

Source Drinking Water Quality Guidelines

Guideline Summary

Ministry of Environment & Climate Change Strategy

Water Protection & Sustainability Branch



The **Water Quality Guideline Series** is a collection of British Columbia (B.C.) Ministry of Environment and Climate Change Strategy water quality guidelines. Water quality guidelines are developed for a variety of water uses; aquatic life, drinking water sources, recreation and aesthetics and wildlife. The Water Quality Guideline Series focuses on publishing water quality guideline technical reports and guideline summaries using the best available science to aid in the management of B.C.'s water resources. For additional information on water quality parameter specific guidelines visit: <http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>

ISBN: 978-0-7726-7162-2

Citation:

British Columbia Ministry of Environment. 2017. B.C. Source Drinking Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series, WQG-01. Prov. B.C., Victoria B.C.

Author's Affiliation:

Water Quality & Aquatic Science
Water Protection & Sustainability Branch
Ministry of Environment & Climate Change Strategy
PO Box 9362 Stn Prov Govt
Victoria B.C.
V8W 9M2

Cover Photo:

Warneford River in Northeast B.C.

© Copyright 2017

EXECUTIVE SUMMARY

The British Columbia (B.C.) Ministry of Environment and Climate Change Strategy (ENV) develops ambient water quality guidelines (WQGs) for chemical substances and physical attributes of importance for both fresh and marine waters. These WQGs are used to assess and manage the health, safety and sustainability of B.C.'s aquatic resources as well as to support environmental assessments and decisions related to the protection of water uses including aquatic life, wildlife, drinking water sources and recreation. Ambient source drinking water quality guidelines (SDWQGs) are used to reduce adverse risks to drinking water sources, and therefore indirectly to human health. These guidelines are particularly relevant in multi-use watersheds where cumulative impacts are of concern with regard to human health. Ambient SDWQGs are a key component of source water protection and the multi-barrier approach to drinking water safety by providing benchmarks which are considered in decisions affecting water quality made within the ENV (ENV 1991a). Ambient SDWQGs are also an important contribution to the Province's *Action Plan for Safe Drinking Water* (HLTH 2002). SDWQGs apply to drinking water sources from surface water and groundwater.

The numeric values and narrative statements provided in this document are the most up to date SDWQGs and replace the SDWQGs contained in individual B.C. WQG overview and technical documents.

SDWQGs are established through one of two approaches:

- adoption of Health Canada's Guidelines for Canadian Drinking Water Quality in collaboration with the Ministry of Health (HLTH);
- development of a provincial guideline when none are available from Health Canada, or when required by B.C.-specific circumstances. In these cases, ENV collaborates with the B.C. Ministry of Health (HLTH) and other pertinent groups to develop or adopt an appropriate guideline.

It is important to differentiate between ENV's SDWQGs and the HLTH's drinking water quality treatment standards. The SDWQGs guidelines presented in this document apply to the ambient water before it is treated and distributed for domestic use. These guidelines do not supersede or invalidate any requirement related to drinking water quality established under the *Drinking Water Protection Act*. See [Health Canada's](#) or [ENV's technical documents](#) for the level of protection each guideline represents.

These SDWQGs are used to inform resource management decisions related to drinking water quality. The *Environmental Management Act* (EMA) gives ENV authority to develop guidelines which are used to inform resource management decisions, and conduct human health risk assessments and source water assessments. As with all ambient WQGs, the SDWQGs are not directly enforceable, but may be used to support the development of waste management permits, approvals, plans or operating certificates.

In this update, one of four options occurred for each water quality parameter (Table 1):

- 1) No change to guideline.
- 2) Guideline updated: New science resulted in a WQG being adopted from Health Canada or B.C. ENV's Land Remediation Section.
- 3) New guideline: WQG has not been previously adopted from Health Canada. Some of these new parameters already have B.C. aquatic life WQGs.
- 4) Guideline archived: Guideline is no longer needed or relevant for B.C.

GUIDELINE SUMMARY TABLE

Table 1. B.C. water quality guidelines for drinking water sources.

| Parameter¹ | Maximum Allowable Concentration (MAC) | Aesthetic Objective (AO) | Guideline Source | 2017 Update |
|----------------------------------|--|---------------------------------|-------------------------|---|
| Aluminum | 9.5 mg/L | N/A | ENV 2010 | Increased from Health Canada's operational treatment guideline of 0.2 mg/L to the B.C. Land Remediation interim water standard. |
| Arsenic | 0.01 mg/L | N/A | Health Canada 2006a | Decreased from 0.025 mg/L |
| Benzene | 0.005 mg/L | N/A | Health Canada 2009a | No change |
| Benzo[a]pyrene | 0.000 01 mg/L | N/A | Health Canada 1988 | No change |
| Boron | 5.0 mg/L | N/A | ENV 2003a | No change |
| Cadmium | 0.005 mg/L | N/A | Health Canada 1986a | New for DW use in B.C. |
| Chlorate | 1.0 mg/L | N/A | Health Canada 2008 | No change |
| Chloride | N/A | 250 mg/L | Health Canada 1987a | No change |
| Chlorophenols: | | | | |
| <i>Monochlorophenol</i> | N/A | 0.0001 mg/L | ENV 1997a | No change |
| <i>2,4-dichlorophenol</i> | 0.9 mg/L | 0.003 mg/L | Health Canada 1987b | No change |
| <i>Total Dichlorophenols</i> | N/A | 0.0003 mg/L | ENV 1997a | No change |
| <i>2,4,6-trichlorophenol</i> | 0.005 mg/L | 0.002 mg/L | Health Canada 1987b | No change |
| <i>Total Trichlorophenols</i> | N/A | 0.002 mg/L | ENV 1997a | No change |
| <i>2,3,4,6-tetrachlorophenol</i> | 0.1 mg/L | 0.001 mg/L | Health Canada 1987b | No change |
| <i>Total Tetrachlorophenols</i> | N/A | 0.001 mg/L | ENV 1997a | No change |
| <i>Pentachlorophenol</i> | 0.06 mg/L | 0.03 mg/L | Health Canada 1987b | No change |
| Colour, True | N/A | 15 TCU | Health Canada 1979a | No change |
| Copper | N/A | 1.0 mg/L | Health Canada 1992a | Increased from 0.5 mg/L |
| Cyanide | 0.2 mg/L | N/A | Health Canada 1991 | No change |

