. Ontario Ministry of Environment and Energy. ISBN 0-7778-4619-5. 32p.

5. National Academy of Sciences. 1972. Water Quality Criteria 1972, Washington, DC., 1972. (The Blue Book).

6. Canadian Food and Drug Directorate, Health Protection Branch. 1979. Food and Drug Regulations.

7. Plumley, F. G. and D. E. Davis. 1980. The effects of a photosynthetic inhibitor, atrazine, on salt marsh adaphic algae in culture, microcosms, and in the field. Estuaries 3: 217-223.

8. Haywood, G. P. and R. W. Drinnan (Dobrocky Seatech Ltd.). 1983. A Literature Review and Report on Barium Toxicity in Fresh Water, In Relation to the Monkman Coal Project, February, 1983, 49 p. (Prepared for: Petro-Canada Exploration Ltd.).

9. Spangenberg, J. V., and G. N. Cherr. 1996. Developmental effects of barium exposure in a marine (Mytilus californianus). Environ. Toxicol. Chem. 15: 1769-1774.

10. 20460. EPA 440/5-86-001. (The Gold Book).

11. US EPA. 1976. Quality Criteria for Water, July 1976. (The Red Book).

12. American Fisheries Society. 1979. A Review of the EPA Red Book: Quality Criteria for Water, April 1979.

13. American Water and Waste Association (AWWA) Mainstream. March, 1994. Information Collection Rule proposed. page 3.

14. Martin. J. 1994. TOC and TOX testing: A key component for drinking water D/DBP regulations. Amer. Environ. Lab. 10: 5-6.

15. US Environmental Protection Agency. 1989. Drinking water health advisory: Pesticides. Office of Drinking Water Advisories, Washington, D.C.

16. Fletcher, T., G. L. Stephenson, J. Wang, and C. D. Wren. 1996. Scientific criteria document for the development of provincial water quality guidelines for cobalt (stable isotope). Ontario Ministry of Environment and Energy. ISBN 0-7778-4673-X. 44p.

17. BC Department of Health Services and Hospital Insurance. 1969. Health Branch. Recommended Water Quality Standards, 1969.

18. Aquatic Ecosystem Objectives Committee. 1983. Annual Report, November 1983, Windsor, Ontario. Great Lakes Science Advisory Board, Report to the International Joint Commission.

19. Andrews, D. and C. Neville. 1994. Scientific criteria document for the development of provincial water quality guidelines for alkylleads. Ontario Ministry of Environment and Energy. ISBN 0-7778-2856-1. 42p.

20. Clark, M. J. R. A Compilation of Water Quality Criteria, Report No. 78-7, Pollution Control Branch, Ministry of Environment.

21. Kszos, L. A., J. A. Stewart and P. A. Taylor. 1992. An evaluation of nickel toxicity to Ceriodaphnia dubia and Daphnia magna in a contaminated stream and in laboratory tests. Environ. Toxicol. Chem. 11: 1001-1012.

22. Sigma Environmental Consultants Ltd. 1983. Summary of Water Quality Criteria For Salmonid Hatcheries (SECL 8067, Revised Edition, October 1983) (Prepared for Dept. of Fisheries and Oceans).

23. Ontario Ministry of Environment. 1984. Water Management, Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment (May, 1984).

24. Department of Environment, Inland Waters Branch. 1972. Guidelines for Water Quality Objectives and Standards, Technical Bulletin No. 67, Ottawa, Canada.

25. International Joint Commission. 1981. Report to the Great Lakes Science Advisory Board. Report of the Aquatic Ecosystem Objectives Committee, November 1981.

26. Nijman, R. A. 1990. Queen Charlotte Islands, Yakoun River and Tributaries, Water Quality Assessment and Objectives. Ministry of Environment, Water Management Division, Water Quality Branch, Victoria, BC.

27. Sweet, H. R. and R. H. Fetrow. 1975. Ground-Water Pollution By Wood Waste Disposal. Ground Water. 13(12):227-231.

28. Pollution Control Board. 1979. Pollution Control Objectives for the Mining, Smelting, and Related Industries of British Columbia. Ministry of Environment, Victoria, BC.

29. Pontius, F.W. 1996. An update of the federal regs. Jour. Amer. Water Works Ass. Arch 1996: 36-46.

30. Stephenson, G. L., D. J. Spry, B. W. Muncaster, C. D. Wren, and T. Fletcher. 1994. Proposed scientific criteria document for the development of a provincial water quality guideline for thallium. Standards Development Br., Ontario Ministry of Environment and Energy. 27p.

