



# Guidelines for Canadian Drinking Water Quality

## Summary Table

*Prepared by the*  
Federal-Provincial-Territorial Committee on Drinking Water  
of the  
Federal-Provincial-Territorial Committee  
on Health and the Environment

March 2006

The *Guidelines for Canadian Drinking Water Quality* are published by Health Canada on behalf of the Federal-Provincial-Territorial Committee on Drinking Water (CDW). This summary table is updated regularly and published on Health Canada's web site ([www.healthcanada.gc.ca/waterquality](http://www.healthcanada.gc.ca/waterquality)). It supersedes all previous versions, as well as the published booklet of the *Sixth Edition of the Guidelines for Canadian Drinking Water Quality*.

These guidelines are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and on the availability of treatment and analytical technologies. Aesthetic effects (e.g., taste, odour) are taken into account when these play a role in determining whether consumers will consider the water drinkable. Operational considerations are factored in when the presence of a substance may interfere with or impair a treatment process or technology (e.g., turbidity interfering with chlorination or UV disinfection) or adversely affect drinking water infrastructure (e.g., corrosion of pipes).

In general, the highest priority guidelines are those dealing with microbiological contaminants, such as bacteria, protozoa and viruses. Any measure taken to reduce concentrations of chemical contaminants should not compromise the effectiveness of disinfection.

Inquiries can be directed to: [water\\_eau@hc-sc.gc.ca](mailto:water_eau@hc-sc.gc.ca)

## Table of Contents

Membership of the Federal-Provincial-Territorial Committee on Drinking Water . . . . .	3
New, revised, reaffirmed and proposed guidelines . . . . .	4
Table 1. New and revised guidelines . . . . .	4
Table 2. Reaffirmed guidelines . . . . .	5
Table 3. Proposed Guidelines . . . . .	6
Guidelines for microbiological parameters . . . . .	7
Bacteriological guidelines . . . . .	7
Protozoa . . . . .	7
Viruses . . . . .	8
Boil water advisories . . . . .	8
Turbidity . . . . .	8
Guidelines for chemical and physical parameters . . . . .	9
Table 4. Parameters with guidelines . . . . .	9
Table 5. Parameters without numerical guidelines . . . . .	12
Table 6. Parameters that have been archived . . . . .	12
Guidelines for radiological parameters . . . . .	13
Table 7. Primary List of Radionuclides . . . . .	14
Table 8. Secondary list of radionuclides . . . . .	15

## Membership of the Federal-Provincial-Territorial Committee on Drinking Water

### Jurisdictional representatives

Alberta	Department of Environment	Mr. Karu Chinniah
British Columbia	Ministry of Health Services	Mr. Barry Boettger
Manitoba	Department of Water Conservation	Mr. Don Rocan
New Brunswick	Department of Health and Wellness	Mr. Ivan Brophy
Newfoundland and Labrador	Department of Environment and Conservation	Mr. Martin Goebel
Northwest Territories	Stanton Territorial Health Authority	Mr. Duane Fleming
Nova Scotia	Department of Environment and Labour	Ms. Judy MacDonald
Nunavut Territory	Department of Health and Social Services	Mr. Bruce Trotter
Ontario	Ministry of the Environment	Dr. Satish Deshpande
Prince Edward Island	Department of Environment, Energy and Forestry	Mr. George Somers
Québec	Ministère du Développement durable, de l'Environnement et des Parcs	Ms. Caroline Robert
Saskatchewan	Department of the Environment	Mr. Sam Ferris
Yukon Territory	Department of Health and Social Services	Ms. Patricia Brooks
Canada	Department of Health	Dr. John Cooper

### Liaison officers

Federal-Provincial-Territorial Committee on Health and the Environment (CHE)	Dr. Jim Popplow
Environment Canada/Canadian Council of Ministers of the Environment	Dr. Doug Spry
Canadian Advisory Council on Plumbing	Mr. Tim Macaulay

### Committee secretary

Health Canada (Water Quality and Health Bureau, Safe Environments Programme, Healthy Environments and Consumer Safety Branch)	Mr. David Green
----------------------------------------------------------------------------------------------------------------------------------	-----------------

*Guidelines for Canadian Drinking Water Quality—Summary Table***New, revised, reaffirmed and proposed guidelines**

Guidelines for several chemical, physical and microbiological parameters are new or have been revised since the publication of the *Sixth Edition of the Guidelines for Canadian Drinking Water Quality* in 1996. These new and revised guidelines are presented in Table 1.

