British Columbia Water Quality Guidelines: Drinking Water Sources

Guideline Summary

Water Protection & Sustainability Branch

Ministry of Environment

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BRITISH COLUMBIA

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Abbreviations

AF	Allocation factor
AO	Aesthetic objective
BC	British Columbia
BW	Body weight
DWPA	*Drinking Water Protection Act*
IR	Ingestion rate
MAC	Maximum acceptable concentration
ENV	BC Ministry of Environment
HLTH	BC Ministry of Health
NOAEL	No observed adverse effect level
RWQG	Recreational water quality guideline
SDWQG	Source drinking water quality guideline
TCU	Total colour units
TDI	Tolerable daily intake
THM	Trihalomethane
WQG	Water quality guideline

Glossary

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 a food has been exposed to conditions that pose an increased risk that the food may be contaminated 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 food (Buchanan 2000).

Interim Guidelines: Interim guidelines are developed when data is available but is limited. Interim guidelines may be revised to guideline status when more information becomes available.

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.

Tolerable Daily Intake: the daily amount of a chemical that has been assessed safe for human health on a long-term basis (usually a whole lifetime).

Guideline Derivation

Ambient source drinking water quality guidelines (SDWQGs) are used to assess water quality and manage natural and human use to protect human health. These guidelines are particularly relevant in multi-use watersheds (e.g. water could be used for recreation, drinking and resource development) where cumulative impacts are of concern. Ambient SDWQGs are a key component of any source water protection strategy and an important contribution to the Province's *Action Plan for Safe Drinking Water* (HLTH 2002).

The numeric values and narrative statements provided in this document are the most up to date SDWQGs and replace the SDWQGs contained in British Columbia (BC) Water Quality Guideline (WQG) overview and technical documents.

SDWQGs are established through one of two approaches:

- adoption of Health Canada's Guidelines for Canadian Drinking Water Quality;
- development of a provincial guideline when none are available from Health Canada, or when only an operational treatment guideline is available. In these cases, ENV collaborates with HLTH and other pertinent groups to develop an appropriate guideline.

It is important to differentiate between ENV`s SDWQGs and HLTHs 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.* As with all ambient WQGs, the SDWQGs are not legally enforceable. These WQGs are meant to be used as a policy tool to guide decisions related to permits and authorizations under the *Environmental Management Act;* WQGs can be used to establish the allowable limits in waste discharges. These limits are set out in waste management permits, approvals, plans, or operating certificates which do have legal standing. An exceedance of the WQGs presented in this document does not imply that unacceptable risks are present, but that

the potential for adverse effects is increased and additional investigation and monitoring should be conducted.

Health Canada and the BC *Action Plan for Safe Drinking Water* recognize the importance of ambient WQGs as a source water protection strategy (Health Canada 2002a, HLTH 2002). It is not possible to completely eliminate risk of contamination from drinking water sources, but source water protection as part of the multi-barrier approach to drinking water safety helps to reduce risks to public health.

Guideline Summary Table

Table 1. BC ambient water quality guidelines for drinking water sources.

