

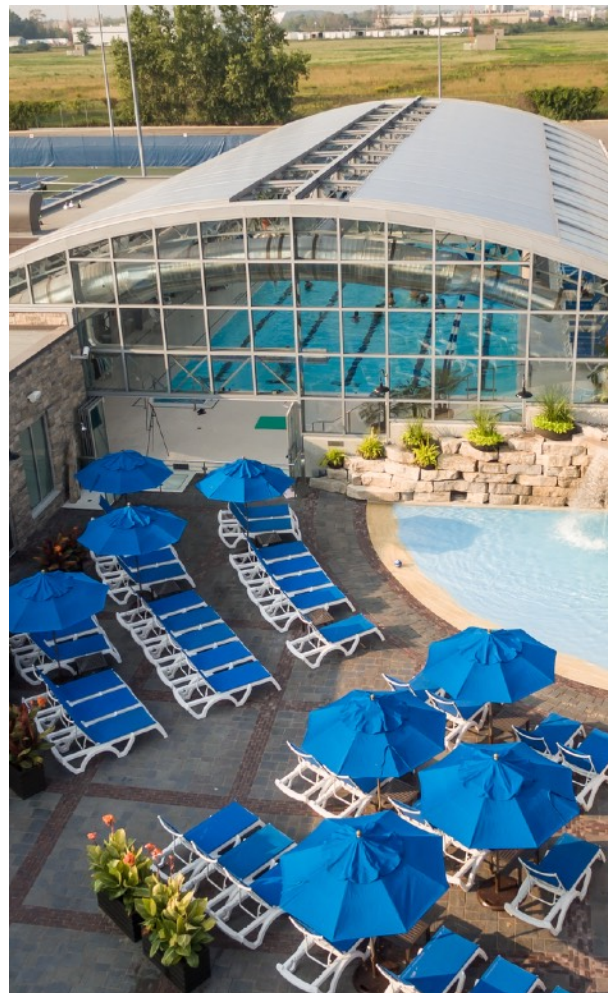
# Corrosion-Free Pools; Fact or Fiction?

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**F**ew buildings present the risks and challenges found in indoor swimming pool enclosures or natatoriums. *With far higher interior moisture loads than typical buildings and a potentially corrosive interior environment, natatoriums put structural and enclosure systems to the test, especially in cold or even mixed climates.*<sup>1</sup> In addition, geography has an impact. Coastal location structures are also at risk from sea/salt air, while inland locations may suffer from pollution and other environmental factors.

Indoor pools, in all locations, suffer from the effects of chloramines, the off-gases in the air, which have become worse as pools have become bigger/warmer and as attractions; such as slides, surfing, splash pads, have become common features. Chloramines are toxic. They cause corrosion, irritate skin and eyes and are a



**Chlorine remains the primary disinfectant used to sanitize pools. Chloramines are gases that form as a disinfectant by-product of chlorination.**

known respiratory health hazard to swimmers, lifeguards and other pool occupants.<sup>2</sup> If you notice a chlorine-type smell, the air is probably contaminated with chloramines.<sup>3</sup>

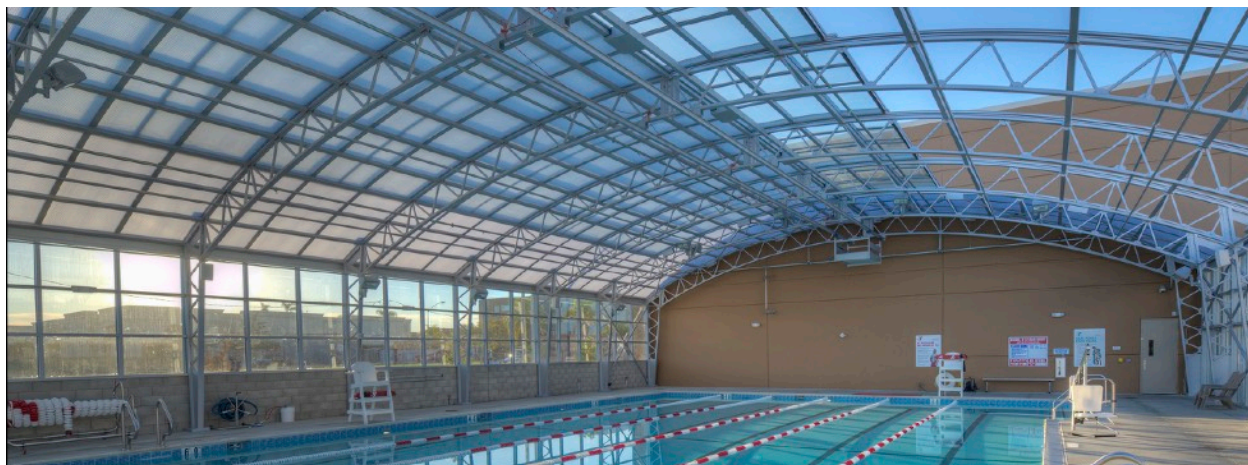
As a result, operators and owners are continually on the lookout for building envelope failures that can appear quickly and severely and are caused by improper design and construction. Building envelope failures can include roof membranes, vapor and air barriers, foundations and cracks in cladding, all of which can lead to energy loss and potential structural member degradation.

