

## ***New Free Chlorine Standards for Indoor Pools and Water Parks***

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### ***NEW FREE CHLORINE STANDARDS ARE OUT. ARE YOU FAMILIAR WITH THE CHANGES IN FREE CHLORINE LEVELS?***

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Many public and private indoor pool owners are just becoming aware that the free chlorine levels are on the rise. This is due primarily to outbreaks of serious health issues such as E. coli where swimmers have become gravely ill because of improperly sanitized pool water.

Contaminants introduced by swimmers can dramatically influence the operation of indoor and outdoor swimming pools. Sources include micro-organisms from infected swimmers and body oils including sweat, cosmetics, suntan lotion, urine, saliva and fecal matter. In addition, the interaction between disinfectants and pool water contaminants can produce a mixture of chloramines and other disinfection by-products.

Pathogenic contaminants are of greatest concern in swimming pools as they have been associated with numerous recreational water illnesses (RWIs). Public health pathogens can be present in swimming pools as viruses, bacteria, protozoa and fungi. Diarrhea is the most commonly reported illness associated with pathogenic contaminants, while other diseases associated with untreated pools are Cryptosporidiosis and Giardiasis. Other illnesses commonly occurring in poorly maintained swimming pools include otitis externa, commonly called swimmers ear, skin rashes and respiratory infections.

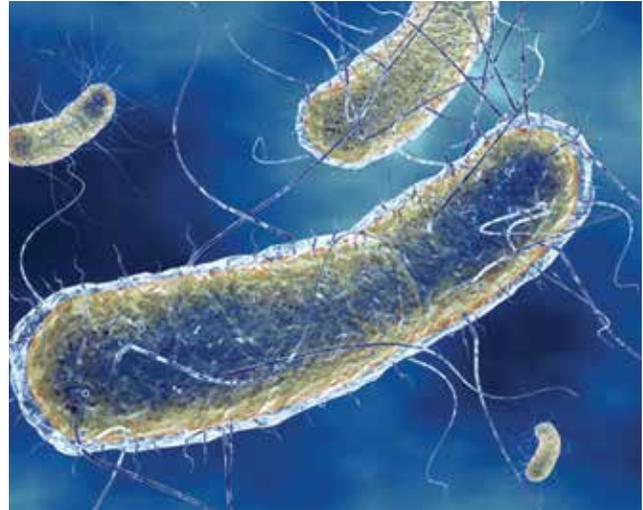


## ***E. COLI OUTBREAK CATALYST FOR CHANGE INDUSTRY STANDARDS***

While there are many documented instances where pathogenic contaminants have caused illnesses, a terrible problem surfaced in a public pool in Atlanta in 1998. It was discovered that a lower than acceptable levels of free chlorine were suspected to have allowed an E. coli outbreak that sickened and killed swimmers, primarily children. Safe levels of free chlorine at 1.5 - 2.0 PPM were approved by Aquatic Facility Operator Manual (AFOM), National Pool & Spa Institute Handbook (NPSI) and by State Departments of Public Health (DPH)

In June of that year, the Georgia Department of Public Health launched an investigation to determine the source of E. coli O157:H7 infections. They interviewed the families of those sickened and determined the outbreak to be at a specific water park where all had recently visited.

Upon further investigation it was revealed chlorine levels did not meet the AFOM, NPSI and DPH suggested requirements in the park's pools on all days victims had been exposed to the bacteria. The Georgia Department of Health determined that bacteria had either grown in the water due to the inadequate chlorination, or had been present in the environment surrounding the pools.



Georgia's DPH required that public pools have a minimum free chlorine level of 1 part per million. That level of free chlorine is sufficient to kill E. coli fairly rapidly, scientists say. But at this particular water park, there was not enough of the chemical to protect children who ingested the deadly bacteria.

Even if the swimmer does not consciously drink the water, a few drops can find their way into the swimmer's mouth by licking the lips, as an example. If there are a few E. coli bacteria, it can be enough to cause the disease and subsequent illness.

Ultimately 26 culture-confirmed E. coli cases were linked to the water park outbreak with one death resulting. Forty percent of outbreak victims under five years old developed hemolytic uremic syndrome, or HUS, a serious complication from E. coli poisoning that can lead to kidney failure and central nervous system impairment.

Of these children who developed HUS, one was so severe that her nephrologist (kidney specialist) identified it as the worst he had ever seen. Not only did she develop kidney failure, but she sustained damage to all of her major organs, and suffered a stroke that caused extensive brain damage. Fifty-two days after hospitalization, she was released home to begin a very different life from the one she had before her visit to the water park.

## ***ELEVATING THE FREE CHLORINE LEVELS***

In reaction to this outbreak, the Georgia Department of Public Health instituted more stringent free chlorine requirements to prevent another occurrence of this magnitude. The free chlorine requirements were raised from 1.5 - 2.0 PPM to 3.0 - 5.0 PPM. The goal being there is sufficient free chlorine available at all times to neutralize organic matter in the pool water. This practice was soon adopted by many state health organizations, resulting in a new standard in the pool industry.

