



## Canadian Drinking Water Quality Chemical and Physical Parameters\*

Type1	Parameter (approval, reaffirmation)	MAC (mg/L)	Other value (mg/L)	Common sources of parameter in water	Health considerations	Comments
T	Aluminum (1998)	None	OG: < 0.1 (conventional treatment); < 0.2 (other treatment types)	Aluminum salts used as coagulants in drinking water treatment; naturally occurring	There is no consistent, convincing evidence that aluminum in drinking water causes adverse health effects in humans.	The operational guideline applies to treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. For treatment plants using aluminum-based coagulants, monthly samples should be taken of the water leaving the plant; the OGs are based on a running annual average of monthly samples.
I	Ammonia (2013)	None required	None	Naturally occurring; released from agricultural or industrial wastes; added as part of chloramination for drinking water disinfection	Levels of ammonia, either naturally present in the source water or added as part of a disinfection strategy, can affect water quality in the distribution system (e.g., nitrification) and should be monitored.	Guideline value not necessary as it is produced in the body and efficiently metabolized in healthy people; no adverse effects at levels found in drinking water. To help prevent nitrification, limit excess free ammonia entering the distribution system to below 0.1 mg/L, and preferably below 0.05 mg/L, measured as nitrogen. Nitrification can lead to the formation of nitrite/nitrate, decreased chloramine residual and increased bacterial count.
I	Antimony (1997)	0.006	None	Naturally occurring (erosion); soil runoff; industrial effluents; leaching from plumbing materials and solder	<b>Health basis of MAC:</b> Microscopic changes in organs and tissues (thymus, kidney, liver, spleen, thyroid)	MAC takes into consideration analytical achievability; plumbing should be thoroughly flushed before water is used for consumption.
I	Arsenic (2006)	0.010 ALARA	None	Naturally occurring (erosion and weathering of soils, minerals, ores); releases from mining; industrial effluent	<b>Health basis of MAC:</b> Cancer (lung, bladder, liver, skin) (classified as human carcinogen) <b>Other:</b> Skin, vascular and neurological effects (numbness and tingling of extremities)	MAC based on treatment achievability; elevated levels associated with certain groundwaters; levels should be kept as low as reasonably achievable.
I	Asbestos (1989, 2005)	None required	None	Naturally occurring (erosion of asbestos minerals and ores); decay of asbestos-cement pipes	None	Guideline value not necessary; no evidence of adverse health effects from exposure through drinking water.

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P	Atrazine (1993)	0.005	None	Leaching and/or runoff from agricultural use	Health basis of MAC: Developmental effects (reduced body weight of offspring) Other: Potential increased risk of ovarian cancer or lymphomas (classified as possible carcinogen)	MAC applies to sum of atrazine and its N-dealkylated metabolites - diethylatrazine, deisopropylatrazine, hydroxyatrazine, diaminochlorotriazine; Persistent in source waters.
P	Azinphos-methyl (1989, 2005)	0.02	None	Leaching and/or runoff from agricultural use	Health basis of MAC: Neurological effects (plasma cholinesterase)	All uses were phased out by 2012.
I	Barium (1990)	1.0	None	Naturally occurring; releases or spills from industrial uses	Health basis of MAC: Increases in blood pressure, cardiovascular disease	None
O	Benzene (2009)	0.005	None	Releases or spills from industrial uses	Health basis of MAC: Bone marrow (red and white blood cell) changes and cancer (classified as human carcinogen) Other: Blood system and immunological responses	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing.
P	Bromoxynil (1989, 2005)	0.005	None	Leaching or runoff from agricultural use	Health basis of MAC: Reduced liver to body weight ratios	None
I	Cadmium (1986, 2005)	0.005	None	Leaching from galvanized pipes, solders or black polyethylene pipes; industrial and municipal waste	Health basis of MAC: Kidney damage and softening of bone	None
I	Calcium (1987, 2005)	None required	None	Naturally occurring (erosion and weathering of soils, minerals, ores)	None	Guideline value not necessary, as there is no evidence of adverse health effects from calcium in drinking water; calcium contributes to hardness.