| Parameter ¹ | Maximum Allowable Concentration (MAC) | Aesthetic Objective (AO) | Guideline Source | 2017 Update |
|---------------------------------------|---|--------------------------|---------------------|---|
| Cyanobacterial Toxins: Microcystin-LR | 0.0015 mg/L | N/A | Health Canada 2002 | New for DW use in B.C. |
| Diisopropanolamine (DIPA) | 21 mg/L | N/A | ENV 2003b | No change |
| Ethylbenzene | 0.14 mg/L | 0.0016 mg/L | Health Canada 2014 | MAC new for DW use in B.C. AO decreased from 0.0024 mg/L. |
| Fluoride | 1.5 mg/L | N/A | Health Canada 2010a | No change |
| Iron | N/A | 0.3 mg/L | Health Canada 1978 | New for DW use in B.C. |
| Lead | 0.01 mg/L | N/A | Health Canada 1992b | Decreased from 0.05 mg/L |
| Manganese | N/A | 0.05 mg/L | Health Canada 1987c | New for DW use in B.C. |
| Mercury | 0.001 mg/L | N/A | Health Canada 1986b | No change |
| Methyl Tertiary-Butyl Ether | N/A | 0.015 mg/L | Health Canada 2006b | Decreased from 0.02 mg/L |
| Microbial Indicators: | | | | |
| Fecal coliforms | ≤ 10 coliforms/100 mL; 90 th percentile (minimum of 5 samples) | N/A | ENV 1988 | No change |
| <i>Escherichia coli</i> | ≤ 10 <i>E. coli</i> /100 mL; 90 th percentile (minimum of 5 samples) | N/A | ENV 1988 | No change |
| Enterococci | ≤ 3 Enterococci/100 mL; 90 th percentile (minimum of 5 samples) | N/A | ENV 1988 | No change |
| Molybdenum | 0.25 mg/L | N/A | ENV 1986 | No change |
| Nitrate | 45 mg/L (nitrate) 10 mg/L (nitrate-N) | N/A | Health Canada 2013b | No change |
| Nitrite | 3.0 mg/L (nitrite) 1.0 mg/L (nitrite-N) | N/A | Health Canada 2013b | No change |
| Organic Carbon, Total | 4.0 mg/L | N/A | ENV 1998 | No change |
| Phosphorus, Total | N/A | 0.01 mg/L | ENV 1985 | No change |

| Parameter ¹ | Maximum Allowable Concentration (MAC) | Aesthetic Objective (AO) | Guideline Source | 2017 Update |
|------------------------|---------------------------------------|--------------------------|---------------------|----------------------------|
| | | (lakes) | | |
| Selenium | 0.01 mg/L | N/A | ENV 2014 | No change |
| Sulfolane | 0.27 mg/L | N/A | ENV 2003c | No change |
| Sulphate | N/A | 500 mg/L | Health Canada 1994 | No change |
| Temperature | N/A | 15°C | Health Canada 1979b | No change |
| Toluene | 0.06 mg/L | 0.024 mg/L | Health Canada 2014 | New MAC for DW use in B.C. |
| Turbidity | See Table 2 | N/A | ENV 1997b | No change |
| Xylenes, Total | 0.09 mg/L | 0.02 mg/L | Health Canada 2014 | New for DW use in B.C. |
| Zinc | N/A | 5.0 mg/L | Health Canada 1979c | No change |

¹ Metal guidelines are based on **total** concentrations

Table 2. B.C. source drinking water quality guidelines for turbidity (ENV 1997b).

| Background Turbidity [†] | Guideline |
|---|---|
| Raw drinking water with treatment for particulates | Change from background [†] of 5 NTU at any time when background is ≤ 50 NTU; Change from background of 10% when background is > 50 NTU. |
| Raw drinking water without treatment for particulates | Change from background [†] of 1 NTU at any time when background is ≤ 5 NTU; Change from background of 5 NTU at any time. |
| Natural background turbidity is > 50 NTU | Induced* turbidity should not exceed 10% of the background turbidity. |

[†]There are operational and per-operational background levels. Operational background levels are based on comparisons to levels measured at upstream control sites. Per-operational background levels are based on historical background levels (ENV 1997b).

