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Minding Your THMs

By Lou Ellen Ruesink, Editor, Texas Water Resources

Trihalomethanes. That's a big word for something you can't see, smell, or taste . . . a word for something virtually unknown before 1974.

Chances are good, though, that trihalomethanes (THMs) in your water supply will soon be (if they are not already) a topic of conversation and a matter of concern for you and your neighbors. The exact amount of THMs in your drinking water may even become a political or economic issue in your community.

THMs are synthetic organics found in treated drinking water. They form when chlorine, the most common disinfectant used in Texas water supplies, is added to water containing organics.

Organics occur naturally in nearly all surface water in Texas. Water in East Texas is especially rich in organics from decaying vegetation and from animal and plant life in reservoirs and rivers. Most groundwater in Texas is relatively free of organics, but there are isolated wells producing water with high organic levels.

Natural organics, while not harmful themselves, team up with chlorine during the water treatment process to form the potentially dangerous trihalomethane, chloroform. Three other THMs are formed when organics combine with chlorine, bromine, or iodine, but chloroform is by far the most prevalent in drinking water.

The formation of THMs continues as long as there is a chlorine residual in the water. Since the state requires a residual amount of chlorine or some other disinfectant all the way to the consumer's tap, THMs can--and do--form throughout the water distribution system.

Even though the effects of chloroform and other THMs on the human body are still unknown, tests have found that chloroform can cause cancer in rats and mice. The National Cancer Institute considers chloroform a potential human carcinogen and recommends that its consumption be limited.

Maximum Levels

The U. S. Environmental Protection Agency (EPA), responsible for setting Federal drinking water standards, has had an especially difficult problem in determining the "safe" level for trihalomethanes. EPA scientists and other experts agree that THMs do pose potential health hazards when consumed over a long period of time.

How long, no one knows. How many THMs are safe to consume, no one knows. Questions remain unanswered partly because few scientists knew about--let alone studied--THMs in water before 1974. All decisions regarding them have been based on research conducted since THMs were discovered in drinking water in 1974.

In 1979, EPA established a maximum level of 0.10 milligrams per liter for a combination of four THMs including chloroform. EPA based this level on public health considerations balanced with the ability of public water supplies to meet that level with technology presently available to them. The maximum level was also set considering how many THMs are presently believed to be safe for lifetime consumption. Three THMs in addition to chloroform were included in the maximum level set by EPA because of their structural similarities to chloroform.

The new limits on THMs will mean little more to most Texas water systems than a yearly sample and a report to the Texas Department of Health in Austin. Systems using groundwater low in organic content fall into this category. Systems drawing raw water from a reservoir or river but consistently producing water low in THMs will monitor and report only once each quarter for each treatment plant.

Public water systems taking water from rivers or reservoirs or groundwater with high organic levels which have not already done so, will have to make changes in their treatment processes in order to reduce the THM levels below the 0.10 milligrams per liter standard set by EPA. These systems will be required to measure and report their THM levels from four locations each quarter for each treatment plant in their systems.

EPA monitoring requirements began in November 1980 when cities over 75,000 in population were given one year to monitor THM levels and to reduce them to meet the Federal standard. All but three or four of the 23 cities in Texas over 75,000 in population have already been able to meet acceptable levels. Many have reduced their levels by adding ammonia during treatment. Ammonia reacts with chlorine to form chloramine, an alternative disinfectant.

Even though EPA requirements give cities with populations between 10,000 and 75,000 until November 1982 to monitor THMs, all 170 Texas cities of this size have monitored

THMs since March 1981. These cities have until January 1984 to reduce trihalomethane levels to meet EPA standards.

Towns with populations under 10,000 are not included in present Federal regulations. This does not mean that these towns will not voluntarily be monitoring or attempting to reduce the THMs in their drinking water. EPA did not include them in its initial requirements because changes in any treatment system require careful supervision and because much is yet to be learned about reducing THM levels. Small water supply systems will be able to take advantage of the THM monitoring and reduction methods developed by the larger systems before they are required to meet EPA standards.