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P	Carbaryl (1991, 2005)	0.09	None	Leaching or runoff from agricultural use	Health basis of MAC: Decreased kidney function (may be rapidly reversible after exposure ceases)	None
P	Carbofuran (1991, 2005)	0.09	None	Leaching or runoff from agricultural use	Health basis of MAC: Nervous system effects (cholinesterase inhibition) and growth suppression	None
O	Carbon tetrachloride (2010)	0.002	None	Industrial effluents and leaching from hazardous waste sites	Health basis of MAC: Liver toxicity Other: Kidney damage; liver tumours (classified as probable carcinogen)	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing.
D	Chloramines (1995)	3.0	None	Monochloramine is used as a secondary disinfectant; formed in presence of both chlorine and ammonia	Health basis of MAC: Reduced body weight gain Other: immunotoxicity effects	MAC is for total chloramines based on health effects associated with monochloramine and analytical achievability.
DBP	Chlorate (2008)	1	None	By-product of drinking water disinfection with chlorine dioxide; possible contaminant in hypochlorite solution	Health basis of MAC: Thyroid gland effects (colloid depletion)	As chlorate is difficult to remove once formed, its formation should be controlled by respecting the maximum feed dose of 1.2 mg/L of chlorine dioxide and managing /monitoring formation in hypochlorite solutions.
I	Chloride (1979, 2005)	None	AO: ≤ 250	Naturally occurring (seawater intrusion); dissolved salt deposits, highway salt, industrial effluents, oil well operations, sewage, irrigation drainage, refuse leachates	None	Based on taste and potential for corrosion in the distribution system.
D	Chlorine (2009)	None required	None	Used as drinking water disinfectant	Guideline value not necessary due to low toxicity at concentrations found in drinking water	Free chlorine concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.0 mg/L.

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D	Chlorine dioxide (2008)	None required	None	Used as drinking water disinfectant (primary disinfection only)	A guideline for chlorine dioxide is not required because of its rapid reduction to chlorite in drinking water	A maximum feed dose of 1.2 mg/L of chlorine dioxide should not be exceeded to control the formation of chlorite and chlorate.
DBP	Chlorite (2008)	1	None	By-product of drinking water disinfection with chlorine dioxide	Health basis of MAC: Neurobehavioural effects (lowered auditory startle amplitude, decreased exploratory activity), decreased absolute brain weight, altered liver weights	Chlorite formation should be controlled by respecting the maximum feed dose of 1.2 mg/L of chlorine dioxide and managing /monitoring formation in hypochlorite solutions.
P	Chlorpyrifos (1986)	0.09	None	Leaching and/or runoff from agricultural or other uses	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	Not expected to leach significantly into groundwater.
I	Chromium (1986)	0.05	None	Naturally occurring (erosion of minerals); releases or spills from industrial uses	Health basis of MAC: Enlarged liver, irritation of the skin, respiratory and gastrointestinal tracts from chromium (VI) Other: Chromium (III) is an essential element	MAC is protective of health effects from chromium (VI).
T	Colour (1979, 2005)	None	AO: ≤ 15 TCU	Naturally occurring organic substances, metals; industrial wastes	None	May interfere with disinfection; removal is important to ensure effective treatment.
I	Copper (1992)	None	AO: ≤ 1.0	Naturally occurring; leaching from copper piping	Copper is an essential element in human metabolism. Adverse health effects occur at levels much higher than the aesthetic objective	Based on taste, staining of laundry and plumbing fixtures; plumbing should be thoroughly flushed before water is used for consumption.
I	Cyanide (1991)	0.2	None	Industrial and mining effluents; release from organic compounds	Health basis of MAC: No clinical or other changes at the highest dose tested	Health effects from cyanide are acute; at low levels of exposure, it can be detoxified to a certain extent in the human body.

