

## WHAT IS PH, ANYWAY?

When everything goes well, all you need to understand about pH are four points:

1. Keep pool water pH between 7.4 and 7.8.
2. Use commercial grade muriatic acid or sodium bisulfate to lower pH.
3. Use soda ash or caustic soda to raise pH.
4. Replace pH test reagents at least every 6 months.

To know how to stay out of trouble or how bad it really is when things aren't perfect, a deeper understanding of pH is helpful.

pH is a measure of the hydrogen ion concentration in water. The hydrogen ion is the chemical substance that determines whether water is acid or base. (The term alkaline is often mis-used in place of base.) pH is measured on a 0-14 scale in which pH 7 is said to be neutral, pH 0-7 is acid or acidic and pH 7-14 is base or basic. When water is pH 0-7, it tends to dissolve and carry away the minerals by which it passes. This process is called corrosion. Acids corrode. In general, water of pH 1 is more corrosive than water of pH 2, pH 3 more corrosive than pH 4, etc. Corrosion damage in public pools is almost always long-term and very costly to amend. It is the primary reason for mechanical equipment renovation in public pools. When water is pH 7-14 it tends to leave behind or precipitate the minerals it already has. This process is called scaling. Bases cause scale. In general water of pH 13 causes more scale than water of pH 12, pH 11 more scale than pH 10, etc. Scale is seldom a catastrophic problem in most public pools. Severe scale corrosion usually results in heater or heat exchanger replacement, but not total renovation.

Any corrosion is bad as it is irreversible. However, some scale is good as it can be in the form of a thin film which will protect the inner surfaces of plumbing and mechanical equipment.

Because a little scale is a good thing and because corrosion damage is much more likely to be a major problem than scale damage the ideal pH range for public pools of 7.4-7.8 is very slightly basic. Allowing pool water to drift out of this range only a few times a year and for only a few hours at a time is not serious. Whatever damage might occur from minor, infrequent pH excursions of short duration will be inconsequential.

On the other hand, pool water which remains most of the time at pH 8.0-8.5 will almost certainly result in premature heater replacement. Pool water kept at pH 6.5-6.8 most of the time can shorten mechanical equipment life to as little as 2 to 3 years. The November POOLFAX issue told the story of a pool where the pH was kept at about 3.5.<sup>1</sup> In that case an entire replumbing and equipment replacement was needed after 3 weeks.

In determining the possibility for scale or corrosion damage, pH is by

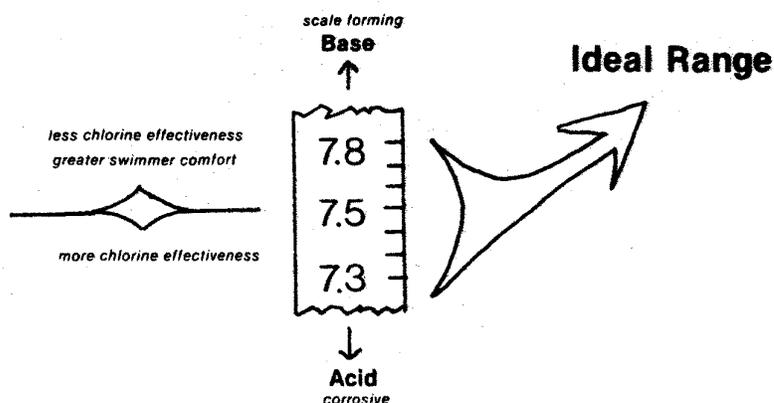
far the greatest single determining factor. While the other three factors, total alkalinity, calcium hardness and temperature, are important, all three together are not as important as pH.

### *pH and Chlorine*

Wide excursions in pH generally have little or no effect on bathers in unchlorinated-water. No human being has so far been able to tell the difference between unchlorinated water of pH 5 and pH 9. The pH of most popular soft drinks and alcoholic drinks is about 3 to 5. The pH of tomato juice is about 4. The pH of tap water in the United States ranges from 6.5-10.5.