*Induced turbidity results in an increase in turbidity from human (swimming, runoff, erosion or effects from forestry, agriculture and/or other development activities), natural (rainstorm) or biological (phytoplankton growth) causes.

Contents

| | |
|--|-----|
| EXECUTIVE SUMMARY | III |
| GUIDELINE SUMMARY TABLE | IV |
| LIST OF TABLES | IX |
| ABBREVIATIONS | IX |
| GLOSSARY..... | IX |
| GUIDELINE RATIONALE | 1 |
| 1.1 Aluminum (Al)..... | 1 |
| 1.2 Arsenic (As)..... | 1 |
| 1.3 Benzene | 1 |
| 1.4 Benzo[a]pyrene..... | 1 |
| 1.5 Boron (B)..... | 1 |
| 1.6 Cadmium (Cd) | 1 |
| 1.7 Chlorate | 2 |
| 1.8 Chloride..... | 2 |
| 1.9 Chlorophenols..... | 2 |
| 1.10 Colour, True | 2 |
| 1.11 Copper (Cu)..... | 3 |
| 1.12 Cyanide | 3 |
| 1.13 Cyanobacterial Toxins: Microcystin-LR..... | 3 |
| 1.14 Diisopropanolamine (DIPA) | 3 |
| 1.15 Ethylbenzene | 3 |
| 1.16 Fluoride..... | 3 |
| 1.17 Iron (Fe) | 3 |
| 1.18 Lead (Pb)..... | 3 |
| 1.19 Manganese (Mn)..... | 4 |
| 1.20 Mercury (Hg)..... | 4 |
| 1.21 Methyl Tertiary-Butyl Ether (MTBE) | 4 |
| 1.22 Microbiological Indicators of Waterborne Pathogens: | 4 |
| 1.22.1 Fecal Coliforms | 4 |
| 1.22.2 Escherichia coli | 4 |
| 1.22.3 Enterococci..... | 5 |
| 1.22.4 Pseudomonas aeruginosa | 5 |
| 1.23 Molybdenum (Mo)..... | 5 |
| 1.24 Nitrate..... | 5 |
| 1.25 Nitrite..... | 5 |
| 1.26 Organic Carbon, Total..... | 5 |
| 1.27 pH..... | 6 |
| 1.28 Phosphorus (P), Total..... | 6 |

| | | |
|------|------------------|---|
| 1.29 | Selenium (Se) | 6 |
| 1.30 | Sulfolane | 6 |
| 1.31 | Sulphate | 6 |
| 1.32 | Temperature | 6 |
| 1.33 | Toluene | 6 |
| 1.34 | Turbidity | 7 |
| 1.35 | Xylenes, Total | 7 |
| 1.36 | Zinc (Zn) | 7 |
| | REFERENCES CITED | 8 |

LIST OF TABLES

| | |
|--|----|
| Table 1. B.C. water quality guidelines for drinking water sources. | iv |
| Table 2. B.C. source drinking water quality guidelines for turbidity (ENV 1997b). | vi |
| Table 3. B.C. water quality guidelines for chlorophenols in drinking water sources (Health Canada 1987b). | 2 |
| Table 4. B.C. water quality guidelines for total chlorophenols in drinking water sources (ENV 1997a). | 2 |

ABBREVIATIONS

| | |
|-------|--|
| AO | Aesthetic objective |
| B.C. | British Columbia |
| MAC | Maximum acceptable concentration |
| ENV | B.C. Ministry of Environment and Climate Change Strategy |
| HLTH | B.C. Ministry of Health |
| NOAEL | No observed adverse effect level |
| SDWQG | Source drinking water quality guideline |
| TCU | Total colour units |
| THM | Trihalomethane |
| WQG | Water quality guideline |

GLOSSARY

Aesthetic Objective: established for parameters that may impair the taste, smell, or colour of water; or which may interfere with the supply of good quality water. They do not cause adverse health effects.

Ambient: Ambient refers to open waters such as rivers, lakes and streams, as opposed to closed water supply systems that distribute treated water or wastewater.

Indicator Organism: An indicator organism is a microorganism or group of microorganisms that indicate water has been exposed to conditions that pose an increased risk of contamination with a pathogen, or held under conditions conducive for pathogen growth (Buchanan 2000). Indicator organism presence does not necessarily point to the presence of pathogenic organisms (Banks and Board 1983), but provides a way of indirectly measuring a microbiological attribute that is related to an increased risk that a pathogenic microorganism may be present in water (Buchanan 2000).

Maximum Acceptable Concentration: a level that has been established for certain substances that are known or suspected to cause adverse health effects.

No Observed Adverse Effect Level: The highest tested concentration of a substance at which no such adverse effect is found in exposed test organisms where higher doses or concentrations resulted in an adverse effect.

Operational Water Treatment Guideline: An operational guidance value, provided by Health Canada in this case, used in water treatment processes which treated water must meet before it enters the distribution system.