31. Andrews, D., K. Reid, and C. Neville. 1995. Scientific criteria document for the development of provincial water quality guidelines for organotins. Ontario Ministry of Environment and Energy. ISBN 0-7778-3068-X. 93p.

32. Ontario Ministry of Environment. 1989. Parameters Listing System (PALIS). Drinking Water Section, Water Resources Branch, Toronto.

33. Environment Canada. Guidelines for surface water quality, Vol. 1, Inorganic chemical substances. (Series of reports 1979 to 1983).

34. International Joint Commission. Great Lakes Science Advisory Board. 1987 Report of the Aquatic Ecosystem Objectives Committee.

35. Interim Sediment Quality Guidelines. 1995. Pre-publication Draft. Prepared by Guidelines Division, Environment Canada. September 1995.

36. Jaagumagi, R. 1992. Development of the Ontario Provincial Sediment Quality Guidelines for PCBs and the Organochlorine Pesticides. Water Resources Branch, Ontario Ministry of the Environment.

37. Sediment Management Standards, Washington State Department of Ecology, April 1991.

38. Long, E. R., and Morgan, L. G. 1990. The Potential for Biological Effects of Sediment Sorbed Contaminants Tested in the National Status and Tends Program, National Oceanic and Atmospheric Administration, Seattle, Washington.

39. Barrick, R., S. Becker, L. Brown, H. Beller and R. Pastorok. 1988. Sediment Quality Values Refinement: 1988 Update and Evaluation of Puget Sound AET. Vol.1 Prepared for the Puget Sound Estuary Program. PTI Environmental Services, Bellevue, Wash. (Cited from: D. D. MacDonald, S. L Smith, M. P. Wong and P. Murdoch. 1992. The development of Canadian Marine Environmental Quality Guidelines. Marine)

40. US Environmental Protection Agency. 1991. Proposed sediment quality criteria for the protection

of benthic organisms: Endrin. Office of Water, US EPA, Washington, DC.

41. Environment Canada and Ministry of the Environment of Quebec. July 1992. Interim criteria for quality assessment of St. Lawrence River Sediment. Environment Canada, St. Lawrence Centre, and Ministry of the Environment of Quebec.

42. Pavlov, S. R., R. Kadeg, A. Turner and M. Marchlik. 1987. Sediment quality criteria methodology validation: Uncertainty analysis of sediment normalization theory for nonpolar organic contaminants. Report SCD No. 14, Office of Water, Criteria and Standards Division, Washington, D. C. 95pp. (Cited from Long and Morgan 1990, page 80).

43. Puget Sound Dredged Disposal Analysis. 1989. Management Plan Report: Unconfined Openwater Disposal of Dredged Material Phase II (north and south Puget Sound). Washington State Department of Natural Resources, Olympia, Wash. Cited from D. D. MacDonald, S. L. Smith, M. P. Wong and P. Murdoch. 1992. The development of Canadian marine environmental quality guidelines. Marine Environmental Quality Series No.1. Ecosystem Sciences and Evaluation Directorate, EcoHealth Branch, Ottawa, Ont.

44. Jaagumagi, R. 1992. Development of the Ontario Provincial Sediment Quality Guidelines for Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, and Zinc. Water Resources Branch, Ontario Ministry of the Environment.

45. Canadian Sediment Quality Guideline for Mercury. 1997. Pre-publication Draft. Prepared by Guidelines Division, Environment Canada. 106p (plus Appendix II).

46. Nagpal, N. K. 1992. Water quality criteria for polychlorinated biphenyls. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, BC.

47. Persaud, D., R. Jaagumagi, and A. Hayton. 1992. Guidelines for the protection and management of aquatic sediment quality in Ontario. Report No. ISBN 0772992487. Ontario Ministry of Environment, Water Resources Branch.

48. International Joint Commission. 1981. Report to the Great Lakes Science Advisory Board. Report of the Aquatic Ecosystem Objectives Committee, Nov. 1981.

49. Environment Ontario. 1988. Scientific Criteria Document For Development of Provincial Water Quality Objectives and Guidelines, Resin Acids. ISBN 0-7729-4347-8.

50. Persaud, D., R. Jaagumagi, and A. Hayton. 1993 (March). Guidelines for the protection and management of aquatic sediment quality in Ontario. Report No. ISBN 0772992487. Ontario Ministry of Environment, Water Resources Branch.

51. Anon. 1999 (March).Complying with the Stage 1 D/DEP Rule. JAWWA, 91(3): 16-32.

Return to the Table of Contents

•Top •Copyright •Disclaimer •Privacy GOVERNMENT OF BRITISH COLUMBIA