**Table 1. New and revised guidelines**

Parameter	Guideline (mg/L)	Previous guideline (mg/L)	CHE approval
<i>Microbiological parameters<sup>a</sup></i>			
Bacteriological		0 coliforms/100 mL	
<i>E. coli</i>	0 per 100 mL		2006
Total coliforms	0 per 100 mL		2006
Heterotrophic plate count	No numerical guideline required		2006
Emerging pathogens	No numerical guideline required		2006
Protozoa	No numerical guideline required	None	2004
Enteric viruses	No numerical guideline required	None	2004
Turbidity	0.3/1.0/0.1 NTU <sup>b</sup>	1.0 NTU	2004
<i>Chemical and physical parameters</i>			
Aluminum	0.1/0.2 <sup>c</sup>	None	1999
Antimony	0.006	None	1997
Bromate	0.01	None	1999
Cyanobacterial toxins—microcystin-LR	0.0015	None	2002
Fluoride	1.5	1.5	1996
Formaldehyde	No numerical guideline required	None	1998
Trichloroethylene (TCE)	0.005	0.05	2005
Uranium	0.02	0.1	2000

<sup>a</sup>Refer to section on Guidelines for microbiological parameters.

<sup>b</sup>Based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

<sup>c</sup>This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.

*Guidelines for Canadian Drinking Water Quality—Summary Table*

The Federal-Provincial-Territorial Committee on Drinking Water has established a science-based process to systematically review older guidelines to assess the need to update them. Table 2 provides the list of parameters whose guidelines remain appropriate and have been reaffirmed as a result of this review. Health Canada and the FPT Committee on Drinking Water will continue to monitor research on these parameters and recommend any revision(s) to the guidelines that is deemed necessary.

**Table 2. Reaffirmed guidelines (2005)**

Asbestos	Colour	Glyphosate	Silver
Azinphos-methyl	Cyanazine	Iron	Taste
Bendiocarb	Diazinon	Magnesium	Temperature
Benzo(a)pyrene	Dicamba	Malathion	Terbufos
Bromoxynil	2,4-Dichlorophenol	Methoxychlor	2,3,4,6-Tetrachlorophenol
Cadmium	Diclofop-methyl	Metribuzin	Toluene
Calcium	Dimethoate	Odour	2,4,6-Trichlorophenol
Carbaryl	Diquat	Paraquat	Trifluralin
Carbofuran	Diuron	Phorate	Xylenes
Chloride	Gasoline	Picloram	Zinc

## Guidelines for Canadian Drinking Water Quality—Summary Table

Table 3 outlines the guidelines which are being or have been developed and are awaiting approval through the Federal-Provincial-Territorial process. All current public consultation documents are available on Health Canada's web site ([www.healthcanada.gc.ca/waterquality](http://www.healthcanada.gc.ca/waterquality)).

**Table 3. Proposed Guidelines** (not yet approved)

Parameter	Proposed guideline (mg/L)		Current status
	MAC <sup>a</sup>	AO <sup>a</sup>	
Arsenic	0.005		Consultation concluded <sup>c</sup>
Bromodichloromethane (BDCM) <sup>b</sup>	0.016		Consultation concluded <sup>c</sup>
Chloral hydrate			In preparation
Chlorite	1.0		Consultation concluded <sup>c</sup>
Chlorate	1.0		
Chlorine dioxide	NNGP <sup>a</sup>		
Haloacetic Acids—Total (HAAs)			In preparation
2-Methyl-4-chlorophenoxyacetic acid (MCPA)			In preparation
Methyl <i>tertiary</i> -butyl ether (MTBE)		0.015	Consultation concluded <sup>c</sup>
Potassium			In preparation
Radiological Characteristics			In preparation
Trihalomethanes—Total (THMs)	0.1		Consultation concluded <sup>c</sup>

<sup>a</sup>MAC = maximum acceptable concentration; AO = aesthetic objective; NNGP = no numerical guideline proposed.

<sup>b</sup>Refer to Trihalomethane document.

<sup>c</sup>Final guideline technical document in preparation

## Guidelines for microbiological parameters

### Bacteriological guidelines

#### *Escherichia coli*

The maximum acceptable concentration (MAC) of *Escherichia coli* in public, semi-public, and private drinking water systems is none detectable per 100 mL.

Testing for *E. coli* should be carried out in all drinking water systems. The number, frequency, and location of samples for *E. coli* testing will vary according to the type and size of the system and jurisdictional requirements.