GUIDELINE RATIONALE

1.1 Aluminum (Al)

SDWQG: 9.5 mg/L (Maximum allowable concentration (MAC))

Rationale: The B.C. Land Remediation Section's toxicologically derived total Al water standard for use under the Contaminated Sites Regulation (ENV 2010) of 9.5 mg/L was adopted, recognizing advances in health research and the additional Al added to drinking water during treatment. Health Canada has not established a health-based water quality guideline (WQG) as "there is no consistent, convincing evidence that Al in drinking water causes adverse health effects in humans" (Health Canada 1998). Health Canada's current Al guideline applies to drinking water treatment systems; one of the few guidelines for Canadian drinking water quality that is a technical water treatment operational guideline, solely applicable to treated water (Health Canada 1998).

1.2 Arsenic (As)

SDWQG: 0.01 mg/L (MAC)

Rationale: B.C. adopted Health Canada's As guideline of 0.01 mg/L (Health Canada 2006a). Health Canada set this guideline at 0.01 mg/L or as low as reasonably achievable, as the MAC is based on municipal- and residential-scale treatment achievability. Arsenic is classified as a human carcinogen, therefore "every effort should be made to maintain As levels in drinking water as low as possible" (Health Canada 2006a). Further, source water protection efforts are encouraged to prevent increases in As above natural background levels.

1.3 Benzene

SDWQG: 0.005 mg/L (MAC)

Rationale: B.C. will continue to use Health Canada's total benzene MAC of 0.005 mg/L (Health Canada 2009a) to protect against bone marrow changes and cancer.

1.4 Benzo[a]pyrene

SDWQG: 0.000 01 mg/L (MAC)

Rationale: Benzo[a]pyrene is a polycyclic aromatic hydrocarbon. B.C. will continue to use Health Canada's benzo[a]pyrene guideline of 0.000 01 mg/L (Health Canada 1988) due to concerns of its carcinogenic effects to humans.

1.5 Boron (B)

SDWQG: 5.0 mg/L (MAC)

Rationale: B.C. will continue to use its B guideline of 5.0 mg/L (ENV 2003a) to prevent adverse health effects from B exposure. Adverse health effects range from vomiting, diarrhea, irritability and seizures, to death, depending on the dose.

1.6 Cadmium (Cd)

SDWQG: 0.005 mg/L (MAC)

Rationale: B.C. adopted Health Canada's Cd guideline of 0.005 mg/L (Health Canada 1986a) based on health considerations. The main source of Cd intake for humans is from food but Cd is not an essential element in human nutrition. As it is difficult to reduce Cd levels in food, Cd concentrations in drinking water should be maintained as low as possible to avoid overexposure (Health Canada 1986a).

1.7 Chlorate

SDWQG: 1.0 mg/L (MAC)

Rationale: B.C. adopted Health Canada's chlorate guideline of 1.0 mg/L to reduce formation of disinfection-by-products, harmful compounds that can be created when raw water is disinfected with chlorine dioxide (Health Canada 2008). In B.C., the main source of chlorates in the ambient aquatic environment is from pulp mill effluent where chlorine dioxide is used for bleaching (ENV 2002).

1.8 Chloride

SDWQG: 250 mg/L (Aesthetic objective (AO))

Rationale: B.C. will continue to use Health Canada's guideline of 250 mg/L for chloride to protect drinking water sources from undesirable taste and prevent corrosion in water distribution systems (Health Canada 1987a).

1.9 Chlorophenols

SDWQG: See Tables 3 and 4.

Rationale: B.C. will continue to use Health Canada's guidelines for four chlorophenols (Health Canada 1987b) as toxicity thresholds to prevent risks to human health (Table 3). B.C. will also continue to use the ENV (1997a) WQGs for total chlorophenols (Table 4).

Table 3. B.C. water quality guidelines for chlorophenols in drinking water sources (Health Canada 1987b).

| Chlorophenol | MAC | AO |
|---------------------------|-------|--------|
| | mg/L | mg/L |
| 2,4-dichlorophenol | 0.9 | 0.0003 |
| 2,4,6-trichlorophenol | 0.005 | 0.002 |
| 2,3,4,6-tetrachlorophenol | 0.1 | 0.001 |
| pentachlorophenol | 0.06 | 0.030 |

Table 4. B.C. water quality guidelines for total chlorophenols in drinking water sources (ENV 1997a).

| Chlorophenols, Total | AO |
|----------------------|-------------|
| Monochlorophenols | 0.0001 mg/L |
| Dichlorophenols | 0.0003 mg/L |
| Trichlorophenols | 0.002 mg/L |
| Tetrachlorophenols | 0.001 mg/L |
| Pentachlorophenol | 0.03 mg/L |

1.10 Colour, True

SDWQG: 15 TCU (AO)

Rationale: B.C. will continue to use Health Canada's guideline of 15 total colour units (TCU) (Health Canada 1979a). Colour is primarily an aesthetic concern in drinking water, however keeping colour levels ≤ 15 TCUs also helps to ensure drinking water sources can be treated effectively.

1.11 Copper (Cu)

SDWQG: 1.0 mg/L (AO)

Rationale: B.C. will continue to use Health Canada's Cu guideline of 1.0 mg/L (Health Canada 1992a) to prevent laundry and plumbing staining. Adverse health effects occur at much greater levels than this guideline.

1.12 Cyanide

SDWQG: 0.2 mg/L (MAC)

Rationale: B.C. will continue to use Health Canada's guideline of 0.2 mg/L (Health Canada 1991) to minimize human health effects from the acute toxicity of cyanide.

