

# Pool Chemistry & Sanitation

## Helpful Hints & Suggestions

### National Swimming Pool Foundation: Water Chemistry Guidelines

The table below presents target ranges for important water chemistry parameters. These guidelines were last updated for the 2014 edition of the NSPF® Pool & Spa Operator™ Handbook and are taught to students in CPO® (Certified Pool/Spa Operator) classes (generally commercial pool operators). For more information on CPO classes, go to [www.nspf.org](http://www.nspf.org).

### Recommended Guidelines for Water Quality

Parameter	Min.	Ideal	Max.	Who
Free Chlorine, ppm	1.0	2.0–4.0	5.0	Pools, Waterparks
	2.0	3.0–5.0	10.0	Spas
Combined Chlorine, ppm	0	0	0.2	Pools, Waterparks
	0	0	0.5	Spas
Total Bromine, ppm	2.0	4.0–6.0	10.0	All types
PHMB, ppm	30	30–50	50	All types
pH	7.2	7.4–7.6	7.8	All types
Total Alkalinity, ppm as CaCO <sub>3</sub>	60	80–100* 100–120**	180	All types
Total Dissolved Solids, ppm	NA	NA	1,500 over start-up***	All types
Calcium Hardness, ppm as CaCO <sub>3</sub>	150	200–400	1,000	Pools, Waterparks
	100	150–250	800	Spas
Heavy Metals	None	None	None	All types
Visible Algae	None	None	None	All types
Bacteria	None	None	Local code	All types
Cyanuric Acid, ppm	0	30–50	****	All types
Temperature, °F	78°F	80.5°F	82°F	Competition pools
	-	Personal preference	104°F	Other pools
	-	-	104°F	Spas
Ozone, ppm	-	-	0.1 over 8 hr. time-wtd. avg.	All types
ORP	Calibrate to disinfectant level*****			All types

† These commonly accepted chemical parameters do not supersede product label directions or local or state codes and regulations.

\* For calcium hypochlorite, lithium hypochlorite, or sodium hypochlorite.

\*\* For sodium dichlor, trichlor, chlorine gas, BCDMH.

\*\*\* Including TDS contribution of salt found in chlorine generating systems.

\*\*\*\* Dictated by state or local codes. Typically 100 ppm. (Some codes are higher, some are lower.)

\*\*\*\*\* Some state or local codes may dictate a minimum and maximum.

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## RECOMMENDED GUIDELINES FOR WATER QUALITY

### SEE LOCAL HEALTH REGULATION

- Ensure water chemistry is properly maintained and consistently monitored.
- Indoor pools on average use approximately 1/4 lb. to 1/2 lb. of chlorine per 10,000 gallons of water per day.
- Outdoor pools on average use approximately 2/3 lb. to 1 1/2 lb. of chlorine per 10,000 gallons of water per day.
- Shock the pool when combined chlorine is .2 ppm or more.
  - Add one (1) pound of calcium hypochlorite per 10,000 gallons of water.
  - Add the chlorine to a bucket of water. Stir until it dissolves, then add to pool water.
- To find your combined chlorine, take a free chlorine reading. Then, subtract that from your total chlorine. This number will be your combined chlorine.

There are different types of chlorine feed systems: Calcium Hypochlorite, Sodium Hypochlorite (Bleach) and Trichlor. It is best to set the chlorine feed in the **mid-range** position and feed at a steadier continuous rate. This may also prolong equipment life by limiting on/off cycles. If the feed is set too **low**, residuals could drop below acceptable levels therefore causing undesirable conditions or even pool closure. If the feed rate is set too **high**, residuals can overshoot therefore fading swim suits or causing undesirable conditions or even pool closure. Free residual will drop during periods of usage in pools and in inclement weather on outdoor pools. Maintain about 0.5 ppm above the desired operating rate to help offset bather load consumption.

### Total Alkalinity

Total alkalinity acts as a “buffer” in the water to prevent large changes in pH. Higher than desired alkalinity can result in cloudy water, with the pH measuring more than 8. Low alkalinity can cause corrosion of piping and pitting of concrete or plaster surfaces as well as erratic pH swings. Generally, maintain 80-100 ppm total alkalinity but if calcium levels climb above 700 ppm, alkalinity levels may need to be lowered below 80 in order to maintain overall water balance. Contact your pool specialist for recommendations.

### pH

The pH scale measures the acidity or basicity of pool water on a 1 (most acidic) to 14 (most basic) scale. Because pH is a logarithmic scale even a 0.1 or 0.2 pH unit change can have a noticeable effect on water balance. Often a slightly cloudy pool can be made crystal clear by lowering the pH by 0.1 or 0.2 particularly if the water is around 7.6.

### Sodium Hypochlorite - (Liquid Bleach)

If sodium hypochlorite is used, a little over a pint of Muriatic acid will be required to counteract the effect on pH of 1 pound of chlorine feed in the form of sodium hypochlorite. A mid-range setting on the acid feeder is also desirable and therefore, the acid should be diluted. Ten or more to one is usual. If diluting always add acid to water, never add water to acid.

### Calcium Hypochlorite – (Tablet)

If calcium hypochlorite is used, a little less than a pint of Muriatic acid will be required to counteract the effect on pH of 1 pound of chlorine fed in the form of calcium hypochlorite. A mid-range setting on the acid is desirable and therefore, the acid should be diluted. Ten or more to one is usual. If diluting always add acid to water, never add water to acid.

### Trichlor – (Tablet)

If trichlor is used, about 1 pound of soda ash will be required to neutralize each pound of chlorine fed. A 15% solution is the maximum practical solubility of soda ash in water, therefore, dissolve approximately 1 pound of soda ash per one gallon of water (60 to 65 lbs. in a 55-gallon drum). On large pools, caustic soda may be used for pH control in lieu of soda ash. It is pumped directly from the container in which it is supplied and at full strength.

### CO2 – (Gas)

CO2 is a safe alternative to Muriatic acid for pH control in swimming pools.

CO2 becomes a mild acid when dissolved in water (Carbonic acid).

On a standard feed CO2 flow meter, a normal setting would be 10 to 14 CFH (cubic feet per hour). Larger feed systems are available.

CO2 has a byproduct called bicarbonate which contributes to the rise of alkalinity. Alkalinity will need to be adjusted periodically with Muriatic acid, 1 pint per 10,000 gallons will lower 8 to 10 ppm.

### Calcium Hardness

Calcium hardness is a measure of the dissolved calcium in the water. It has a wide range of acceptability and will be very dependent on how much and what type of make-up water is used to maintain the level of water in the pool. For ease of control, calcium hardness is typically allowed to find its own level in a pool (as long as it is between 200 and 400 is recommended) and then the alkalinity is adjusted to ensure balanced water. Only if the calcium falls outside of this range is any adjustment necessary on hardness.

### Stabilizer - (Outdoor Pools Only)

Cyanuric acid when added to pool water stabilizes the chlorine by converting most of it to a form that is resistant to sunlight. It significantly reduces chlorine consumption particularly on sunny days and in pools with large areas of shallow water. Maintaining a level of 20-50 ppm of stabilizer is recommended.