

What is the Purpose of Drinking Water Quality Guidelines/Regulations?

Water is essential to life and a nominal supply of clean-safe drinking water is required for the sustenance of life. Concern regarding safe-clean drinking water commenced at the turn of the 20th century, when science coupled with technology unraveled the implications associated with contaminated drinking water. Today, in developed nations, it is standard practise to provide the populace with safe-reliable drinking water, as safe drinking water in most industrialized countries is recognized as a basic human right and a cost effective measure of reducing disease (i.e., preventative medicine). In developed countries, drinking water quality guidelines and regulations are based on current, published-scientific research related to health effects, aesthetic effects, and operational considerations. All these important parameters aim at providing potable and palatable drinking water to reduce water borne diseases and foster healthy living.

Briefly, the purpose of having drinking water quality guidelines and regulations is to ensure that all human beings within a country have access to safe drinking water. In developing countries, it is estimated that over 80% of disease is caused by contaminated drinking water and as a consequence, over 30% of work productivity is lost. Meaning, water is largely the cause of most disease and a considerable amount of work potential is compromised because of this.

Guideline vs. Regulation – What’s the difference?

First off, it’s important to understand the discrepancy between the terms “guideline” and “regulation”, as this difference is critically important. The term guideline, can be defined as follows: “a line by which one is guided: an indication or outline of policy or conduct” (Merriam-Webster, 2008). Meaning, a guideline is often a benchmark that should be followed, but technically, isn’t lawfully required to be followed. Conversely, the term regulation can be defined as: “an authoritative rule dealing with details or procedures <safety regulations>; a rule or order issued by an executive authority or regulatory agency of a government and having the force of law” (Merriam-Webster, 2008). Therefore, a regulation is similar to a guideline, in that, benchmarks are established, but in contrast to a guideline, regulations are enforceable by law. Regulations, in the context of drinking water, are clearly preferred, because any deviation from the benchmark can result in legal contravention against the negligent body; thus, ensuring safe drinking water.

In Canada, we have drinking water quality guidelines, whereas the United States (U.S) and the European Union (EU) have drinking water quality regulations. Further, Canada is amongst one of the few developed countries that has guidelines in lieu of regulations and, has no national regulatory body for enforcing drinking water quality standards. The ensuing paragraphs will explain the differences in Canadian Drinking Water Quality Guidelines to the U.S and the EU regulations, as well as the WHO’s guidelines.

Drinking Water in Canada

Since 1968, Canada's drinking water quality standards have been developed and maintained by the Federal-Provincial-Territorial Committee on Drinking Water and published by Health Canada. The *Guidelines for Canadian Drinking Water Quality* and *Guideline Technical Documents* are key supporting documents that provide guidelines and direction for safe-drinking water in Canada. These guidelines provide direction concerning Maximum Allowable Concentrations (MACs) for 1) Microbial characteristics, 2) Chemical and radiological characteristics, and 3) Aesthetic quality and operational characteristics. Health Canada currently lists 82 guideline characteristics that are suitable for safe-human consumption of drinking water. Seeing as these are guidelines only, it is largely the responsibility of municipal and provincial governments to maintain and adhere to these guidelines; there is no national regulatory body for drinking water in Canada. Meaning, it is the sole responsibility of the provinces and territories to develop, implement, and enforce municipal and public water supplies. As defined by Health Canada, the following are the Federal Government's (Health Canada) main responsibilities concerning drinking water in Canada as defined on Health Canada's website:

1. Developing national drinking water guidelines with provincial and territorial drinking water authorities
2. Providing emergency advice in cases of drinking water contamination, when requested by another government department or agency
3. Developing guidelines for water used for recreational activities, such as lakes where people swim
4. Ensuring the safety of drinking water on cruise ships, airlines, passenger ferries, trains, and other common carriers
5. Working with other departments to make sure all federal government employees have access to safe drinking water in their workplaces
6. Monitoring drinking water quality on First Nations reserves, as part of its wider mandate to deliver public health services in these communities
7. Regulating the safety and quality of bottled water, prepackaged ice, and water used in food processing
8. Working in collaboration with partners and stakeholders on broader water quality issues, including the development of water policies and research priorities

As shown above, the Federal Government has no designated responsibilities concerning quality control or ensuring due-diligence. So, who is accountable?? Below are important facts concerning drinking water in Canada.