1.13 Cyanobacterial Toxins: Microcystin-LR

SDWQG: 0.0015 mg/L (MAC)

Rationale: Microcystin-LR is a hepatotoxin and classified as a possible carcinogen. B.C. adopted Health Canada's microcystin-LR guideline of 0.0015 mg/L (Health Canada 2002) to protect against liver effects. This guideline is also believed to be protective against exposure to other microcystins (total microcystins) that may be present. The major route of human exposure to cyanobacterial toxins is the consumption of drinking water (Health Canada 2002). See HLTH (2014) for more information on decision protocols for cyanobacterial toxins in B.C. drinking water.

1.14 Diisopropanolamine (DIPA)

SDWQG: 21 mg/L (MAC)

Rationale: B.C. will continue to use the SDWQG of 21 mg/L for DIPA to protect human health (ENV 2003b). Health Canada does not currently have a drinking WQG for DIPA. DIPA is an organic chemical used in natural gas processing and a variety of industrial and household applications. In natural gas processing facilities, it is used to remove acid gases from natural gas streams (ENV 2003b).

1.15 Ethylbenzene

SDWQG: 0.14 mg/L (MAC), 0.0016 mg/L (AO)

Rationale: B.C. adopted Health Canada's ethylbenzene MAC of 0.14 mg/L to protect against cancer and non-cancer health effects, and the AO of 0.0016 mg/L to protect against unfavorable odour (Health Canada 2014).

1.16 Fluoride

SDWQG: 1.5 mg/L (MAC)

Rationale: B.C. will continue to use Health Canada's fluoride guideline of 1.5 mg/L to prevent dental fluorosis (Health Canada 2010a).

1.17 Iron (Fe)

SDWQG: 0.3 mg/L (AO)

Rationale: B.C. adopted Health Canada's Fe guideline of 0.3 mg/L (Health Canada 1978) to prevent unpleasant taste in drinking water and staining of laundry and plumbing fixtures.

1.18 Lead (Pb)

SDWQG: 0.01 mg/L (MAC)

Rationale: B.C. adopted Health Canada's Pb guideline of 0.01 mg/L (Health Canada 1992b) based on biochemical and neurobehavioral chronic effects. The guideline applies to average concentrations in water consumed for extended periods. As Pb is classified as a probable carcinogen to humans, exposure should be kept to a minimum.

1.19 Manganese (Mn)

SDWQG: 0.05 mg/L (AO)

Rationale: B.C. adopted Health Canada's Mn guideline of 0.05 mg/L (Health Canada 1987c) to prevent unpleasant taste in drinking water and staining of laundry and plumbing fixtures.

1.20 Mercury (Hg)

SDWQG: 0.001 mg/L (MAC)

Rationale: B.C. will continue to use Health Canada's Hg guideline of 0.001 mg/L (Health Canada 1986b). In the environment, mercury poses many risks to human health. Mercury is a potent neurotoxin, particularly to infants and children. It also biomagnifies in the food chain and has carcinogenic effects (Health Canada 1986b).

1.21 Methyl Tertiary-Butyl Ether (MTBE)

SDWQG: 0.015 mg/L (AO)

Rationale: B.C. adopted Health Canada's MTBE guideline of 0.015 mg/L (Health Canada 2006b). This guideline protects against odours that make water unpalatable. The guideline is lower than concentrations associated with potential toxic effects and is therefore also considered protective of human health.

1.22 Microbiological Indicators of Waterborne Pathogens:

The purpose of SDWQGs for microbiological indicators is to help us manage drinking water sources and avoid microbial contamination from anthropogenic and/or natural sources. As analytical methods and costs limit the ability to monitor for specific pathogens of concern in drinking water sources, bacterial indicator organisms are monitored as an indicator of risk of the possible presence of disease causing pathogens (Health Canada 2013a). Microbiological pathogens are considered the most significant threat to public health from drinking water because the effects can be acute; if ingested, pathogens can cause gastrointestinal illness within hours or days (HLTH 2012). The three main types of pathogens that pose a risk to human health in drinking water are viruses, bacteria and protozoa (HLTH 2012). The kinds of microorganisms typically identified as potential threats to Canadian drinking water supplies include the bacterium *E. coli O157:H7* and the protozoa *Cryptosporidium* and *Giardia* (CCME 2004).

1.22.1 Fecal Coliforms

SDWQG: ≤ 10 coliforms/100 mL; 90th percentile (minimum of 5 samples)

Rationale: B.C. will continue to use the ENV (1988) fecal coliform indicator guideline as measuring coliforms in source drinking water provides an important reference point when assessing the effectiveness of drinking water treatment systems. However, fecal coliforms are not the current recommended indicator of waterborne pathogens. The fecal coliform group contains species of non-fecal origin that have the potential for regrowth in the environment; leading to less certainty in their ability to predict sources of fecal contamination (Tallon *et al.* 2005). The USEPA (2012) determined that, as a group, fecal coliforms were a poor indicator of risk for illness in humans. Fecal coliform standards under the *Drinking Water Protection Regulation* remain unchanged by this guideline update.

