S A S K A T C H E W A N

Water Security Agency

Trihalomethanes (THMs)

Surface water treatment plant operators must be diligent in plant operations to minimize the formation of Trihalomethanes (THMs). THMs are formed when chlorine, which is generally used for disinfection, reacts with naturally occurring organic compounds (called precursors) present in raw water. Surface water typically has higher levels of these precursors. THMs formed as by-products of disinfection have been detected in chlorinated water supplies throughout the world.

The Maximum Acceptable Concentration (MAC) for total THMs in drinking water is 0.1 mg/l (100 µg/l). This level is determined by a locational running annual average of a minimum of quarterly samples taken at a point in the distribution system with the highest potential THM levels. THMs that are most commonly found in drinking water include chloroform, bromodichloromethane, dibromochloromethane and bromoform. The THM MAC is based on the risk associated with chloroform, which is classified as a possible human carcinogen by Health Canada. Drinking water with THMs at the MAC level of 0.1 mg/l represents a 1 in 1,000,000 carcinogenic risk based on a consumption rate of 1.5 litres per day for 70 years. The cancer risk is considered to be possible based on laboratory studies in animals as well as human studies that have suggested a link between exposure of elevated THMs and colorectal cancers. The MAC level includes a safety factor and is in place to protect the most vulnerable over a lifetime of consumption. However, adequate disinfection should not be compromised in attempting to meet guidelines for THMs.

There are several factors that increase the THM formation and/or formation rate in drinking water, including increased time, higher temperatures, higher pH values, larger amounts of precursors, higher free chlorine residuals and higher concentrations of bromide.

Consumers can reduce THM levels in drinking water by placing water in their refrigerators in an open top container overnight. Boiling water when preparing tea or coffee will also reduce the levels of THM's. THM's can also be removed from drinking water by activated carbon filtration and other means. If you choose to use an activated carbon filter, it is essential to follow the manufacturer's instruction. Since the sale of water treatment devices is not regulated in Canada it is wise to select devices such as activated carbon filters certified by the National Sanitation Foundation for removal of Trihalomethanes.

At the municipal scale there are a number of options to control THM concentrations in drinking water including reservoir management, treatment to remove THM precursors, treatment to remove THMs after formation and the use of alternative disinfectants.

The major and preferred mechanism for THM control in a conventional surface water treatment plant is THM precursor removal in the coagulation and sedimentation processes. Water treatment plants should optimize all their unit processes to increase precursor removal. Other technologies that may be effective at removing THM precursors are oxidation, adsorption, membrane filtration and biological degradation. However, if precursor removal techniques fail or are unfeasible, it is possible to remove THMs after they are produced.

THMs can be removed by diffused air or tower aeration or possibly by other technologies. However, all proposed technological solutions should be pilot tested and approved by the Water Security Agency (WSA) to ensure their efficiency before full-scale implementation.

Changing disinfection practices, such as replacing chlorine with an alternative disinfectant, is another possible method of THM control. Ozone, chlorine dioxide, chloramines and ultraviolet light are all alternatives to conventional chlorine disinfection. These alternatives produce significantly less THMs, however other disinfection by-products may be formed. Little is known about the toxicity and nature of these by-products. Another change in disinfection practice that may be effective in controlling THM formation is moving the point of chemical (chlorine) addition during the treatment of water. Like any technological solution, alternative disinfection practices would have to be bench tested, properly designed by an engineering consultant and approved by WSA.

If you have any questions, please contact your Environmental Project Officer.

Water Security Agency, EPB 211B, March 31, 2016