#### Total coliforms

The MAC of total coliforms in water leaving a treatment plant in a public system and throughout semi-public and private supply systems is none detectable per 100 mL.

For distribution systems in public supplies where fewer than 10 samples are collected in a given sampling period, no sample should contain total coliform bacteria. In distribution systems where greater than 10 samples are collected in a given sampling period, no consecutive samples from the same site or not more than 10% of samples should show the presence of total coliform bacteria.

Testing for total coliforms should be carried out in all drinking water systems. The number, frequency, and location of samples for total coliform testing will vary according to the type and size of the system and jurisdictional requirements.

#### Heterotrophic plate count

No MAC is specified for heterotrophic plate count (HPC) bacteria in water supplied by public, semi-public, or private drinking water systems. Instead, increases in HPC concentrations above baseline levels are considered undesirable.

#### Emerging pathogens

No MAC for current or emerging bacterial waterborne pathogens has been established. Current bacterial waterborne pathogens include those that have been previously linked to gastrointestinal illness in human populations. Emerging bacterial waterborne pathogens include, but are not limited to, *Legionella*, *Mycobacterium avium* complex, *Aeromonas hydrophila*, and *Helicobacter pylori*.

#### Protozoa

Although *Giardia* and *Cryptosporidium* can be responsible for severe and, in some cases, fatal gastrointestinal illness, it is not possible to establish MACs for these protozoa in drinking water at this time. Routine methods available for the detection of cysts and oocysts suffer from low recovery rates and do not provide any information on their viability or human infectivity. Nevertheless, until better monitoring data and information on the viability and infectivity of cysts and oocysts present in drinking water are available, measures should be implemented to reduce the risk of illness as much as possible. If the presence of viable, human-infectious cysts or oocysts is known or suspected in source waters, or if *Giardia* or *Cryptosporidium* has been responsible for past waterborne outbreaks in a community, a treatment and distribution regime and a watershed or wellhead protection plan (where feasible) or other measures known to reduce the risk of illness should be implemented. Treatment technologies in place should achieve at least a 3-log reduction in and/or inactivation of cysts and oocysts, unless source water quality requires a greater log reduction and/or inactivation.

## Viruses

Although enteric viruses can be responsible for severe and, in some cases, fatal illnesses, it is not possible to establish MACs for enteric viruses in drinking water at this time. Treatment technologies and watershed or wellhead protection measures known to reduce the risk of waterborne outbreaks should be implemented and maintained if source water is subject to faecal contamination or if enteric viruses have been responsible for past waterborne outbreaks. Where treatment is required, treatment technologies should achieve at least a 4-log reduction and/or inactivation of viruses.

## Boil water advisories

General guidance on the issuing and rescinding of boil water advisories is provided. In the event of an advisory, a rolling boil for 1 minute is considered adequate.

## Turbidity

Waterworks systems that use a surface water source or a groundwater source under the direct influence of surface water should filter the source water to meet the following health-based turbidity limits, as defined for specific treatment technologies. Where possible, filtration systems should be designed and operated to reduce turbidity levels as low as possible, with a treated water turbidity target of less than 0.1 NTU at all times. Where this is not achievable, the treated water turbidity levels from individual filters:

1. For **chemically assisted filtration**, shall be less than or equal to **0.3 NTU** in at least 95% of the measurements made, or at least 95% of the time each calendar month, and shall not exceed 1.0 NTU at any time.
2. For **slow sand or diatomaceous earth filtration**, shall be less than or equal to **1.0 NTU** in at least 95% of the measurements made, or at least 95% of the time each calendar month, and shall not exceed 3.0 NTU at any time.
3. For **membrane filtration**, shall be less than or equal to **0.1 NTU** in at least 99% of the measurements made, or at least 99% of the time each calendar month, and shall not exceed 0.3 NTU at any time. If membrane filtration is the sole treatment technology employed, some form of virus inactivation<sup>1</sup> should follow the filtration process.

It is not expected that all water supplies will be able to meet this revised turbidity guideline immediately. Therefore, supplementary treatment should be considered in the interim to ensure delivery of safe drinking water.

---

<sup>1</sup>Some form of virus inactivation is required for all technologies. The difference is that chemically assisted, slow sand and diatomaceous earth filters are credited with log virus reductions and membrane filters receive no credit.



