WHAT ABOUT CHLORAMINE?

Water Treatment with Chlorine + Ammonia

It's really not funny that children who've never seen a cow sometimes think that milk comes from the grocery store. But we all can be just as unaware of the amazing technology and infrastructure that we trust to give us safe, clean water whenever we turn on the kitchen faucet or the bathroom shower.

Greensboro has a robust well operated community water system

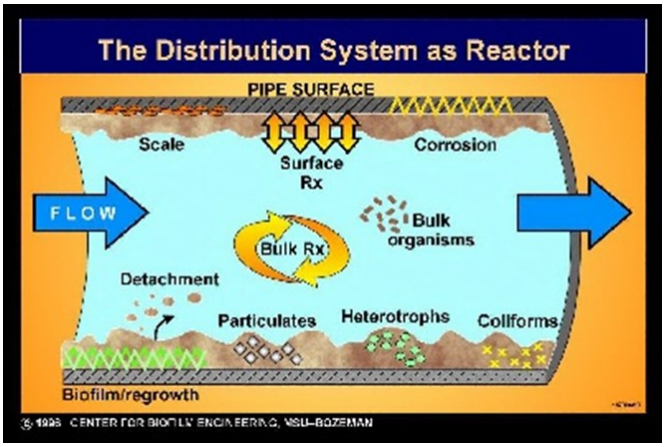
thanks to our highly educated and conscientious water treatment leadership and personnel. Our city water treatment policies depend on the funding we allocate to that municipal responsibility as well as our cooperative interactions with the other water systems that Greensboro interconnects and interacts with.

> One of the issues that water treatment engineers deal with is the formation of toxic substances that result from chemical reactions between water disinfection chemicals (traditionally chlorine) and microscopic particles of organic material (such as decomposing plant material) that remain in disinfected water. Those compounds of disinfectant-and-organic-material are called **D**isinfection **B**y-**P**roducts (DBPs).
>
> The health risks due to Disinfection By-Products (DBPs) are not fully known. However, a substantial number of these DBPs have been shown to be toxic in many biological assays. Although over 600 DBPs have been isolated and identified, that is only a fraction of all the toxic **halogenated organic material** that can form as a result of disinfection of raw waters.

Forty years ago, in 1979, the EPA began the formal regulation of some DBPs. That regulatory action was extended in 1998 with the publication of the **Disinfectants/Disinfection Byproducts Rule—Stage 1.** Then **Stage 2** of the **Disinfectants/Disinfection Byproducts Rule** became universally effective on October 1, 2013. This very gradual implementation of safe water regulations is typical of the way the process proceeds.

In order to comply with the **Stage 2 Disinfectants/ Disinfection Byproducts Rule**, our Department of Water Resources chose **chloramination** as an interim disinfection measure due to considerations of cost and interconnectivity with our water system partners—High Point, Winston-Salem, Reidsville and Burlington.

Chloramination is a process that results in the addition of ammonia along with chlorine to form chloramine. The **ammonia inhibits the action of the chlorine** and therefore reduces the formation of the chlorine DPBs. It also reduces disinfection potency. Greensboro Water Resources was aware of some of the **drawbacks of using chloramine** for disinfecting drinking water. Recognizing that a longer term solution would be required, the department started **planning for a better way** to permanently address the DPB problem.



Distribution System Fouling with Chloramination:

Nitrification

Nitrification is a microbial process that converts ammonia and similar nitrogen compounds into nitrite (NO_2^-) and then nitrate (NO_3^-).

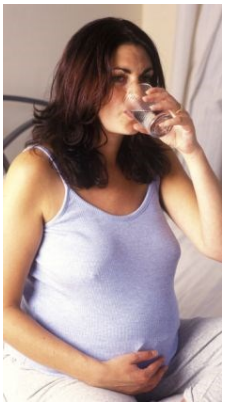
Biofouling

E-Coli Bacteria
Legionella Bacteria
Naegleria fowleri (brain-eating amoeba) *Note: For neti pot sinus cleaning use only sterile water, never tap water.*

The method required to clean up Distribution System Fouling is periodic **Chlorine Burnouts** that last 60 days or more.

- Turn off the ammonia.
- Turn up the chlorine dose.
- Open up the fire hydrants.
- Burnout the system.

Burnout the Environment? Where does the sediment, biofilm, debris and high level of chlorine go?



Impact of Chlorine Burnouts On Infants

A chlorine spike that typically lasts two months exposes a pregnant woman and her fetus to excessive trihalomethane during critical periods of prenatal development. Scientific research has shown that such intensive exposure can have serious consequences for the child. Ironically and illogically, the primary reason for switching to chloramine from standard chlorine disinfection was to protect infants from trihalomethane generated by chlorine interacting with organic matter. During periods of chlorine burnout it is not usual to warn healthcare providers and pregnant women to avoid ingesting tap water.

The better way is filtering with Granular Activated Carbon (GAC) which removes the organic particles at the beginning of the treatment process so that they are not present to interact with chlorine to form the problematic chlorine DBPs that have so far been identified and regulated by the EPA.

Since the initiation of chloramination by many water systems around the US, there is growing evidence of a number of unintended consequences of that treatment strategy. They can include adverse immediate and chronic health effects for some consumers, damage to metal and plastic plumbing elements, fouling of the distribution system due to nitrification, scaling, and bacteriological outbreaks, loss of system disinfection because of the weaker residual effectiveness of chloramine, and environmental damage. Additionally, other even more toxic DPBs, such as nitrosamines, have been identified.