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O	Cyanobacterial toxins-- Microcystin-LR (2000)	0.0015	None	Naturally occurring (released from blooms of blue-green algae)	Health basis of MAC: Liver effects (enzyme inhibitor)	MAC is protective of total microcystins; avoid algaecides like copper sulphate, as they may cause toxin release into water.
					Other: Classified as possible carcinogen	
P	Diazinon (1986, 2005)	0.02	None	Runoff from agricultural or other uses	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	Not expected to leach significantly into groundwater.
P	Dicamba (1987, 2005)	0.12	None	Leaching or runoff from agricultural or other uses	Health basis of MAC: Liver effects	Readily leaches into groundwater.
					(vacuolization, necrosis, fatty deposits and liver weight changes)	
O	1,2-Dichlorobenzene Table 2 footnote 2 (1987)	0.2	AO: ≤ 0.003	Releases or spills from industrial effluents	Health basis of MAC: Increased blood cholesterol, protein and glucose levels	AO based on odour; levels above the AO would render drinking water unpalatable.
O	1,4-Dichlorobenzene Table 2 footnote 2 (1987)	0.005	AO: ≤ 0.001	Releases or spills from industrial effluents; use of urinal deodorants	Health basis of MAC: Benign liver tumours and adrenal gland tumours (classified as probable carcinogen)	AO based on odour; levels above the AO would render drinking water unpalatable.

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O	1,2-Dichloroethane (2014)	0.005	None	Releases or spills from industrial effluents; leachate from waste disposal	Health basis of MAC: Cancer of the mammary gland (classified as probable carcinogen)	The MAC is protective of both cancer and non-cancer effects and takes into consideration all exposures from drinking water, which include ingestion as well as inhalation and dermal absorption during showering and bathing.
O	1,1-Dichloroethylene (1994)	0.014	None	Releases or spills from industrial effluents	Health basis of MAC: Liver effects (fatty changes)	None
O	Dichloromethane (2011)	0.05	None	Industrial and municipal wastewater discharges	Health basis of MAC: Liver effects (liver foci and areas of cellular alteration). Other: Classified as probable carcinogen	The MAC is protective of both cancer and non-cancer effects and takes into consideration all exposures from drinking water, which include ingestion as well as inhalation and dermal absorption during showering and bathing.
O	2,4-Dichlorophenol (1987, 2005)	0.9	AO: ≤ 0.0003	By-product of drinking water disinfection with chlorine; releases from industrial effluents	Health basis of MAC: Liver effects (cellular changes)	AO based on odour; levels above the AO would render drinking water unpalatable.
P	2,4-Dichlorophenoxy acetic acid (2,4-D) (1991)	0.1	None	Leaching and/or runoff from use as a weed controller; releases from industrial effluents	Health basis of MAC: Kidney effects (tubular cell pigmentation)	None
P	Diclofop-methyl (1987, 2005)	0.009	None	Leaching and/or runoff from use as a weed controller; added directly to water to control aquatic weeds	Health basis of MAC: Liver effects (enlargement and enzyme changes)	Low potential for groundwater contamination.
P	Dimethoate (1986, 2005)	0.02	None	Leaching and/or runoff from residential, agricultural and forestry use	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	None
P	Diquat (1986, 2005)	0.07	None	Leaching and/or runoff from agricultural use; added directly to water to control aquatic weeds	Health basis of MAC: Cataract formation	Unlikely to leach into groundwater.

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P	Diuron (1987, 2005)	0.15	None	Leaching and/or runoff from use in controlling vegetation	Health basis of MAC: Weight loss, increased liver weight and blood effects	High potential to leach into groundwater.
O	Ethylbenzene (2014)	0.14	AO: 0.0016	Emissions, effluents or spills from petroleum and chemical industries	Health basis of MAC: Effects on the liver and pituitary gland. Other: Tumour formation at various sites in animals, including kidney, lung, liver and testes.	MAC is protective of both cancer and non-cancer health effects. MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. AO is based on odour threshold.
I	Fluoride (2010)	0.1 mg/l	None	Naturally occurring (rock and soil erosion); may be added to promote dental health	Health basis of MAC: Moderate dental fluorosis (based on cosmetic effect, not health)	Beneficial in preventing dental caries.
DBP	Formaldehyde (1997)	None required	None	By-product of disinfection with ozone; releases from industrial effluents	None	Guideline value not necessary, as levels in drinking water are below the level at which adverse health effects may occur.
P	Glyphosate (1987, 2005)	0.28	None	Leaching and/or runoff from various uses in weed control	Health basis of MAC: Reduced body weight gain	Not expected to migrate to groundwater.
DBP	<a href="#">Haloacetic acids - Total (HAAs) Table 2 footnote 3 (2008)</a>	0.08 ALAR A	None	By-product of drinking water disinfection with chlorine	Health basis of MAC: Liver cancer (DCA); DCA is classified as probably carcinogenic to humans Other: Other organ cancers (DCA, DBA, TCA); liver and other organ effects (body, kidney and testes weights) (MCA)	Refers to the total of monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA); MAC is based on ability to achieve HAA levels in distribution systems without compromising disinfection; precursor removal limits formation.