*Natatorium investigation reports almost always cite “improper design/construction of the vapor retarder” as a primary cause of moisture problems.<sup>4</sup>*

Building envelope issues are inherent in mixed-use athletic complexes where the pool is attached to a larger facility and designers didn’t fully appreciate the complex distinction/interaction between the specialized systems required for the pool area and/or failed to prevent moisture migration between the pool and the adjacent spaces.<sup>5</sup>

***This is because the air in a natatorium often contains nearly three times the moisture per unit volume as a typical, non-humidified building. It is important to realize the building code is intended for non-humidified/‘general-use’ buildings and does not specifically cover special buildings such as natatoriums and museums—both of which require atypical interior conditions.<sup>6</sup>***

Perhaps the biggest risk to indoor pools is the corrosion danger to the structural steel used in building envelopes over the pool area. *Several structural failures over pools*

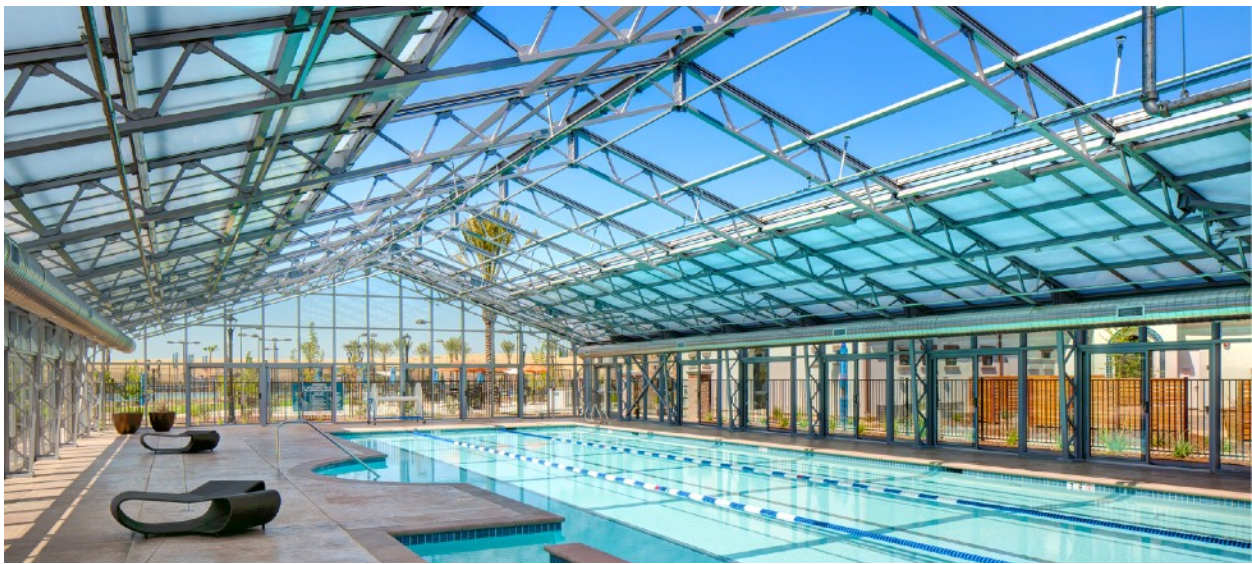




*have led to the sudden collapse of ceilings, along with deaths and injuries. The cause was chloride-induced stress corrosion cracking (SCC).<sup>7</sup>*

An uncoated (or insufficiently coated) steel bar joist roof structure will corrode quickly, creating a maintenance nightmare. Accessible surfaces using stainless steel can be maintained and refinished easily, and with a proper water treatment program, corrosion can be reduced. However, the impact on any part of the building envelope beyond the physical reach of regular maintenance programs remains a major concern.

How do you clean/maintain a roof that's 30-40 ft over the pool on a regular basis? **The answer is... you don't.**



## **The alternative solution.**

The answer is to *ventilate the chemical and filter room air to the outside*.<sup>8</sup>

***New studies demonstrate the correlation between the transmission of COVID-19 in closed environments vs. open air circulation. In a recent Japan study, the odds of a primary case transmitting COVID-19 in a closed environment was 18.7x greater compared to an open-air environment.***

Plus there are a couple of other ideas that have been found to alleviate the impact of corrosion.



The first, as noted, is the introduction of naturally ventilated air. A large volume of air through the pool space will help to eliminate the chloramines the cause the air to be less acidic and corrosive. It has the added benefit of reducing smell and creating a more desirable space for guests. *ASHRAE says to design a natatorium system so that up to 30 percent of the recirculation rate can be brought in as fresh air. We recommend greater fresh air capacity, 50 to 100 percent where feasible.*<sup>10</sup>

The second idea is: *whenever possible use building materials, such as aluminum, that will endure in this environment.*<sup>11</sup>

**Aluminum** is lightweight, high-strength, corrosion-resistant and widely recycled. It maximizes building efficiency by balancing the functions of heating, cooling, lighting, shading and ventilation. In addition, aluminum in buildings has been proven to last for multiple decades with minimal maintenance, lowering the lifecycle footprint of a building.<sup>12</sup>

Building a pool enclosure that doesn't corrode seems like a no brainer. Add to that low-cost natural ventilation and reduced maintenance costs, its an obvious choice.

