FACILITIES & MAINTENANCE

Natatorium Indoor Air Quality

by Eric Knight

Most people may not realize the "pool smell," which is commonly mistaken for chlorine, is actually a symptom of a larger air quality issue in indoor pools. Pool indoor air quality (IAQ) is largely driven by off-gassing disinfection byproducts (DBP's) such as chloramines and chloroform, which form when the pool disinfects dirt and organics in the water.

These airborne pollutants are not only unhealthy, but they can also damage and destroy the building and virtually every metal component in it. In other words, poor IAQ is beyond a health problem; it's a financial problem, and it's a problem that continues to grow over time.

Challenging the Traditional Paradigm for Indoor Pools

We need to challenge the way people think about indoor pools and challenge the paradigm of how they have been traditionally designed for decades. Recent technologies and a new design philosophy for ventilation has proven that IAQ problems can be reduced—if not prevented—by looking at indoor pools from a different perspective.

This article challenges three traditional natatorium design philosophies. Of course, decision-makers should do further research to inform their decisions because design problems have many right answers. Our intent is to share a new way of thinking which will lead to improved natatorium IAQ.

Traditional Natatorium Design Philosophy #1

"The solution to pollution is dilution."

Until the market accepted dehumidification systems for indoor pools, pool ventilation was usually achieved using dedicated outside air systems in some form or another. These systems resulted in decent IAQ but came with high (sometimes extraordinarily high) energy and operating costs.

Beyond costs, dedicated outside air systems are not the most effective for indoor pools, given the realities of indoor pool conditions. Humidity and temperature needs are different in an indoor pool environment than a typical commercial building, as evidenced by thousands of indoor pools suffering from condensation problems and corrosion when they lacked proper dehumidification.

Part of the reason for using dedicated outside air systems was the theory of "solution by dilution," which basically means introducing more outside air to dilute the pollution inside the pool room. Many modern day pool dehumidifiers include a function called "purge," which allows for large amounts of outside air to be brought in and exhausted out. More outside air may make breathing easier, but this approach comes at a high cost. In other words, while the air quality can be better when pollution is diluted, the consequences and high costs tend to outweigh

the benefits. The costs were so high that the market demanded a way to close the energy loop, recycle the heat and save on operating costs.

While pool dehumidifiers have a higher front-end cost, the energy efficiency offer brings about a swift ROI when compared to traditional air handling systems. Pool dehumidifiers recirculate air through a dehumidification loop which can reclaim energy to operate efficiently.

The problem is this: depending on how the system is designed, corrosive chloramine-laden air can recirculate too, which wreaks havoc on the entire mechanical system and threatens its useful life expectancy.

The reality is that "solution by dilution" does not remove pollution from the natatorium; it just dilutes it. Diluted chloramines are still harmful and corrosive, and they are still in the room. A better way to have good IAQ is to focus on capturing pollution and removing it from the space, rather than introducing more fresh air. Doing so addresses the pollution problem directly at its source and reduces the need for excess outside air. The concept is known as "sourcecapture" ventilation.

Traditional Natatorium Design Philosophy #2

"Exhaust from the ceiling."

Heat and humidity rise. For that reason, it makes sense that the vast majority of pools in North America have exhausts in the ceiling. The problem with high exhausts is that chloramines and other DBPs do not rise because their atomic weight is heavier than oxygen. Exhausting warm, humid air from the ceiling makes sense for heat and humidity but does almost nothing to reduce pollution in the space. In effect, it's throwing away the cleanest air in the room.

Since the worst air in the natatorium stays low, low exhaust is more appropriate for indoor pools. Decision-makers should take care, however: there is a crucial difference between "low exhaust" and proper source-capture ventilation. Those who are considering making changes to natatorium ventilation systems should do more research to make the best decisions for their spaces.

Traditional Natatorium Design Philosophy #3

"Return low air to improve circulation."

Many pools are designed with low return grilles, because their designers understood the need to have air movement in the breathing zone (lowest air in the room). Locating HVAC returns low to the pool deck does improve recirculation in most cases, and certainly is better than high returns when it comes to moving air down low.

The problem is that low returns can recirculate chloramine-laden air through the

HVAC system, which compounds an IAQ problem very quickly. Chloramines are also very corrosive, and they are known to cause rust and damage to the internals of an HVAC system faster than normal, which can shorten the life of the equipment. Replacement parts for pool dehumidifiers are not inexpensive, protecting that equipment should be a priority for pool operators and owners.

There are two general types of IAQ problems in pools: stratification and recirculation. Stratification is when there is poor air flow in certain parts of the room that need it, and recirculation is when bad air recirculates through the HVAC system. It is possible to have both, though such a situation is rare.

A different way to improve circulation in a pool is to relieve the room of bad air with proper source-capture ventilation, so that the HVAC system recirculates nothing but clean air. That way, all air being supplied to the room is chloramine free, and the "chloramine bubble" above the pool is broken. This strategy reduces the risk of stratification problems in the breathing zone: it also reduces the risk of chloramine recirculation and corrosion to the HVAC system, therefore potentially extending the system's useful life.

Caring about the User Experience

A good way to design a natatorium is to start with the end users in mind, not just calculations and design guidelines. Planners should start by thinking about the user experience—a swim team breathing hard for two hours at full exertion; the lifeguards sitting on deck, rotating from stand to stand for hours every day; the coaches and spectators during a swim meet.

Designers need to think about those people and how important it is that they can breathe healthy air. Fortunately, the technology and expertise exists today to help natatoriums achieve great IAQ, whether for a new pool or existing pool that has been struggling with a chloramine IAQ problem.

Campus planners should conduct careful research regarding chloramine source-capture ventilation for indoor pools, discovering for themselves the benefits of removing this harmful pollution from the room. Making improvements to the ventilation system can extend the life of the building and equipment, make the environment healthier and more enjoyable, and alleviate a big problem that costs pool owners a lot of money over time.

Every pool user deserves to breathe healthy air, and the aquatics and HVAC industries have a moral imperative to deliver healthy air to them.

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