

# Stink or Swim

## Don't Blame HVAC for Bad Pool Chemistry



Swimmers will often blame the strong chemical smell of indoor pools on “too much chlorine.” Itchy skin, red eyes, coughing, sore throats, asthma attacks, and other irritations and respiratory ailments—along with the strong odor are **NOT** due to chlorine, but to chloramines. These are chemical compounds that build up in swimming pools when it is not properly balanced. A chlorine odor in your pool room indicates a very high chloramine level, that your pool is out of balance, and additionally—you now have a highly corrosive environment! Rust and corrosion on equipment, handrails, steel rafters and lighting fixtures, vents, piping, etcetera indicates a pool that is out of balance, along with humidity issues.

### Where do chloramines come from in an indoor pool?

Chloramines form when “free” chlorine is combined with ammonia, nitrogen, and various other compounds that can be found in perspiration, feces, baby diapers, urine, body oils, lotions, perfumes, and hair spray just to name a few. **Swimmers can help to prevent this problem by showering before entering the swimming pool. We recommend signs be posted in all commercial natatoriums that showers must be taken before entering the pool. This alone will cut down more than 75% of the problem of patrons bringing “waste” factors in the pool.**

A very high chloramine level indicates the pool chemistry is out of balance and in turn, creates a highly corrosive environment as already mentioned. Left uncontrolled, this chemistry attacks and destroys equipment, metal, wiring, controls, other surfaces, any other pool equipment, ladders, railings, controls, and structural members. There will be signs of rust, corrosion, “green” or “white” substances on equipment, mold within the structure in some areas... and this



begins to deteriorate the dehumidification system. First compressors fail, contactors fail, coils begin to leak, etc. Your dehumidification system may have coated coils and interior/exterior panels in G-90 or Stainless Steel, however, the internal components can be damaged beyond repair when pool chemistry is out of balance.

## Going After the Source of the Problem

A pool dehumidification system can remove excess moisture from the natatorium; however it **cannot eliminate** nor will any pool dehumidification system, (contrary to claims of special filters!) control the **harmful chloramine compounds**, control patrons entering the pool without taking showers, or children in diapers using the pool as their bathroom! Many companies today are recommending more outside air—meaning “dilution is the solution.” Unfortunately, this has nothing to do with air flow and everything to do with the water quality, which HVAC contractors have no control over. **Your mechanical firm is not responsible for water quality.**

The pool dehumidifier does not cause this problem, nor can it “fix” the indoor air quality—as this is a water quality issue.

- Although some companies recommend blowing air across an open pool, we—along with many designers—do not recommend this procedure. Indoor pools are not (and should not be) designed to have large amounts of air blowing across a water surface. This air movement across the water cannot control chloramines, has a “chill effect” on patrons, and is a waste of energy because it increases evaporation rate of water. Chloramines are a “heavy, sticky substance” and tend to lay at the pool surface area—where is ingested by patrons. This accounts for the increase in asthma attacks and other respiratory type diseases now found in children that swim on a regular basis in commercial pools. This is dangerous to any human being, especially the elderly and children whose lungs and immune system are more susceptible.
- The *return air* is installed at a higher point in the space when using overhead duct work. When using underground duct work, a low return is required. *Return* and *supply* should never be installed at the same level as that will cause a short circuiting of air flow.
- The return air side of the system is where dehumidification begins—by pulling the moisture-laden air into the dehumidifier over the cold evaporator coils to remove moisture. When pool chemistry is out of balance, this chloramine/chlorine contaminated air is pulled into the *return air* of the dehumidification system where it can cause deterioration and corrosion of equipment and internal components. Blowing air across an open pool does not resolve the issues of chloramines in a pool room.
- Introducing a higher volume of outside air to an indoor pool does not control the water chemistry problem and also creates additional energy costs for owner/operators. Proper air turnovers and the air delivery system can help...but it still remains a water quality issue.



**Automated Pool Chemistry Feeders** - These can become very problematic for commercial pools. Many do not realize that the sensors of these systems collect debris and become “gunked up” (excuse the term but it best describes this!) by the normal daily use of the pool. When this happens, the unit may send a message to the automated system is that there is not enough chlorine in the pool and the chemistry feeder begins to dump even more chlorine into the pool—hence another reason why your pool room may “stink.” The best approach to understanding pool chemistry is to contact your pool company and have your staff trained properly in how to balance a pool.