Institute Research

The regulations established by EPA and enforced by the Texas Department of Health will have a significant impact on Texas water supplies, according to Bill Batchelor, environmental engineer at Texas A&M University.

All Texas surface water and some groundwater, according to Batchelor, contain matter which could form trihalomethanes. The problem in many areas of the state is especially critical, he says, because petrochemical and agricultural activities add to the organics naturally occurring in Texas surface waters. In his study, completed in January 1981, Batchelor sampled water from Lakes Somerville and Livingston and the Neches and Sabine Rivers. He found water from all four sources high in organics or what he calls precursors--contaminants in water which have the potential to form THMs.

The major objective of Batchelor's study was to find methods for water supply systems to reduce the THM level in treated water. His research project was funded by the Texas Water Resources Institute.

Cities generally change their treatment methods in one of three ways, according to the Texas A&M researcher, in order to reduce the number of THMs in the finished water. The three ways are:

- 1. Disinfect with something other than chlorine.
- 2. Allow THMs to form during treatment, then remove them before distribution.
- 3. Lower the organic content of raw water.

Batchelor warns against substituting another disinfectant for chlorine in some situations even though there are other disinfectants capable of killing harmful bacteria in water. The resulting health effects of alternative disinfectants, he says, are even less understood than those for chlorine. Even though chloramine, ozone, and other disinfectants do not form THMs, they may form other reaction byproducts. Since they are not as commonly used or as well researched as chlorine, little is known of their hazards. Alternative disinfectants such as chloramines are also much weaker disinfectants than chlorine.

Efforts to remove THMs after they are formed, according to Batchelor, are generally costly in terms of both energy and money. Another major disadvantage of removing

THMs after they are already formed is that more can form as long as water is in the distribution system because chlorine and organics still remain.

Best Approach

Batchelor feels that the best approach for reducing THMs is for a treatment plant to reduce the amount of natural organics before adding chlorine. Removing organics before treatment, he says, means that treatment plants could continue using chlorine, a proven effective and economical disinfectant.

Organics can be removed before adding chlorine simply and economically in most plants, according to Batchelor, by improving conventional coagulation processes. Coagulation is the process of removing the pollutants suspended in water (the "mud" in "muddy" water). The process involves adding alum (aluminum sulfate) to water to form tiny, sticky particles called floe. The floe gathers together solids suspended in the water and hastens the settling process. Floe particles not heavy enough to settle are filtered out of the water.

Batchelor's research found that the pH (acidity) of the water to be treated strongly influenced how well the coagulation removed organics from the water. By adjusting the pH of the water--a relatively simple and inexpensive process--a water treatment plant can reduce organics and thereby reduce the THMs formed during treatment.

While testing alternative methods, Batchelor found that activated silica effectively removes organics when used in addition to alum or as a coagulant by itself. The use of activated silica, according to him, is "one of the cheaper alternatives" for cities attempting to reduce the THM levels in their drinking water.

Research such as Batchelor's will help cities of all sizes in Texas to comply with the THM standards set by EPA. The methods chosen by each city will vary according to present treatment methods, THM levels, and economic considerations. Federal regulations do not recommend specific treatment methods.

If your city is now producing water with THM levels below Federal maximum, or if it can make minor, inexpensive adjustments to reduce THMs, you may never again read the word trihalomethanes. But if your city is producing water high in THMs, you will likely encounter the word again in connection with a water rate increase, a bond issue, or a political campaign. Water systems unable to deliver water meeting Federal standards by the deadlines will have to notify their customers by letter and through the local news media.

Hopefully, trihalomethane will never be a household word in Texas. It is not yet included in standard dictionaries. Perhaps the prompt regulatory action by EPA, the timely research by scientists like Bill Batchelor, and the universal compliance by Texas water suppliers will alleviate the health effects feared and will keep the word trihalomethanes out of medical history books.