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T	Hardness (1979)	None required	None	Naturally occurring (sedimentary rock erosion and seepage, runoff from soils); levels generally higher in groundwater	Although hardness may have significant aesthetic effects, a guideline has not been established because public acceptance of hardness may vary considerably according to the local conditions; major contributors to hardness -- calcium and magnesium -- are not of direct public health concern	Hardness levels between 80 and 100 mg/L (as CaCO <sub>3</sub> ) provide acceptable balance between corrosion and incrustation; where a water softener is used, a separate unsoftened supply for cooking and drinking purposes is recommended.
I	Iron (1978, 2005)	None	AO: ≤ 0.3	Naturally occurring (erosion and weathering of rocks and minerals); acidic mine water drainage, landfill leachates, sewage effluents and iron-related industries	None	Based on taste and staining of laundry and plumbing fixtures; no evidence exists of dietary iron toxicity in the general population.
I	Lead (1992)	0.010	None	Leaching from plumbing (pipes, solder, brass fittings and lead service lines)	Health basis of MAC: Biochemical and neurobehavioural effects (intellectual development, behaviour) in infants and young children (under 6 years) Other: Anaemia, central nervous system effects; in pregnant women, can affect the unborn child; in infants and children under 6 years, can affect intellectual development, behaviour, size and hearing; classified as probably carcinogenic to humans	Because the MAC is based on chronic effects, it is intended to apply to average concentrations in water consumed for extended periods. Exposure to lead should nevertheless be kept to a minimum; plumbing should be thoroughly flushed before water is used for consumption; most significant contribution is generally from lead service line entering the building.
I	Magnesium (1978)	None required	None	Naturally occurring (erosion and weathering of rocks and minerals)	None	Guideline value not necessary, as there is no evidence of adverse health effects from magnesium in drinking water.
P	Malathion (1986, 2005)	0.19	None	Leaching and/or runoff from agricultural and other uses	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	Not expected to leach into groundwater.

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I	Manganese (1987)	None	AO: ≤ 0.05	Naturally occurring (erosion and weathering of rocks and minerals)	None	Based on taste and staining of laundry and plumbing fixtures.
I	Mercury (1986)	0.001	None	Releases or spills from industrial effluents; waste disposal; irrigation or drainage of areas where agricultural pesticides are used	Health basis of MAC: Irreversible neurological symptoms Health basis of MAC: Kidney effects (increased absolute and relative weights, urinary bilirubin, crystals and pH) Other: Systemic, liver, testicular, reproductive/developmental and nervous system effects	Applies to all forms of mercury; mercury generally not found in drinking water, as it binds to sediments and soil.
P	2-Methyl-4-chlorophenoxy acetic acid (MCPA) (2010)	0.1	None	Leaching and/or runoff from agricultural and other uses		Can potentially leach into groundwater.
O	Methyl tertiary-butyl ether (MTBE) (2006)	None	AO: ≤ 0.015	Spills from gasoline refineries, filling stations and gasoline-powered boats; seepage into groundwater from leaking storage tanks	There exist too many uncertainties and limitations in the MTBE database to develop a health based guideline.	AO based on odour; levels above the AO would render water unpalatable; as the AO is lower than levels associated with potential toxicological effects, it is considered protective of human health.
P	Metolachlor (1986)	0.05	None	Leaching and/or runoff from agricultural or other uses	Health basis of MAC: Liver lesions and nasal cavity tumours	Readily binds to organic matter in soil; little leaching expected in soils with high organic and clay content.
P	Metribuzin (1986, 2005)	0.08	None	Leaching and/or runoff from agricultural use	Health basis of MAC: Liver effects (increased incidence and severity of mucopolysaccharide droplets)	Leaching into groundwater depends on the organic matter content of the soil.
O	Monochlorobenzene (1987)	0.08	AO: ≤ 0.03	Releases or spills from industrial effluents	Health basis of MAC: Reduced survival and body weight gain	AO based on odour

