



SEAWORTHY

The BoatU.S. Marine Insurance and Damage Avoidance Report*

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A Preventable Dockside Tragedy

By Kevin Ritz



Lucas Ritz: 1991 -1999

We were a live-aboard family with three active children at a fresh-water marina on a tributary of the Willamette River near Portland, Oregon. Other kids were already swimming in the cove because it was that kind of day—hot and lazy. This was a common practice by adults as well as children during the warm summer of 1999.

so it was great fun and presumed safe to play in the water. Our children were schooled in aquatic safety. Being young professional people, my wife, Sheryl, and I had taken every precaution we could for peace of mind in a water environment.

On the inside of the dock, the kids were having a great time floating down with the river current on an inner tube. Lucas moved away from the others toward his mother, who was keeping pace on the dock with the children's water activity. As he approached the ladder to get out of the water, he let out a loud gasp, immediately rolling onto his back in his life jacket, apparently unconscious. Sheryl yelled to the other kids to help him and jumped into the water herself.

As the kids approached Lucas, they felt a slight tingly sensation in the water and immediately backed off. Upon

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Our sons Ian, age 10, and Lucas, age eight, asked to swim with their friends. Permission was granted, subject to close adult supervision by parents including their mother, a graduate nurse. The boys were both wearing Type II life jackets,

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"With my digital voltmeter, I went to the area where Lucas had been, put the negative lead to a ground, dropped the positive lead into the water, and immediately got AC voltage."

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hitting the water downstream from Lucas, Sheryl's extremities went numb and she experienced extreme difficulty moving her limbs, which, at the time, she attributed to fear. Somehow, Sheryl managed to pull Lucas to the dockside where others assisted in getting him onto the dock.

I arrived moments later after hearing the commotion and, along with another onlooker, started giving him CPR, which we continued until the paramedics took over approximately 15 to 20 minutes later. Our beloved Lucas was pronounced dead at 6:30 p.m. at Portland's Emanuel Hospital. One moment he was laughing and playing—an instant later, his short life was over, leaving our hearts broken forever.

As parents we suffered agonies of "how did this happen?" This question then turned into "why did this happen?" We relived every moment trying to sort out what we did or didn't do. It was not until the next morning that we were able to start unraveling the pieces of the mystery. The first assumption was that he drowned. However, he was wearing the best life jacket money could buy, which kept his face out of the water even though he was unconscious. He was pulled from a floating position only moments after rolling onto his back and CPR was started immediately. Also, at no time during CPR could we detect a heartbeat and his color was good. Neither of these observations would indicate drowning.

As Sheryl was telling me what had happened, she said she had never been so fearful in her life as to have her extremities tingle and go numb to the point where she could hardly move while in the water. Ian then related to me for the first time that he also felt a tingling as he approached his brother. Upon hearing all this it seemed clear to me that he did not drown, but that somehow, some way, AC electricity was present in the water where the kids were swimming. Our Lucas had been electrocuted.

I then called the County Coroner's office, requesting an autopsy if they had not already done so, because knowledge of the

circumstances and common sense pointed to electrocution, not drowning. They argued that there were no burns on his body. I pointed out that Lucas had been in an electrolytic solution, which eliminated the resistance of the skin (ordinarily skin resistance results in burns when an individual is electrocuted on land). To my complete horror, they responded that they would not know how to test for something like that.

I told them that testing was not difficult and that I was going to test the water in the area. I then called the local Sheriff's Department and left a message telling them my suspicions. With my digital voltmeter, I went to the area where Lucas had been, put the negative lead to a ground, dropped the positive lead into the water, and immediately got AC voltage. I notified the Sheriff's Department, reporting what I had found. They agreed to send out some deputies while I called in an electrician to confirm my suspicions. He arrived later that morning, tracing the electricity to a powerboat that was in the area where the kids had been swimming.

Concerns about liability soon unleashed a stream of other investigators, all of whom were suddenly interested in determining the source of the current. The local utility company wound up sending a team. The owner and manager of the marina arrived. More deputies were called.

