Technical Discussion Paper on Proposed Ontario Drinking Water Quality Standards

Table of Contents

Introduction and Purpose

The government has established a drinking water safety net to guide its approach to delivering safe drinking water in Ontario. The Drinking Water Safety Net is a multi-barrier system that recognizes that all of our activities to deliver safe drinking water are inter-related, and together provide the foundation for an effective drinking water protection system.

The Drinking Water Safety Net includes a source-to-tap focus; a strong legislative and regulatory framework beginning with the *Safe Drinking Water Act, 2002* (SDWA); health-based standards for drinking water; regular and reliable testing; swift, strong action on adverse water quality incidents; mandatory licensing, operator certification and training requirements; a multifaceted compliance improvement toolkit; and, partnership, transparency and public engagement.

This document provides the basis for the consultation on health-based standards, one of the components of the drinking water safety net. The government is seeking stakeholder input on its proposal to update the Ontario Drinking Water Quality Standards (ODWQSs) for arsenic, carbon tetrachloride, benzene, and, vinyl chloride, and to adopt new standards for chlorate, chlorite, 2-methyl-4-chlorophenoxyacetic acid (MCPA), and, haloacetic acids (HAAs). A discussion on trihalomethanes (THMs) is provided as the THMs are in the disinfection by-product class of compounds similar to the HAAs.

Development of Ontario's Drinking Water Quality Standards

In general, Ontario adopts the national Canadian Drinking Water Quality Guidelines (CDWQGs) as Ontario Drinking Water Quality Standards (ODWQSs) under Ontario Regulation 169/03 in the SDWA. The CDWQGs are developed by the Federal-Provincial-Territorial Committee on Drinking Water on which Ontario has a representative. This committee carries out the task of developing new guidelines as well as assessing existing guidelines to determine if they need to be updated due to new health information and developments in science and/or technology. The technical support documents developed by this committee are peer-reviewed internationally and subsequently undergo a public consultation on Health Canada's web site prior to being adopted as national guidelines.

Once adopted as national guideline(s), they are evaluated by Ontario's Advisory Council on Drinking Water Quality and Testing Standards (the Advisory Council) who make recommendations to the Minister on adopting the CDWQG as an ODWQS. The review by the Advisory Council considers the scientific basis of the CDWQG as well as applicability to Ontario's drinking water systems.

In the setting of drinking water quality standards, Ontario is not limited to using the CDWQGs as the basis on which to make decisions. Ontario can develop its own drinking water quality standards.

The following section provides the basis of the CDWQG, the recommendations of the Advisory Council, and the Ministry's proposal for each of the substances. Stakeholder comments are invited on the numerical value of the proposed ODWQSs, the benefits of the proposed standards, potential impacts on municipalities and other drinking water system owners to meet the proposed ODWQSs, the desired time-frame for implementation of the ODWQSs, and, any other comments/suggestions for consideration. The responses received will form the basis of a Regulatory Proposal for these substances.

Arsenic

Introduction

Arsenic is an element that is widely distributed throughout the Earth's crust and therefore is often found naturally in Ontario groundwater. Arsenic is used in the manufacture of a variety of products such as metal alloys, glass, and pharmaceuticals. Its historical uses as a wood preservative and pesticide has declined and are not considered to be an important source of exposure to the general population.

Arsenic is considered to be a human carcinogen. Arsenic exposure has been linked with cancers affecting organs such as the lungs, liver, skin, and the bladder. The current Ontario Drinking Water Quality Standard for arsenic is 0.025 mg/L and was based on the previous CDWQG before it was revised in 2006. The lifetime cancer risk associated with this value is about 80 additional cancers in a population of one million.