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I	Nitrate (2013)	45 as nitrate; 10 as nitrate-nitrogen	None	Naturally occurring; leaching or runoff from agricultural fertilizer use, manure and domestic sewage; may be produced from excess ammonia or nitrification in the distribution system	Health basis of MAC: Methaemoglobinaemia (blue baby syndrome) and effects on thyroid gland function in bottle-fed infants Other: Classified as possible carcinogen under conditions that result in endogenous nitrosation	Systems using chloramine disinfection or that have naturally occurring ammonia should monitor the level of nitrate in the distribution system. Homeowners with a well should test concentration of nitrate in their water supply.
I	Nitritotriacetic acid (NTA) (1990)	0.4	None	Sewage contamination	Health basis of MAC: Kidney effects (nephritis and nephrosis) Other: Classified as possible carcinogen	None
I	Nitrite (2013)	3 as nitrite; 1 as nitrite-nitrogen	None	Naturally occurring; leaching or runoff from agricultural fertilizer use, manure and domestic sewage; may be produced from excess ammonia or nitrification in the distribution system	Health basis of MAC: Methaemoglobinaemia (blue baby syndrome) in bottle-fed infants less than 6 months of age Other: Classified as possible carcinogen under conditions that result in endogenous nitrosation	Systems using chloramine disinfection or that have naturally occurring ammonia should monitor the level of nitrite in the distribution system. Homeowners with a well should test concentration of nitrite in their water supply.
DBP	N-Nitrosodimethylamine (NDMA) (2010)	0.0004	None	By-product of drinking water disinfection with chlorine or chloramines; industrial and sewage treatment plant effluents	Health basis of MAC: Liver cancer (classified as probable carcinogen)	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing.; levels should be kept low by preventing formation during treatment.
A	Odour (1979, 2005)	None	Inoffensive	Biological or industrial sources	None	Important to provide drinking water with no offensive odour, as consumers may seek alternative sources that are less safe.
P	Paraquat (1986, 2005)	0.01 as paraquat dichloride; 0.007 as paraquat ion	None	Leaching and/or runoff from agricultural and other uses; added directly to water to control aquatic weeds	Health basis of MAC: Various effects on body weight, spleen, testes, liver, lungs, kidney, thyroid, heart and adrenal gland	Entry into drinking water unlikely from crop applications (clay binding); however, may persist in water for several days if directly applied to water.

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O	Pentachlorophenol (1987, 2005)	0.06	AO: ≤ 0.03	By-product of drinking water disinfection with chlorine; industrial effluents	Health basis of MAC: Reduced body weight, changes in clinical parameters, histological changes in kidney and liver, reproductive effects (decreased neonatal survival and growth)	AO based on odour; levels above the AO would render drinking water unpalatable.
T	pH (1979)	None	6.5-8.5 Table 2 footnote 4	Not applicable	None	pH can influence the formation of disinfection by-products and effectiveness of treatment.
P	Phorate (1986, 2005)	0.002	None	Leaching and/or runoff from agricultural and other uses	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	Some potential to leach into groundwater.
P	Picloram (1988, 2005)	0.19	None	Leaching and/or runoff from agricultural and other uses	Health basis of MAC: Changes in body and liver weights and clinical chemistry parameters Other: Kidney effects (liver to body weight ratios and histopathology)	Significant potential to leach into groundwater.
I	Selenium (2014)	0.05	None	Naturally occurring (erosion and weathering of rocks and soils) and release from coal ash from coal-fired power plants and mining, refining of copper and other metals.	Health basis of MAC: chronic selenosis symptoms in humans following exposure to high levels Other: Hair loss, tooth decay, weakened nails and nervous system disturbances at extremely high levels of exposure	Selenium is an essential nutrient. Most exposure is from food; little information on toxicity of selenium from drinking water. Selenium can be found in non-leaded brass alloy where it is added to replace lead.
I	Silver (1986, 2005)	None required	None	Naturally occurring (erosion and weathering of rocks and soils)	None	Guideline value not required as drinking water contributes negligibly to an individual's daily intake.
P	Simazine (1986)	0.01	None	Leaching and/or runoff from agricultural and other uses	Health basis of MAC: Body weight changes and effects on serum and thyroid gland	Extent of leaching decreases with increasing organic matter and clay content.