Parameter[1]	MAC[2]	AO[3]	Guideline Source (approved, reaffirmed)
Aluminum	9.5 mg/L	N/A	ENV 2010
Benzene	5.0 µg/L	N/A	Health Canada 2009b
Benzo[a]pyrene	0.01 µg/L	N/A	Health Canada 1988, 2005
Boron	5.0 mg/L	N/A	Health Canada 1990
Cadmium	5.0 µg/L	N/A	Health Canada 1986a, 2005
Chlorate	1.0 mg/L	N/A	Health Canada 2008
Chloride	N/A	250 mg/L	Health Canada 1987a, 2005
Chlorophenols:			
Monochlorophenol	N/A	0.1 µg/L	ENV 1997b
2,4-dichlorophenol	0.9 mg/L	0.3 µg/L	Health Canada 1987b, 2005
Total Dichlorophenols	N/A	0.3 µg/L	ENV 1997b
2,4,6-trichlorophenol	5.0 µg/L	2.0 µg/L	Health Canada 1987b, 2005
Total Trichlorophenols	N/A	2.0 µg/L	ENV 1997b
2,3,4,6-tetrachlorophenol	0.1 mg/L	1.0 µg/L	Health Canada 1987b, 2005
Total Tetrachlorophenols	N/A	1.0 µg/L	ENV 1997b
Pentachlorophenol	0.06 mg/L	0.03 mg/L	Health Canada 1987b, 2005
Colour, True	N/A	15 TCU	Health Canada 1979, 2005
Copper	N/A	1.0 mg/L	Health Canada 1992a
Cyanide	0.2 mg/L	N/A	Health Canada 1991
Cyanobacterial Toxins: Microcystin-LR	1.5 µg/L	N/A	Health Canada 2002b
Diisopropanolamine	21 mg/L	N/A	ENV 2003a
Ethylbenzene	0.14 mg/L	1.6 µg/L	Health Canada 2014b
Fluoride	1.5 mg/L	N/A	Health Canada 2010b
Iron	N/A	0.3 mg/L	Health Canada 1978, 2005
Lead	0.01 mg/L	N/A	Health Canada 1992b
Manganese	N/A	0.05 mg/L	Health Canada 1987c
Mercury	1.0 µg/L	N/A	Health Canada 1986b

[1] Metal guidelines are based on **total** concentrations
[2] Maximum acceptable concentration
[3] Aesthetic objective

Parameter[1]	MAC[2]	AO[3]	Guideline Source (approved, reaffirmed)
Methyl Tertiary-Butyl Ether	N/A	0.015 mg/L	Health Canada 2006b
Microbial Indicators:			
Escherichia coli	Narrative guideline	N/A	ENV 2016
Enterococci	Narrative guideline	N/A	ENV 2016
Molybdenum	0.25 mg/L	N/A	ENV 1986
Nitrate	45 mg/L (nitrate) 10 mg/L (nitrate-N)	N/A	Health Canada 2013c
Nitrite	3.0 mg/L (nitrite) 1.0 mg/L (nitrite-N)	N/A	Health Canada 2013c
Organic Carbon, Total	4.0 mg/L	N/A	ENV 1998
Phosphorus, Total	N/A	0.01 mg/L (lakes)	ENV 1985
Selenium	0.01 mg/L	N/A	ENV 2014
Sulfolane	0.27 mg/L	N/A	ENV 2003b
Sulphate	N/A	500 mg/L	Health Canada 1994
Temperature	N/A	15°C	Health Canada 1979, 2005
Toluene	0.06 mg/L	0.024 mg/L	Health Canada 2014b
Turbidity	See Table 2	N/A	ENV 1997a
Xylenes, Total	0.09 mg/L	0.02 mg/L	Health Canada 2014b
Zinc	N/A	5.0 mg/L	Health Canada 1979, 2005

Table 2. BC source drinking water quality guidelines for turbidity.

Background Turbidity[ŧ]	Guideline
Natural background turbidity ≤ 5 NTU	Induced turbidity[∞] should not exceed 1 NTU at any time
Natural background turbidity ≥ 5 and ≤ 50 NTU	Induced turbidity should not exceed 5 NTU at any time
Natural background turbidity is > 50 NTU	Induced turbidity should not exceed 10% of background

[ŧ]Natural background turbidity should be measured during clear flows. The clear flow period is determined on a site-specific basis; defined as the portion of the hydrograph when suspended sediment concentrations are low (i.e. < 25 mg/L).

∞Induced turbidity results in an increase in turbidity from human (swimming), natural (rainstorm) or biological (phytoplankton growth) causes.

Guideline Update Rationale

Aluminum

SDWQG: 9.5 mg/L (MAC)

Rationale: The BC Land Remediation Section's (ENV 2010) toxicologically derived water standard for use under the Contaminated Sites Regulation 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 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).

