



# HAZARD ALERT

Cherie Berry, Commissioner of Labor

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Occupational Safety and Health Division

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## Swimming Pool Electrical Hazards

Swimming pools are enjoyed by millions of people around the world each year. When thinking of dangers associated with swimming, electrical hazards don't typically come to mind. However, pools utilize numerous pieces of electrical equipment and water and chlorine are excellent conductors of electricity. According to the United States Consumer Product Safety Commission, from 1990 to 2003, there were approximately 60 deaths and 50 serious injuries from electrical equipment in and around swimming pools. In addition, from 2003 to 2014, 14 deaths by electrocution in swimming pools were reported.

*Raleigh, N.C.:* On Labor Day weekend 2016, one such fatality occurred when a swimming pool became electrified due to a faulty water-pump connected to a deteriorated electrical system. The electrical system had not been tested/inspected for approximately three decades.



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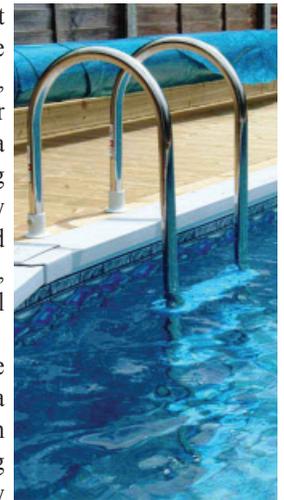
### Electricity and the Human Body

Electrical current naturally passes through the human body on a daily basis, which allows necessary functions like movement and breathing. However, when current is introduced into the body from an outside source, depending on the current level, it can cause detrimental effects. Even small amounts of current can cause painful shocks, resulting in possible loss of muscle control. In some cases, the individual may be able to free himself from the electrical source, receiving only minor injuries. However, if the individual is exposed to even small amounts of current while swimming, the individual could drown while immobilized. This is known as electric shock drowning. Electrocutation is when the current traveling through the body results in death and is often associated with high levels of current that cause cardiac arrest, respiratory arrest, severe muscular contractions, severe nerve damage and burns. If water becomes electrified, swimmers, lifeguards, and/or pool operators are at risk of receiving electrical shocks and could lose their lives from either electric shock drowning or electrocution.

### Signs of Exposure to Electricity

Some tell-tale signs of possible current in the water is when swimmers experience a tingling sensation, experience unusual pain, suddenly have difficulty swimming or receive a minor electrical shock touching a metal rail or ladder. Swimmers experiencing any of these signs should immediately exit the pool, avoiding metal rails and ladders and notify the lifeguard. If possible, all electrical power equipment at the pool should be turned off immediately.

Additionally, if a swimmer seems to be attached to a metal rail or ladder, or if a swimmer suddenly becomes motionless in the water, the swimmer may be experiencing an electrical shock. If a swimmer is suddenly motionless in the water and electrical current is suspected, do not jump in to rescue them.

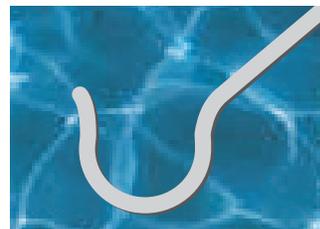


Metal rails and ladders in pools can become energized and should be avoided when exiting a potentially electrified pool.

### Rescue

To perform a rescue, use a fiberglass shepherd's crook/rescue hook and do not touch any metal railing or ladder. If a fiberglass shepherd's crook/rescue hook is not available, turn off all electrical power immediately and call 911.

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If fiberglass rescue hooks are not available, turn off all electrical power and call 911.

## Electrical Equipment Associated With Pools

All electrically powered equipment has the potential to introduce stray electrical current into the pool water. For this reason, it is extremely important to be familiar with the location of the power supply and emergency shut-offs such as panel boxes, circuit breakers and switches.



Common electrical equipment found in and around pools may include:

- ✦ Water pumps
- ✦ Receptacles
- ✦ Fans
- ✦ Decorative fountains
- ✦ Extension cords
- ✦ Cord-and-plug electrical equipment such as speakers, radios, televisions, or refrigerators
- ✦ Water heaters
- ✦ Power switches
- ✦ Lights
- ✦ Underwater vacuums
- ✦ Underground wires

## Safety Requirements

### Bonding

Bonding is the act of joining metallic parts together to reduce voltage between parts. It creates a conductive path that ensures electrical continuity and the capacity to conduct any imposed current safely. It also ensures that individuals will not receive a shock by becoming the path of imposed equalization if the metallic objects happen to be at different potentials.

National Electric Code (NEC) 2014-680.26 states that metal parts of pool structures must be bonded together with a solid copper conductor, not smaller than 8 American Wire Gauge (AWG). Additionally, metal parts within five feet horizontally and not more than 12 feet vertically from a pool must be bonded.

Examples of metal parts include:

- ✦ Ladders
- ✦ Diving boards
- ✦ Fencing around pool
- ✦ Underwater light fixtures
- ✦ Handrails
- ✦ Pumps
- ✦ Circulation equipment

### Grounding

The Occupational Safety and Health Administration defines an effective ground as an intentional connection to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons. In other words, connecting the live part (the part which carries electrical current under normal conditions) to the earth and back to the power source. OSHA requires permanent, continuous, and effective grounding paths for circuits, equipment, and enclosures. The requirements are detailed in 29 CFR 1910.304-Wiring Design and Protection.

## Ground Fault Circuit Interrupters (GFCI)

Ground fault circuit interrupters are designed to turn off the power when the circuit exceeds an established safety value. OSHA requires GFCIs in wet locations. To prevent electrical shock or electrocution in and around pools, GFCIs should be installed at the following locations:

- ✦ Underwater lighting circuits operating at more than 15 volts
- ✦ All electrical equipment used with pools, spas and hot tubs
- ✦ All outdoor receptacles and any indoor receptacles that could potentially be used to power electrical equipment/appliances within 20 feet of the pool
- ✦ Other locations and/or equipment in accordance with local codes and the NEC requirements

### Additional Requirements

In addition to the safety requirements listed above, other electrical safety regulations for safeguarding employees in their workplaces can be found under 29 CFR 1910, Subpart S-Electrical.

## Additional Recommendations

### Inspections

In North Carolina, there is no requirement to have the electrical systems checked at public or community swimming pools. These pools receive opening inspections every year and throughout the pool season by local health departments, but they do not check the electrical systems.

Hiring a qualified licensed electrician to perform regular inspections of the entire electrical system, including upgrading outdated wiring to meet current electrical code specifications, is recommended. Inspections should be conducted whenever modifications or repairs to the electrical systems have been made.

It is also recommended that electrical equipment be evaluated regularly by the pool operator. Pool operators should check GFCI outlets around the pool to determine proper functionality and should inspect extension cords and cord-and-plug equipment used around or in the pool for any signs of damage such as strain relief, cuts and nicks. These types of checks and inspections should be performed on a routine basis and any damaged equipment should be immediately pulled out of service.

### Warning Equipment/Devices

Several companies sell devices that activate visual and/or audible alarms when current is detected in a body of water such as a pool or lake. Depending on the specific device they can float on the water like a buoy or are installed at specific locations such as ladders, railings or docks. These devices will provide a warning to alert individuals nearby when the water suddenly becomes electrified. These devices also will provide advance warning to individuals before entering the water.

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