1. There is no watchdog or national regulatory body concerning drinking water quality in Canada. It is largely the responsibility of municipal governments to maintain drinking water quality standards set out by the Federal-Provincial-Territorial Committee on Drinking Water.
2. Canada does not have drinking water quality regulations, only guidelines that are not enforced by a regulatory body.
3. Bacteriological guideline parameters suggest that only *Escherichia coli*, Total Coliforms, and Heterotrophic Plate Count tests be used to measure microorganisms in Canadian drinking water. This is of concern because there are many other microorganisms that can cause health effects through the ingestion of water. Coliform bacteria (bacteria commonly found in stool from warm blooded animals) are found in only 1/3 of water borne outbreaks, the other 2/3 of water borne diseases are caused by viruses and protozoa; therefore, coliform bacteria are not accurate indicators of drinking water contamination. What's more, is that chlorine is the primary disinfecting agent used against microbes in drinking water; however, chlorine is ineffective at extirpating viruses, protozoa, and other pathogens. So, as it stands, there is a

1/3 chance that contaminated water will be identified through the coliform microbial test that Health Canada exclusively relies on for identifying drinking water contaminated with microbes.

4. No numerical guideline is recommended for safe levels of protozoa or viruses in Canadian drinking water; therefore, no testing takes place for these organisms. Both protozoa and viruses are capable of causing severe health implications, so why isn't there a benchmark and why aren't they recommended for testing?
5. No numerical guideline is recommended for emerging pathogens.
6. Guidelines for physical and chemical parameters do not include Maximum Acceptable Concentrations (MACs) for the following chemicals: Chloride, Copper, Ethylbenzene, Iron, Manganese, Sodium, Sulfate, Sulphide, Xylenes, and Zinc.
7. Toxicology data used to derive MACs are based on animal laboratory experiments using acute doses; therefore, little information is known concerning the health implications associated with chronic exposure to low doses.

Clearly, drinking water in Canada is not as safe as it could be, but how bad is it?? A recent report published in the spring of 2008 titled, *Investigative Report: 1766 boil-water advisories now in place across Canada*, found that over 1700 boil advisories were in place throughout Canadian communities and, that an estimated 90 Canadians die each year from drinking contaminated water. Further, the report found that the quality of drinking water in Canada is largely dependant on where one resides; typically water quality is excellent in urban areas and marginal in rural and First Nation reserves. This disparity is largely the result of varying source waters and water quality treatment systems that aren't effective at treating poor quality source waters. So, how does Canada measure up with other countries? Let's find out!

Drinking Water in the United States

In the U.S., the Safe Drinking Water Act (SDWA; passed in 1974) is the guiding framework that maintains and directs drinking water quality standards. The SDWA gives the Environmental Protection Agency (EPA) the responsibility to set and enforce standards for drinking water. The National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. The primary standards ensure all drinking water in the U.S is safe for human consumption. To compliment the primary standards, the U.S has non-enforceable Secondary Drinking Water Regulations that address the cosmetic and aesthetic attributes of drinking water (e.g., colour, taste, tooth discolouration, etc.). These standards coupled with stringent enforcement, produce high quality potable drinking water.

Drinking water standards from the EPA specify the levels of contaminants, disinfection agents, and disinfection by-products that are allowed in drinking water. Under the SDWA, water utilities are required to monitor the drinking water and more importantly, results MUST be reported to the state or the EPA. Further, the EPA currently requires drinking water to be monitored for 90 contaminants. Now that's accountability!! As well, the EPA develops a list every five years of unregulated contaminants that may pose health implications and hence, be added to the primary or secondary standards.

How about microbial parameters? In Canada, the guidelines recommend that only *E. coli*, Heterotrophic Plate Count, and Total Coliforms are tested, but in the U.S., the EPA requires the following microbial testing: *Cryptosporidium*, *E. coli*, *Giardia lamblia*, *Legionella*, Total Coliforms, Heterotrophic Plate Count, and Viruses (enteric). The EPA regulation requires 99.9 % removal of all viruses and protozoan organisms before the water can be deemed safe for human consumption. Canadian guidelines don't bother to recommend testing for these organisms, let

alone suggesting 99.9% of them are removed from drinking water. Clearly, the U.S drinking water quality monitoring regulations are considerably more thorough than Canadian guidelines.

How about chemical parameters? As previously mentioned, the EPA requires and enforces water utilities to monitor for 90 contaminants. In Canada, Health Canada provides numerical guideline parameters for less than 70 contaminants. As well, Canadian guidelines are often in order of magnitude or more for numerous contaminants (e.g., PCBs, organochlorines, etc.) and in many cases, a numerical value is not provided. It should be noted, that in most cases, any contaminant that is ingested in considerable amounts can be harmful to human health. What's important here, is that Canadian guidelines recommend testing for less contaminants and recommend considerably higher concentrations for chemical and microbial parameters in comparison to the EPA.

Drinking Water Directive (DWD) - European Union

The European Union (EU) drinking water regulations are guided primarily by the Drinking Water Directive (DWD), which emphasizes both human health, as well as the environment. Under the guidance of the DWD, member states are required to regularly test and monitor a total of 48 microbiological and chemical parameters in the drinking water. These 48 parameters are derived from the World Health Organization's standards (Remember, the EPA requires that 90 parameters are tested in the U.S). Member states are required to monitor drinking water (this is done at the tap inside public and private premises) and report at three yearly intervals to the European Commission. The Commission then publishes a synthesis report taking into account the water quality monitoring standards set out by the DWD. The EU drinking water regulations are adequate, however, they do fall short of the stringent and diligent regulations set out by the EPA. In comparison to Canada, the EU has considerably more accountability, which comes in the form of stringent monitoring and reporting regulations.