Arsenic

SDWQG: **Archived**

Rationale: BC archived the SDWQG for arsenic (As) (ENV 2001) due to a high natural variability in As levels in ambient waters. Health Canada also only has an operational treatment drinking water quality guideline. Given BC's aquatic life WQG of 5 µg/L is more conservative than Health Canada's water quality treatment guideline of 10 µg/L, BC thinks it is reasonable that the aquatic life WQG will protect drinking water sources from potential As degradation in permitting decisions. Health Canada's current As drinking WQG of 10 µg/L or as low as reasonably achievable (ALARA) is an operational water treatment guideline based on treatment achievability (Health Canada 2006a). As arsenic represents a high risk to human health and cannot be removed below 10 µg/L with current drinking water treatment methods, it is essential to ensure source water protection efforts are in place to prevent increases in As from natural background levels.

Benzene

SDWQG: 5.0 µg/L (MAC)

Rationale: BC will continue to use Health Canada's (2009b) total benzene MAC of 5.0 µg/L to protect against bone marrow changes and cancer.

Benzo[a]pyrene

SDWQG: 0.01 µg/L (MAC)

Rationale: Benzo[a]pyrene (BaP) is a polycyclic aromatic hydrocarbon. BC will continue to use Health Canada's (1988) guideline of 0.01 µg/L for BaP due to concerns about its carcinogenic effects to humans.

Boron

SDWQG: 5.0 mg/L (MAC)

Rationale: BC will continue to use Health Canada's (1990) guideline of 5.0 mg/L to prevent adverse health effects from boron exposure. Adverse health effects range from symptoms like vomiting, diarrhoea, irritability and seizures, to death, depending on the dose.

Cadmium

SDWQG: 5.0 µg/L (MAC)

Rationale: BC adopted Health Canada's (1986a) guideline of 5.0 µg/L for cadmium (Cd) based on health considerations. Cd is not an essential element in human nutrition. The main source of Cd intake for humans is from food (Health Canada 1986a); because it is difficult to reduce Cd levels in food, Cd concentrations in drinking water should be maintained as low as possible to avoid overexposure.

Chlorate

SDWQG: 1.0 mg/L (MAC)

Rationale: BC adopted Health Canada's (2008) guideline of 1.0 mg/L for chlorate to reduce formation of disinfection-by-products, a harmful product created when chlorine dioxide is used for drinking water disinfection (Health Canada 2008). In BC, the main

sources of chlorates in the ambient aquatic environment are from pulp mill effluent where chlorine dioxide is used for bleaching (ENV 2002).

Chloride

SDWQG: 250 mg/L (AO)

Rationale: BC will continue to use Health Canada's (1987a) aesthetic objective (AO) 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).

Chlorophenols

SDWQG: See Tables 3 and 4.

Rationale: BC will continue to use Health Canada's (1987b) guidelines for four chlorophenols as toxicity thresholds to prevent risks to human health: 2,4-dichlorophenol (DCP), 2,4,6-trichlorophenol (TCP), 2,3,4,6-tetrachlorophenol (TTCP), and pentachlorophenol (PCP) (Table 3). BC will also continue to use the ENV (1997b) WQGs for total monochlorophenols (MCPs), DCPs, TCPs, TTCPs and PCP (Table 4).

Table 3. BC water quality guidelines for chlorophenols in drinking water sources.

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. BC water quality guidelines for total chlorophenols in drinking water sources.

Chlorophenols, Total	**AO**
Monochlorophenols	0.1 µg/L
Dichlorophenols	0.3 µg/L
Trichlorophenols	2.0 µg/L
Tetrachlorophenols	1.0 µg/L
Pentachlorophenol	0.03 mg/L

Colour, True

SDWQG: 15 TCU (AO)

Rationale: BC will continue to use Health Canada's (1979) AO guideline of 15 total colour units (TCU). Colour may be indirectly linked to health; however, according to Health Canada (1979), the primary concerns for reducing colour have to do with aesthetics. Keeping colour levels ≤ 15 TCUs helps ensure drinking water sources can be treated effectively.

Copper

SDWQG: 1.0 mg/L (AO)

Rationale: BC will continue to use Health Canada's (1992a) AO guideline of 1.0 mg/L for copper to protect against potential laundry and plumbing staining. Adverse health effects occur at much greater levels than this guideline.