*Guidelines for Canadian Drinking Water Quality—Summary Table***Guidelines for chemical and physical parameters**

Table 4 provides the complete list of all current numerical Guidelines for chemical and physical parameters. Parameters for which the health-based guideline was developed as an interim maximum acceptable concentration (IMAC) are identified with an asterisk (\*) in the table below. The use of these 'interim' MACs was discontinued by the Federal-Provincial-Territorial Committee on Drinking Water in 2003. For more information on specific guidelines, please refer to the guideline technical document for the parameter of concern.

**Table 4. Parameters with guidelines**

Parameter	Health-based guideline (mg/L)	AO [or OG] (mg/L)	Year of approval or reaffirmation
Aldicarb	0.009		1994
Aldrin + dieldrin	0.0007		1994
Aluminum <sup>a</sup>		[0.1/0.2]	1998
*Antimony <sup>b</sup>	0.006		1997
*Arsenic	0.025		1989
*Atrazine + metabolites	0.005		1993
Azinphos-methyl	0.02		2005
Barium	1		1990
Bendiocarb	0.04		1986
Benzene	0.005		1986
Benzo[a]pyrene	0.00001		2005
*Boron	5		1990
*Bromate	0.01		1998
*Bromoxynil	0.005		2005
Cadmium	0.005		2005
Carbaryl	0.09		2005
Carbofuran	0.09		2005
Carbon tetrachloride	0.005		1986
Chloramines—total	3		1995
Chloride		≤250	2005
Chlorpyrifos	0.09		1986
Chromium	0.05		1986
Colour <sup>d</sup>		≤15 TCU	2005
Copper <sup>b</sup>		≤1.0	1992
*Cyanazine	0.01		2005
Cyanide	0.2		1991

## Guidelines for Canadian Drinking Water Quality—Summary Table

Parameter	Health-based guideline (mg/L)	AO [or OG] (mg/L)	Year of approval or reaffirmation
Cyanobacterial toxins—Microcystin-LR <sup>c</sup>	0.0015		2002
Diazinon	0.02		2005
Dicamba	0.12		2005
1,2-Dichlorobenzene <sup>e</sup>	0.2	≤0.003	1987
1,4-Dichlorobenzene <sup>e</sup>	0.005	≤0.001	1987
*1,2-Dichloroethane	0.005		1987
1,1-Dichloroethylene	0.014		1994
Dichloromethane	0.05		1987
2,4-Dichlorophenol,	0.9	≤0.0003	2005
*2,4-Dichlorophenoxyacetic acid (2,4 -D)	0.1		1991
Diclofop-methyl	0.009		1987
*Dimethoate	0.02		2005
Dinoseb	0.01		1991
Diquat	0.07		2005
Diuron	0.15		2005
Ethylbenzene		≤0.0024	1986
Fluoride	1.5		1996
*Glyphosate	0.28		2005
Iron		≤0.3	2005
Lead <sup>b</sup>	0.01		1992
Malathion	0.19		2005
Manganese		≤0.05	1987
Mercury	0.001		1986
Methoxychlor	0.9		2005
*Metolachlor	0.05		1986
Metribuzin	0.08		2005
Monochlorobenzene	0.08	≤0.03	1987
Nitrate <sup>f</sup>	45		1987
Nitilotriacetic acid (NTA)	0.4		1990
Odour		Inoffensive	2005
*Paraquat (as dichloride) <sup>g</sup>	0.01		2005
Parathion	0.05		1986
Pentachlorophenol	0.06	≤0.030	1987
pH <sup>h</sup>		6.5–8.5	1995

## Guidelines for Canadian Drinking Water Quality—Summary Table

Parameter	Health-based guideline (mg/L)	AO [or OG] (mg/L)	Year of approval or reaffirmation
Phorate	0.002		2005
*Picloram	0.19		2005
Selenium	0.01		1992
*Simazine	0.01		1986
Sodium <sup>i</sup>		≤200	1992
Sulphate <sup>j</sup>		≤500	1994
Sulphide (as H <sub>2</sub> S)		≤0.05	1992
Taste		Inoffensive	2005
Temperature		≤15°C	2005
*Terbufos	0.001		2005
Tetrachloroethylene	0.03		1995
2,3,4,6-Tetrachlorophenol	0.1	≤0.001	2005
Toluene		≤0.024	2005
Total dissolved solids (TDS)		≤500	1991
Trichloroethylene	0.005		2005
2,4,6-Trichlorophenol	0.005	≤0.002	2005
*Trifluralin	0.045		2005
*Trihalomethanes-total (THMs) <sup>k</sup>	0.1		1993
Turbidity <sup>l</sup>			2004
*Uranium	0.02		1999
Vinyl chloride	0.002		1992
Xylenes—total		≤0.3	2005
Zinc <sup>b</sup>		≤5.0	2005

<sup>a</sup>This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.