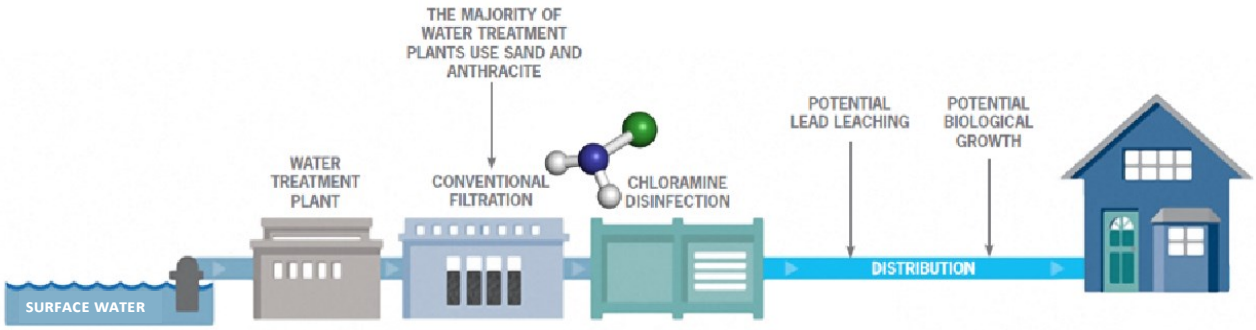
The EPA Office of Drinking Water has never suggested, directed or required the use of chloramine for compliance with the **Stage 2 Disinfectants/Disinfection Byproducts Rule**, and the EPA has not disallowed it either. Currently they are reevaluating chloramine use, particularly as it relates to the DBP's that are formed by chloramination. Given the observed problems, the likelihood exists for the EPA to develop additional regulatory requirements surrounding the use of chloramine for disinfection purposes. That could mean that it might no longer be an option for our system anyway.

At this time, the EPA believes that the best way to control DBPs is both to regulate known byproducts and to **limit the quantity of disinfection byproduct precursors** (e.g., decomposing plant material) allowed to react with disinfectants.

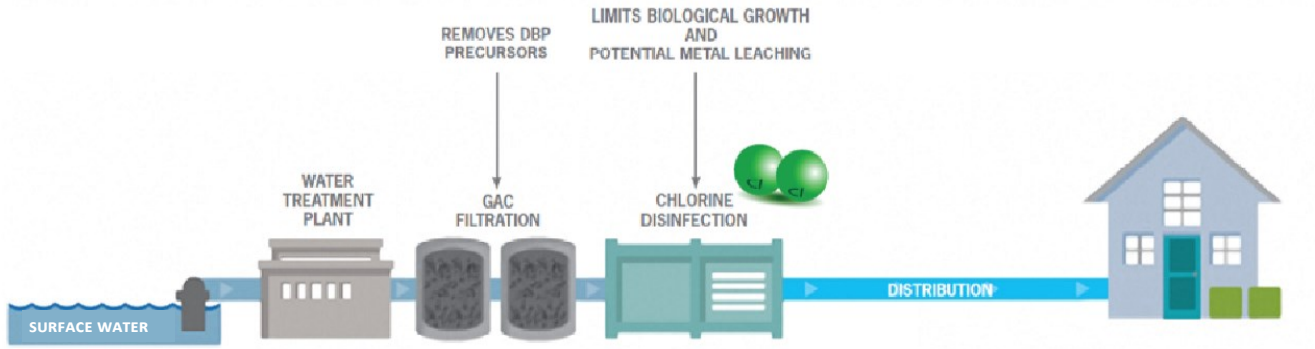
Implementing improved treatment for our drinking water using Granulated Activated Carbon (GAC) filtration requires capital investment. GAC filtration would provide the added benefit of removing other chemicals of concern such as PFOA and PFOS and pharmaceuticals, in addition to removing the organic material. And ending the use of chloramine would end it's damaging effects on our water distribution infrastructure.

Clean Water Greensboro urges the City to make upgrading our water treatment a top priority. The City Council should address the funding and administrative measures required to allow our Department of Water Resources to move with all deliberate speed to replace chloramination with GAC filtration, which will allow a return to safe traditional chlorine disinfection without the problems of disinfection byproducts (DPBs) and with the added benefits of removing other problematic chemicals that have been detected in our watershed and also preserving the integrity of our water distribution system.

Greensboro's current chloramine treatment model



Improved treatment model using GAC filtration and chlorine



About Granular Activated Carbon (GAC)

GAC is a porous material that removes organic compounds from liquids by a process known as "adsorption." In adsorption, organic molecules contained in water are attracted and bound to the surface of the pores of the activated carbon as the water is passed through.

The primary raw material used in the production of activated carbons is bituminous coal that is crushed, sized and processed in low temperature bakers followed by high-temperature activation furnaces. Activation develops the pore structure of the carbon. Through adjustments in the activation process, differentiated pores for a particular purification application are developed.

The adsorptive capacity of granular activated carbon (GAC) makes it ideal for removing a variety of contaminants from water. GAC is also an environmentally responsible product that can be reactivated through thermal oxidation and used multiple times for the same application.

ADVANTAGES OF GAC FILTRATION

- **Removes most problem contaminants**
- **Eliminates need for chloramine**
- **Allows chlorination to safely maintain water disinfection throughout the system**
- **Chlorine can be removed by common household filters; those filters do not remove chloramine**
- **No chloramine means less water system corrosion**
- **No chloramine means less leaching of lead from water system and household plumbing fixtures**