**Salt Water Pools** - If you are using salt, you have a much higher risk of deterioration and corrosion due to the highly corrosive nature of salt. This must be balanced properly. If your system has an external plate heat exchanger for pool heat recovery and it is stainless steel, most likely a titanium heat exchanger will need to be purchased as these are typically destroyed by salt water in less than 18 months. **We do not recommend salt water pools.** They are difficult to balance, companies are all over the board with the PPM to be maintained (we've been told anywhere from 1800 PPM to 6400 PPM), and it appears no one company has been able to resolve the issues with corrosion due to salt.



Pool Balancing is **NOT** a daily function, **it could be hourly** depending upon how busy, how many people, and how many hours the pool is open. In some facilities the manager uses a BIO GUARD STICK every hour or so when it is extremely busy.

## There Is No Such Thing as a Leak Proof Diaper

Please note that certain rules are applicable to maintaining your pool water. Babies and small children should not be allowed in the pool with diapers or “leak proof” swim diapers. It's been proven—they leak—and this bacterium enters the pool—Ecoli bacteria. Babies and small children generally have a state of diarrhea as their stomachs are not as fully developed as adults. It is recommended that in all commercial pools signs be posted that no children with diapers are allowed in the pool...period.

All factories require pool balancing records/photos when filing warranty claims for “defective parts.” All staff/owners must be trained in the proper pool chemistry procedures and the pool must be maintained at all times to maintain the integrity of your warranty.

**SUMMARY: If you can smell ANY chemical/chlorine, the pool is out of balance! This is a water quality issue. A dehumidifier can't fix it. Your mechanical firm can't fix it.**

## Chlorine, Salt, Bromine Pool Chemistry and Balancing

When pool water chemistry (chlorine, salt, bromine, etc.), is properly balanced, it will remain free of odor and protect bathers from bacteria and germs. Chlorine, the primary pool treatment process, kills germs and destroys harmful organic contaminants introduced into the water by bathers. Chloramines are formed in pools when chlorine molecules attach to ammonia and other organic by-products of the human body.

Pool operators have traditionally controlled waterborne bacteria chemically with chlorine, meaning that the gaseous chlorine-based byproduct can linger and recirculate through the HVAC dehumidification system causing damage to components, wiring, contactors, relays, compressors, etc. Although conventional mechanical fabric media filters on the dehumidification systems can trap airborne particulates, gases such as chloramines are not captured.

- Improperly balanced pool water chemistry can attack the indoor pool's HVAC system the building's structural components and anything metal in a pool room. When the water is not properly balanced it becomes a highly corrosive and creates an unhealthy environment. Corrosion is the first sign of poor pool chemistry. The deterioration to HVAC systems follows shortly and can cause premature failures. The replacement of hot gas reheat, evaporator coils, air coils, compressors, blowers, etc. can be extremely costly. Wiring and controls can become “faulty” and not all of the internal wiring can be replaced. We cannot stress enough that pool chemistry must be addressed at all times along with maintaining the proper temperature and humidistat settings in the pool room.



Hotel pool room equipment in the process of deterioration due to improper pool water chemistry

- Combined chlorine compounds cause eye irritation and the so-called “chlorine odor” that swimmers often complain about. Free chlorine in water, under normal concentration, has no discernible odor. Only a comprehensive pool water chemistry program and continuous monitoring will keep your pool crystal clear and odor free.
- Chloramines condense along with moisture from the pool on cold surfaces forming a corrosive chloride-rich solution.
- The chloride solution forms a harmful substance that will corrode metals, including stainless steel, where it forms a particularly serious stress corrosion-cracking problem.
- The chloramines in the air can cause significant damage to metal surfaces, such as window and door frames, ladders, ductwork, pool heaters, and HVAC equipment.
- The higher the concentration of chloramines in the air, the more corrosive the condensate.

Chlorine's efficiency at reducing ammonia is affected by several factors, including water temperature, water pH, total chlorine concentration, and level of dissolved solids in the water. Because of their higher operating temperature and higher ratio of occupancy per unit water volume, spas produce greater quantities of air contaminants than pools.