<sup>b</sup>Faucets should be thoroughly flushed before water is taken for consumption or analysis.

<sup>c</sup>The guideline is considered protective of human health against exposure to other microcystins (total microcystins) that may also be present.

<sup>d</sup>TCU = true colour unit.

<sup>e</sup>In cases where total dichlorobenzenes are measured and concentrations exceed the most stringent value (0.005 mg/L), the concentrations of the individual isomers should be established.

<sup>f</sup>Equivalent to 10 mg/L as nitrate–nitrogen. Where nitrate and nitrite are determined separately, levels of nitrite should not exceed 3.2 mg/L.

<sup>g</sup>Equivalent to 0.007 mg/L for paraquat ion.

<sup>h</sup>No units.

<sup>i</sup>It is recommended that sodium be included in routine monitoring programmes, as levels may be of interest to authorities who

---

**Guidelines for Canadian Drinking Water Quality—Summary Table**


---

wish to prescribe sodium-restricted diets for their patients.

<sup>j</sup>There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L.

<sup>k</sup>Expressed as a running annual average. The guideline is based on the risk associated with chloroform, the trihalomethane most often present and in greatest concentration in drinking water.

<sup>l</sup>Refer to section on Guidelines for microbiological parameters for information related to various treatment processes.

### Parameters without guidelines

Some chemical and physical parameters for which a Guideline Technical Document is available have been identified as not requiring a numerical guideline, because currently available data indicate that it poses no health risk or aesthetic problem at the levels generally found in drinking water in Canada.

**Table 5. Parameters without numerical guidelines**

---

Ammonia	Asbestos
Calcium	Formaldehyde
Gasoline	Hardness <sup>a</sup>
Magnesium	Radon
Silver	

---

<sup>a</sup>Public acceptance of hardness varies considerably. Generally, hardness levels between 80 and 100 mg/L (as CaCO<sub>3</sub>) are considered acceptable; levels greater than 200 mg/L are considered poor but can be tolerated; those in excess of 500 mg/L are normally considered unacceptable. Where water is softened by sodium ion exchange, it is recommended that a separate, unsoftened supply be retained for culinary and drinking purposes.

### Archived parameters

The Federal-Provincial-Territorial Committee on Drinking Water has established a science-based process to systematically review older guidelines and archive older guidelines which are no longer required. Guidelines are archived for parameters which are no longer found in Canadian drinking water supplies at levels that could pose a risk to human health, including pesticides which are no longer registered for use in Canada, and for mixtures of contaminants that are addressed individually. Table 6 provides the list of parameters whose guidelines have been archived as a result of this review.

**Table 6. Parameters that have been archived<sup>a</sup>**

---

Chlordane (total isomers) <sup>b</sup>	Polychlorinated biphenyls (PCBs)
Dichlorodiphenyltrichloroethane (DDT) + metabolites <sup>b</sup>	Polycyclic aromatic hydrocarbons (PAH) <sup>c</sup>
Endrin <sup>b</sup>	Resin acids
Heptachlor + heptachlor epoxide <sup>b</sup>	Tannin
Lignin <sup>b</sup>	Temephos <sup>d</sup>
Lindane <sup>b</sup>	Total organic carbon (TOC)
Methyl-parathion <sup>b</sup>	Toxaphene <sup>b</sup>
Mirex	Triallate <sup>d</sup>
Pesticides (total)	2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) <sup>d</sup>
Phenols (total)	2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) <sup>b</sup>
Phthalic acid esters (PAE)	

---

<sup>a</sup>Published in the 1978 version of the *Supporting Documentation* for these parameters (available upon request).

<sup>b</sup>In 1978 'Pesticides' Supporting Documentation.

<sup>c</sup>Other than benzo[a]pyrene.

<sup>d</sup>No documentation available.

## Guidelines for radiological parameters

In setting dose guidelines for radionuclides in drinking water, it is recognized that water consumption contributes only a portion of the total radiation dose and that some radionuclides present are natural in origin and therefore cannot be excluded. Consequently, maximum acceptable concentrations for radionuclides in drinking water have been derived based on a committed effective dose of 0.1 mSv<sup>2</sup> from one year's consumption of drinking water. This dose represents less than 5% of the average annual dose attributable to natural background radiation.

