

# Public Swimming Pool - Water Characteristics

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	Free Available Chlorine (FAC)				Bromine Residual	
	Without Cyanuric Acid		With Cyanuric Acid			
	Min	Max	Min	Max	Min	Max
Swimming Pools	1.0 PPM	10.0 PPM	2.0 PPM	10.0 PPM	2.0 PPM	=
Spas	3.0 PPM	10.0 PPM	3.0 PPM	10.0 PPM	4.0 PPM	=
Wading Pools						
Spray Grounds						
			Min		Max	
pH			7.2		7.8	
Cyanuric Acid (CYA)			0 PPM		100 PPM	
Temperature			N/A		104°F	
Clarity	Clear visibility from the deck must be maintained down to the bottom of the pool at the deepest end.					
In addition to chemical disinfection, Spray Grounds when equipped with UV:						
Ultraviolet Disinfection (UV)			Min		Max	
			40 mJ/cm <sup>2</sup>		=	

**Free Available Chlorine (FAC)** is the active form of chlorine effective against germs and algae. The two most common disinfectants applied to pools are chlorine and bromine. Maintaining a residual is essential; a concentration expressed in parts per ppm (ppm).

**pH** is essential for water balance. FAC strength is inversely related or opposite the pH value; as pH increases then disinfection decreases. Likewise, a decrease in pH will raise disinfection strength. Scale formation could be a signal of alkaline water characteristic with elevated pH levels while corrosive water can be an indicator of acidic characteristic with pH levels on the lower end of the spectrum.

**Cyanuric Acid (CYA)** is not required but helps to stabilize and reduce excessive loss of FAC in water following exposure to UV sunlight. However, high amounts of cyanuric acid could diminish the effects of disinfection. Prolonged or continued use of chlorinated cyanurate compounds is not advised since high levels can impede disinfection.

**Temperature** is influential to water balance and can have a significant effect on bather discomfort.

**Clarity** is critical for locating swimmers in distress, seeing other swimmers, identifying pool depth, and other potential underwater hazards. Cloudy water could indicate poor filtration, high pool user occupancy, and overall compromised water quality.

**Ultraviolet Disinfection (UV)**. To aid in germ inactivation and reduce chloramine levels, UV can be supplemented into existing chlorine disinfectant systems. UV light treatment systems do not produce residual disinfection and must be used in conjunction with chlorine or bromine.

**Chloramine or Combined Chlorine** is noticeably present when strong and acrid chlorine odors are produced by airborne disinfection byproducts that can cause breathing discomfort and irritation; requiring corrective measures. Urine, body waste, and organic contaminants are the primary contributors to chloramine formation. Conditions within indoor pool environments can make combined chlorine more persistent. Air saturated with chloramines can also condense onto building surfaces causing corrosion to steel and other material. At the same time, rapid expulsion of indoor air can lead to a cold and unpleasant swim environment. Adequate amounts of exhaust ventilation and fresh air intake are essential for maintaining the indoor pool environment free from persistent chloramine odors. The balance between chloramine production, its ventilation, and the conservation of warm air recirculation could require further assessment and consultation from qualified experts in ventilation. Renovating the ventilation system requires consultation with HVAC technical resources, and approval from Environmental Health Plan Review and the Local Building Authority.

Reengineering the entire ventilation system is not the only means of reducing chloramine levels. Instead super-chlorination and supplemental oxidation can be applied for chloramine reduction. However success depends on existing water characteristics, the ratio of ammonia to chlorine, and if not performed properly can lead to additional problems. Mixing incompatible chemicals can lead to accidents and unwanted consequences. Consultation with service professionals is absolutely essential prior to proceeding with any chemical adjustments.

Replenishing or diluting the pool with fresh potable water can also reduce chloramine levels and restore desired and acceptable water characteristics. However the potable water distribution in many jurisdictions may already contain combined chlorine since disinfection of the water often involves chloramination as required for extended disinfection of the water supply. This could raise the existing pool chloramine concentration; rendering the water supply incapable of dilution. Filtering the incoming potable water with granulated activated carbon (GAC) can reduce chloramine often inherent in the water supply. Given ongoing efforts in water conservation with many jurisdictions, alternatives to dilution and water replacement may be preferable. Consult with pool service professionals to explore further options including water recycling and reverse osmosis. Adhere to restrictions against dumping pool water into the storm drain. Pool water should only be discharged to the sanitary sewer. However there could be restrictions on discharging water with salt generated chlorine or waters with high total dissolved solids (TDS). Contact your local water district for more information on how to dispose of your pool water.

Supplemental treatments like ultraviolet (UV), ozone, advanced oxidation, and similar technology may not only reduce chloramine persistence, but could also enhance water characteristics. Any or all supplemental systems will require consultation with approval from Environmental Health Plan Review, since mechanisms for these systems may entail separate design principles and sizing calculations. **DO NOT INSTALL EQUIPMENT WITHOUT APPROVAL.**

Monitoring for chloramine can also present difficulty. Existing field tests are not available to differentiate between organic and inorganic chloramine. Additionally, testing methods applied for measuring chloramine in air are more complicated. Given the challenges of treatment and monitoring of airborne chlorine byproducts, refer to these additional procedures provided by the US Center for Disease Control (CDC):

<https://www.cdc.gov/healthywater/swimming/aquatics-professionals/chloramines.html>