1.22.2 Escherichia coli

SDWQG: ≤ 10 *E. coli* /100 mL; 90th percentile (minimum of 5 samples)

Rationale: B.C. will continue to use the ENV (1988) fecal microbiological indicator *E. coli* for estimating pathogen contamination in drinking water sources because it is the only member of the coliform group that is found in the feces of warm blooded animals and also outnumbers the other thermotolerant coliforms in both human and animal excreta (WHO 2011). The presence of

E. coli in water indicates fecal contamination and thus the strong potential for health risks, regardless of whether specific pathogens such as enteric protozoa or viruses are observed. However, the absence of *E. coli* does not necessarily indicate that enteric protozoa or viruses are also absent (Health Canada 2012).

1.22.3 Enterococci

SDWQG: ≤ 3 enterococci /100 mL; 90th percentile (minimum of 5 samples)

Rationale: B.C. will continue to use the ENV (1988) fecal microbiological indicator enterococci. Enterococci are the preferred fecal bacterial indicator in reservoirs, sewage contaminated waters and marine waters. Most enterococci species do not multiply in water and have an advantage over *E. coli* in that they survive longer in water (WHO 2011).

1.22.4 *Pseudomonas aeruginosa*

SDWQG: Archived

Rationale: B.C. will archive the microbial indicator *Pseudomonas aeruginosa* as it is not the recommended indicator for pathogens in drinking water sources.

1.23 Molybdenum (Mo)

SDWQG: 0.25 mg/L (MAC)

Rationale: B.C. will continue to use the ENV Mo guideline of 0.25 mg/L (ENV 1986). Mo is a trace element considered essential in human nutrition; however excessive intake may present toxic risks (Health Canada 2010b). Runoff over Mo-bearing mineral deposits and drainage from Mo mines are known sources of Mo discharged to surface waters in B.C. (ENV 1986; B.C. Ministry of Energy, Mines and Petroleum Resources 2009). ENV originally developed a SDWQG as there were several Mo mines operating in B.C. and Health Canada does not have a Mo drinking water guideline.

1.24 Nitrate

SDWQG: 45 mg/L as nitrate (10 mg/L as nitrate-nitrogen) (MAC)

Rationale: B.C. will continue to use Health Canada's nitrate guideline (Health Canada 2013b). This guideline is based on the no observed adverse effect level (NOAEL) for infantile methaemoglobinaemia and effects on thyroid gland function in bottle-fed infants in North American populations.

1.25 Nitrite

SDWQG: 3.0 mg/L as nitrite (1.0 mg/L as nitrite-nitrogen) (MAC)

Rationale: B.C. will continue to use Health Canada's nitrite guideline (Health Canada 2013b). This guideline is based on the NOAEL for infantile methaemoglobinaemia in bottle-fed infants less than 6 months of age in North American populations.

1.26 Organic Carbon, Total

SDWQG: 4.0 mg/L (MAC)

Rationale: B.C. will continue to use the ENV SDWQG of 4.0 mg/L (ENV 1998) as Health Canada does not have a drinking water guideline for total organic carbon. This MAC was derived with evidence from the USEPA's Disinfectants and Disinfection-By-Products rule and other studies (ENV 1998). These studies indicated that if the total organic carbon levels remained at or below 4.0 mg/L in drinking water sources, the risk of trihalomethane (THM) formation in treated drinking water would likely remain below the THM guideline of 0.1 mg/L established by Health Canada (2009b).

1.27 pH

SDWQG: Archived

Rationale: B.C. archived the SDWQG for pH (ENV 1991b) due to the high natural variability of pH in ambient waters and the fact that the SDWQG applied only to waters requiring disinfection.

1.28 Phosphorus (P), Total

SDWQG: 0.01 mg/L (AO). For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).

Rationale: B.C. will continue to use the ENV (1985) SDWQG of 0.01mg/L as Health Canada does not have a drinking water guideline for P. There is a well-defined relationship between P, generally measured at spring overturn, and the amount of algal biomass in a lake during the growing season. A P guideline is recommended to reduce the risks of algal blooms and impairment of drinking water sources during the growing season (ENV 1985).

1.29 Selenium (Se)

SDWQG: 0.01 mg/L (MAC)

Rationale: B.C. will continue to use the ENV (2014) Se SDWQG of 0.01 mg/L. In 2015, Health Canada revised their Se MAC from 0.01 mg/L to 0.05 mg/L. At that time, HLTH determined that 0.01 mg/L was appropriate to prevent health risks from Se exposure conditions in B.C.

1.30 Sulfolane

SDWQG: 0.27 mg/L (MAC)

Rationale: B.C. will continue to use the ENV (2003c) sulfolane SDWQG of 0.27 mg/L as Health Canada does not currently have a guideline. Sulfolane is an organic chemical widely used in the sweetening (i.e. removal of acidic gasses) of natural gas.

1.31 Sulphate

SDWQG: 500 mg/L (AO)

Rationale: B.C. will continue to use Health Canada's sulphate guideline of 500 mg/L (Health Canada 1994). Concentrations above 500 mg/L in drinking water can cause diarrhea and dehydration. This AO also protects against unpleasant taste.

1.32 Temperature

SDWQG: 15°C (AO)

Rationale: B.C. will continue to use Health Canada's temperature guideline of 15°C (Health Canada 1979b). Although temperature does not have a direct relationship to health, the importance of temperature is recognized as a determinant of other water quality parameters that directly affect human health. Water temperatures greater than 15°C can reduce residual chlorine levels and encourage the growth of nuisance organisms leading to unpleasant tastes and odours.