Basis of the Canadian Drinking Water Quality Guideline

The revised CDWQG for arsenic is 0.01 mg/L and was established based on the incidence of lung, bladder, and liver cancers in humans, through the calculation of the risk from lifetime exposure from drinking water. Although exposure to arsenic at any level can pose a potential health risk, minimizing exposure to arsenic from all sources will offer the best protection of human health. Certified treatment technology for both municipal and residential systems is capable of reducing arsenic levels to 0.01 mg/L and this was the basis of the revised Canadian Drinking Water Quality Guideline. The lifetime cancer risk associated with this value is about 33 additional cancers in a population of one million.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council reviewed Health Canada's supporting document for arsenic and recommended that "…the Ministry of the Environment endorse the revised Guideline for

Canadian Drinking Water Quality of 0.01 mg/L (10 µg/L) for arsenic in drinking water and adopt it as an Ontario Drinking Water Quality Standard". The letter further noted that Health Canada's rationale used to establish the revised arsenic guideline represents the best information presently available anywhere in the world and by adopting the revised arsenic Guideline, Ontario will be advancing its commitment to maintain up-to-date, science-based drinking water standards that will ensure ongoing protection of water quality in this province.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for Arsenic

The ministry recommends the adoption of the revised Canadian Drinking Water Quality Guideline of 0.01 mg/L for arsenic as the Ontario Drinking Water Quality Standard. Strengthening the Ontario Drinking Water Quality Standard for arsenic will afford the best achievable protection for Ontarians and bring it in-line with other Provinces and Territories as well as with enforceable international standards in the United States and in the European Union. Based on the most recent test results, the adoption of a more stringent drinking water quality standard for arsenic would require about 25 drinking water systems regulated by the ministry, including 3 municipal residential drinking water systems, to provide treatment upgrades or other solutions. It is also estimated that about 100 small drinking water systems under the jurisdiction of the Ministry of Health and Long-Term Care and local health units may also need treatment upgrades or other solutions in some arsenic-rich areas of the province.

Carbon Tetrachloride

Introduction

Carbon Tetrachloride is a man-made chemical used in a variety of industrial processes. It is known to be an ozone depleting substance and its production was banned in Canada in 1996 although it may be imported for certain uses. Historically, it was used in the production of chlorofluorocarbons (for refrigerant use), spray can propellant, and manufacturing pharmaceuticals. It was also used as a cleaning fluid and a degreaser in manufacturing industries and as a dry cleaning agent; and a solvent for oils, lacquers, varnishes, and resins. According to some literature sources, the use of carbon tetrachloride as a grain fumigant was believed to have resulted in the largest amounts of environmental releases.

Carbon tetrachloride is chemically stable but undergoes decomposition by sunlight when it evaporates and migrates to the upper atmosphere. Its decomposition results in chlorine-containing compounds that deplete ozone. The current Ontario Drinking Water Quality Standard for carbon tetrachloride is 0.005 mg/L and was based on the Canadian Drinking Water Quality Guideline of the same value established in 1986.

Basis of the Canadian Drinking Water Quality Guideline

Exposure to carbon tetrachloride through drinking water can cause liver toxicity and possibly cancer. Health Canada re-evaluated this Guideline in 2011 as new science for both toxicity as well as exposure scenarios based on ingestion, inhalation and dermal contact became available. The evaluation using new science resulted in Canadian Drinking Water Quality Guideline for carbon tetrachloride of 0.002 mg/L (2 µg/L) based on non-cancer toxic effects on the liver through ingestion of the water as well by inhalation of carbon tetrachloride during showering and bathing. While some studies have found that carbon tetrachloride can cause cancer, the levels of exposure associated with cancer were higher than those at which adverse effects on the liver were observed. That is, a guideline protective of non-cancer effects would also be protective of cancer effects.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council reviewed Health Canada's supporting document for carbon tetrachloride and concurred with the rationale used by Health Canada to arrive at a new guideline value of 0.002 mg/L and recommended that the Ontario Drinking Water Quality Standard for carbon tetrachloride be reduced from the current 0.005 mg/L to 0.002 mg/L.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for Carbon Tetrachloride

The ministry proposes to adopt the revised CDWQG of 0.002 mg/L as the ODWQS. The ministry notes that because carbon tetrachloride usually contaminates groundwater sources via industrial spills or releases from old landfill sites, there is always a potential for finding carbon tetrachloride in drinking water sources and a more stringent standard is more protective of human health. Based on the most recent test results, the adoption of a more stringent standard for carbon tetrachloride would require fewer than five drinking water systems regulated by the ministry to provide treatment upgrades or other solutions.