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I	Sodium (1979)	None	AO: ≤ 200	Naturally occurring (erosion and weathering of salt deposits and contact with igneous rock, seawater intrusion); sewage and industrial effluents; sodium-based water softeners	None	Based on taste; where a sodium-based water softener is used, a separate unsoftened supply for cooking and drinking purposes is recommended.
I	Sulphate (1994)	None	AO: ≤ 500	Industrial wastes	High levels (above 500 mg/L) can cause physiological effects such as diarrhoea or dehydration	Based on taste; it is recommended that health authorities be notified of drinking water sources containing sulphate concentrations above 500 mg/L.
I	Sulphide (1992)	None	AO: ≤ 0.05	Can occur in the distribution system from the reduction of sulphates by sulphate-reducing bacteria; industrial wastes	None	Based on taste and odour; levels above the AO would render water unpalatable.
A	Taste (1979, 2005)	None	Inoffensive	Biological or industrial sources	None	Important to provide drinking water with no offensive taste, as consumers may seek alternative sources that are less safe.
T	Temperature (1979, 2005)	None	AO: ≤ 15°C	Not applicable	None	Temperature indirectly affects health and aesthetics through impacts on disinfection, corrosion control and formation of biofilms in the distribution system.
P	Terbufos (1987, 2005)	0.001	None	Leaching and/or runoff from agricultural and other uses	Health basis of MAC: Nervous system effects (cholinesterase inhibition)	Based on analytical achievability.
O	Tetrachloroet hylene (1995)	0.03	None	Industrial effluents or spills	Health basis of MAC: Increased liver and kidney weights Other: Classified as possible carcinogen; limited evidence of an increased risk of spontaneous abortion	Readily leaches into groundwater; MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing.
O	2,3,4,6-Tetrachloroph enol (1986, 2005)	0.1	AO: ≤ 0.001	By-product of drinking water disinfection with chlorine; industrial effluents and use of pesticides	Health basis of MAC: Developmental effects (embryotoxicity)	AO based on odour; levels above the AO would render drinking water unpalatable.

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Type1	Parameter (approval, reaffirmation)	MAC	Other value	Common sources of parameter in water	Health considerations	Comments
O	Toluene (2014)	0.06	AO: 0.024	Emissions, effluents or spills from petroleum and chemical industries	Health basis of MAC: Adverse neurological effects, including vibration thresholds, colour discrimination, auditory thresholds, attention, memory and psychomotor functions Other: Insufficient information to determine whether toluene is carcinogenic to humans.	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. AO is based on odour threshold.
A	Total dissolved solids (TDS) (1991)	None	AO: ≤ 500	Naturally occurring; sewage, urban and agricultural runoff, industrial wastewater	None	Based on taste; TDS above 500 mg/L results in excessive scaling in water pipes, water heaters, boilers and appliances; TDS is composed of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, sulphate and nitrate.
O	Trichloroethylene (2005)	0.005	None	Industrial effluents and spills from improper disposal	Health basis of MAC: Developmental effects (heart malformations) Other: Classified as probable carcinogen	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing.
O	2,4,6-Trichlorophenol (1987, 2005)	0.005	AO: ≤ 0.002	By-product of drinking water disinfection with chlorine; industrial effluents and spills	Health basis of MAC: Liver cancer (classified as probable carcinogen)	AO based on odour; levels above the AO would render drinking water unpalatable.
P	Trifluralin (1989, 2005)	0.045	None	Runoff from agricultural uses	Health basis of MAC: Changes in liver and spleen weights and in serum chemistry	Unlikely to leach into groundwater.
DBP	Trihalomethanes Table 2 footnote 3 (THMs) (2006)	0.1	None	By-product of drinking water disinfection with chlorine; industrial effluents	Health basis of MAC: Liver effects (fatty cysts) (chloroform classified as possible carcinogen) Other: Kidney and colorectal cancers	Refers to the total of chlorodibromomethane, chloroform, bromodichloromethane and bromoform; MAC based on health effects of chloroform. MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection. Recommended strategy is precursor removal. The separate MAC for BDCM was rescinded in April 2009.