### **No Uniform National Standards**

Accordingly to the National Swimming Pool Foundation (NSPF), there are currently no uniform national standards governing the design, construction, operation, and maintenance of swimming pools and other treated aquatic facilities. They go on to say the code requirements for preventing and responding to recreational water illnesses (RWIs) can vary significantly among local and state agencies.

The Model Aquatic Health Code (MAHC) is still in development. It is intended to be a guideline to transform the typical health department pool program into a science-based, risk reduction effort to prevent disease and injuries and promote healthy recreational water experiences.

### **Higher Free Chlorine Levels Generate More Combined Chlorines, Faster**

Chloramines generated in one week at 1.5 - 2.0 PPM free chlorine levels are now generated in less than five hours of 3.0 - 5.0 PPM levels!

When combined chlorine levels exceed 0.2 PPM, they evaporate into the air at an accelerated rate through off-gassing. These gases combine with the humidity creating a highly corrosive cocktail that condense on colder surfaces causing deterioration of metallic material and creates chlorine stress corrosion of stainless steel.

#### **Unexpected Side Effects of Higher Free Chlorine**

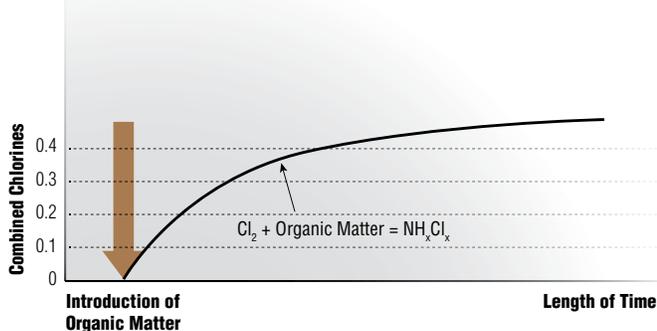
Little attention was given to the free chlorine change until some indoor pool dehumidifier coils began to fail. The greater availability of free chlorine caused a rapid surge in combined chlorines (chloramines) at a rate 4 to 5 times that of the of 1.5 - 2.0 PPM levels. The rapid off-gassing of the combined chlorines had a corrosive effect on copper as it condensed on the coil surface.

## LOWER FREE CHLORINE REQUIREMENTS EFFECTIVE BUT SLOWER

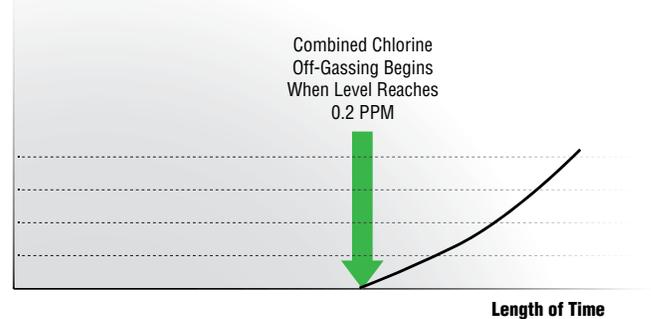
Traditional free chlorine levels of 1.5 - 2.0 PPM neutralized harmful organic matter in the pool water creating combined chlorines at a predictable rate. As long as the chloramine level does not exceed 0.2PPM, the chloramines remain suspended in the pool water where they can easily be managed through traditional pool shocking, ventilation or UV treatment. Fewer combined chlorines in the air reduce the quantity reuniting with water vapor to condense on cold metal surfaces.

When combined chlorine levels exceed 0.2 PPM in the water, they evaporate into the air at an accelerated rate through off-gassing. These gases combine with the humidity creating a highly corrosive cocktail that condense on colder surfaces causing deterioration of metallic material and creates chlorine stress corrosion of stainless steel.

**Free Chlorine: 1 to 1.5 PPM –**  
*Chloramine Formation in the Water*



**Free Chlorine: 1 to 1.5 PPM –**  
*Chloramine Formation in the Air*



## POOL SHOCKING

Definition: Traditionally, the method of reducing chloramines has been the “shocking” process. This shocking process involves forcing a chemical reaction to convert the chloramines to its benign components.

Shocking: Raise the Free Chlorine Level to 10 times the combined chlorine level. This is the Stoichiometric Ratio for the chemical reaction to occur.

