# Procedure for Hyperchlorination in Public Swimming Facilities

Following are basic procedures and examples that if followed will provide a safe and effective means to hyperchlorinate your swimming facility. The most common disinfectant used to kill bacteria in swimming pools is chlorine. Chlorine is a very strong oxidizer. Chlorine is available as a gas, liquid, or a granular powder or tablet. **Extreme care must be used when handling any form of chlorine.**

It is important to remember these basic safety rules for handling sanitizing products as they are highly reactive and may give off dangerous gases:

1. Always add chemicals to water, **NEVER** add water to chemicals.

2. Keep chemicals in a cool location away from heat and direct sunlight.

3. Keep muriatic acid, rags, paints, oils, etc., far from chlorine products.

4. **NEVER** re-use emptied chlorine pails for refuse or storage of other chemicals.

5. **NEVER** combine different chlorine products.

6. Keep all chemicals and test kits out of the reach of children.

**The following information relates to the use of chlorine disinfectant in the forms of calcium hypochlorite or sodium hypochlorite.**

When it is necessary to increase the level of chlorine in a swimming pool or spa, the following procedure should be used:

1. Determine the free available chlorine (FAC) in the pool water in ppm (mg/l). Use the DPD test kit.

2. Determine the amount in ppm (mg/l) you want to increase the chlorine.

3. Determine the ppm (mg/l) change using the following to increase: Desired ppm - current ppm (FAC) = ppm (mg/l) change. Example: Desired ppm (20.0) - Current ppm or FAC (2.0) = 18 ppm (mg/l) change.

4. Identify the chlorine compound to be used to increase the chlorine level. Use product label chemical dosage, product label chemical adjustment, or a formula to determine the amount of product to use to produce 1 ppm (mg/l) free chlorine per 10,000 gallons of pool water. (CalHypo is 2 oz/10,000 gal to achieve change of 1 ppm, Chlorine gas is 1.3 oz/10,000 gallons to achieve 1 ppm of change).

5. Make sure the pH is within the acceptable range of 7.2-7.8. These chlorine compounds will significantly change the pH and affect the effectiveness of the chlorine.

6. Determine the volume of water the pool holds.

Parts per million (ppm) is calculated by weight. One ppm is equal to 1 pound of chlorine in 1 million pounds of water. One million pounds of water is approximately 120,000 gallons. Converting to ounces, (1 pound = 16 ounces) 1 ounce of chlorine in 7,500 gallons equals 1 ppm.

***EXAMPLE 1:*** How much calcium hypochlorite (65% available chlorine) must be added to a 100,000 gallon pool to raise the chlorine residual from 1.0 ppm to 20 ppm?

100,000 gallons/7,500 = 13.3 ounces of chlorine to raise the residual 1 ppm. However, the residual needs to be raised 19.0 ppm (20 - 1). Therefore, 13.3 ounces x 19 ppm = 252.7 ounces of chlorine to raise the residual 19 ppm. But, calcium hypochlorite is only 65 percent available chlorine. Therefore, 252.7 ounces / 0.65 = 389 ounces of calcium hypochlorite (65% available chlorine) is needed to raise the residual from 1.0 ppm to 20 ppm.

***EXAMPLE 2:*** How much sodium hypochlorite (10% available chlorine) must be added to a 100,000 gallon pool to raise the chlorine residual from 1.0 ppm to 20 ppm?

100,000 gallons/7,500 = 13.3 ounces of chlorine to raise the residual 1 ppm. However, the residual needs to be raised 19 ppm (20 - 1). Therefore, 13.3 ounces x 19 ppm = 252.7 ounces of chlorine to raise the residual 19 ppm. But, sodium hypochlorite is only 10 percent available chlorine. Therefore, 252.7 ounces /0.10 = 2,257 ounces of sodium hypochlorite (10% available chlorine) is needed to raise the residual from 1 ppm to 20 ppm.

Following these examples, inserting the appropriate gallonage, desired residual and the available chlorine content of the product in use will provide the amount of that product that must be added to your facility to achieve hyperchlorination. Additional product, as well as chemicals to maintain appropriate pH must be added during the **16-hour contact time**.

The pH of pool water must be maintained between 7.2 and 7.6. In this pH range, the chlorine or bromine disinfectant effectively destroys microorganisms, reduces eye irritation, and minimizes damage to the pool and its equipment. The pH level of the pool water can be changed by adding concentrated acids or bases to the water. To raise the pH, soda ash (sodium carbonate) or sodium hydroxide may be added. To lower the pH, muriatic acid (diluted hydrochloric acid) or sodium bisulfate may be added.

Stabilized chlorine products should not be used to hyperchlorinate. Cyanuric acid is a chemical used as a stabilizing agent against the effects of sunlight on chlorine. Cyanuric acid, which combines with chlorine, becomes a chlorinated cyanurate used for disinfection. The ideal cyanuric acid level is between 25 ppm and 50 ppm. The maximum cyanuric acid concentration is 100 ppm. If the cyanuric acid level exceeds 100 ppm, the pool water must be partially drained and replaced with fresh water until the cyanuric acid level is 50 ppm or less.

**Products labeled as "Shock" treatments are not to be used for hyperchlorination**

**To return the facility water quality to operational levels, use the following options:**

- Utilize a reducing agent such as Sodium Thiosulfate
  - Determine the ppm (mg/l) change (decrease): current ppm - desired ppm (mg/l) = ppm (mg/l) change. Example: current ppm (20) - desired ppm (1.0) = ppm change (19)
  - Identify the chlorine reducing compound to be used to neutralize the chlorine level. Use product label chemical dosage, product label chemical adjustment, the formula from above to determine the amount of product to use to produce a drop of 1 ppm free chlorine per 10,000 gallons of pool water (2.6 oz. sodium thiosulfate will reduce a 10,000 gallon pool by 1 ppm, so amount to add = 2.6/10,000 x 19 = 49.4 oz. sodium thiosulfate/10,000 gallons)
- Backflush the filtration system, thereby emptying treated water from the facility and replace with potable water to appropriate operational levels. Balance pH and chlorine to prescribed levels.
- Open main drain of the facility, releasing treated water to the sanitary sewer, replace with potable water. Balance pH and chlorine to prescribed levels.

**Some commonly asked questions about testing the pool water.**

- ***The DPD chlorine test indicates there is no chlorine in the pool, but the chlorinator is on and operating. Why does this happen?***

  This is often an indication of too much chlorine in the water, which causes the DPD to bleach out.Repeat the test with a diluted sample. To dilute a sample, fill half the sample vial with pool water and the other half with distilled water. This is a 1 to 1 dilution. Multiply the result by the appropriate factor: for a 1:1 dilution, multiply the result by 2; for a 1:2 dilution, multiply by 3.

- ***The DPD chlorine test sample turns cloudy when the first reagent is added. Will the test still work?***

  Yes. A sample usually turns cloudy when the first DPD reagent is added to water with high levels of hardness which precipitate the calcium. The cloudiness will not affect the test results and should disappear when the second DPD reagent is added.

- ***When testing for pH, why do I get a blue/purple color instead of a yellow to red color when using phenol red?***

  A false pH reading may occur when high levels of chlorine (> 10 ppm) are present. The phenol red is converted to chlorphenol red, which is dark purple in color when the water is alkaline (basic). To eliminate the chlorine interference, add 1 drop of chlorine neutralizer (thiosulfate) before adding the indicator.