1.33 Toluene

SDQWG: 0.06 mg/L (MAC), 0.024 mg/L (AO)

Rationale: B.C. adopted Health Canada's toluene guidelines (Health Canada 2014). The AO is based on a threshold concentration to reduce taste and odour issues while the MAC is based on adverse neurological effects that may occur at concentrations greater than 0.06 mg/L.

1.34 Turbidity

SDQWG:

| Water Use | Guideline |
|---|--|
| Raw drinking water with treatment for particulates | Change from background [†] of 5 NTU at any time when background is \leq 50 NTU; Change from background of 10% when background is $>$ 50 NTU. |
| Raw drinking water without treatment for particulates | Change from background of 1 NTU at any time when background is \leq 5 NTU; Change from background of 5 NTU at any time. |
| Natural background turbidity is $>$ 50 NTU | Induced turbidity should not exceed 10% of the background turbidity. |

[†]There are operational and per-operational background levels. Operational background levels are based on comparisons to levels measured at upstream control sites. Per-operational background levels are based on historical background levels (ENV 1997b)

Rationale: B.C. will continue to use the ENV (1997b) guidelines for turbidity. Health Canada's turbidity guideline is not appropriate for source waters as it is an operational water treatment guideline specific to water treatment filter type. Turbidity is caused by biotic and abiotic suspended or dissolved substances in the water body. Minimizing induced turbidity in source water decreases the level of water treatment required for safe consumption (ENV 1997).

1.35 Xylenes, Total

SDWQG: 0.09 mg/L (MAC), 0.02 mg/L (AO)

Rationale: B.C. adopted Health Canada's guidelines for total xylenes (Health Canada 2014) to protect drinking water sources from unpleasant odours and human health from adverse neuromuscular effects.

1.36 Zinc (Zn)

SDWQG: 5.0 mg/L (AO)

Rationale: B.C. will continue to use Health Canada's Zn guideline of 5.0 mg/L (Health Canada 1979c). The guideline is an AO to prevent an undesirable bitter taste and the formation of a greasy film when water is boiled.

REFERENCES CITED

- [CCME] Canadian Council of Ministers of the environment. 2004. From Source to Tap: Guidance on the Multi-Barrier Approach to Safe Drinking Water. Federal-Provincial-Territorial Committee on Drinking Water and the CCME Water Quality Task Force. Accessed online from http://www.ccme.ca/files/Resources/water/source_tap/mba_guidance_doc_e.pdf
- [ENV] British Columbia Ministry of Environment. 1985. British Columbia Ambient Water Quality Guidelines: Nutrients and Algae. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/nutrients-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 1986. British Columbia Ambient Water Quality Guidelines: Molybdenum. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/molybdenum-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 1988. British Columbia Ambient Water Quality Guidelines: Microbial Indicators. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/microbiology-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 1991a. British Columbia Water Quality: Policy Statements. Victoria, B.C. Accessed online from <http://www.env.gov.bc.ca/wat/wq/homesubs/policy.html>
- [ENV] British Columbia Ministry of Environment. 1991b. British Columbia Ambient Water Quality Guidelines: pH. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/ph-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 1997a. British Columbia Ambient Water Quality Guidelines: Chlorophenols. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/chlorophenols-tech.pdf>
- [ENV] British Columbia Ministry of Environment, Lands and Parks. 1997b. British Columbia Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments. Technical Appendix. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/turbidity-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 1998. British Columbia Ambient Water Quality Guidelines: Technical Appendix- Organic Carbon. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/organic-carbon-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 2002. British Columbia Ambient Water Quality Guidelines: Chlorate. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/chlorate-tr.pdf>
- [ENV] British Columbia Ministry of Environment. 2003a. British Columbia Ambient Water Quality Guidelines: Boron. Water Protection and Sustainability Branch, Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/boron/boron-tech-appnx.pdf>
- [ENV] British Columbia Ministry of Environment. 2003b. British Columbia Ambient Water Quality Guidelines: Diisopropanolamine (DIPA). Prepared by Komex International Ltd for the B.C. Ministry of Environment. Accessed online

