

## Weighing the Risks of Chlorination?

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## Interior Health's Role under the Drinking Water Protection Act

- Medical Health Officers are appointed by Cabinet as Drinking Water Officers to administer and enforce the Drinking Water Protection Act and Regulation.
- Medical Health Officers delegate duties to Environmental Health Officers.

## Waterborne Illness

- Symptoms can range from mild to severe, from an upset stomach to severe diarrhea requiring hospitalization.
- The very young, seniors, and people with compromised immune systems are more likely to become ill and suffer severe symptoms.
- Waterborne illnesses can cause deaths.

## But I've never been sick...

- You may have been ill but didn't think it was from the water.
- Disease-causing organisms are not evenly distributed in the drinking water so some people can get sick and others not.
- Our ability to detect cases of waterborne illness is limited. Outbreaks must typically involve large numbers of people to be detected.

## Pathways of Pathogens into Distribution Systems:

- Treatment Breakthrough
- Leaking pipes, valves, joint seals
- Cross Connection and Backflow
- Finished Water Storage Vessels
- Improper treatment of equipment or materials before or during main repair
- Intentional introduction of contaminants
- Biofilms

## Typical Barriers to Pathogen entry into Distribution Systems

- Source protection
- Disinfection and Treatment
- Cross Connection Programs
- AWWA Standards for Operation and Maintenance
- Residual Chlorination

## Chlorine Residual in Distribution Systems

- Provides disinfectant barrier in the distribution system to inactivate pathogens
- Can be monitored to indicate:
  - system upsets (sudden loss of residual)
  - stagnant water (gradual loss of residual)
- Can reduce biofilm growth.

## History of Chlorine Use

- Before cities began treating drinking water with chlorine, cholera, typhoid fever, dysentery and hepatitis A killed thousands of people each year
- Chlorine was first used in New Jersey and Chicago in 1908
- By 1917 chlorine was used to disinfect drinking water in Canadian cities

## Science Lessons

- Chlorine is able to kill bacteria and viruses
- Chlorine can react with organic compounds in water to form Disinfection By-Products (DBPs)
- The amount of DBPs formed depends on many factors: amount of organics, temperature of water, pH, chlorine dose
- Surface water sources have more organic compounds than well sources
- There are ways to minimize the amount of disinfection by-products produced

## Science Lessons

- Currently, more than 600 individual compounds have been detected as DBPs from various disinfection processes (Richardson et al. 2007).
- Analytical methods have only become sufficiently sensitive within the last decade to detect "new" DBPs at the trace levels which they will typically occur in drinking water (Hrudey 2008).

## Science Lessons

- Since 1970's disinfection by-products have been studied to determine whether they cause cancer, birth defects, miscarriages or other adverse health effects.
- A thorough review of these studies indicates that no "certain" health effect has been proven between any DBP within current guideline levels and any specific health outcome
- There is enough information however to warrant continuing research and to meet current guideline levels

## Guidelines for Canadian Drinking Water Quality

- Health Canada, US Environmental Protection Agency and WHO have published levels at which they believe a lifetime exposure will not produce adverse health effects
- GCDWQ:
  - Halo-acetic Acids: Total (HAAs) 0.080 mg/l
  - Trihalomethanes: Total (THMs) 0.100 mg/l

**World Health Organization:  
International Agency for Research on  
Cancer (1999)**

- The estimated risks to health from disinfectants and their by-products are extremely small in comparison to the real risks associated with inadequate disinfection.
- Disinfection should not be compromised in attempting to control such by-products.
- The destruction of microbial pathogens through the use of disinfectants is essential for the protection of public health.
- Epidemiological studies conducted to date do not provide any evidence that disinfectants and their by-products affect human health at the concentrations found in drinking-water.



**DBPs in Drinking Water and Public  
Health in Canada, A Primer for  
Public Health Practitioners  
Reviewing Evidence from over 30  
Years of Research (2008)**

- Steve E. Hrudey, FRSC, FSRA, DSc (Eng), PhD, PEng, Professor Emeritus University of Alberta
- National Collaborating Centre on Environmental Health (2008)



**Hrudey (2008)**

- over 30 years of health related research into DBPs in drinking water indicates that there is no "certain" health effect that has been proven between any DBP within currently regulated levels and any specific health outcome.
- The overall results of epidemiology studies for birth defects are not supportive of a causal linkage between exposure to chlorination DBPs and any birth defects.



**Hrudey (2008)**

- A major portion of the complexity of the chlorination DBPs issue arises from the inherent limitations of our primary scientific approaches to studying the problem: toxicology and epidemiology.
- Each has its own limitations and neither is perfect for answering the questions necessary to address a complex public health issue



**Hrudey (2008)**

- It is necessary to maintain a sensible, precautionary approach to managing DBPs that recognizes that it is at least as likely that there may be no adverse health effects from current disinfection practices as it is that future research may be able to establish a more certain causal relationship for one or more DBPs and specified health outcomes.



**How can we use what we have  
learned to make good decisions?**

- Use a multi-barrier approach to provide safe drinking water
- Design the right treatment process for the source water quality
- Protect the source water and distribution system from contamination
- Monitor the drinking water for DBP



## Summary

- Chlorine destroys disease-causing bacteria and viruses, is cost-effective, and easy to control
- Chlorine in the distribution system provides a disinfectant barrier, can reduce microbial re-growth, and can be monitored to provide immediate warning of adverse events.

## Summary

- Current understanding of DBPs is that they present a very low risk of adverse health effects
- There is still much to learn about DBPs
- Chlorination practices should strike a balance between ensuring disinfection and reducing the formation of DBPs.
- Consumers who remain concerned about chlorinated water can use activated carbon filters to remove chlorine and some its byproducts

## Questions?

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