How Does the World Health Organization Measure Up?

The World Health Organization's (WHO) drinking water quality guidelines are the international reference points for drinking water quality standards. Although the WHO provides thorough guidelines and recommendations for best management strategies (e.g., water-safety plans, applications for management strategies, etc.), it does fall short in recommending numerical benchmarks for acceptable parameters for microbial and chemical concentrations in drinking water compared to the U.S. Furthermore, many of the acceptable concentrations the WHO does recommend for individual contaminants, are significantly higher than what is set by the U.S EPA. For example, for the contaminant Alachlor, the U.S EPA regulates a maximum concentration of 2 micro-litres per litre, whereas the WHO recommends 20 micro-litres per litre. Examples of such considerable discrepancies are widespread when comparing standards from each organization. With this in mind, one must question whether the WHO should be used as the international standard for drinking-water quality standards.

What does this mean for Canadians?

Relative to other developed nations, the safety of Canada's drinking water quality is questionable. For example, in 2006, the Suzuki Foundation conducted a comparative analysis comparing Canadian guidelines to those of the WHO, U.S, EU, and Australia and found that *"more than ¾ of the Guidelines for Canadian Drinking Water Quality relating to chemical contaminants appear to provide less protection for public health than standards or guidelines in other industrialized nations"*. So, what exactly does this mean?? Well, it means that the

Canadian guidelines are lax in comparison to other developed nations. For example, European Union standards recommend concentrations 70 times less for the radionuclide tritium than Canadian drinking water guidelines. And what's more, is that the WHO guidelines recommend 10 times less the amount of uranium in drinking water than Canadian guidelines. Passels of similar examples exist when comparing Canadian guidelines to other industrialized nations drinking water quality standards. As Canadians, this finding is most definitely troubling.

As already mentioned, Canada does not have a national regulatory body and does not have regulations, only guidelines. In fact, Canada does not recognize safe-potable drinking water as a basic human right!! What's more, is that Canada has no recommended guidelines for many organic and inorganic contaminants, which is somewhat worrisome, as many of these contaminants can cause neurological and endocrine complications in humans. With such minimal vigilance and accountability, incidences, such as, the Walkerton, ON crisis in 2000 (Walkerton's drinking water supply became contaminated with *E. coli*, resulting in the death of seven people) can likely be expected in the future. *E. coli* contamination can be especially fatal to young, elder, and immuno compromised members of society and, severe long-term health implications have been linked to *E. coli* contamination (e.g., renal failure, etc.). Until appropriate regulations and a national regulatory body are established, Canadians will be at an unnecessary risk for drinking water contamination.

How can the Canadian federal government make drinking water safer??

The task of addressing such a formidable conundrum is by no means easy; however, the following recommendations would undoubtedly provide relief to the major drinking water issues.

1. Establish drinking water regulations.
2. Establish a national-independent regulatory agency that monitors and enforces drinking water regulations throughout Canada.
3. Establish stringent monitoring procedures that encompass seasonal patterns and require frequent reporting to the regulatory body.
4. Recognize safe-potable drinking water as a basic human right.
5. Encourage innovation and research into improving drinking water quality systems and aim at protecting source waters.
6. Promote and champion water conservation programs throughout Canada.
7. Ensure the sage operation of water treatment facilities by properly training water operators.
8. Provide funding to support new standards and the augmentation of existing infrastructure.
9. Re-evaluate acceptable concentrations for contaminants, as Canada's acceptable concentrations fall well short of the EPA's acceptable concentrations.
10. Increase testing and monitoring for numerous microbiological (e.g., *Cryptosporidium*, etc.) and chemical parameters (e.g., Iron, Copper, etc.).

If the above recommendations were promulgated, they would render Canadian drinking water considerably safer. The implementation of these suggestions would reduce the probability of disease, save lives, and save the Canadian health care system millions of dollars (it is estimated that disease from contaminated water cost the health care system \$300 million a year). In 2005, the First Nation community of Kashechewan in northern Ontario discovered that their drinking water supply was contaminated with *E. coli*. Extensive chlorine shocking only exacerbated issues and as a result, over a quarter of the community (population 1900) was airlifted to southern medical facilities. This evacuation cost the federal government over 16 million dollars. In Montreal, Quebec, hospitals cite that water borne illnesses are the cause of about 1/3 of all gastrointestinal complaints. In summation, the adoption of these recommendations would ensure the provision of considerably higher quality drinking water, would reduce the probability

of disease, and save the federal government millions of dollars in associated medical costs.

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