To facilitate the monitoring of radionuclides in drinking water, the reference level of dose is expressed as an activity concentration, which can be derived for each radionuclide from published radiological data. The National Radiological Protection Board has calculated dose conversion factors (DCFs) for radionuclides based on metabolic and dosimetric models for adults and children. Each DCF provides an estimate of the 50-year committed effective dose resulting from a single intake of 1 Bq<sup>3</sup> of a given radionuclide.

The MACs of radionuclides in public water supplies are derived from adult DCFs, assuming a daily water intake of 2 L, or 730 L/year, and a maximum committed effective dose of 0.1 mSv, or 10% of the International Commission on Radiological Protection limit on public exposure:

$$\text{MAC (Bq/L)} = \frac{1 \times 10^{-4} \text{ (Sv/year)}}{730 \text{ (L/year)} \times \text{DCF (Sv/Bq)}}$$

When two or more radionuclides are found in drinking water, the following relationship should be satisfied:

$$\frac{C_1}{\text{MAC}_1} + \frac{C_2}{\text{MAC}_2} + \dots + \frac{C_i}{\text{MAC}_i} \leq 1$$

where  $C_i$  and  $\text{MAC}_i$  are the observed and maximum acceptable concentrations, respectively, for each contributing radionuclide.

MACs for radionuclides that should be monitored in water samples are listed in Table 7. If a sample is analysed by gamma-spectroscopy, additional screening for radionuclides that may be present under certain conditions can be performed. MACs for these radionuclides are given in Table 8. MACs for a number of additional radionuclides, both natural and artificial, can be found in the sixth edition of the guidelines booklet.

Water samples may be initially screened for radioactivity using techniques for gross alpha and gross beta activity determinations. Compliance with the guidelines may be inferred if the measurements for gross alpha and gross beta activity are less than 0.1 Bq/L and 1 Bq/L, respectively, as these are lower than the strictest MACs. Sampling and analyses should be carried out often enough to accurately characterize the annual exposure. If the source of the activity is known, or expected, to be changing rapidly with time, then the sampling frequency should reflect this factor. If there is no reason to suppose

<sup>2</sup>Sievert (Sv) is the unit of radiation dose. It replaces the old unit, rem (1 rem = 0.01 Sv)

<sup>3</sup>Becquerel (Bq) is the unit of activity of a radioactive substance, or the rate at which transformations occur in the substance. One becquerel is equal to one transformation per second and is approximately equal to 27 picocuries (pCi).

*Guidelines for Canadian Drinking Water Quality—Summary Table*

that the source varies with time, then the sampling may be done annually. If measured concentrations are consistent and well below the reference levels, this would be an argument for reducing the sampling frequency. On the other hand, the sampling frequency should be maintained, or even increased, if concentrations are approaching the reference levels. In such a case, the specific radionuclides should be identified and individual activity concentrations measured.

**Table 7. Primary List of Radionuclides**

Radionuclide		Half-life $t_{1/2}$	DCF (Sv/Bq)	MAC (Bq/L)
<i>Natural radionuclides</i>				
Lead-210	<sup>210</sup> Pb	22.3 years	$1.3 \times 10^{-6}$	0.1
Radium-224	<sup>224</sup> Ra	3.66 days	$8.0 \times 10^{-8}$	2
Radium-226	<sup>226</sup> Ra	1600 years	$2.2 \times 10^{-7}$	0.6
Radium-228	<sup>228</sup> Ra	5.76 years	$2.7 \times 10^{-7}$	0.5
Thorium-228	<sup>228</sup> Th	1.91 years	$6.7 \times 10^{-8}$	2
Thorium-230	<sup>230</sup> Th	$7.54 \times 10^4$ years	$3.5 \times 10^{-7}$	0.4
Thorium-232	<sup>232</sup> Th	$1.40 \times 10^{10}$ years	$1.8 \times 10^{-6}$	0.1
Thorium-234	<sup>234</sup> Th	24.1 days	$5.7 \times 10^{-9}$	20
Uranium-234 <sup>a</sup>	<sup>234</sup> U	$2.45 \times 10^5$ years	$3.9 \times 10^{-8}$	4
Uranium-235 <sup>a</sup>	<sup>235</sup> U	$7.04 \times 10^8$ years	$3.8 \times 10^{-8}$	4
Uranium-238 <sup>a</sup>	<sup>238</sup> U	$4.47 \times 10^9$ years	$3.6 \times 10^{-8}$	4
<i>Artificial radionuclides</i>				
Cesium-134	<sup>134</sup> Cs	2.07 years	$1.9 \times 10^{-8}$	7
Cesium-137	<sup>137</sup> Cs	30.2 years	$1.3 \times 10^{-8}$	10
Iodine-125	<sup>125</sup> I	59.9 days	$1.5 \times 10^{-8}$	10
Iodine-131	<sup>131</sup> I	8.04 days	$2.2 \times 10^{-8}$	6
Molybdenum-99	<sup>99</sup> Mo	65.9 hours	$1.9 \times 10^{-9}$	70
Strontium-90	<sup>90</sup> Sr	29 years	$2.8 \times 10^{-8}$	5
Tritium <sup>b</sup>	<sup>3</sup> H	12.3 years	$1.8 \times 10^{-11}$	7000