Cyanide

SDWQG: 0.2 mg/L (MAC)

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

Cyanobacterial Toxins: Microcystin-LR

SDWQG: 1.5 µg/L (MAC)

Rationale: BC adopted Health Canada's (2002b) guideline of 1.5 mg/L for microcystin-LR to protect against liver effects as microcystin-LR is a hepatotoxin and is classified as a possible carcinogen. This guideline is believed to be protective of human health against exposure to other microcystins (total microcystins) that may also be present. It is further noted to avoid algaecides like copper sulphate in drinking water sources as they may cause toxin release into the water (Health Canada 2002b). The major route of human exposure to cyanobacterial toxins is the consumption of drinking water (Health Canada 2002b).

Diisopropanolamine (DIPA)

SDWQG: 21 mg/L (MAC)

Rationale: BC will continue to use ENV (2003a) SDWQG of 21 mg/L for DIPA to protect human health. Health Canada does not currently have a drinking WQG for DIPA (Health Canada 2014a). Diisopropanolamine 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 2003a).

Ethylbenzene

SDWQG: 0.14 mg/L (MAC), 1.6 µg/L (AO)

Rationale: BC will continue to use Health Canada's (2014b) MAC to protect against cancer and non-cancer health effects, and the AO to protect against unfavorable odour.

Fluoride

SDWQG: 1.5 mg/L (MAC)

Rationale: BC will continue to use Health Canada's (2010b) guideline for fluoride to prevent dental fluorosis.

Iron

SDWQG: 0.3 mg/L (AO)

Rationale: BC adopted Health Canada's (1978) AO guideline of 0.3 mg/L for iron to prevent unpleasant taste and staining of laundry and plumbing fixtures.

Lead

SDWQG: 0.01 mg/L (MAC)

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

Manganese

SDWQG: 0.05 mg/L (AO)

Rationale: BC will continue to use Health Canada's (1987c) AO guideline of 0.05 mg/L for manganese to prevent undesirable tastes and staining to plumbing fixtures and laundry.

Mercury

SDWQG: 1.0 µg/L (MAC)

Rationale: BC will continue to use Health Canada's (1986b) guideline of 1.0 µ/L for mercury. 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).

Methyl Tertiary-Butyl Ether (MTBE)

SDWQG: 0.015 mg/L (AO)

Rationale: BC adopted Health Canada's (2006b) updated guideline of 0.015 mg/L for MTBE. This aesthetic objective is based on odour that would make water unpalatable. The guideline is less than concentrations associated with potential toxic effects and is therefore also considered protective of human health.

Microbiological Indicators of Waterborne Pathogens:

Fecal Coliforms

SDWQG: **Archived**

Rationale: BC archived the fecal coliform indicator guideline (ENV 1988) as it is not the 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) and subsequently, risk to human health. Fecal coliforms can survive at elevated temperatures (44 ± 0.5 °C) and it is assumed they are associated with the gut of warm-blooded animals (Tallon et al. 2005), but this is not always the case. The USEPA (2012) determined that as a group, fecal coliforms were a poor indicator of the risk of digestive

system illness in humans. Fecal coliform standards under the *Drinking Water Protection Regulation* remain unchanged by this guideline update.

Escherichia coli and Enterococci

SDWQG: A narrative guideline is provided. Guidance is provided below to facilitate getting to know what is a common *E. coli* and Enterococci concentration for your drinking water source.

Rationale:

Microbiological Indicators

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. BC recommends the fecal indicator, *Escherichia coli* (*E. coli)*, be used to estimate 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 it also outnumbers the other thermotolerant coliforms in both human and animal excreta (WHO 2003). It is to be noted that not all *E. coli* is pathogenic and the absence of the recommended fecal indicators should not be interpreted to mean that all pathogenic microorganisms are also absent (Health Canada 2012). Enterococci is the preferred fecal bacterial indicator in reservoirs, sewage contaminated waters and marine waters.

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).

