

Under the Surface

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Is your pool 15, 20, 25 years old? It may be time to conduct a natatorium facility audit.

Look at most swimming pools and you'll typically see children and adults frolicking in sparkling, crystal-clear water. A soothing sight, but if your pool facility is more than 20 years old, are there serious problems lurking underneath the water's surface, in the recirculation system, and within natatorium walls and ceilings?

Many indoor swimming pools in high schools, colleges, universities and community centers were built in the 1940's, '50's and '60s, well before the advent of refrigerated dehumidification, automatic water-quality controllers, epoxy coating, economical lighting systems and safety features in the pool, on the deck and in the filter room and ceiling.

Those individuals responsible for the safety of patrons and students will likely take preventive action to avoid catastrophic accidents, but many are less motivated to take steps to prevent deterioration to the building, tanks and the natatorium mechanical systems. This may be because these types of problems are perceived as slow to develop or are not perceived at all – usually because of frequent turnover of people in charge or a lack of technical understanding of the aggressive forces that can destroy natatorium components.

Pool operators must look beyond those factors that could cause catastrophic accidents to those smaller telltale signs that might indicate trouble is brewing. One method of accomplishing this is to perform a natatorium audit, a systematic examination of the facility that will provide information essential for wise decision-making by those in charge.

Why execute a natatorium audit?

The best reason is to enable the person in charge to develop a clear understanding of the condition of each component of the pool system and to recognize any hazardous conditions. With this information, a facility manager can take necessary action to correct the deficiencies, arrest the damaging process, or at least identify the hazards and give prompt and sufficient notice of the problem to users.

The audit will also point out steps to make the natatorium safer, both for users and for staff who must work in this unique environment, often for many hours at a time.

Many older facilities have become obsolete relative to current safety standards pertaining to water depth, signage, chemical handling, delivery systems management procedures, supervisory rules and emergency action plans. If any of these areas in the natatorium are compromised, serious accidents or damage can occur.

Unfortunately, “ignorance is bliss” is often the rule of the day. A number of administrators and operators don’t really want to have their life complicated by knowing the situation or undertaking the effort to obtain the support – both financial and administrative –for the required repairs or renovation necessary to bring the facility back to its proper and safe condition.

With estimates of the cost for repairs, renovations or replacement, however, the responsible administrator can present a well-organized request for funding approval—backed up with specific data—to higher decision-makers.

The audit should be conducted by someone who has expertise in swimming pool management, tank construction, filtration, water heating, chemical treatment and controllers, and water chemistry, as well as construction of decks, walls, roof and ceiling systems, heating ventilation, air conditioning, dehumidification, fenestration and both underwater and over-water lighting—in short, all natatorium systems, finishes and materials.

The auditor should have previous experience and demonstrated expertise in examining a natatorium, as well as report writing. This expertise should have been developed over many years through exposure to several hundred facilities. The auditor’s technical background should also include an in-depth awareness of current product and system technology. Without this background, expert analysis and meaningful recommendations may not occur.

Of equal importance is field experience with repairs, renovations and replacements. This experience allows the auditor to see the problem from the owner’s perspective and that of the person who will be responsible for making the repairs.

The table below lists those components and systems that should be examined during the natatorium audit.

The Natatorium Audit: What should be examined?

Swimming Pool(s):

- Dimensions
(compare with as-built drawings)
- Existing leaks
- Interior surfaces and materials
(examine underwater using scuba gear)
- Piping systems
(valves and fittings)
- Filtration systems
(sand beds, underdrain or septums)
- Chemical treatment systems
- Water quality controllers
- Recirculation system and monitors
- Backwash discharge
- Underwater fittings, hydrostat valves
- Perimeter overflow system
- Pool markings
- Deck markings
(warning signs condition and locations)
- Deck equipment
(proper material, condition and locations)
- Tile grout joints and sealants
- Pool water analysis

Support Spaces:

- Filter room
- Chemical rooms
- Storage areas
- Access to delivery areas
- Ventilation in filter and chemical rooms
- Pool offices
- Loose-equipment storage areas
- Custodial areas

Natatorium:

- Deck finish
- Deck drainage
- Window and door casements
on interior and exterior walls
- Wall-mounted fixtures and equipment
- Window glazing
- HVAC, dehumidification ductwork,
hangers, fasteners, material finishes
- Seating and railings
- Ceiling system
- Acoustic Features
- Roof systems
- Wall finishes
- Deck circulation
- Signage
- Competitive swimming and
diving components

Corrosion is probably the most common problem that can occur in the natatorium. In some cases, the result is mostly cosmetic, but if allowed to grow unchecked, the structural integrity of the building or the equipment can be destroyed to the point where systems failure occurs. The best-case scenario is that damaged deck equipment must be

replaced, while the worst is the catastrophe of a roof collapsing, which could result in the death of people in the natatorium. In between these extremes are pool piping failure, electrical wiring failure or shorting, freeze damage to exterior walls and roof systems caused by moisture, the failure of vapor retarders or air barriers, or the failure of finishes.