from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/dipa-tech.pdf>

- [ENV] British Columbia Ministry of Environment. 2003c. British Columbia Ambient Water Quality Guidelines: Sulfolane. Prepared by Komex International Ltd for the B.C. Ministry of Environment. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/sulfolane-tech.pdf>
- [ENV] British Columbia Ministry of Environment. 2010. Director's Interim Standards for Contaminated Sites. Generic Numerical Drinking Water Standards for Aluminum, Iron and Manganese. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/policies-and-standards/directors-interim-standards.pdf>
- [ENV] British Columbia Ministry of Environment. 2014. British Columbia Ambient Water Quality Guidelines: Technical Report- Selenium. Water Protection and Sustainability Branch. Victoria, B.C. Accessed online from https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/bc_moe_se_wqg.pdf
- [HLTH] British Columbia Ministry of Health Services. 2002. Action Plan for Safe Drinking Water in British Columbia. Victoria, B.C. Accessed online from http://www2.gov.bc.ca/assets/gov/environment/air-land-water/safe_drinking_printcopy.pdf
- [HLTH] British Columbia Ministry of Health. 2012. Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia. Version 1.1. Victoria, B.C. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/surfacewater-treatment-objectives.pdf>
- [HLTH] British Columbia Ministry of Health. 2014. Decision Protocols For Cyanobacterial Toxins In B.C. Drinking Water And Recreational Water. Accessed online from <http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/documents/cyanobacteria-sampling-protocols-sept3-2015.pdf>
- Health Canada. 1978. Guidelines for Canadian Drinking Water Quality: Technical Document-Iron. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-iron-fer-eau/index-eng.php>
- Health Canada. 1979a. Guidelines for Canadian Drinking Water Quality: Technical Document-Colour. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-colour-couleur-eau/index-eng.php>
- Health Canada. 1979b. Guidelines for Canadian Drinking Water Quality. Technical Document - Temperature. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-temperature-eau/index-eng.php>
- Health Canada. 1979c. Guidelines for Canadian Drinking Water Quality: Technical Document-Zinc. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-zinc.html>
- Health Canada. 1986a. Guidelines for Canadian Drinking Water Quality: Technical Document-Cadmium. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-cadmium-eau/index-eng.php>
- Health Canada. 1986b. Guidelines for Canadian Drinking Water Quality: Technical Document-Mercury. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-mercury-mercure-eau/index-eng.php>

- Health Canada. 1987a. Guidelines for Canadian Drinking Water Quality: Technical Document-Chloride. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-chloride-chlorure-eau/index-eng.php>
- Health Canada. 1987b. Guidelines for Canadian Drinking Water Quality: Technical Document-Chlorophenols. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-chlorophenols-eau/index-eng.php>
- Health Canada. 1987c. Guidelines for Canadian Drinking Water Quality: Technical Document-Manganese. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-manganese-eau/index-eng.php>
- Health Canada. 1988. Guidelines for Canadian Drinking Water Quality: Technical Document-Benzo[a]pyrene. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-benzo-a-pyrene-eau/index-eng.php>
- Health Canada. 1991. Guidelines for Canadian Drinking Water Quality: Technical Document-Cyanide. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-cyanide-cyanure-eau/index-eng.php>
- Health Canada. 1992a. Guidelines for Canadian Drinking Water Quality: Technical Document-Copper. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-copper-cuivre-eau/index-eng.php>
- Health Canada. 1992b. Guidelines for Canadian Drinking Water Quality: Technical Document-Lead. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-lead-plomb-eau/index-eng.php>
- Health Canada. 1994. Guidelines for Canadian Drinking Water Quality. Technical Document - Sulphate. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-sulphate-sulfate-eau/index-eng.php>
- Health Canada. 1998. Guidelines for Canadian Drinking Water Quality. Technical Document – Aluminium. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/healthy-living-vie-saine/water-aluminum-eau/alt/water-aluminum-eau-eng.pdf>
- Health Canada. 2002. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Cyanobacterial Toxins Microcystin-LR. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-cyanobacteria-cyanobacterie-eau/index-eng.php>
- Health Canada. 2006a. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Arsenic. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-arsenic-eau/index-eng.php>
- Health Canada. 2006b. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Methyl Tertiary-Butyl Ether (MTBE). Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-mtbe-eau/index-eng.php>
- Health Canada. 2008. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Chlorite and Chlorate. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-chlorite-chlorate-eau/index-eng.php>

- Health Canada. 2009a. Guidelines for Canadian Drinking Water Quality. Technical Document – Benzene. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-benzene-eau/index-eng.php>
- Health Canada. 2009b. Guidelines for Canadian Drinking Water Quality. Technical Document - Trihalomethanes. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-trihalomethanes-eau/index-eng.php>
- Health Canada. 2010a. Guidelines for Canadian Drinking Water Quality. Technical Document – Fluoride. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-fluoride-fluorure-eau/index-eng.php>
- Health Canada. 2010b. Report on Human Biomonitoring of Environmental Chemicals in Canada. Results by Chemical Group. Metals and Trace Elements. Molybdenum. Accessed online from <http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/section8-eng.php>
- Health Canada. 2012. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Enteric Protozoa: *Giardia* and *Cryptosporidium*. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. (Catalogue No H129-23/2013E-PDF).
- Health Canada. 2013a. Guidance on the Use of the Microbiological Drinking Water Quality Guidelines. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/micro/index-eng.php>.
- Health Canada. 2013b. Guidelines for Canadian Drinking Water Quality: Nitrate and Nitrite. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Available online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-nitrate-nitrite-eau/index-eng.php>
- Health Canada. 2014. Guidelines for Canadian Drinking Water Quality. Guideline Technical Document-Toluene, Ethylbenzene and the Xylenes. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Ottawa, Ontario. Accessed online from <http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-toluene-eau/index-eng.php>
- Tallon, P., Magajna, B., Lofranco, C. and Leung, K.T. 2005. Microbial Indicators of Fecal Contamination in Water: A Current Perspective. *Water Air Soil Pollut.*, 166:139-166.
- [USEPA] United States Environmental Protection Agency. 2012. Fecal Bacteria-Monitoring and Assessment. Accessed online from <http://water.epa.gov/type/rsl/monitoring/vms511.cfm>
- [WHO] World Health Organization. 2011. Guidelines for Drinking Water Quality. Fourth Edition. Accessed online from http://apps.who.int/iris/bitstream/10665/44584/1/9789241548151_eng.pdf