Benzene

Introduction

Benzene is an organic chemical that exists in both liquid and vapour forms at room temperatures. It is colorless and flammable, with a very distinct odor. It is used as a solvent as well as in the synthesis of many chemicals. Although benzene can originate from natural sources in the environment, most environmental exposure, including from drinking water, is from industrial activities. For the general population, the highest exposure to benzene is from gasoline vapours at gasoline stations and by vehicle exhaust as gasoline contains about 1% benzene. Although most foods contain benzene, the amounts are not present in quantities sufficient to cause health concerns. At current levels of benzene observed in the drinking water, a very small proportion of the total human exposure to benzene (less than 1%) is from drinking water.

Basis of the Canadian Drinking Water Quality Guideline

Benzene is a known, potent human carcinogen with risk at any level of exposure whether one is exposed to it through air, food or water. Exposure to benzene has been shown to cause leukemia.

Currently, the Canadian Drinking Water Quality Guideline as well as the Ontario Drinking Water Quality Standard for benzene is 0.005 mg/L (5 µg/L). The Canadian Drinking Water Quality Guideline for Benzene is based on a theoretical carcinogenic risk of an additional 20 cases of cancer in a population of one million exposed to drinking water level containing 5 µg/L benzene over a lifetime.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council on Drinking Water Quality and Testing Standards recommended a more stringent drinking water quality standard of 0.001 mg/L (1 µg/L) for benzene. The rationale for their recommendation is that chemical standards for carcinogenic contaminants should be established at a level which represents an estimated lifetime (70 years) risk of cancer incidence that is considered to be "essentially negligible" or as close to "essentially negligible" as reasonably practicable. For all intents and purposes, this is 10^{-6}, or a risk of one in one million. The Advisory Council also noted that some jurisdictions such as the European Union and Australia already have drinking water quality guidelines that are 0.001 mg/L for benzene. The current drinking water quality standard for benzene is 0.0005 mg/L in the Province of Quebec.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for Benzene

The ministry proposes to revise the ODWQS to 0.001 mg/L (1 µg/L). The ministry notes that because benzene usually contaminates groundwater sources via industrial spills or releases from old landfill sites, there is always a potential for finding benzene in drinking water sources and a more stringent standard is more protective of human health. Based on the most recent test results, the adoption of a more stringent standard for benzene would require fewer than 5 drinking water systems regulated by the ministry to provide treatment upgrades or other solutions.

Vinyl Chloride

Introduction

Vinyl chloride is a man-made chemical that is used to manufacture polyvinylchloride (PVC), a polymer used to make a variety of products such as plastic pipes, electrical insulation, industrial and household equipment, medical supplies, food packaging materials, and variety of building and construction products. It can enter drinking water through leaching from polyvinyl chloride pipes, from industrial discharges from chemical and latex manufacturing plants, or as a result of the degradation of synthetic solvents such as trichloroethylene.

The current Canadian Drinking Water Quality Guideline and the Ontario Drinking Water Quality Standard for vinyl chloride is 0.002 mg/L (2 µg/L).

Basis of the Canadian Drinking Water Quality Guideline

Vinyl chloride is classified as a human carcinogen, with sufficient evidence that it can cause cancers in both humans and animals. Exposure to vinyl chloride has been linked with liver and neurological effects, in both humans and animals. However, it should be noted that effects observed on humans are associated with occupational exposure levels which are considerably higher than what can be obtained via drinking water. Liver cancer is the most serious endpoint that follows exposure from ingestion or inhalation to vinyl chloride in both animal studies as well as humans.