<sup>a</sup> The activity concentration of natural uranium corresponding to the chemical guideline of 0.02 mg/L (see separate guideline technical document on uranium) is about 0.5 Bq/L.

<sup>b</sup> Tritium is also produced naturally in the atmosphere in significant quantities.

## Guidelines for Canadian Drinking Water Quality—Summary Table

**Table 8. Secondary list of radionuclides**

Radionuclide		Half-life $t_{1/2}$	DCF (Sv/Bq)	MAC (Bq/L)
<i>Natural radionuclides</i>				
Beryllium-7	$^7\text{Be}$	53.3 days	$3.3 \times 10^{-11}$	4000
Bismuth-210	$^{210}\text{Bi}$	5.01 days	$2.1 \times 10^{-9}$	70
Polonium-210	$^{210}\text{Po}$	138.4 days	$6.2 \times 10^{-7}$	0.2
<i>Artificial radionuclides</i>				
Americium-241	$^{241}\text{Am}$	432 years	$5.7 \times 10^{-7}$	0.2
Antimony-122	$^{122}\text{Sb}$	2.71 days	$2.8 \times 10^{-9}$	50
Antimony-124	$^{124}\text{Sb}$	60.2 days	$3.6 \times 10^{-9}$	40
Antimony-125	$^{125}\text{Sb}$	2.76 years	$9.8 \times 10^{-10}$	100
Barium-140	$^{140}\text{Ba}$	12.8 days	$3.7 \times 10^{-9}$	40
Bromine-82	$^{82}\text{Br}$	35.3 hours	$4.8 \times 10^{-10}$	300
Calcium-45	$^{45}\text{Ca}$	165 days	$8.9 \times 10^{-10}$	200
Calcium-47	$^{47}\text{Ca}$	4.54 days	$2.2 \times 10^{-9}$	60
Carbon-14 <sup>a</sup>	$^{14}\text{C}$	5730 years	$5.6 \times 10^{-10}$	200
Cerium-141	$^{141}\text{Ce}$	32.5 days	$1.2 \times 10^{-9}$	100
Cerium-144	$^{144}\text{Ce}$	284.4 days	$8.8 \times 10^{-9}$	20
Cesium-131	$^{131}\text{Cs}$	9.69 days	$6.6 \times 10^{-11}$	2000
Cesium-136	$^{136}\text{Cs}$	13.1 days	$3.0 \times 10^{-9}$	50
Chromium-51	$^{51}\text{Cr}$	27.7 days	$5.3 \times 10^{-11}$	3000
Cobalt-57	$^{57}\text{Co}$	271.8 days	$3.5 \times 10^{-9}$	40
Cobalt-58	$^{58}\text{Co}$	70.9 days	$6.8 \times 10^{-9}$	20
Cobalt-60	$^{60}\text{Co}$	5.27 years	$9.2 \times 10^{-8}$	2
Gallium-67	$^{67}\text{Ga}$	78.3 hours	$2.6 \times 10^{-10}$	500
Gold-198	$^{198}\text{Au}$	2.69 days	$1.6 \times 10^{-9}$	90
Indium-111	$^{111}\text{In}$	2.81 days	$3.9 \times 10^{-10}$	400
Iodine-129	$^{129}\text{I}$	$1.60 \times 10^7$ years	$1.1 \times 10^{-7}$	1
Iron-55	$^{55}\text{Fe}$	2.68 years	$4.0 \times 10^{-10}$	300
Iron-59	$^{59}\text{Fe}$	44.5 days	$3.1 \times 10^{-9}$	40
Manganese-54	$^{54}\text{Mn}$	312.2 days	$7.3 \times 10^{-10}$	200
Mercury-197	$^{197}\text{Hg}$	64.1 hours	$3.3 \times 10^{-10}$	400
Mercury-203	$^{203}\text{Hg}$	46.6 days	$1.8 \times 10^{-9}$	80
Neptunium-239	$^{239}\text{Np}$	2.35 days	$1.2 \times 10^{-9}$	100
Niobium-95	$^{95}\text{Nb}$	35.0 days	$7.7 \times 10^{-10}$	200
Phosphorus-32	$^{32}\text{P}$	14.3 days	$2.6 \times 10^{-9}$	50
Plutonium-238	$^{238}\text{Pu}$	87.7 years	$5.1 \times 10^{-7}$	0.3

