WATER SUPPLY AND WATER QUALITY

How does water clean itself?

Water is purified in large part by the routine actions of living organisms. Energy from sunlight drives the process of photosynthesis in aquatic plants, which produces oxygen to break down some of the organic material such as plant and animal waste. This decomposition produces the carbon dioxide, nutrients and other substances needed by plants and animals living in the water. The purification cycle continues when these plants and animals die and the bacteria decompose them, providing new generations of organisms with nourishment.

However, there are many toxic substances which are affected only slowly, or not at all, by this and other processes. These are called *persistent* and can be of great environmental concern.

pH

The acidity of a water sample is measured on a pH scale. This scale ranges from **0** (maximum acidity) to **14** (maximum alkalinity). The middle of the scale, **7**, represents the neutral point. The acidity increases from neutral toward **0**.

The scale is logarithmic, a difference of one pH unit represents a tenfold change. For example, the acidity of a sample with a pH of **5** is ten times greater than that of a sample with a pH of **6**. A difference of 2 units, from **6** to **4**, would mean that the acidity is one hundred times greater, and so on. **Typical rain has a pH of 5.6**; slightly acidic because of the carbon dioxide picked up in the Earth's atmosphere by the rain.

Human health and water quality

In Canada we are lucky to have plentiful supplies of good drinking water sources. Water-related illnesses - typhoid fever, cholera, dysentery are almost unknown today. Waste and wastewater treatment, the development and enforcement of drinking water guidelines, public health practices and education have resulted in a decrease in water related illnesses in Canada. Developing nations typically are less fortunate: 80% of diseases are water-related. Prevention of water-borne disease requires constant vigilance against bacterial contamination. Periodic beach closures.

Of serious concern today are the toxic chemicals that enter our waters from many different sources, including industry, agriculture and the home. Little is known about the effects of these toxic substances on human health; often the effects do not become noticeable for long periods of time, and it is difficult to distinguish them from the effects of other factors that impact on our day-to-day life (e.g., nutrition, stress, air quality). Much more remains to be done to control toxic chemical pollution. Meanwhile, we can all contribute to the prevention of water pollution by not abusing the water or the land.

Municipal water supply

People in industrial societies are accustomed to the availability of pure water at the turn of a tap. In most of the developing countries, a small fraction of the population, largely in urban areas, has access to tap water.

Assuring safe drinking-water supply is the principal concern of the city water system. This is accomplished through water purification and distribution engineering system. Municipal water system is designed to serve domestic use, industrial use and other municipal uses, such as firefighting, street cleaning, etc. The municipal water system requires sources of freshwater, purification system, and distribution system requiring pipes and pressure.

There are four potential sources of municipal water: direct precipitation, surface water, groundwater and recycled water. Ground water is by far the most common source of urban water supply. Electric pump is used to distribute water from the groundwater reservoir to the

distribution pipes. Most often water is pumped into a storage reservoir rather than directly into the distribution pipes. Surface sources may consist of a natural lake or a stream blocked by a dam.

If storage is located at sufficiently high elevation it may provide the natural pressure for distribution through pipes. Otherwise water may have to be pumped into a water tower.

In Canada, the drinking water quality is monitored at the federal level by the Department of National health and Welfare. *The Guidelines for Canadian Drinking Water Quality* are, however, developed and revised from time to time jointly by the Federal-Provincial Subcommittee on Drinking Water. The main reason for deriving drinking water guidelines is to protect human health.

Two main components for these guidelines include: (a) microbiological characteristics of the water and (b) chemical contaminants, in particular, carcinogens. The microbiological guidelines deal with the prevention of water-borne bacterial and viral diseases. For chemicals not to be considered carcinogenic, the guidelines follow certain technical criteria, such as the MAC (maximum acceptable concentration) and ADI (acceptable daily intake).

Wastewater treatment to improve water quality

Traditionally, wastewater quality discharge standards have focused on BOD (biochemcal oxygen demand), suspended solids, and bacterial quality. To meet these standards most wastewater discharges now receive secondary treatment and, where required, effluent disinfection using chlorine. In recent years other effluent contaminants have become of increasing concern. These include ammonia and its toxicity to fish species, the macro nutrients phosphorous and nitrogen and the byproducts of chlorine used in disinfection. Some of these substances have been found to be toxic and carcinogenic.

Alternatives to the traditional methods of removal of these substances have been described in a recent publication by Taniguchi (1993). This paper focuses on three items dealing with the science and technology of removal of ammonia and biological nutrient, and effluent disinfection.

Water demand management in Canad*a*

Economic measures such as realistic water pricing hold the key to adopting water demand management as a complementary adjunct to current supply management approaches. The current Canadian water pricing practice encourages elevated demand for water, a type of misuse, by both municipal and industrial sectors.

Walkerton slide

- E-Coli - Escherichia coli is a deadly bacteria
- Bloody diarrhea and abdominal pain and deadly to children and the elderly
- Some may have affects for the rest of their lives
- Saskatchewan March 2001, North Battleford thousands of residents (14000 population) suffered from vomiting and diarrhea and fever due to cryptosporidium in municipal water

Recommendations

- Multibarrier approach
- Watershed approach by province (WSB)
- Create goodwill and acceptance/trust by local community
- Federal and provincial source-tap water guidelines

Concluding Remarks

According to news and reports, most tap and well water in the United States is not safe for drinking due to heavy industrial and environmental pollution. Toxic bacteria, chemicals and heavy metals routinely penetrate and pollute natural water sources making people sick while exposing them to long term health consequences such as liver damage, cancer and other

serious conditions. We have reached the point where all sources of our drinking water, including municipal water systems, wells, lakes, rivers, and even glaciers, contain some level of contamination. Even some brands of bottled water have been found to contain high levels of contaminants in addition to plastics chemical leaching from the bottle.

A good water filtration system installed in your home is the only way to proactively monitor and ensure the quality and safety of your drinking water. Reverse osmosis water purification systems can remove 90-99% of all contaminants from city and well water to deliver healthy drinking water for you and your family.

Neskantaga First Nation

I mentioned the water woes of Neskantaga (Lansdowne House).
A video with discussion is available at
http://aptn.ca/news/2015/12/23/neskantaga-first-nation-in-ontario-waits-its-turn-for-promised-fresh-water/