Health Canada reviewed the most recent information on vinyl chloride with emphasis on new science with respect to vinyl chloride toxicity via drinking water. Using modern scientific analytical techniques, evidence from animal studies suggests that very young children (less than 5 weeks of age) may be more sensitive to the carcinogenic effects of vinyl chloride than adults; in fact, current scientific evidence suggests a 2-fold increased sensitivity if children under the age of 5 weeks are exposed to vinyl chloride. Therefore, the concentrations representing "essentially negligible" lifetime risk (i.e. a risk of 1-10 additional liver tumours in a population of one million) of combined liver tumours in children less than 5 weeks of age would range from 0.00004 to 0.0004 mg/L.

However, Health Canada also noted that there was a limit with treatment technologies that could remove vinyl chloride from the water. Municipal drinking water systems can employ treatment technologies based on air stripping and ozone to remove vinyl chloride, but residential drinking water treatment devices are not able to treat to levels below 0.002 mg/L (2 µg/L). For this reason, Health Canada reaffirmed the existing guideline.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council reviewed Health Canada's supporting document for vinyl chloride and in a letter to the Minister of the Environment noted that Health Canada's reaffirmation of the guideline value of 0.002 mg/L would still result in a cancer risk of 50 in a population of one million.

However, the Advisory Council also recognized that adopting a standard that reflects a risk of one additional cancer per population of one million (0.00004 mg/L) would be problematic as it cannot be reliably measured using existing accredited methods by analytical laboratories at these levels. Consequently, their recommendation was to revise the Ontario Drinking Water Quality Standard for vinyl chloride from the current 0.002 mg/L to 0.001 mg/L recognizing that it provided a marginally reduced risk from exposure to vinyl chloride while being measureable by current laboratory detection methods.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for Vinyl Chloride

The ministry recognizes that the basis of the Canadian Drinking Water Quality Guideline of 0.002 mg/L for vinyl chloride is based on technology limitations with residential drinking water treatment devices. However, because municipal drinking water systems have the technical capability to achieve a vinyl chloride level below 0.001 mg/L, adopting a more stringent Ontario Drinking Water Quality Standard of 0.001 mg/L is justified on the basis of the science recognizing that young children may be more susceptible to the effects of vinyl chloride. Consequently, the ministry is proposing that a more stringent Ontario Drinking Water Quality Standard of 0.001 mg/L be adopted for vinyl chloride.

Chlorite and Chlorate

Introduction

The proper use of chlorine-based disinfectants has virtually eliminated water-borne diseases. Chlorine is used for disinfection of filtered water at water treatment plants (primary disinfection) and is also added to the treated drinking water to prevent bacterial regrowth in the distribution system (secondary disinfection) that delivers the water to the community.

Most systems in Ontario use chlorine and/or chloramine (another common chlorine-based chemical) for disinfection. Chlorine dioxide, though short-lived as it decomposes to chlorite and chlorate, is a powerful primary disinfectant that also removes organic matter from the water. This improves the efficacy of other treatment processes (i.e. filtration) to deliver high-quality water. However, it is not appropriate for use as a secondary disinfectant as it will break down to chlorite and chlorate rapidly and will not provide residual levels necessary to prevent bacterial regrowth. Based on the most recent test results, fewer than ten municipal residential drinking water systems use chlorine dioxide.