## Winning the Battle Against Chloramines

The following measures have demonstrated a potential to reduce chloramine concentrations in the air and water:

- **Ozonation** - In low concentrations, ozone has substantially reduced the concentration of combined chlorine in the water. In high concentrations, ozone can replace chlorine as the primary disinfection process; however, ozone is unable to maintain sufficient residual levels in the water to maintain a latent biocidal effect. This necessitates maintenance of chlorine as a residual process at concentrations of 0.5 to 1.5 PPM.
- **Water Exchange Rates** - High concentrations of dissolved solids in water have been shown to directly contribute to high combined chlorine (chloramine) levels. Adequate water exchange rates are necessary to prevent the buildup of biological wastes and their oxidized components in pool and spa water. Conductivity measurement is an effective method to control the exchange rate of water in pools and spas to effectively maintain water quality and minimize water use.
- Air Turnovers, outside air, and properly designed duct work/air delivery systems can help, but they cannot remove contaminants. Chloramines are almost like a “sticky” substance. They have to be washed off when continual off-gassing of pools occurs. Mechanical contractors have been blamed for the chlorine odors and the inability to remove these by moving more air flow in the structure. Proper pool chemistry and pool balancing, working in conjunction with good air turnover rate, is imperative.
- DXair recommends that once the pool is established, all staff should be trained by the pool company in managing these areas.
- **DO NOT** store chemicals in the mechanical space. People tend to forget to cap off chemicals tightly and they can escape into the mechanical space. Accidental spills also create a corrosive environment. It is recommended to store all chemicals separately from any mechanical equipment room. **NEVER** leave open buckets of chemicals in any mechanical space.
- **DO NOT** leave the mechanical room open to the pool room. A door should be installed between mechanical space and pool room environment to prevent chlorinated air travelling into areas such as mechanical spaces or other spaces of offices, buildings, and homes.



# CAUTION

- 1** Chemical levels in the pool water must be maintained within acceptable limits at all times to avoid health hazards and/or possible equipment damage. **Chlorine levels in excess of 6 PPM (parts per million) are to be avoided. pH levels below 7.2 and above 7.6 are to be avoided.** If bromine is used, contact your pool company's pool chemistry professional and determine where bromine should be kept at all times. Failure to follow these "rules" will result in pool equipment with deterioration, repairs, shortened life spans.
- 2** The stainless steel plate heat exchangers should not be used on saltwater pools with a level of salt in excess of \_\_\_\_\_ (check with your pool chemistry professional to determine PPM levels as they vary). Exceeding salt levels will void the warranty and the manufacturer will take no responsibility for pool, dehumidification system and/or heat exchanger damage. If an external heat exchanger is used, a titanium heat exchanger will always be recommended. Salt water pools are not recommended for indoor pools where pool dehumidification systems and duct work come into contact with poorly maintained chemistry.
- 3** Bromine: if using a bromine pool, contact your pool company chemistry professional to be trained in the proper balances of bromine (and all chemicals).
- 4** Automatic chemical feeders should never be installed up stream of the system's heat exchangers. Super chlorinated water, such as produced by such feeders, can destroy the heat transfer surface within the exchanger. When automatic chemical feeders are installed downstream of the heat exchanger, certain precautions must be taken to prevent heat exchanger damage. A check valve (non-metallic) must be installed in the water piping between the heat exchanger and the chemical feeder. This will prevent the super chlorinated water in the chemical feeder from draining back into the heat exchanger when the pool water pump is shut off. You must check chemical feeders often—as the sensors can get "gunked up" (only way to describe it)—and because the feeder doesn't sense the chlorine in the pool, it may continually add more when it is not needed. Train the staff in keeping all equipment maintained properly.

**PLEASE UNDERSTAND THAT IF CHEMICALS ARE ALLOWED TO DETERIORATE YOUR SYSTEM YOUR WARRANTY IS VOIDED.**

Have the pool company come in and train the staff as to proper chemistry and to maintain daily records (clipboard on the wall of mechanical) of the balancing.

Maintain your temperature settings and humidistat settings. **THIS IS IMPORTANT:** Pool water should be between 80-84 degrees (pick a number). Now set the AIR TWO DEGREES above that number. (i.e. 84 water, 86 air). You should never exceed 86 air temperature setting, and the water should never be set higher than your air temperature. Set the humidistat between 50-60% (around 55-56% generally works well. **Now DO NOT CHANGE these settings!** When water is warmer than air, you double the moisture, humidity, and begin to pull the water out of the pool. This can cause increased humidity and the unit may not be designed to keep up with it. You'll see signs of corrosion, rust, etc. also when the humidity levels are too high in the structure. A poor combination of high humidity and chlorine will deteriorate your equipment rapidly.

NOTE: Some circumstances such as therapy and rehab pools, and other specialty pools, dictate higher air temperatures. DXair equipment will always be sized to cover this additional load of evaporation.