Analytical methods and costs limit the ability to monitor for specific pathogens of concern in drinking water sources. Instead, bacterial indicator organisms like non-pathogenic *E. coli* and enterococci are monitored as an indicator of risk of the possible presence of

disease causing pathogens (Health Canada 2013b). However, province wide numerical guidelines for *E.coli* and enterococci in drinking water sources are not practical due to the temporal and spatial variation in microbial concentrations, not only within a waterbody, but across the province (Krewski et al. 2004; Meays et al. 2006). It is not possible to completely eliminate the risk of waterborne disease from pathogens in drinking water sources (Health Canada 2013b), however, it is critical to reduce risks to protect public health through strategies like source water protection (SWP) (Health Canada 2013). Health Canada recognizes the importance of ambient (or source) WQGs in protecting drinking water sources (Health Canada 2002a).

The Multi-Barrier Approach and Source Water Protection

As part of SWP, knowing the background *E. coli* and Enterococci concentration for a particular drinking water source is important in determining if pathogens are present and if there's been an increase.

An established principle in drinking water risk management is to rely on multiple barriers to protect against pathogens. Using a multi-barrier approach minimizes the likelihood that pathogens will pass through the treatment system and be present in consumers drinking water. In any drinking water system, SWP provides the first barrier for the protection of water quality, helps maintain quality over time and decreases the amount of treatment required (HLTH 2012). In BC, the Source-to-Tap Approach has been adopted for the management of drinking water sources (HLTH 2002; HLTH & MWLAP 2004; HLTH 2010). The Drinking Water Source-to-Tap Screening Tool considers potential contaminant sources within 50 metres of the source water intake. These include examining and determining the effect of roads, natural debris, bank erosion, livestock, manure storage, storm water discharges, septic systems, wildlife, forestry, and mining or gas on the watershed (HLTH & MWLAP 2004).

Water Quality Assessment

Measuring the microbial quality of the source water is crucial for determining and assessing variability. Knowing the nature, location and contribution made by individual

microbial contamination sources make it possible to predict peak events and determine effective control measures. Also, measuring water quality parameters that influence the microbial safety of drinking water is valuable in assessing for potential contamination and in helping assess risks to public health. Numerous water quality parameters influence treatment performance and therefore the microbiological safety of drinking water. These non-microbial parameters should be considered when assessing drinking water sources:

Rainfall: Rain can degrade source drinking water quality by driving the movement of pathogens and potentially causing sewer overflow. Although not a measure of fecal loading, rainfall events are useful in predicting source water quality deterioration (CCME 2004).

Flow: It is important to consider the flow rate of surface waters used for drinking. Low flow may lead to microbiological degradation and higher concentrations of pathogens (CCME 2004).

Temperature: High water temperatures can encourage the growth of nuisance organisms in drinking water sources (Health Canada 1995b).

pH: With increasing pH levels, the efficiency of chlorine disinfection decreases during drinking water treatment processes (Health Canada 1995c).

Nutrients: High nutrient (phosphorus, nitrogen) levels may lead to the prolonged survival and growth of *E. coli*, even in the absence of recent fecal contamination (Health Canada 2013a).

Turbidity: Turbidity is an indirect measure of total suspended solids; reflecting the source water pollution level and varying with algal growth and rainfall events. Turbidity is likely the most generally applicable and widely used non-microbial parameter that can provide data about pathogen numbers, as an increase in turbidity in often accompanied by an increase in pathogen concentration (WHO 2003). High turbidity measurements, or measurement fluctuations, can indicate changes in source drinking water quality (Health

Canada 2013b). Further, turbidity levels are important because microorganisms can be intimately associated with suspended particles in the water (Health Canada 2003).

Further source water assessment information can be found in the *Comprehensive Drinking Water Source-to-Tap Assessment Guideline* (HLTH 2010) and *Guidance for the Derivation and Application of Water Quality Objectives in British Columbia* (ENV 2013).