Basis of the Canadian Drinking Water Quality Guideline

Chlorite and chlorate have been shown to be associated with adverse health effects on the basis of animal studies. Chlorite has been shown to impact the nervous system as observed in a study where rats exposed to chlorite displayed reduced startle amplitude (reaction to sudden noise) decreased brain weight and altered liver weights over two generations. Similar studies on chlorate found changes in thyroid function leading to hormonal imbalances. The Canadian Drinking Water Quality Guidelines for each of these substances is 1 mg/L. Currently there is no Ontario Drinking Water Quality Standard for either of these substances. However systems that use chlorine dioxide are already required under their municipal license to monitor and take steps to ensure that the levels of chlorite and chlorate remain below 1 mg/L, respectively.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council on Drinking Water Quality and Testing Standards reviewed Health Canada's Drinking Water Quality Guidelines for chlorite, chlorate, and chlorine dioxide. Their recommendation was that the Ministry of the Environment endorse the new Canadian Drinking Water Quality Guidelines of 1 mg/L for Chlorite and 1 mg/L for Chlorate in drinking water and adopt them as Ontario Drinking Water Quality Standards. They also noted that systems that use sodium hypochlorite for chlorination could find higher levels of chlorate and these systems should monitor for chlorate on a quarterly basis.

Ministry's Proposal for an Ontario Drinking Water Quality Standards for Chlorate and Chlorite

The ministry proposes to adopt the CDWQGs for chlorate and chlorite of 1 mg/L for each substance as ODWQSs. The ministry notes that adoption of the standards for chlorate and chlorite will ensure that systems that are considering the use of chlorine dioxide for primary disinfection would be aware of the additional standards that they would be required to meet.

2-methyl-4-chlorophenoxyacetic acid (MCPA)

Introduction

2-Methyl-4-chlorophenoxyacetic acid (MCPA) is a phenoxyacetic acid herbicide, registered in Canada for use on agricultural sites, fine turf, forestry applications and at industrial sites. It is among the top 10 pesticides sold in Canada and is used across the country. The Prairie Provinces are the highest users of MCPA. The detection of MCPA in surface water is common in the vicinity of agricultural areas although the levels detected are not a concern to human or environmental health. MCPA has been detected infrequently in drinking water sources in Ontario.

Basis of the Canadian Drinking Water Quality Guideline

Health Canada carried out a toxicity assessment on MCPA. Studies reported in the literature have been inconclusive on the effects of MCPA on humans. Furthermore, most studies failed to find any carcinogenic effects upon exposure to MCPA. Non-carcinogenic effects were also studied and concluded that the most sensitive organ is the kidney. Exposure studies on animals indicate that continuous exposure to MCPA results in enlarged kidneys which may compromise their function. Based on these animal studies, the Canadian Drinking Water Quality Guideline for MCPA was set at 0.1 mg/L.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council on Drinking Water Quality and Testing Standards reviewed the Health Canada's Drinking Water Quality Guideline for MCPA. They recommended that the Ministry of the Environment establish an Ontario Drinking Water Quality Standard for 2-Methyl-4-chlorophenoxyacetic Acid (MCPA) of 0.1 mg/L.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for MCPA

The ministry proposes to adopt the CDWQG of 0.1 mg/L as the ODWQS. The ministry already monitors for the presence of MCPA in routine pesticide scans of drinking water and investigates if MCPA is detected at any level[1].

Trihalomethanes (THMs)

Introduction

The use of chlorine in the treatment of drinking water has virtually eliminated waterborne diseases because chlorine can kill or inactivate most microorganisms commonly found in water. However, chlorine also reacts with naturally occurring dissolved organic matter (e.g., from decaying leaves and vegetation) to form a group of disinfection by-products (DBPs) known as trihalomethanes.

The majority of drinking water treatment plants in Canada use some form of chlorine to disinfect drinking water as part of the raw water treatment process at the treatment plant and/or to maintain chlorine residual in the distribution system to prevent bacterial regrowth. The health risks from disinfection by-products, including trihalomethanes, are much lower than the risks from consuming water that has not been disinfected. Utilities should make every effort to maintain concentrations of all disinfection by-products as low as reasonably achievable without compromising the effectiveness of disinfection.

The THMs most commonly found in drinking water are chloroform, bromodichloromethane (BDCM), dibromochloromethane (DBCM) and bromoform. Of these, chloroform has been the most extensively studied, there are some scientific data available on BDCM, and insufficient data are available to develop guidelines for either DBCM or bromoform.

