POOL & HOT TUB ALLIANCE

July 2020

FACT SHEET

Chloraminated Tap Water

Brought to you by the PHTA Recreational Water Quality Committee (RWQC)

I. INTRODUCTION

This fact sheet will describe the chloramination process for tap water, the reasons for chloramination, and the impact of chloraminated water on pools and spas.

Many pool and hot tubs operators understand that the primary source of "combined chlorine" in the water results from the reaction of chlorine sanitizer with bather perspiration and waste. However, another potential source is chloraminated tap water, which may be used for fill and makeup water. When pool and hot tub operators use tap water to fill, they may inadvertently be adding considerable amounts of combined chlorine.

II. SUMMARY OF CHARACTERISTICS

Chloramination is a process that adds free chlorine (usually chlorine gas, sodium hypochlorite or calcium hypochlorite) and ammonia to water to form chloramines. The process is often used by water treatment authorities to treat drinking water. If you have any questions as to whether or not your water is chloraminated, contact your local water authority or visit the U.S. Environmental Protection Agency website.

- The chloramination process may produce any of three inorganic chloramines: (1) monochloramine (NH_2Cl), (2) dichloramine ($NHCl_2$), and (3) trichloramine (nitrogen trichloride, NCl_3).
- Monochloramine (NH_2Cl) is the preferred chloramine in treated drinking water. Monochloramine is an oxidizer and has been found to be effective in controlling bacteria regrowth.
- Compared to free chlorine, monochloramine is more stable and lasts longer which is important to large water distribution systems.
- The mixture of chloramines will depend on pH, chlorine/ammonia ratio, temperature, alkalinity, and contact time. The combined chlorine in treated drinking water should be primarily monochloramine.
- The typical concentration of monochloramine in treated drinking water is between 1 and 3 ppm as Cl_2.
- Chloraminated fresh-fill or makeup water may contribute to monochloramine (NH_2Cl) and small amounts of dichloramine ($NHCl_2$) and trichloramine (nitrogen trichloride NCl_3) in swimming pool water.

III. GENERAL DESCRIPTION

Municipal drinking water is commonly chloraminated to create a longer lasting disinfectant residual and to limit the formation of certain EPA-regulated chlorination disinfection byproducts. Both chlorine and small amounts of ammonia are added to the water separately. They react together to form chloramines, which are detected as combined chlorine in pool water. This process produces monochloramine which is less of an irritant than other common chloramines, such as dichloramine and trichloramine. Chloramine disinfection with monochloramine is used in both small and large water treatment plants and usually controlled by measuring total chlorine residual concentration. While use of monochloramine works well for drinking water, it does not work in pool and hot tub water.

IV. REMEDIAL STEPS FOR POOLS & HOT TUBS

Fresh Fills. It is best to avoid using chloraminated tap water for fresh fills of pools and hot tubs. Verify the origin of your source water. Refer to the RWQC Source Water Fact Sheet. Test your fill water for combined chlorines. If combined chlorine is present, take the following remedial steps after filling the pool or hot tub:

1. If necessary, adjust the pH to 7.4-7.6.
2. Oxidize the pool/hot tub using a non-stabilized chlorine oxidizer to achieve an acceptable concentration of combined chlorines.

Makeup Water. Makeup water is water that is added to a pool or hot tub to replace water that has been lost from evaporation, splash out, or backwashing. The volume of makeup water is small compared to the total volume of the pool or hot tub. When chloraminated makeup water is added to a pool, the impact is much less than when chloraminated water is used to fill a pool. The impact may be important to operators of pools with high bather loads, where compliance with the maximum combined chlorine concentration is difficult.

After adding makeup water, the pool water should be tested to determine the concentration of chloramines. If the combined chlorine concentration is unacceptable, it can be reduced by adjusting the pH to 7.4-7.6 and oxidizing with non-stabilized chlorine. After the desired combined chlorine concentration has been attained, balance the pH and alkalinity.

V. NOTES

Testing. Chloraminated water may present a problem with DPD testing of free chlorine concentration when combined chlorine is above 1–2 ppm. An interference will occur in the DPD test for free chlorine if the reading is not taken within 30 seconds. This will result in high free chlorine readings. A separate total chlorine test would be required after the free chlorine test.

VI. REFERENCES

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5. James M. Montgomery, *Water Treatment Principles and Design,* John Wiley & Sons, New York, NY, 1985.
6. Recreational Water Quality Committee (RWQC) “Source Water” Fact Sheet, 2020, Pool & Hot Tub Alliance (PHTA), https://www.apsp.org/resources/factsheets.
7. Snoeyink, V.L., and Jenkins, D. *Water Chemistry*, Wiley, 1980.
8. Federal register/vol.71, no.2/January 4, 2006.