

## Water Chemistry

### Chlorine

The most common chemical used in the treatment of swimming pool water is chlorine. It not only eliminates bacteria and algae through a disinfecting (killing) action, it also oxidizes (chemically destroys) other materials such as dirt and chloramines.

### Forms of Chlorine

Chlorine exists as a solid, a liquid and a gas. The strength of each type is determined by the amount of chloride within the material that is effective both as a disinfectant and an oxidizer.

1. Liquid chlorine (sodium hypochlorite) contains 12-16% available chlorine. (Household liquid bleach generally contains about 5% available chlorine, and is, therefore, of a lesser strength than pool chlorine.)
2. Solid Chlorine (powder or granules)
  - a. Calcium Hypochlorite - contains 65-75% available chlorine.
  - b. Chlorinated Isocyanurates - contains varying percentages of available chlorine.
  - c. Lithium Hypochlorite - contains 30-35% available chlorine
3. Gaseous Chlorine contains 100% available chlorine. This substance is highly toxic and, therefore, requires special procedures when it is used.

### Chlorination

State codes require that chlorine be injected into the pool water through the use of an approved chlorinator. When chlorine (in any form) is added to water, a weak acid called Hypochlorous acid is produced. It is this acid, not the chlorine, which gives water its ability to oxidize and disinfect. Proper chlorination and filtration gives pool water its clear, sparkling appearance.

### Chlorine Demand and Free Chlorine Residual

As chlorine is introduced into pool water, a portion is always consumed during the processes of disinfection and oxidation. That portion of available chlorine consumed is referred to as chlorine demand. The hypochlorous acid left after the chlorine demand has been satisfied is referred to as the free chlorine residual. This is what we read when we test the pool water for chlorine. State codes require that the free chlorine residual be at least 1.0 ppm throughout the pool. Maintaining a higher residual 1.5 - 3.0 is recommended, though, to insure that the residual level does not drop below the minimum.

### Superchlorination

Some of the available chlorine will react with nitrogen-containing compounds to form chloramines (combined chlorine). A common source of nitrogen is ammonia, produced from perspiration and urine. Chloramines give off a strong chlorine odor and are irritating to the eyes. When these two conditions are present, most people think that the chlorine residual is too high, however, just the opposite is true. In order to eliminate chloramines, the pool operator must raise the chlorine residual to 5 to 10 times the normal level. This procedure, called superchlorination, oxidizes the chloramines leaving only free chlorine. Depending on the swimmer loads, it is recommended that a pool be superchlorinated as often as once a week in hot weather and once a month during cooler weather in order to control the formation of chloramines.



1. Potassium dichloro-s-triazinetrione (potassium dichloroisocyanurate).
2. Sodium dichloro-s-triazinetrione (sodium dichloroisocyanurate)
3. Trichloro-s-triazinetrions (trichchloroisocyanurate)

It has been determined that bacteria in the presence of cyanuric acid are destroyed at a slower rate. Therefore, when a pool has been stabilized, the free chlorine residual must be maintained above 1.5 ppm minimum to offset this phenomenon.

### **Handling and Storage of Chemicals**

Care should be taken in the handling and storage of all swimming pool chemicals. The materials should be stored separately from one another and should **never** be mixed, in order to prevent harmful chemical reactions from occurring. (Pool chlorine and pool acid, if mixed, will produce chlorine gas, which if inhaled, could be fatal.) Chemicals should never be added directly into the pool while it is open for use! Time should be allowed for the chemicals to circulate throughout the pool before allowing swimmers to enter.

**Note:** This rule does not apply to chlorine added to the system through a chlorinator

### **Water Temperature**

It is generally recommended that the pool water be maintained between 78 to 82 degrees Fahrenheit, although this level is not acceptable to everyone. It should be remembered, however, that at levels above this range, chlorine dissipates faster, algae grows better, and the formation of scale (calcium carbonate deposits) is more likely to occur. State regulations do not require the pool water to be heated.