Basis of the Canadian Drinking Water Quality Guideline

In its evaluation of trihalomethanes in 2006, Health Canada based the trihalomethane guideline of 0.100 mg/L (100 µg/L) as an annual average of quarterly (four) samples on the health risks of chloroform. The guideline, however, applies to the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane and bromoform.

While numerous studies suggest that chloroform exposure is linked to cancers of the bladder and colon, there seems to be a threshold level above which these effects are observed. As a result, Health Canada used a specialized data analysis technique, physiologically based pharmacokinetic modeling, to assess the effects of chloroform exposure. Health Canada's

[1] The detection of any pesticide that is not listed in Schedule 2 of Ontario Regulation 169/03- *Drinking Water Quality Standards* triggers an investigation by the ministry irrespective of the level at which it is found in drinking water.

assessment resulted in a proposed health-based guideline of 0.080 mg/L for total THMs and a national consultation was carried out in 2004.

The national consultation resulted in comments that, while generally supportive of a more stringent level, questioned if the health benefit was measureable. As a result of the comments received from the national consultation, Health Canada concluded that meeting a guideline of 0.080 mg/L for THMs in drinking water may present significant financial implications for treatment plants with little additional health benefit. As the increase in health risks from exposure to THMs at levels up to 0.100 mg/L is not expected to be significantly different from exposure at 0.08 mg/L, a guideline of 0.100 mg/L (100 µg/L) for THMs in drinking water, based on an annual average of quarterly samples was reaffirmed.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council on Drinking Water Quality and Testing Standards reviewed the Health Canada's Drinking Water Quality Guidelines for THMs. Their letter of advice to the Minister noted Health Canada's new scientific/technical review and rationale incorporated additional exposure routes from drinking water, such as inhalation and dermal absorption, resulting in a calculated value of 80 µg/L (0.080 mg/L). The Advisory Council further noted that most Ontario drinking water systems had the ability to meet this proposed lower standard and doing so would result in promoting and encouraging the optimization of treatment processes and best management practices, which should be actively encouraged in Ontario. The Advisory Council therefore recommended that the Ministry of the Environment set a more stringent Ontario Drinking Water Quality Standard of 0.08 mg/L (80 µg/L) as an annual average for total trihalomethanes in drinking water based on quarterly testing.

Overview of the United States' Policy for THMs in Drinking Water

The ministry recognizes that the United States Environmental Protection Agency (US EPA) promulgated a maximum contaminant level (equivalent to a standard) of 0.080 mg/L (locational running annual average of quarterly samples) for THMs in drinking water. The ministry notes that the basis of the US EPA's adoption of 0.080 mg/L was based on 90% of U.S. systems being able to achieve compliance in a cost-effective manner with the best available technology (BAT) (e.g., enhanced coagulation). It was expected that some systems would need to put in other (advanced) technologies for more difficult to treat water. For example, there are moderate to high levels of bromide in the surface water and groundwater in many parts of the U.S. Coagulation removes total organic carbon (TOC), but not bromide. Brominated THMs (and also brominated HAAs) are believed to be more potent carcinogens than chlorinated THMs/chlorinated HAAs and their formation should be minimized, considering cost and technical feasibility, without compromising disinfection. Moreover, brominated THMs weigh more than chlorinated species and the lower standard was to reduce the sum of all species. In summary, the intent of reducing the maximum contaminant level of total THMs was to promote the use of BAT (e.g., enhanced coagulation, changes in the points of chlorination, removal of TOC, etc.) to protect the consumer from exposure to DBPs of health concern. Bromide levels in Ontario's drinking water sources are lower by comparison to many areas of the U.S. and lowering the drinking water quality standard for trihalomethanes may not provide the same level of health benefit as was the case for the U.S. based on the occurrence of bromine resulting in the necessity of controlling brominated DBPs.

