Disinfection Byproducts in Drinking Water

What Are Disinfection Byproducts And How Are They Formed?

Chlorine is added to drinking water to kill or inactivate harmful organisms that cause various diseases. This process is called disinfection. However, chlorine is a very active substance and it reacts with naturally occurring substances to form compounds known as disinfection byproducts (DBPs). The most common DBPs formed when chlorine is used are trihalomethanes (THMs), and haloacetic acids (HAAs).

What Types Of Water Systems Are Most Likely To Have DBPs?

Water systems using sources with higher amounts of organic substances will form more DBPs when disinfected than those that do not. Sources with higher organics levels include:

- Surface waters, such as lakes, rivers and streams.
- Springs and wells that are shallow and/or located near surface waters.

Groundwater, especially those from deep wells, tends to contain little organic substances. Even if they chlorinate the water, lesser amounts of DBPs are typically found.

Do DBPs Have Harmful Health Effects?

Scientists have conducted studies on health effects of exposure to high levels of DBPs on laboratory animals. These studies have shown that several DBPs cause cancer in laboratory animals. In addition, some DBPs cause undesirable effects in the animals' growth and reproduction. It is, however, difficult to estimate how the results of these high dosage studies on laboratory animals can be applied to low dosage, long-term exposure for humans.

Scientists have also studied the relationship between drinking chlorinated water and cancer rates. Some of these studies suggest an increased cancer risk to those using chlorinated drinking water, while others found no increased risk. Other studies that investigate whether chlorinated drinking water has an effect on reproduction and development also show inconsistent results. At the present time, the U.S. Environmental Protection Agency (EPA) does not believe there is enough evidence to state conclusively that DBPs cause these types of health effects. Research on the health effects of DBPs is not complete and the federal government continues funding research on this topic.

Are There Regulations Regarding DBPs?

Although, at present, there is no conclusive evidence showing DBPs in water is associated with cancer or other health effects, there are some concerns, given the research information and the large number of people drinking chlorinatedl water. In 1979, EPA established total trihalomethane (TTHM) levels for certain types of water systems. In 1998, EPA finalized the "Stage 1 Disinfectants and Disinfection Byproducts Rule (DBPR)." These new rules replace the original TTHM Rule. The Washington State Department of Health incorporated these rules into the State's Drinking Water Regulations in April 2003, and these rules became effective January 1, 2004.

Why Can't One Simply Remove The DBPs Formed During Treatment?

DBP formation is not instantaneous. The amount formed depends upon factors such as chlorine concentration, temperature and length of contact time between the chlorine and water. The rules specify that some or all the samples must be collected at the end of the distribution system from locations that represent maximum residence time.

What Can Be Done To Reduce The Amount Of DBPs Formed?

Sometimes, it is possible to reduce the amount of DBPs formed by one or more of the following methods:

- Removing the organic substances that react with the chlorine to produce DBPs.
- Avoid maintaining residuals that are higher than necessary for public health protection.
- Changing the location where the chlorine is added.
- Using a different type of disinfectant.

Disinfectants other than chlorine have certain advantages and disadvantages and some form other

types of DBPs. For a more thorough discussion of alternative disinfectants, request or download the fact sheet "Alternative Disinfectants" from the Washington State Department of Health.

Should Chlorination Be Discontinued In Order To Avoid DBPs?

The primary reason for adding chlorine to water is to make it safe to drink by killing or inactivating harmful microorganisms that cause diseases such as typhoid, cholera, dysentery, and giardiasis. Health professionals regard the chlorination of water as one of the most important advances in the field of public health protection. Chlorinating drinking water has saved millions of lives.

Research is still continuing on the health effects of DBPs and improvements in water treatment technology. Because of the immense benefits in reduction of infectious diseases, and the simplicity and low cost of water treatment using chlorine, chlorination is the most appropriate choice as a method of ensuring safe drinking water for most water systems.

Contacting Us

City of Olympia | Water Quality Section
360.709.2774
publicworks@ci.olympia.wa.us
olympiawa.gov/drinkingwater

Washington State DOH | Drinking Water
1.800.521.0323

Updated 2016|CS