\*) According to Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment  
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Type1	Parameter (approval, reaffirmation)	MAC	Other value	Common sources of parameter in water	Health considerations	Comments
I	Uranium (1999)	0.02	None	Naturally occurring (erosion and weathering of rocks and soils); mill tailings; emissions from nuclear industry and combustion of coal and other fuels; phosphate fertilizers	Health basis of MAC: Kidney effects (various lesions); may be rapidly reversible after exposure ceases	Based on treatment achievability; MAC based on chemical effects, as uranium is only weakly radioactive; uranium is rapidly eliminated from the body.
O	Vinyl chloride (2013)	0.002 ALAR A	None	Industrial effluents; degradation product from organic solvents in groundwater; leaching from polyvinyl chloride pipes	Health basis of MAC: Liver cancer (classified as human carcinogen) Other: Raynaud's disease, effects on bone, circulatory system, thyroid, spleen, central nervous system	Based on analytical achievability. MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. Leaching from polyvinyl chloride pipe is not expected to be significant.
O	Xylenes (total) (2014)	0.09	AO: 0.02	Emissions, effluents or spills from petroleum and chemical industries	Health basis of MAC: Adverse neuromuscular effects Other: Insufficient information to determine whether xylenes are carcinogenic to humans.	MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. AO is based on odour threshold.
I	Zinc (1979, 2005)		AO: ≤ 5.0	Naturally occurring; industrial and domestic emissions; leaching may occur from galvanized pipes, hot water tanks and brass fittings	None	AO based on taste; water with zinc levels above the AO tends to be opalescent and develops a greasy film when boiled; plumbing should be thoroughly flushed before water is consumed.

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Microbiological Parameters\*

Parameter (approval)	Guideline	Common sources	Health considerations	Applying the guideline
Enteric protozoa: <i>Giardia</i> and <i>Cryptosporidium</i> (2012)	Treatment goal: Minimum 3 log removal and/or inactivation of cysts and oocysts	Human and animal faeces	<i>Giardia</i> and <i>Cryptosporidium</i> are commonly associated with gastrointestinal upset (nausea, vomiting, diarrhoea). Less common health effects vary. <i>Giardia</i> infections may include prolonged gastrointestinal upset, malaise and malabsorption. <i>Cryptosporidium</i> infections, in immunocompromised individuals, can occur outside the gastrointestinal tract including in the lungs, middle ear, and pancreas.	Monitoring for <i>Cryptosporidium</i> and <i>Giardia</i> in source waters will provide valuable information for a risk-based assessment of treatment requirements. Depending on the source water quality, a greater log removal and/or inactivation may be required.
Enteric viruses (2011)	Treatment goal: Minimum 4 log reduction (removal and/or inactivation) of enteric viruses	Human faeces	Commonly associated with gastrointestinal upset (nausea, vomiting, diarrhoea); less common health effects can include respiratory symptoms, central nervous system infections, liver infections and muscular syndromes.	Routine monitoring for viruses is not practical; characterize source water to determine if greater than a 4 log removal or inactivation is necessary.
<i>Escherichia coli</i> ( <i>E. coli</i> ) (2012)	MAC: None detectable per 100 mL	Human and animal faeces	The presence of <i>E. coli</i> indicates recent faecal contamination and the potential presence of microorganisms capable of causing gastrointestinal illnesses; pathogens in human and animal faeces pose the most immediate danger to public health.	<i>E. coli</i> is used as an indicator of the microbiological safety of drinking water; if detected, enteric pathogens may also be present. <i>E. coli</i> monitoring should be used, in conjunction with other indicators, as part of a multi-barrier approach to producing drinking water of an acceptable quality.
Total coliforms (2012)	MAC of none detectable/100 mL in water leaving a treatment plant and in non-disinfected groundwater leaving the well	Human and animal faeces; naturally occurring in water, soil and vegetation	Total coliforms are not used as indicators of potential health effects from pathogenic microorganisms; they are used as a tool to determine how well the drinking water treatment system is operating and to indicate water quality changes in the distribution system. Detection of total coliforms from consecutive samples from the same site or from more than 10% of the samples collected in a given sampling period should be investigated.	Total coliforms should be monitored in the distribution system because they are used to indicate changes in water quality. In <b>water leaving a treatment plant</b> , total coliforms should be measured in conjunction with other indicators to assess water quality; the presence of total coliforms indicates a serious breach in treatment. In a <b>distribution and storage system</b> , detection of total coliforms can indicate regrowth of the bacteria in biofilms or intrusion of untreated water. In <b>non-disinfected groundwater</b> , the presence of total coliforms may indicate that the system is vulnerable to contamination, or it may be a sign of bacterial regrowth.

