

LIGHTNING SAFETY FOR PEOPLE AT SWIMMING POOLS

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People Safety is totally separate from *Building/Facility Safety* when it comes to lightning protection considerations. The two subjects are mutually exclusive. This Paper intends to educate, to inform and to propose defenses.

1. Why is Absolute Lightning Protection Impossible?

Lightning has its own agenda. Each lightning signature in amperes is different. Amps are current...most houses have 100 or 200 Amp service. Lightning ranges from a low of 3000 amps to over 500,000 amps. This is known as $I = \text{Current}$. Duration of the strike is in micro-seconds or thousands of a second. Typically, the strike event is over in less than 1 second, say .500 or .600 of a second. This is $T = \text{Time}$. Duration of Current opposed to duration of Time is expressed as DI/DT . Think of it as an 800 pound gorilla moving at one third the speed of light. Lightning attaches to all conductors according to their respective conductivity. Think wood. Think stucco. Think metal. Think the human body. Afterall --- human body is 65% salt water --- a first class conductor.

2. Bonding and Grounding (B&G) of Swimming Pools and Their Buildings.

B&G are required by the USA National Electrical Code (NEC) and all local jurisdictions. NEC describes electrical safety for fire protection and for electrical shock hazards. However, if a stupid person puts a metal pencil in an electrical outlet and stands in water, B&G serve no safety purpose. Grounding a pool cannot of itself control lightning behavior to the electrical circuitry nor to adjacent metallic conductors. When lightning strikes, generally ALL conductors carry some current according to their respective impedances.

3. Lightning Protection of Buildings/Facilities.

The guideline document in the USA is *NFPA-780, Standard for the Installation of Lightning Protection Systems*. Chapter 4 describes the defenses for buildings/facilities. The principle requirements are: Lightning Rods to defend against fires and structural damage (not for people); B&G to attempt to convey

lightning to earth (not for people); Surge protection for electrical circuits (not for people). NFPA-780, in Annex M, takes a cautious approach to evacuate indoor and outdoor pools during thunderstorms. We agree.

4. Lightning Safety for People at Swimming Pools.

B&G may not work for people safety. Wet floor? Touching a metal object which is carrying the DI/DT of lightning? Operating electrical equipment when lightning energizes the circuit? Being within “flashover distance” (thought to be a minimum separation distance of 6 feet) of an unintended conductor such as a metal door/metal window frame/metal diving board/metal light fixture below waterline in the pool? Where is lightning safety for people at swimming pools? Where to go? Evacuate the outdoor/indoor pool and the showers. Avoid all wet floors. Avoid all electrical circuits. Avoid all metal objects. Avoid open shelters. Seek safety in vehicles. Seek safety in building administrative areas.

5. Evacuate before or when lightning gets eight to five miles distant. Five miles is what the military and the major airports use for suspension of outdoor operations. How to determine this distance? (Be cautious of hand-held detectors in the \$200-\$800 range as they often approximate or guess about lightning.) Use one of more “Apps” on smartphones for better data. Consider: *Lightning Finder App* (\$6/year) or *Weatherbug “Spark”* (free). Or other? How to notify people? Public Address System. Siren. Voice. Other?.

Indoor pool activity suspension when lightning threatens have been adopted by: NCAA; YMCA; Red Cross; US Lifesaving Assoc.; FEMA; NOAA; Vaisala; Prof. Martin Uman (UFL); NFPA-780; USA Today; NATA; CDC; International Lifesaving Assoc.; Boy Scouts; College of Emergency Physicians; US Swimming Assoc.; and we at NLSI.

Small wonder that incident statistics are elusive. Wait 30 minutes after the last observed thunder or lightning before resuming swimming pool activities. Not popular choices, but a safe one recommended by many organizations. We suggest that *Safety is the Prevailing Directive*.