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Lightning Risks and Indoor Pools

As readers know, lightning, an awesome natural phenomenon involving a discharge of atmospheric electricity equivalent to 50,000 volts accompanied by a vivid flash and subsequent thunder (McKechnie, 1983), presents a potentially serious risk to all humans around the world. It is the second most common weather-related cause of fatalities in the U.S., second only to flooding (Holle, Lopez, & Zimmermann, 1999). Statistics suggest that the millions of lightning strikes result on average in 60 to 100 fatalities annually in the U.S.A. Some have suggested that up to 10 times that many individuals, or from 300 to 1000 persons, may suffer non-fatal lightning-related injuries each year. Such non-fatal injuries often produce chronic and permanent health problems such as neurologic deficits and severe burns (Andrews, Cooper, Darveniza, & Mackerras, 1992).

I recommend that anyone interested in the lightning phenomenon explore a number of online sources simply by searching "lightning" or "lightning safety," using one of the popular internet search engines. I was fascinated to learn a number of interesting facts and theories about lightning including terms, types, and causes (Wikipedia, 2009). I also came across a large number of photographs and videos (e.g., HowStuffWorks, 2009) that illustrate that, although lightning often strikes the tallest object, it does not always do so. Instead, a number of adjacent objects often have the probability of being struck as a lightning "bolt" approaches within 30 meters of the earth. Why one object ends up completing the electrical circuit is not always clear. If you want some really fascinating, yet potentially annoying, rain and thunder sounds, one can download audio files, both free and for-a-fee, for your computer. (I was tempted, but I decided not to include an audio file of thunder in the online version of this editorial for the entertainment of online readers. You can download your own, if interested.)

Lightning Safety Recommendations

Literature related to lightning safety practices is reasonably abundant and fairly consistent, albeit largely based on expert opinion, observations, and commonsense. Lightning safety recommendations rarely seem to have resulted from robust scientific studies for obvious reasons: because of its transient nature and deadly power, lightning is one phenomenon that lends itself to more naturalistic observations than to carefully designed empirical research studies. Some of the few research studies have come from an area of electrical engineering known as power engineering. Early electrical engineers designed studies dating as far back as the early 1900s in order to learn how to protect newly-built high voltage electrical transmission lines from the vagaries of electrical storms. Some investigators even attempted to create their own forms of lightning in the laboratory for experimental purposes. Most of the existing lightning safety recommendations and guidelines (e.g., from the National Oceanographic and Atmospheric Agency, NOAA, and its National Weather

Service, NWS, appear to be traceable back to a few common non-experimental sources including the National Lightning Safety Institute, NLSI, a non-profit, but proprietary interest group, and the Lightning Safety Group, another interest group meeting in conjunction with the American Meteorological Society, AMS.

One common lightning safety recommendation deals with avoiding sources of water during electrical storms. It cautions people who are outdoors to stay away from pools, lakes, puddles, wet poles, even wet grass. In fact, the AMS recommends following a so called "30-30" rule for outdoor pools, beaches, and swimming areas: Patrons should leave the water and take cover when there is 30 seconds or less between a lightning flash and the sound of thunder and outdoor facilities should remain closed to patrons until 30 minutes following the last sight of lightning or sound of thunder (AMS Council, 2002). A related indoor caution is that persons should avoid any contact with plumbing and not take baths or showers during periods of lightning (American Society of Safety Engineers, 2005; AMS Council, 2002; Roeder, 2002). Apparently the theory is that water and plumbing serve as a potential part of an electrical circuit for any lightning strike seeking to go to "ground." Anyone whose body becomes part of such an electrical "short circuit" risks suffering death, severe burns, or neurological impairment. Of course, upon reflection I do wonder how any aquatic life (e.g., fish, waterfowl, aquatic mammals) survives if simply being in contact with water during lightning storms is supposedly deadly.

Aquatic Issue and Controversy

I mention the two particular lightning safety recommendations dealing with aquatics because they have become the source of an interesting controversy over the past year. The issue is whether indoor swimming pools should be evacuated during electrical storms in a similar fashion to outdoor pools (Griffiths & Griffith, 2008; Kithil, 2008; Kithil & Johnston, 2008). To this point in time, the controversy seems to have stirred more rhetoric than resolution. In a provocative 2008 article published in *Aquatics International*, a trade magazine, Tom Griffiths and Mathew Griffith argued in "When Lightning Strikes" that no lightning-related fatalities had ever been reported in an indoor pool or aquatic structure, presumably because of building shell around the pool and the electrical "ground fault" system required by codes to protect the pool and swimmers. They also suggest that forcing patrons to exit a pool during a thunderstorm might increase the danger to patrons by sending them to take refuge in the showers or locker room with their extensive plumbing or, worse, to leave the building to go to a parking lot outside where their risk from lightning is especially high (Griffiths & Griffith, 2008).

In response to "When lightning strikes," Richard Kithil, President and CEO of the aforementioned National Lightning Safety Institute, posted two rebuttal articles on the NLSI website (Kithil, 2008; Kithil & Johnston, 2008) citing the need to take a conservative and liability-oriented approach. Kithil argued that the absence of lightning-related injury or fatality in indoor pools did not constitute proof that it could not happen. He also reasoned that lightning is notoriously "fickle," that electrical ground fault systems, especially older ones, might be overwhelmed by the high voltage of a lightning strike and that liability issues arising from a sound risk management system should dictate being conservative and removing patrons

from indoor swimming pools under the same policy as outdoor pools. Although Kithil suggested that a number of organizations including the YMCA and NCAA have guidelines for closing indoor pools due to lightning, in fact, it appears only the YMCA explicitly has that written policy (YMCA Services Corporation, 2003).

A Temporary Resolution?

I am intrigued that none of the "expert" guidelines (e.g., AMS, 2002; Roeder, 2002) directly address the risks associated with lightning and indoor pools, leaving it up to individual facilities and their staffs to draw inferences (or not) from the oblique recommendation to stay away from indoor plumbing during electrical storms. It seems to me that the AMS as the scientific organization with the greatest expertise with respect to lightning should take the lead in issuing a clear statement and recommendation. The whole area of electrical and lightning safety is beyond the purview and expertise of most aquatic professionals. Despite some reservations on my own part, it seems that until such time as a scientific organization with the necessary expertise provides a standard, aquatic professionals should probably err on the side of caution and close indoor facilities when an electrical storm is in the vicinity. Of course, it will be difficult for an indoor facility to employ the "30-30" rule because the sight and sound of lightning and thunder is not nearly so easy to discern as in outdoor facilities. It also would seem important that indoor and outdoor facilities alike make provisions for patrons to go to a safe area away from plumbing and definitely not allow patrons to exit the facility during a thunderstorm. Rather than worry primarily about "liability," I believe the motivating factor should be the health and safety of patrons.

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