Counsilman · Hunsaker
AQUATICS FOR LIFE

POOL WATER CHEMICAL TREATMENT OPTIONS

All public swimming pools require sanitizing systems to eliminate microbes in the water to provide a healthy swimming environment. There are many options available today and there are some common misconceptions regarding what systems are available and their relative merits. The purpose of this overview is to provide some basic information about these systems and their effectiveness, safety, and practical application.

There are three basic categories of water treatment systems commonly used in swimming pools: Sanitizers, Supplemental Sanitizers, and pH Buffers.

SANITIZERS

All public swimming pools must have a chemical sanitizer, as mandated by the local public health code. The function of the sanitizer is to kill micro-organisms. This is generally done by adding a chemical sanitizer to the water as it passes through the treatment system in the pool equipment room. This effectively treats the water at the point of injection, but also leaves residual sanitizer in the pool water itself to handle contamination sources in the pool. The following options are available:

1. Sodium Hypochlorite
    a. 12% free available chlorine
    b. Liquid
    c. Dilutes over time
    d. Classified as an irritant
2. Calcium Hypochlorite
    a. 65% free available chlorine
    b. Tablet
    c. Longer shelf life than sodium hypochlorite
    d. Classified as a Class 3 oxidizer and is corrosive
3. Gas Chlorine
    a. 100% free available chlorine
    b. Gas
    c. Chlorine gas is extremely corrosive and has been known to corrode all metal within an equipment room.
    d. Not allowed by most health codes due to hazardous nature.
4. Bromine
    a. Commonly used on smaller bodies of water (hot tubs) with low bather loads.
    b. Twice the bromine is required to reach the same oxidation potential of chlorine.
    c. Bromine is a much less aggressive oxidizer compared to chlorine.
    d. Bromine BCDMH is classified as a corrosive – either class one or class two oxidizer. It is not flammable in and of itself, but it may ignite combustible materials in which it comes into contact, and as such is identified as a hazard.
5. Chlorine Generation (Salt System)
    a. Non-ionized, coarse, sun-dried or pelletized salt (normally in 40 lb. bags) is initially added to the pool water to develop a concentration of 0.5% (5,000 ppm).
    b. A small amount of electricity is used by the chlorine generator during the electrolytic process.
    c. Salt systems generate pure sodium hypochlorite at a near neutral pH and therefore have less effect on pH than most other pool chlorines.
    d. 4 ppm of free chlorine is reported to be ten times more corrosive than 4,000 ppm in salinity.

A common misconception is that salt systems provide a chlorine-free pool. This is incorrect. Chlorine serves as the primary chemical sanitizer in all of the above systems except Bromine.

SUPPLEMENTAL SANITIZERS

In addition to the above chemical sanitizers, secondary water treatment systems are available to further improve the water quality. It should be noted that none of these systems are permitted by health codes to serve as a primary source of water treatment. They are only permitted as supplementary systems. This is because they do not result in providing any residual chlorine in the pool itself, where contamination is most likely to occur. Water is only treated in the equipment room.

However, the advantage of these supplemental systems is in their effectiveness at reducing Chloramines (combined chlorine). Chloramines are compounds formed when chlorine combines with other chemicals from human perspiration, body oils, and other byproducts. These chloramines have been shown to affect the air quality in the natatorium, particularly just above the surface of the water. It is the "chloramines' in the air which produce the common "chlorine smell" often experienced at indoor aquatic facilities if not treated effectively. They have been shown to cause health problems, particularly in people with respiratory problems such as asthma. These supplemental sanitizers are also effective as sanitizers, even though not permitted as a primary means. These systems include:

1. Ultraviolet Light (UV)
    a. Reduces combined chlorine (chloramines). Indoor air quality will improve.
    b. The frequency of super-chlorination of the pool is reduced with UV installed.
    c. UV is highly effective against chlorine resistant pathogens like Cryptosporidium and Giardia; as well as the vast majority of bacteria, viruses, yeast, and mold.
        i. Chloramines reduction: < 0.2ppm
        ii. Disinfection: > 99.99% for Cryptosporidium and E. coli.
    d. Medium pressure.
    e. Need to budget $1,000 per year for bulb replacement.
2. Ozone
    a. Reduces combined chlorine (chloramines). Indoor air quality will improve.
    b. The frequency of super-chlorination of the pool is reduced.
    c. Full DIN system treats 100% of flow – very expensive
    d. Sidestream Ozone system treats approximately 25% of flow – still very expensive.
    e. Ozone systems are very complicated to operate – need pool operator that has experience with Ozone.

pH BUFFERS

The sanitizers discussed in this overview have a high pH and thus raise the pH of the pool water therefore it is necessary to add pH buffers to lower the pH levels of the pool. The options available are:

1. CO2
    a. CO2 (Carbon Dioxide) is a pH balancing chemical that is effective with "soft" source water.
    b. Used when the total alkalinity is less than 70 ppm. CO2 raises the TA in the water.
    c. CO2 is injected into water to release oxygen and carbonic acid.
    d. No fire rating is required.
2. Muriatic Acid
    a. 31.5% solution of hydrochloric acid.
    b. Muriatic acid reacts with the sanitizer, thus counteracting the pH, raising effects of the sanitizer. It has a pH of approximately 3. In the pool, it will lower the pH and total alkalinity. Typically delivered in 15-gallon carboys.
    c. Muriatic acid (hydrochloric acid) is classified as a corrosive and is highly reactive.
    d. Muriatic acid is used where the total alkalinity in the source water is above 70 ppm.