



CITY OF NORTH RICHLAND HILLS

CONSUMER HEALTH DIVISION

BREAKPOINT CHLORINATION

Know Your Chlorines

If you're using chlorine as a disinfectant for your pool or spa, make sure that you are testing for both **free chlorine** and for **combined chlorine**.

Free chlorine levels must be maintained between 1.0-10 ppm for pools, and between 2.0-10 ppm for spas.

Maintaining free chlorine in these ranges (and superchlorinating if needed to control Cryptosporidium and Giardia) will help ensure that you are protecting swimmers from recreational water illnesses caused by bacteria, viruses, and parasites.

Combined chlorine (also called chloramines) are chemical compounds formed by chlorine combining with nitrogen-containing contaminants in pool water. These are still disinfectants, but they are 40 to 60 times less effective than free available chlorine. Contaminants come from swimmer wastes such as sweat, urine, body oil, etc. This is why requiring all bathers to shower before entering the pool is a good idea.

If you smell "chlorine" coming from your pool, in most cases what you really smell are combined forms of chlorine, also called chloramines.

Explaining Breakpoint Chlorination

Breakpoint chlorination is not the same as superchlorinating the water to control Cryptosporidium and Giardia. See the separate handout from the Centers for Disease Control and Prevention to learn more about controlling Cryptosporidium and Giardia.

High levels of chloramines in the water will cause a strong "chlorine" smell, will cause eye irritation and skin irritation to swimmers, and will cause corrosion to surfaces and equipment in the pool area. Chloramines can usually be eliminated from the pool water by performing breakpoint chlorination with chlorine or super oxidation with a non-chlorine oxidizer. Ultraviolet systems and ozone systems can sometimes be effective at reducing chloramine levels in pools, but occasional breakpoint chlorination or super oxidation may sometimes be needed.

Breakpoint chlorination is adding enough chlorine to eliminate problems associated with combined chlorine.

Specifically, breakpoint chlorination is the point at which enough free chlorine is added to break the molecular bonds between the chlorine and ammonia or nitrogen compounds in combined chlorine molecules. **Aim for a ratio of ten times the amount of additional free chlorine to combined chlorine to properly reach breakpoint chlorination.** When sufficient free chlorine (FC) is added to pool water, the inorganic chloramines are converted to dichloramine, then to nitrogen trichloride, and then to nitrogen gas. Any excess chlorine leftover will become the free chlorine residual (FC).

When to Breakpoint Chlorinate

It is recommended that breakpoint chlorination or super oxidation be utilized when combined chlorine levels read 0.2 ppm or higher. **The maximum level of combined chlorine allowed in a pool/spa is 0.4 ppm.**

Remember: Total Chlorine= Free Chlorine + Combined Chlorine

Follow the instructions on your test kit to test for both free chlorine and combined chlorine. Some test kits will enable you to determine combined chlorine directly. Other test kits will enable you to determine total chlorine and free



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chlorine levels; knowing this information, you will be able to calculate your combined chlorine levels using the formula above.

How do I know how much additional free chlorine to add?

Test your water for both free chlorine and combined chlorine.

Multiply your combined chlorine result by 10. This will give you the amount of additional free chlorine needed (in ppm) to properly breakpoint chlorinate the pool/spa water.

For example, if **your free chlorine level is 1.0 ppm**, and your **combined chlorine level is 0.4 ppm**, you need to add enough chlorine to **raise the free chlorine levels by at least 4 ppm** in order to reach a sufficient breakpoint chlorination. In other words, you need to make sure that **your free chlorine level is raised to 5 ppm** to reach a sufficient breakpoint chlorination. You would hold the level at 5 ppm free chlorine until you test the water and detect no combined chlorine; then, you can either let the free chlorine level drop naturally or add sodium thiosulfate to reduce the chlorine level. Do not let the free chlorine level drop below 1 ppm in pools or 2 ppm in spas.

Once you know what chlorine level you need to reach, determine how much product you need to add:

If you're using an automatic feed system, you can adjust the flow of chlorine being fed into the system until you reach the correct free chlorine level.

If you're adding chlorine manually, do this:

- Calculate the volume of water in your pool or spa. Ask your health inspector for help if you do not already know this number.
- Follow the label directions of the chemical you are using. For example, the label might say that you need to add 1 lb of product to raise the free chlorine level by 1 ppm in 10,000 gallons of water. If your pool volume is 30,000 gallons, you would need to add 3 lb of this product to raise the free chlorine level 1 ppm.
- **Do not use stabilized chlorine products (i.e. dichlor, trichlor, or other chlorine products that contain cyanuric acid) to breakpoint chlorinate. This will result in an overdosing of cyanuric acid; once cyanuric acid levels reach 100 ppm, the pool/spa must be closed because chlorine will no longer be effective at killing bacteria/viruses/etc.**
- Never use skimmers to dose chemicals into the pool/spa.
- Always use the correct personal protective equipment when handling chemicals.

Questions?

You can reach NRH Consumer Health during normal business hours by calling 817-427-6650 or by emailing consumerhealth@nrhtx.com

You can reach the health inspector on call 24/7 by calling 817-281-1000 and asking Dispatch to connect you to the health inspector on call.