### Shocking Chemical Equation

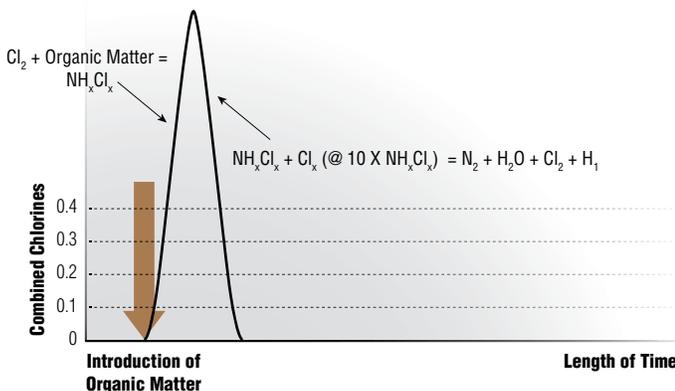


## HIGHER FREE CHLORINE CAUSE SPIKES IN RATE OF COMBINED CHLORINE OFF-GASSING

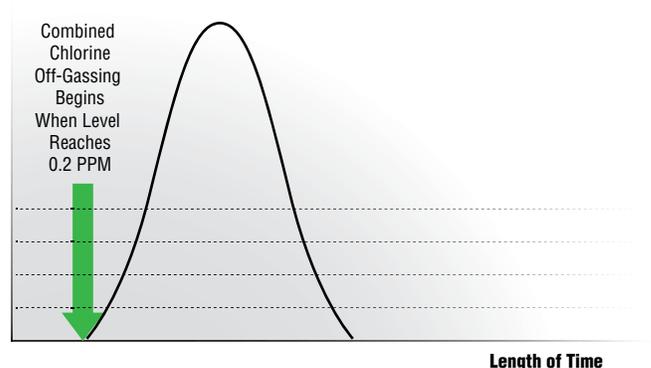
With the new free chlorine standard of 3.0 - 5.0 PPM, the rate of combined chlorine development spikes instantaneously. The greater quantities of available free chlorine react more quickly with organic matter, instantly sanitizing the pool water. This reaction also favors the generation of the more volatile tri-chloramines.

The rapid rate of reaction with organic matter causes combined chlorine off-gassing at an overwhelming and not easily controllable rate. Chloramine off-gassing from the pool occurs at 4 to 5 times the rate of chloramine off-gassing when Free Chlorine is 1.0 to 1.5 ppm. The result is a greater quantity of combined chlorines off gassing in the air where they combine with evaporation and condense on cold surfaces.

**Free Chlorine: 3 to 5 PPM –**  
*Chloramine Formation in the Water*



**Free Chlorine: 3 to 5 PPM –**  
*Chloramine Formation in the Air*



### Higher Free Chlorine Level Constantly Shocks Combined Chlorines

After the free chlorine and organic matter is converted to chloramines, the free chlorine level remains at 5 PPM. This high free chlorine level "Shocks" the chloramines still remaining in the pool water back to Nitrogen Gas (N<sub>2</sub>) + Water (H<sub>2</sub>O) + Free Chlorine (Cl<sup>-</sup>) + Hydrogen (H<sup>+</sup>). If the free chlorine level remains at 5 PPM, then combined chlorine can be as high as 0.5 and shocking will be spontaneous. After the Shocking and organic matter stops being introduced into the pool, the chloramine level in the pool and air rapidly drops to less than 0.2 ppm.

### GOING FROM FREE CHLORINE TO COMBINED CHLORINE

When the pool is first filled free chlorine level is raised to 3.0 - 5.0 PPM. Free chlorine is non-volatile (does not evaporate), and has no odor. When there are no chlorine odors in the pool space, it is a positive sign that the chlorine chemistry is in balance.

If the pool is not used, the free chlorine will remain at approximately 3.0 - 5.0 PPM. As organic matter like sweat and urine are introduced into pool by bathers, the free chlorine combines with organic matter, neutralizing it, forming Combined Chlorine or "chloramines". Combined chlorines in the pool water will rarely exceed 0.2 PPM, as it is already shocking at 3.0 - 5.0 PPM and will keep the combined chlorines below 0.2 PPM.

### Ultraviolet (UV)—Alternative Chloramines Control without Shocking

- Automatically controls chloramines to less than 0.1 ppm
- Owners claim UV is almost "maintenance free"
- First cost twice that as standard chlorinators



### POOLPAK OFFERS AN ALTERNATIVE TO COPPER COILS WITH HIGH PERFORMANCE COATED COILS

PoolPak offers an alternative to their enduring copper coils with a coil that has aluminum fins and copper-tubes with a high corrosion-resistant coated finish that is electrostatically applied. They are available in the Electro-Guard\* for dry coil application and the Electro-Guard Plus\* for wet coil application.

#### PoolPak Coil Packages

- Electro-Guard Plus coils for wet only
- Electro-Guard coils for dry only
- Hycor Blue (hydrophilic) coated fin/copper tube coils will be offered for all applications
- Hycor Blue coating replacing Mt. Holly Gold non-hydrophilic coating
- All copper offered for use as wet and/or dry coils

\* Please see PoolPak Publication MK2-PTL\_COATEDCOIL for more information.

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