Meanwhile, the electrician and I continued our investigation, focusing on the powerboat. We found a 12V wire lying on top of an AC wire, which had gotten hot enough to melt its own insulation and that of the hot (black) AC wire. This put 120V AC into the entire ground system of the boat, including the engines and propellers. This, coupled with lack of an AC safety ground, forced the voltage and electrical current into the surrounding water.

Fresh water is not a good electrical conductor; therefore the AC was unable to reach ground at a sufficient current to trip the breaker. Because of its high salinity, the human body is a much better conductor of electricity than fresh water. (Saltwater is more conductive than the human body,

which explains why electric shock deaths have not occurred in saltwater.) As Lucas approached the ladder, he passed into the field of AC current and, for a brief moment, completed the circuit to ground. His heart was stopped instantly; the insidious path of electrical current took the life of our son.

At first we considered this a freak accident—a unique set of circumstances that just happened to us. But this event completely changed my life and my focus. I was determined to understand how this could happen and to do everything I could to keep it from happening again. I did not want anyone else to suffer the pain we had suffered. With the collaboration of my business partner, Andy Tufts, I wrote a couple articles for The American Boat and Yacht Council (ABYC), describing the accident and the actions that I have taken to create public and professional awareness of the problem, to provide education and a better understanding of the concepts involved, and to encourage the following of the ABYC standards and the use of ground fault-type devices onboard boats and in marinas.

I determined to enhance my own knowledge so that I would have a solid understanding of the workings of AC currents in freshwater environments. Andy and I have done that using many different avenues, not the least of which was ABYC. We are now both ABYC Master Technicians. Also, the thrust of our marine business changed significantly from emphasis primarily on sales to one concentrating on keeping boats electrically safe using ABYC standards. Our business motto became "Safer Boating Begins With A Safe Boat." On-line, I also started checking out freshwater drownings with the suspicion that many were possibly electrical current related.

Much has happened in the years since and all of it good. The awareness of "electric shock drowning" as a serious freshwater issue has significantly increased. A USCG-funded ABYC grant implemented by Capt. David Rifkin and James Shafer has greatly added to the understanding of how AC current behaves in fresh water.

The truth is that most people electrically

shocked in fresh water, unlike my son, *are* drowned. This is because of skeletal muscle paralysis caused by low levels of AC current using the body as part of its return path to its source. This is what Sheryl experienced when she jumped into the water to rescue Lucas. That she didn't drown or get electrocuted was due to the voltage gradient of the electrical current from its source. She entered the water farther from the faulty boat leak than Lucas. Depending upon several bodily factors, a range of say 15 to 30 milliamps (mA) of AC current will create muscle paralysis, and the drowning of even good swimmers is the result. An AC current flow of around 100 mA will put the heart into fibrillation, and death will likely follow within seconds. This is a very serious problem, but it is preventable.

First and foremost, no one should go in the water at a marina. Signs should be posted on every pier warning people to stay out of the water. But, since not everyone will read this article, and since people often ignore signs, (as happened in the case of 19-year-old girl in 2005), or may fall into the water accidentally, the only certain cure is to have GFCI-type devices installed on boats that would automatically interrupt the flow of electricity in the case of a fault. There have been at least 60 needless fatalities and 100 unwarranted casualties from freshwater electrically induced faults. The solution in the future may be ELCI's (see sidebar).