Molybdenum

SDWQG: 0.25 mg/L (MAC)

Rationale: BC will continue to use ENV (1986) molybdenum guideline of 0.25 mg/L. ENV originally developed a SDWQG as there were several molybdenum mines operating in British Columbia and Health Canada does not have a drinking water guideline for molybdenum (Health Canada 2014a). Drainage from molybdenum bearing mineral deposits and molybdenum mines are known sources of molybdenum discharged to surface waters in BC (ENV 1986; Ministry of Energy, Mines and Petroleum Resources 2009). Molybdenum is a trace element considered essential in human nutrition; however excessive intakes may present toxic risks (Health Canada 2010a).

Nitrate

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

Rationale: BC will continue to use Health Canada's (2013c) guideline for nitrate. 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.

Nitrite

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

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

Organic Carbon, Total

SDWQG: 4.0 mg/L (MAC)

Rationale: BC will continue to use ENV (1998) SDWQG 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 (2009a).

pH

SDWQG: **Archived**

Rationale: BC archived the SDWQG for pH (ENV 1991) due to a high natural variability in ambient waters and the 1991 guideline pertaining specifically to disinfection as a treatment requirement. There are other types of drinking water treatment in BC other than just disinfection. As pH control is important during drinking water treatment, Health Canada only has an operational treatment drinking water quality guideline of 7.0 to 10.5 in finished water.

Phosphorus, Total

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

Rationale: BC will continue to use ENV (1985) SDWQG as Health Canada does not currently 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).

Selenium

SDWQG: 0.01 mg/L (MAC)

Rationale: BC developed a provincial Selenium (Se) SDWQG (ENV 2014) of 0.01 mg/L. In 2015, Health Canada updated the Se MAC from 0.01 mg/L to 0.05 mg/L. BC HLTH determined that 0.01 mg/L should remain the MAC for British Columbians to account for specific Se exposure conditions in the Province. Health Canada agrees with the need to take a province specific approach in this situation.

Sulfolane

SDWQG: 0.27 mg/L (MAC)

Rationale: BC will continue to ENV (2003b) guideline of 0.27 mg/L for sulfolane as Health Canada does not currently have a guideline for sulfolane (Health Canada 2014a). Sulfolane is an organic chemical widely used in the sweetening (i.e. removal of acidic gasses) of natural gas.

Sulphate

SDWQG: 500 mg/L (AO)

Rationale: BC will continue to use Health Canada's (1994) AO guideline of 500 mg/L for sulphate . At human exposure to drinking water concentrations above 500 mg/L, diarrhoea or dehydration can occur. This AO also protects against unpleasant taste.

Temperature

SDWQG: 15°C (AO)

Rationale: BC will continue to use Health Canada's (1979) guideline for temperature. 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 can encourage nuisance organisms to grow and lead to unpleasant tastes and odours.

Toluene

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

Rationale: BC adopted Health Canada's (2014b) updated guidelines for toluene. 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.

Turbidity

SDQWG:

Background Turbidity[ŧ]	Guideline
Natural background turbidity ≤ 5 NTU	Induced turbidity[∞] should not exceed 1 NTU at any time
Natural background turbidity ≥ 5 and ≤ 50 NTU	Induced turbidity should not exceed 5 NTU at any time
Natural background turbidity is > 50 NTU	Induced turbidity should not exceed 10% of background

[ŧ]Natural background turbidity should be measured during clear flows. The clear flow period is determined on a site-specific basis; defined as the portion of the hydrograph when suspended sediment concentrations are low (i.e. < 25 mg/L).

[∞]Induced turbidity results in an increase in turbidity from human (swimming), natural (rainstorm) or biological (phytoplankton growth) causes.

Rationale: BC will continue to use ENV (1997a) guidelines for turbidity. Health Canada's turbidity guideline is not appropriate in this case as it is an operational water treatment guideline and does not relate to drinking water sources. Turbidity is caused by biotic and abiotic suspended or dissolved substances in the water body. The amount of drinking water treatment decreases by keeping turbidity within the guideline (ENV 1997).

Xylene, Total

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

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

Zinc

SDWQG: 5.0 mg/L (AO)

Rationale: BC will continue to use Health Canada's (1979) guideline of 5.0 mg/L for zinc . It is an aesthetic objective to prevent an undesirable bitter taste and the formation of a greasy film when water is boiled.

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