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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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TRIHALOMETHANES

- **bromodichloromethane**
- **bromoform**
- **dibromochloromethane**
- **chloroform**

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TRIHALOMETHANES

Bromodichloromethane, dibromochloromethane, bromoform and chloroform are currently the trihalomethanes (THMs) of public health concern in drinking water. There are other THMs under study that may be added to the list of regulations in the future. There are other families of disinfection byproducts that are recognized as drinking water contaminants. They are discussed in other drinking water fact sheets. Trihalomethanes in drinking water are undesirable but are created by unavoidable reactions of chlorine disinfectants with organic materials already in the water. Many of these same compounds are manufactured deliberately and distributed for use in industry. Some of the uses include manufacture of pharmaceuticals, chemical manufacture, as ingredients in fire retardants and as solvents for fats, oils and waxes. Some of the THMs found in drinking water may be from contamination from these industrial processes.

OCCURRENCE OF THM'S IN WATER SUPPLIES

Studies conducted in the 1970's and more recently by the Environmental Protection Agency (EPA) confirmed the presence and the hazards posed by THMs in drinking water. Their formation is due to the reaction of chlorine-based disinfectants with organic materials present in the untreated water supplies. Organic contaminants generally come from natural materials in the environment such as decaying plants, leaves and other dead materials in surface water sources. This organic material is generally measured and discussed as total organic carbon (TOC). Amounts of THMs formed are directly related to the amount of TOC and the amount of disinfectant used. The reactions that form THMs occur during treatment, storage and distribution within drinking water systems, and are further influenced by pH, time and temperature.

TESTING, REPORTING AND EXPOSURE ROUTES FOR THM'S

In 1979 EPA began requiring public water systems which served more than 10,000 persons to test for and report the concentrations of THMs in their drinking water. The initial limit EPA adopted was 0.1 parts per million (ppm) total combined THMs. In 2001 EPA adopted a more protective maximum contaminant level (MCL) for all sizes of community and non-transient water systems of 0.08 ppm total combined THMs. EPA has also adopted regulatory goals (MCLGs) for bromodichloromethane (zero), for bromoform (zero), for dibromochloromethane 0.06 ppm). Chloroform must be included in total THM concentrations, but at this time there is no MCL or MCLG for this compound.

The major routes of exposure to THMs in drinking water are through drinking the water, eating foods prepared with water, and by breathing vapor or mist from the water. Studies have shown

that the major exposure route is inhalation during showering, bathing, general cleaning and washing clothing and dishes.

HEALTH RISKS

The primary health concerns with THMs in the past has been injury to the liver, kidneys, central nervous system and increased risk of bladder cancer. More recent research is showing associations between THM exposure and a variety of fertility, menstrual and gestational disorders, including miscarriage, stillbirth and birth defects. THMs are also associated with animal cancer risk, suggesting that they are possible human carcinogens as well. EPA estimates that 3-4 additional cancers may occur among every 10,000 persons consuming 2 liters of water which contains only 0.1 ppm chloroform on a daily basis for 70 years. Many scientific studies use a shorter exposure period (20, 30 or 40 years) because it is uncommon for a person to use the same water supply for a complete lifetime. There is no reason to believe that inhalation of THMs is less hazardous than ingestion of the same amounts in drinking water.

REMOVING THM'S FROM DRINKING WATER

The production of THMs in drinking water is best controlled by removing as much organic matter as possible from water before adding chlorine disinfectants. Coagulation, sedimentation and filtration will greatly reduce the amount of organic carbon (TOC) which would other wise react to form THMs. THMs are more difficult and expensive to remove from water once they have formed. Some THMs can be removed from water by oxidation and activated carbon filtration.

Another way to avoid THMs is to use something other than chlorine gas or hypochlorites as disinfectants. Chloramines, chlorine dioxide, UV light and ozone are other possible disinfectants, but they also produce harmful by-products.

Researchers continue to study THMs and other disinfection by-products to discover ways to minimize and remove them from drinking water. There will continue to be changes in technology and in drinking water regulations as more information becomes available.

If you have questions or would like advice about removing THMs from your drinking water please contact the DHS Drinking Water Program.