

Breathing Easier: Improving Air Quality at Indoor Swimming Pools

By Bob G. Vincent

December 6, 2019

In a nutshell...

Poor air quality in indoor swimming pool facilities can cause breathing problems for swimmers and others. The problem is not due to “too much chlorine” but mainly to chemical reactions between chlorine and substances brought into the water by swimmers. A team of researchers is developing a model of the factors that contribute to air quality in indoor pool facilities. The research results should help identify design and operational changes for better air quality in these facilities.

When the weather turns chilly, many avid swimmers flock to indoor swimming pools. One issue that may concern patrons is a harsh chemical odor in the air around some indoor pools. Typically, that odor has been attributed to “too much chlorine” in the water. The truth is a bit more complicated and involves multiple factors including:

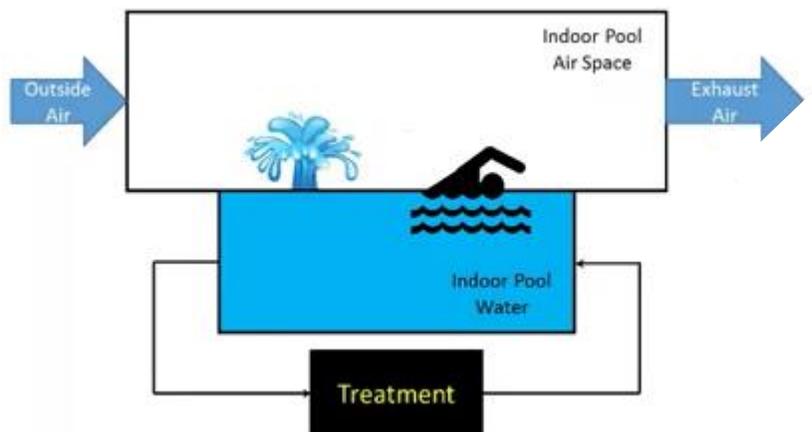
- Pool water chemistry
- Pool water treatment
- Pool water mixing
- Air mixing above the pool

Currently, a team of scientists and engineers is exploring these factors to develop a [model](#) to help optimize air quality at indoor pool facilities. They are collecting data from swimming pools to help *measure* the factors listed above. This article describes these factors.

Swimming Pool Water Chemistry

Swimming pool water chemistry is affected by the activities of both pool staff and swimmers. Pool staff add water treatment chemicals to pools to maintain proper pH and disinfectant levels.

Swimmers, whether they realize it or not, add nitrogen containing compounds into the pool via their urine, sweat, natural skin moisturizers, and personal care products. A chemical reaction between chlorine and those nitrogen containing compounds release an irritant into the air called *trichloramine*, or TCA. TCA is the main cause of the [strong chemical odor](#) around some indoor pools and can lead to respiratory health symptoms. The more swimmers there are in the water, the greater their chemical “input.” Showering before swimming and not “peeing in the pool” help to reduce the amount of TCA that is formed.



*A diagram of factors that determine indoor pool air quality
Courtesy of Prof. E.R. Blatchley III, Purdue University*

Swimming Pool Water Treatment

Most swimming pools are treated with a chlorine-based disinfectant to help control microbes that can make swimmers sick. These include *Pseudomonas aeruginosa* (causes swimmer's ear), *Legionella* (causes Legionnaire's Disease and Pontiac Fever), *E. coli* and norovirus (cause diarrhea). When applied appropriately, chlorine provides ongoing protection against many waterborne pathogens. However, it does not easily inactivate *Cryptosporidium* (*Crypto*), a parasite that causes diarrhea. (People with diarrhea should not enter the pool.) *Crypto*, a major cause of waterborne illness spread in pools, requires filtration and supplemental disinfection such as ultraviolet light (UV) or ozone treatment, which inactivates *Crypto*. As a bonus, these treatments also help degrade TCA in the water.

Swimming Pool Water Mixing

When swimming pool water is mixed by bathers, more chloramine is bubbled into the air. This factor depends on the number of people in the water and their activity level. For example, a swim meet involving fast-paced competitors in each lane of the pool releases more TCA into the air than a water fitness class involving stationary activities.

Air Mixing above the Pool

Air flow above the swimming pool is controlled by the heating, ventilation, and air conditioning (HVAC) system. Indoor pools must have air-handling systems that continuously circulate fresh air into the facility. Air circulation helps remove TCA and other volatile compounds. It is important to design and monitor the air handling capacity of the HVAC system to ensure it provides enough fresh air flow into the facility.

Preventing Chloramine Buildup in the Air of Indoor Pools

The research team includes participants from Purdue University, Michigan State University, and the Free University of Brussels. Using data collected from a variety of indoor pools, the team is building a scientific model to identify how the factors discussed here influence indoor air quality. The results will provide data to better inform updates to the Centers for Disease Control and Prevention's (CDC's) [Model Aquatic Health Code](#). The code is an ever-evolving source of free, evidence-based guidance for the design, construction, operation, and maintenance of public swimming pools and spas.

Indoor swimming pools are intended to offer a healthy option for exercise and recreation. We congratulate the research team for investigating the important problem of air quality in indoor pool facilities and look forward to their results. We all want to swim healthy and breathe easier around the pool, and you can do your part by never peeing in the pool, and showering prior to entry.

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