Chloramine Basics

Wescor has been asked many times for our opinion on using high volumes of outside air to handle chloramine build-up in pool rooms. This article is a primer for those wanting basic knowledge on controlling chloramines in pool rooms and is not meant to be a definitive guide to water and air chemistry in pool rooms.

Chloramine chemistry

Pool and spa water must be chemically treated, because people using pools and spas contaminate them with organic wastes such as sweat, perfume, urine, and other ammonia-containing compounds. For decades chlorine has been the preferred chemical used to maintain safe water for swimming, because, when mixed with water, chlorine forms hypochlorous acid—a potent bactericide.

Hypochlorous acid in its free state is called free chlorine. Free chlorine is very reactive and combines with ammonia in the water to form combined chlorine compounds, also known as chloramines. Compared to free chlorines, chloramines have lost most of their bactericide effectiveness.

People often comment on the chlorine smell in pool rooms. What they smell is not chlorine but chloramines—specifically the chloramine by-products ammonia and nitrogen. Beside their unpleasant smell, chloramines are also a main culprit in swimmers' red-eye syndrome and some respiratory ailments.

The amount of chloramines found in the pool is directly correlated to the cleanliness of the swimmers and to how much they sweat in the pool. Requiring swimmers to shower before entering the pool greatly reduces the amount of ammonia and nitrogen in the pool. The warmer the water, the more swimmers sweat and, again, this results in more chloramines and less free chlorines.

The chloramines found in pool water are a by-product of the use of chlorine as a disinfectant. These chloramines are inorganic compounds and are found in one of three states: monochloramine, dichloramine, and trichloramine. Trichloramine has a high toxicity level and is considered the major cause of swimmer discomfort. It is insoluble and is thus most likely to exist in vapor form. Because it is four times heavier than air, trichloramine is found just above water level, where swimmers are breathing.

Maintaining proper pool chemistry

Maintaining proper pool chemistry depends on:

- Reducing the introduction of ammonia and nitrogen by requiring swimmers to shower before entering the pool.
- Maintaining the proper amount of chlorine in the pool.

If there is enough free chlorine in the pool, it combines with the chloramines and breaks them down into their basic elements such as water, carbon dioxide, and various salts. When this breakdown occurs, the pool chemistry is functioning properly, and the chlorine smell and side effects of the chloramines are reduced. However, chloramines can never be entirely eliminated from the pool or the air, because they are a natural by-product of the disinfectant process.

Shocking the pool to remove chloramines

Chloramines must be removed if the proper amount of chlorine is not maintained. The traditional method is to shock the pool with a large amount of chlorine. A less traditional method of shocking uses a non-chlorine reactive agent such as potassium peroxymonosulfate.

To shock a pool with chlorine, the pool operator adds three to six times more chlorine than is normally used and raises the level of free chlorines to a high level for four hours before dropping the level back to its normal level. Shocking an indoor pool with chlorine is not recommended, because there will be a concentrated level of trichloramines at the pool surface and on the pool deck.

Indoor pools are not (and should not be) designed to have a large amount of air blown across the pool surface. Although high air volume will help during the few hours when the pool is shocked, it chills swimmers and wastes energy the rest of the time, because the air flowing across the pool surface raises the evaporation rate. The increased evaporation rate also increases the rate of trichloramine release. In addition, removing the trichloramines from the pool surface and introducing them into the pool room's air handling system increases their corrosive effects on that system as well as all other metals in the pool room.

The better way to contain chloramines

Better methods than shocking have been developed to contain chloramines if maintaining proper pool chemistry is not possible.

- An automatic chemical-feed system should be required for commercial pools. The ideal system is a 24-hour controller that responds to changes in water quality caused by variable swimmer loads.

- Ozone can be also be added to the chlorinated water through an ozone generator which oxidizes the ammonia and nitrogen compounds. In addition, ozone kills all pathogenic bacteria and viruses it comes in contact with.

- Another method gaining popularity is using UV light with chlorine. UV light eliminates chloramines by breaking them down into water, carbon dioxide, and salts.

Using either ozone or UV light can substantially reduce the amount of chlorine necessary to disinfect the pool, but neither one solves the trichloramine problem because most of the

trichloramines are in the air above the pool surface and are therefore not affected by either the ozone or UV in the water.

The best method of controlling the negative effects of chloramines is a combination of a chemical-feed system, an ozone or UV system, and, a source-capture-and-exhaust system for the vaporized trichloramines. A source-capture system pulls a small but continuous amount of air across the pool surface and exhausts the highly-corrosive air directly outside without introducing it into the pool room's air handling system. It is important that the source-capture system and the pool room's dehumidification/air handling system be designed together to maximize the effectiveness of the source capture system.

Conclusion

The answer to the chloramine smell in pool rooms is not introducing a high volume of outside air. Using high amounts of outside air to sweep the trichloramines off the pool surface is generally not effective and increases operating cost while causing swimmer discomfort.

Chloramines can be successfully contained by using a 24-hour reactive chemical-feed system and an ozone or UV-light system in combination with a source-capture system. The source-capture system should be designed to work in conjunction with the room's dehumidification system.

Contact Wescor for additional information on pool dehumidification and source-capture technology.

Oregon, SW Washington, and Idaho
Portland Office
(503) 452-2498

Washington and Alaska
Seattle Office
(206) 933-9651

www.wescorhvac.com