However, when chlorine is added to pool water, the pH effect on comfort becomes important. Free available chlorine is far more active in water which is acidic and much less active in water which is basic. Hence, the higher the pH, the greater the swimmer comfort level, but also the less effective the oxidizing effect of the chlorine residual.

Because of the effect on swimmer comfort and because historically far more pools suffer corrosion damage than scale damage, many industry experts today are beginning to recommend pH 7.5-8.0 as the new ideal range for public pools.



## Phenol Red

The most common pH test reagent used around public pools is phenol red. It is a red liquid, which turns orange to pink in the test procedure. The shelf life of phenol red is said to be six months but this time period is only true if the reagent is stored in a cool, dark place. Any light, especially sunlight and storage for any length of time in temperatures above 85 or 90 degrees can severely shorten the useful life of phenol red. It is a very inexpensive reagent and should be replaced regularly from a reputable supplier. It is generally a good idea not to buy phenol red from someone you don't know as some vendors are not careful about how long they store phenol red before sending it to their customers.

## Moving pH

### *Muriatic Acid*

The most common chemical used to move pH in hypochlorinated pools is commercial grade muriatic acid. This product is an inexpensive form of hydrochloric acid which is perfectly sufficient for use in public pools. Hydrochloric acid is readily available in a higher grade which is used in the laboratory. The higher grade is more expensive and not at all necessary for pool use. Muriatic is a fuming acid and should be kept tightly capped at all times. Make sure that the tank lids for muriatic storage fit tightly. If they do not use a weather strip or similar material to make them fit tightly, then you can use small pieces of sponge rubber or similar material to

plug any other openings such as the small hole where the suction tube of a chemical metering pump might be lowered into the tank. In a very few years, if not months, muriatic fumes can destroy all electrical or electronic equipment in the room. Telephones, automatic controls, clocks, elevators and hoists can all be destroyed in short order given a little muriatic fumes, a little time and less than perfect ventilation. When transferring muriatic acid from one container to another, always wear rubber gloves, rubber apron and safety goggles.

If by accident you get a little muriatic acid on your skin, you can wash the area immediately to avoid serious harm. Some operators keep a small pail or bag of soda ash handy and sprinkle the affected area before washing.

### *Sodium Bisulfate*

At some pools, sodium bisulfate is used to lower pH. This is a white granular or powdered material which is mixed in water. It is considerably more expensive to use than muriatic acid but does not require special care in handling, nor are its fumes as damaging to electrical equipment.

### *Soda Ash*

Soda ash is used regularly in gas chlorinated pools and in brominated pools. A proper soda ash feed system involves a tank with mixer and a positive displacement chemical metering pump. The mixture of soda ash in water should be about 5% to

7%; about 20 pounds of soda ash per 50 gallons of water. The small orifices around the ball check valves of the soda ash feeder, especially the injection fitting where the slurry is actually fed into the recirculation system, must be cleaned frequently to prevent clogging.

### *Sodium Hydroxide*

In some pools, sodium hydroxide, also called caustic soda or liquid caustic, is used to raise pH instead of soda ash. 25% or 50% strength sodium hydroxide is extremely effective in raising pH. It is less expensive than soda ash. It requires no tank, no mixer and a very small metering pump. Sodium hydroxide must be handled with a great deal of care and should never be transferred from one container to another. It should be fed directly from the container in which it was delivered. Also, sodium hydroxide begins to freeze at about 50 or 60 degrees depending on the solution strength. If the equipment room is likely to fall to or below these temperatures, a thermostatically controlled heating strap can be used around the container.

The use of bicarbonate of soda, also called bicarb or baking soda, to raise pH is a mis-use of this chemical. Bicarbonate of soda is used in pools primarily to raise total alkalinity. While it does raise pH, it is not the most effective chemical for the money to do so, and its effect on total alkalinity may or may not be advantageous.

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