Furthermore, the ministry notes that the adoption of the Canadian Drinking Water Quality Guideline for HAAs (see next substance in the document) will result in treatment process optimization programs at drinking water systems. It is noted that both THMs and HAAs are DBPs and the treatment process optimization should result in decreased levels for both THMs and HAAs. Consequently, in meeting the HAA standard, the THMs levels will also be reduced. In effect, by introducing the new standard for HAAs, best management practices will result in a lower THMs levels. Municipal drinking Water Systems may need time and financial resources to optimize treatment processes. It should be noted that in the U.S., systems that made treatment process changes to control HAAs typically resulted in minimizing THM formation.

While the current Ontario drinking Water Quality Standard for THMs provides an adequate level of health protection, optimization of treatment processes will further reduce the THMs levels in keeping with the recommendation from the Advisory Council to proactively optimize treatment process in keeping with best management practices. The ministry has developed a guidance document that provides operational steps that drinking water systems can use to optimize treatment processes to improve efficiency and reduce THMs and other disinfection by-products such as HAAs.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for THMs

The ministry is proposing to maintain the current Ontario Drinking Water Quality Standard of 0.100 mg/L as an annual average of quarterly results.

Furthermore, the ministry notes that the adoption of the Canadian Drinking Water Quality Guideline for haloacetic acids (see next substance in this document) will likely result in additional treatment process optimization programs at drinking water systems. It is noted that both THMs and HAAs are disinfection by-products and the treatment process optimization should result in decreased levels for both THMs and HAAs. Drinking Water Systems may need time and financial resources to optimize treatment processes.

While the current standard provides adequate level of health protection, optimization of treatment processes will further reduce the THMs levels in keeping with the recommendation from the Advisory Council to proactively optimize treatment process in keeping with best management practices.

Haloacetic Acids (HAAs)

Introduction

Haloacetic acids (HAAs) are a group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring dissolved organic matter (e.g., from decaying leaves and vegetation). The use of chlorine in the treatment of drinking water has virtually eliminated waterborne diseases because chlorine can kill or inactivate most microorganisms commonly found in water. The majority of drinking water treatment plants in Canada use some form of chlorine to disinfect drinking water. Chlorine is used to disinfect water at the treatment plant and to maintain chlorine residual in the distribution system to prevent bacterial regrowth. Disinfection is an essential component of public drinking water treatment; the health risks from disinfection by-products, including haloacetic acids, are much lower than the risks from consuming water that has not been appropriately disinfected. Ontario does not currently have a Drinking Water Quality Standard for haloacetic acids in drinking water.

Basis of the Canadian Drinking Water Quality Guideline

In 2008, Health Canada established the Canadian Drinking Water Quality Guideline for haloacetic acids at a level of 0.080 mg/L as an annual average. The haloacetic acids found in drinking water are monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA). Of those on which the Canadian Drinking Water Quality Guideline is based, DCA and TCA have been most extensively studied. The Canadian Drinking Water Quality Guideline is primarily designed to be protective against the health effects of DCA. DCA and TCA are the HAAs that are typically formed at the highest levels in low-bromide waters and DCA is the more potent of the two. DCA is a probable human carcinogen and has also been linked with birth defects in animal studies. The guideline value of 0.080 mg/L is for the sum of the five different HAAs (MCA, DCA, TCA, MBA, and DBA) based on an annual average of quarterly samples. In addition, drinking water systems should strive to minimize the formation of all disinfection by-products by optimizing their treatment processes.

Advice from the Advisory Council on Drinking Water Quality and Testing Standards

The Advisory Council on Drinking Water Quality and Testing Standards reviewed the Health Canada's Drinking Water Quality Guidelines for HAAs. Their letter of advice recognized that DCA, one component of HAAs, posed a cancer risk that would be considered to be essentially negligible at a level of 0.010 mg/L- a level much lower than the guideline value. However, it was noted in the Advisory Council's advice that a DCA level of 0.010 mg/L was not achievable without compromising disinfection of drinking water. Nevertheless, the Advisory Council recommended that Ontario adopt a more stringent drinking water standard of 0.060 mg/L for HAAs. Their letter of advice noted that their evaluation of drinking water data in Ontario indicated that most drinking water systems could meet the lower HAAs limit which would promote and encourage the optimization of treatment processes, and best management practices. They also noted that the United States Environmental Agency's maximum contaminant limit for the sum of five HAAs is 0.060 mg/L using the similar rationale of best operating practices