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Parameter (approval)	Guideline	Common sources	Health considerations	Applying the guideline
Turbidity (2012)	Treatment limits for individual filters or units: Conventional and direct filtration: $\leq 0.3$ NTU Table 1 footnote 1 slow sand and diatomaceous earth filtration: $\leq 1.0$ NTU Table 1 footnote 2 membrane filtration: $\leq 0.1$ NTU Table 1 footnote 3	Naturally occurring particles: <i>Inorganic</i> : clays, silts, metal precipitates <i>Organic</i> : decomposed plant & animal debris, microorganisms	Filtration systems should be designed and operated to reduce turbidity levels as low as reasonably achievable and strive to achieve a treated water turbidity target from individual filters of less than 0.1 NTU. Particles can harbour microorganisms, protecting them from disinfection, and can entrap heavy metals and biocides; elevated or fluctuating turbidity in filtered water can indicate a problem with the water treatment process and a potential increased risk of pathogens in treated water.	Guidelines apply to individual filter turbidity for systems using surface water or groundwater under the direct influence of surface water. The decision to exempt a waterworks from filtration should be made by the appropriate authority based on site-specific considerations, including historical and ongoing monitoring data. To ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less. For systems that use groundwater, turbidity should generally be below 1.0 NTU.

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**Radiological Parameters\***

Parameter (approval)	MAC (Bq/L)	Common sources	Health basis of MAC	Comments
Cesium-137 (2009)	10	Nuclear weapons fallout and emissions from nuclear reactors	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	None
Iodine-131 (2009)	6	Sewage effluent	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	None
Lead-210 (2009)	0.2	Naturally occurring (decay product of radon)	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	Corresponds to total lead concentration of $7 \times 10^{-8}$ µg/L
Radium-226 (2009)	0.5	Naturally occurring	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	None
Radon (2009)	None required	Naturally occurring (leaching from radium-bearing rocks and soils; decay product of radium-226)	Health risk from ingestion considered negligible due to high volatility	Mainly a groundwater concern; if concentrations in drinking water exceed 2000 Bq/L actions should be taken to reduce release into indoor air (e.g. proper venting of drinking water supply)
Strontium-90 (2009)	5	Nuclear weapons fallout	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	None
Tritium (2009)	7000	Naturally occurring (cosmogenic radiation); releases from nuclear reactors	Cancer of the lung, breast, thyroid, bone, digestive organs and skin; leukaemia	Not removed by drinking water treatment
Uranium (1999)	N/A	None	MAC based on chemical properties	See information for Chemical and Physical Parameters

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### Acronyms

A	acceptability (parameter type)
ALARA	as low as reasonably achievable
AO	aesthetic objective
CDW	Committee on Drinking Water (FPT)
D	disinfectant (parameter type)
DBP	disinfectant by-product (parameter type)
HPC	heterotrophic plate count
I	inorganic chemical (parameter type)
MAC	maximum acceptable concentration
NTU	nephelometric turbidity units
O	organic chemical (parameter type)
OG	operational guidance value
P	pesticide (parameter type)
T	treatment-related (parameter type)
TCU	true colour units

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