Air quality in the natatorium has also come under scrutiny in the last few years, partly because of the occurrence of hypersensitivity pneumonitis among lifeguards at a new recreation center in the western United States. This incident is serving as a wake-up call to the industry, which is now seriously examining the whole question of chemical treatment and filtration of pool water, as well as air ventilation, circulation and dehumidification.

What happens if systems are left unchecked? Several relatively new university facilities have been allowed to deteriorate because of an apparent lack of knowledge about the systems and technology of swimming pool/natatorium operation. As a result, systems such as automatic controllers and recorders have not been adjusted, calibrated or repaired when necessary. The failure of these systems has resulted in manual operation and, in some cases, pool chemicals have been added by hand. These developments resulted in erratic levels of chlorine, pH, total alkalinity and total dissolved solids. The pattern of neglect continued into other systems of the natatorium. The result has been accelerated aging of the facilities.

A similar experience occurred at another national-class natatorium in the late 1970's when heating systems were turned off at night to conserve energy. As a result, the humidity level and dewpoint rose, condensation occurred with the chloramine-laced air and hydrochloric acid formed, which then attacked the ferrous metal in the natatorium – even to the extent that the reinforcing steel in the concrete towers and platforms corroded, with resulting rust stains leaching out of the concrete.

At another facility, sodium hypochlorite was kept in a container with a loose-fitting cover and empty drums of muriatic acid were stored without their closure caps in the filter room. The aggressive fumes from these containers corroded all steel (including stainless) and copper in the room, including filters, ace piping, valves, water pipes and electric terminals and wiring. The situation should never have occurred, but once it did, the problem was not recognized until it was pointed out by an outsider. Even then, a long period occurred before remedial action was taken.

The attic space over the natatorium is frequently the location of serious corrosion problems that can have life-threatening consequences. Corrosion is a frequent phenomenon in steel roof and ceiling systems, especially in older natatoria that do not have refrigerated dehumidification. Warm, moist air invades the “attic space” above the suspended ceiling. During cold winter months, this attic space is relatively cold (unless it is heated), and the steel members and metal fasteners have a temperature below the air's dewpoint, which causes condensation to occur and hydrochloric acid to form, resulting in corrosion.

Although corrosion will have no structural consequences on large beams and girders for a number of years, small-diameter hangers and fasteners can be significantly weakened in a short period of time, which can cause a portion of the ceiling to fall.

Natatorium audits on existing natatoria have revealed several findings:

The use of 304 low-carbon stainless steel for rail guards, gutters and bulkheads has resulted in significant custodial work to keep these components corrosion-free. Contrary to common belief, stainless steel will corrode, although at a much slower rate than high-carbon or mild steel. Chlorides in the natatorium's atmosphere will attack the stainless steel, which requires a frequent surface wiping down to prevent chloride buildup and subsequent pitting of the steel.

Experience has also shown that stainless steel that's submerged below water gutter or stainless steel surfaces frequently touched by wet hands (such as grab rails and ladders) do not develop corrosion. However, these stainless steel surfaces that are splattered with water, such as the underside of the splash plate in a fully recessed gutter, can develop pitting and corrosion at butt welds. Likewise, hand rails on diving platforms will sometimes develop pitting unless they are wiped down several times a week.

Stainless steel HVAC ductwork is especially vulnerable to chloride attack and corrosion when used in a natatorium. Paint will help this situation, but hangers and fasteners must be addressed as well.

By comparison, experience has shown that anodized or painted aluminum maintains its physical character in the natatorium space, and is especially effective for HVAC ducts, supply diffusers, window and door casements, and rail guards in balconies.

While ceramic tile is an excellent material for us in pools, and on the deck and walls of a natatorium, problems will develop in the pool because of aggressive water attacking the grout and mortar. The cause is usually traced to improper water chemistry and a failure of operational procedure.

Once the audit is completed, structural and mechanical problems can be analyzed and prioritized for funding and corrective action. In doing so, small deficiencies and irregularities are focused on while they are still easily managed, before they become major and more expensive. A preventive maintenance plan should be established for not only those items that need immediate action, but also items that are in satisfactory condition now but could quickly deteriorate if action is not taken soon.

With this plan, natatorium managers will be able to view the situation in a comprehensive manner and better organize procedures to gain control of the condition of the natatorium and pools, as well as better understand the functionality of the pools and their components and systems.



Ignoring problems can be extremely costly. There are any number of examples where a system failed, with major cost implications, while a repair request was in the budgeting process.

Undertaking a natatorium audit will lengthen the life of your facility, reduce operating costs, upgrade the condition and appearance of the facility and establish a shining reputation for your department and facility.

Training Pays Off

Inadequate training of operational staff is frequently the root cause of many natatorium problems, as owners often do not recognize the technical character of pool and natatorium operation. New, large indoor pool facilities with electronic systems require an educated staff---gone are the days of manually chlorinating the pool and opening a window when the natatorium became hot and humid.

A staff seminar conducted by the agency or firm that executed the audit is a valuable experience. When this is presented in conjunction with the completed audit report, the natatorium manager has the benefit of the existing facility analysis, recommendations of action to take, the estimated cost and the education of the maintenance staff.

With this type of information, the management team will present a facility to users that is safe, sanitary and efficient.

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