Overview of the United States' Policy for HAAs in Drinking Water

The ministry recognizes that leading agencies such as the United States Environmental Protection Agency (US EPA) promulgated a Maximum Contaminant Level (equivalent to a standard) of 0.060 mg/L for the sum of five HAAs in drinking water. The ministry notes that the basis of the US EPA's adoption of 0.060 mg/L for the sum of five HAAs was based on 90% of U.S. systems being able to achieve compliance in a cost-effective manner with the best available technology (BAT) (e.g., enhanced coagulation). It was expected that some systems would need to put in other (advanced) technologies for water that was more difficult to treat due to high levels of total organic carbon (TOC) and or bromide. (Note, there are moderate to high levels of bromide in the surface water and groundwater in many parts of the U.S.) The sum of five HAAs includes two brominated species, but does not include four other brominated HAAs. For systems in moderate to low bromide zones, it was typically the optimization process to meet the standard for THMs that also minimized the formation of regulated and unregulated HAAs. Brominated HAAs are generally more potent carcinogens than chlorinated HAAs and their formation should be minimized, considering cost and technical feasibility, without compromising disinfection. The intent of reducing the maximum contaminant level of the sum of five HAAs was to promote the use of BAT (e.g., enhanced coagulation, changes in the points of chlorination, removal of TOC, etc.) to protect the consumer from exposure to DBPs of health concern. Bromide levels in Ontario's drinking water sources are lower by comparison to many areas of the U.S. In low bromide-waters, the sum of five HAAs accounts for most of the total HAAs, whereas in high-bromide waters the sum of five HAAs will not include a significant portion of the total HAAs as the other four brominated HAAs will also be formed. A drinking water quality standard of 0.080 mg/L for the sum of five HAAs in Ontario's low-bromide waters might provide the same level of health benefit as the U.S. maximum contaminant level of 0.060 mg/L for the sum of five HAAs that includes waters with even moderate levels of bromide.

Ministry's Proposal for an Ontario Drinking Water Quality Standard for HAAs

The ministry, in keeping with its mandate to continually improve drinking water quality in the province, proposes to adopt a new Ontario Drinking Water Quality Standard for the sum of five

HAAs and to adopt Health Canada's Canadian Drinking Water Quality Guideline of 0.080 mg/L as an annual average of quarterly samples.

It is generally noted that systems that have high levels of THMs also have high levels of HAAs. Adopting the existing CDWQG value of 0.080 mg/L would require an estimated 90 drinking water systems to optimize treatment processes to improve efficiency to reduce HAAs, or provide upgrades or find other solutions. Improvements of treatment processes to reduce HAAs will also reduce the THMs levels.

The new standard would improve the overall level of health protection and would minimize the potential impacts on systems throughout the province. The ministry has developed a guidance document that provides operational steps that drinking water systems can use to optimize treatment processes to improve efficiency and reduce DBPs such as HAAs, or provide upgrades or other solutions.

Questions

The ministry is seeking comments or concerns on any or all of the proposed standards from any interested stakeholders. The following questions highlight areas of interest to the ministry with respect to each of the proposed drinking water quality standards but interested stakeholders need not limit comments/concerns exclusively to the following questions:

1. Do you agree with the proposed numerical values for the Ontario Drinking Water Quality Standards described in this document?
2. What benefits do you see in adopting the proposed Ontario Drinking Water Quality Standards?
3. What are the potential impacts on municipalities and other drinking water system owners to meet the proposed Ontario Drinking Water Quality Standards?
4. What is the desired time-frame for implementation of the Ontario Drinking Water Quality Standards and why?