## Guidelines for Canadian Drinking Water Quality—Summary Table

Radionuclide		Half-life t <sub>1/2</sub>	DCF (Sv/Bq)	MAC (Bq/L)
Plutonium-239	<sup>239</sup> Pu	2.41 × 10 <sup>4</sup> years	5.6 × 10 <sup>-7</sup>	0.2
Plutonium-240	<sup>240</sup> Pu	6560 years	5.6 × 10 <sup>-7</sup>	0.2
Plutonium-241	<sup>241</sup> Pu	14.4 years	1.1 × 10 <sup>-8</sup>	10
Rhodium-105	<sup>105</sup> Rh	35.4 hours	5.4 × 10 <sup>-10</sup>	300
Rubidium-81	<sup>81</sup> Rb	4.58 hours	5.3 × 10 <sup>-11</sup>	3000
Rubidium-86	<sup>86</sup> Rb	18.6 days	2.5 × 10 <sup>-9</sup>	50
Ruthenium-103	<sup>103</sup> Ru	39.2 days	1.1 × 10 <sup>-9</sup>	100
Ruthenium-106	<sup>106</sup> Ru	372.6 days	1.1 × 10 <sup>-8</sup>	10
Selenium-75	<sup>75</sup> Se	119.8 days	2.1 × 10 <sup>-9</sup>	70
Silver-108m	<sup>108m</sup> Ag	127 years	2.1 × 10 <sup>-9</sup>	70
Silver-110m	<sup>110m</sup> Ag	249.8 days	3.0 × 10 <sup>-9</sup>	50
Silver-111	<sup>111</sup> Ag	7.47 days	2.0 × 10 <sup>-9</sup>	70
Sodium-22	<sup>22</sup> Na	2.61 years	3.0 × 10 <sup>-9</sup>	50
Strontium-85	<sup>85</sup> Sr	64.8 days	5.3 × 10 <sup>-10</sup>	300
Strontium-89	<sup>89</sup> Sr	50.5 days	3.8 × 10 <sup>-9</sup>	40
Sulphur-35	<sup>35</sup> S	87.2 days	3.0 × 10 <sup>-10</sup>	500
Technetium-99	<sup>99</sup> Tc	2.13 × 10 <sup>5</sup> years	6.7 × 10 <sup>-10</sup>	200
Technetium-99m	<sup>99m</sup> Tc	6.01 hours	2.1 × 10 <sup>-11</sup>	7000
Tellurium-129m	<sup>129m</sup> Te	33.4 days	3.9 × 10 <sup>-9</sup>	40
Tellurium-131m	<sup>131m</sup> Te	32.4 hours	3.4 × 10 <sup>-9</sup>	40
Tellurium-132	<sup>132</sup> Te	78.2 hours	3.5 × 10 <sup>-9</sup>	40
Thallium-201	<sup>201</sup> Tl	3.04 days	7.4 × 10 <sup>-11</sup>	2000
Ytterbium-169	<sup>169</sup> Yb	32.0 days	1.1 × 10 <sup>-9</sup>	100
Yttrium-90	<sup>90</sup> Y	64 hours	4.2 × 10 <sup>-9</sup>	30
Yttrium-91	<sup>91</sup> Y	58.5 days	4.0 × 10 <sup>-9</sup>	30
Zinc-65	<sup>65</sup> Zn	243.8 days	3.8 × 10 <sup>-9</sup>	40
Zirconium-95	<sup>95</sup> Zr	64.0 days	1.3 × 10 <sup>-9</sup>	100

<sup>a</sup> <sup>14</sup>C is also produced naturally in the atmosphere in significant quantities.