The unfortunate reality is that currently

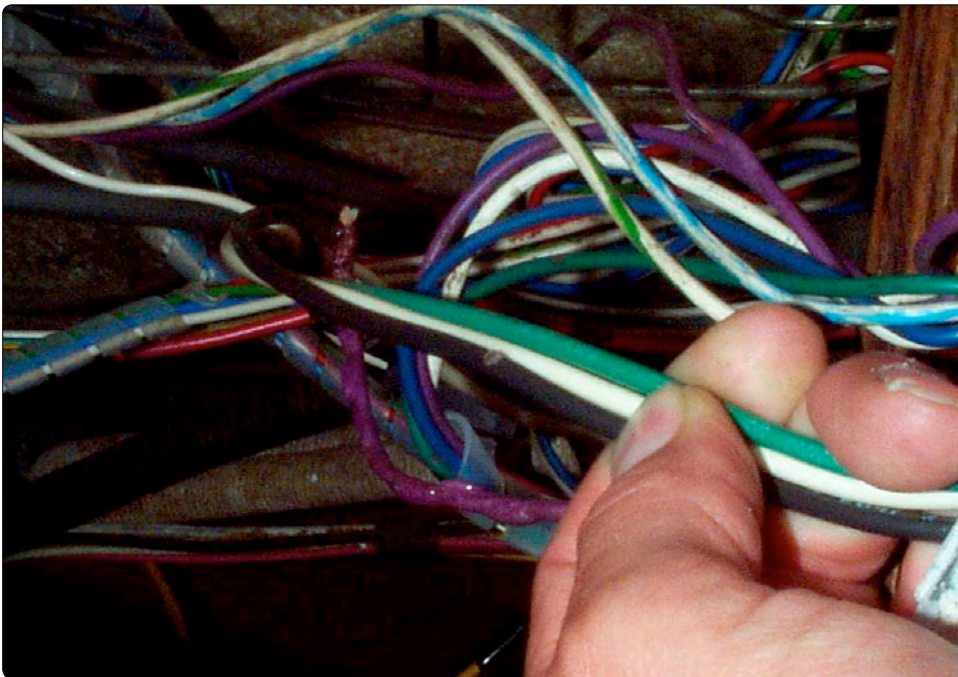
The Long-Term Solution: Equipment Leakage Circuit Interrupters (ELCI)

Lucas's death will not have been in vain if my efforts and involvement with ABYC have played some small part in the creation of a new ABYC E-11 standard that would require the installation of an Equipment Leakage Circuit Interrupter (ELCI) device on boats (already required by code for land-based damp environments such as bathrooms, kitchens, hot tubs, etc.). In our situation, if the 120V AC ground wire had been bonded to the metal components on the boat (i.e. the negative side of the battery), the energizing of the 12V DC system with the 120V AC would have most likely tripped off the shore power breaker, severing electrical current flow. Or, if a Ground Fault Circuit Interrupter (GFCI) breaker had been installed by the marina ahead of the boat's shore power, even 10 mA of current would have tripped it. So, bottom line—if the boat had been properly wired with an ELCI device or the marina placed a GFCI in front of the shore power cord, our son would still be alive today.

Once adopted and implemented on a vessel, the ELCI device, along with ABYC E-11 compliance, coupled with other pertinent ABYC electrical standards, will significantly reduce the odds of an elec-

trically induced death because of an on-board wiring problem. Following standards will not only keep people on the boat electrically protected, but those in the water around the boat will be safe as well. After the accident, GFCI breakers were installed on each of the marina's shore power distribution points. The only problem has been with new people coming to the marina who have tried to bypass the GFCI because their boats have electrical faults and they're tired of resetting breakers.

My business partner and I did extensive research into this issue and have conducted seminars for law enforcement personnel and local, national, and international marine investigators. We also serve as a resource for several agencies if there is a suspicion that electricity might be a factor in a drowning. Our intent is to set up a web site giving technical information on the functioning of electrical currents in fresh water. If this information had been available to us, we would not be still grieving the loss of our son. If this story doesn't say anything else, understand that a relatively simple fix could have prevented years of pain.



Note the very small melt in the AC Hot. This tiny connection between the AC and DC systems was all it took.

there is no post-mortem evidence available to coroners to ascertain whether electricity was involved in a drowning. Nor do most law enforcement personnel have the technical skills or tools to investigate this type of accident. This lack of knowledge, training, and tools leads to questions about how many deaths have occurred due to faulty wiring on boats. Some time after Lucas's death, two Multnomah County River Deputies and I conducted a random sampling of 50 boats in three freshwater marinas in the Portland area. We found 13 boats leaking potentially lethal electrical current into the water. A ratio of 26 percent of faulty boat wiring leads one to wonder if the number of reported electrical deaths in fresh water is only the tip of the iceberg. If you have any doubts about your boat, it should be inspected by an ABYC-certified technician. Do not depend on an electrician with experience only on land. Let's boat safely and save lives.

For more information, contact Kevin Ritz at Kevinritz@gmail.com.