Lastly: *Aluminum is superior to steel and iron in its ability to reflect the infrared (heat) rays of the sun. Properly coated aluminum roofs can reflect up to 95 percent of the solar energy that strikes them, dramatically improving energy efficiency.*<sup>13</sup> This



makes aluminum a key component in LEED-certified green buildings should you be looking for that designation.<sup>14</sup>

## Natatoriums of the Future

Facilities built with non-corrosive materials like aluminum have a significant advantage both from a strength and durability perspective, and a cleanliness one.

A bright, open space that isn't corroded makes these aquatic centers not only more attractive to guests, but in fact they are easier to clean. Also per the experts, using natural ventilation saves money and allows

operators to provide all occupants with a safer and healthier environment which may reduce the risk of virus transmission. During this time of a global pandemic, these are the issues that matter more than ever.

This is a win-win for owners and operators.



**OpenAire** has had the pleasure of building aquatic centers around the globe, challenging the stereotypes of traditional indoor natatoriums. Our aluminum retractable roof enclosures cover commercial pools from spas to retirement communities, to municipal parks and recreation facilities, YMCAs, Boys and Girls Clubs, to hotels, cruise ships and private Health Clubs. We also have an extensive portfolio of waterparks.

**No matter what the sector is, the issues around corrosion for indoor pools are the same.**

A small sample of our aquatic centers include:

- Scheu Family YMCA of Upland, California
- The Fit at Plunge Fitness Center, San Diego, California
- The Cove at Lakefront, Morrisville Aquatic & Fitness Center, North Carolina
- Saarland Therme Resort, Fitness, Spa, Rillchingen, Germany

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- [Grand Cascades Lodge - Crystal Springs Resort, New Jersey](#)
  - [Heritage El Dorado Hills Retirement, El Dorado Hills, California](#)
  - [The Granite Club: Private Members Club, Toronto, Ontario](#)
  - [Ivybridge Leisure Center, Ivybridge, UK](#)

For expanded portfolios of projects in all sectors, please reach out and contact us to see how we can support your future aquatic center dreams, or assist in modifying your existing facility to accommodate the future of improved daylight, hygiene, ventilation, and cleanliness.

**Footnotes:**

1 *Avoiding Problems in Aquatics Facilities: Atypical design for atypical buildings*, Construction Specifier December 25, 2013, Jason S. Der Ananian, PE, and Sean M. O'Brien, PE, LEED AP, <https://www.constructionspecifier.com/avoiding-problems-in-aquatics-facilities-atypical-design-for-atypical-buildings/>

2 *Ventilation Requirements For Indoor Pools*, Gary Lochner, ASHRAE Journal ashrae.org JULY 2017, [www.ashrae.org](http://www.ashrae.org).

3 *Energy efficiency in indoor aquatic facilities*, INV-DG-01, November 2016, Gary Lochner, Unison Comfort Technologies, [innoventair.com](http://innoventair.com)

4 *Avoiding Problems in Aquatics Facilities: Atypical design for atypical buildings*, Construction Specifier December 25, 2013, Jason S. Der Ananian, PE, and Sean M. O'Brien, PE, LEED AP, <https://www.constructionspecifier.com/avoiding-problems-in-aquatics-facilities-atypical-design-for-atypical-buildings/>

5 *ibid.*

6 *ibid.*

7 *A Corrosive Environment*; *Aquatics International Magazine*, September 01, 2011, Dave Schwartz, P.E, [https://www.aquaticsintl.com/facilities/maintenance/a-corrosive-environment\\_o](https://www.aquaticsintl.com/facilities/maintenance/a-corrosive-environment_o)

8 *ibid.*

9 *Closed environments facilitate secondary transmission of coronavirus disease 2019 (COVID-19)* Hiroshi Nishiura, Hitoshi Oshitani, Tetsuro Kobayashi, Tomoya Saito, Tomimasa Sunagawa, Tamano Matsui, Takaji Wakita, MHLW COVID-19 Response Team, Motoi Suzuki, medRxiv 2020.02.28.20029272; doi: <https://doi.org/10.1101/2020.02.28.20029272>,

10 *A Corrosive Environment*; *Aquatics International Magazine*, September 01, 2011, Dave Schwartz, P.E, [https://www.aquaticsintl.com/facilities/maintenance/a-corrosive-environment\\_o](https://www.aquaticsintl.com/facilities/maintenance/a-corrosive-environment_o)

11 *Energy efficiency in indoor aquatic facilities*, INV-DG-01, November 2016, Gary Lochner, Unison Comfort Technologies, [innoventair.com](http://innoventair.com)

12 <https://www.aluminum.org/aluminum-advantage/aluminum-101>

13 <https://www.aluminum.org/product-markets/building-construction>

14 *ibid.*