SAFETY AND SECURITY

By Daren Hatfield

Emergency Egress and SPOF: Squirrels, Rain, and Man-Made Disasters

On January 3rd of this year, an errant squirrel took momentary command of a major university in California by chewing through electrical wiring and knocking out power to the main campus facilities. The loss in power resulted in canceled classes and programs for the day until the needed repairs could be implemented.

Only a week later, Mother Nature's sense of irony was on display when it "pulled the plug" during CES, the premier consumer electronics show, in Las Vegas. Excessive rain the day before caused a transformer flashover that plunged thousands of CES participants into unexpected darkness. Fortunately, in both cases, occupants were not in immediate danger and remained relatively safe until normal power could be restored, but these situations illustrate the unpredictable nature and timing of power outages, and particularly the inherent dangers of designing your emergency lighting system to a Single-Point-Of-Failure (SPOF) common when using generators or large central inverter systems.

Only a Question of When

The event of a power loss within a facility is never a question of if but when it will occur, therefore precautions are taken to protect occupants against such an unpredictable event. Unobstructed corridors and signage showing the shortest route to a building's exit are important, but how effective are they when a room is in complete darkness?

Emergency lighting is the crucial element that ties many of a facility's safeguards together. National, state and local safety codes outline requirements to provide occupants with emergency illumination along the path of egress. How we comply with these national and local codes is often an exercise of finding the solution that meets application, budget, and architectural constraints and preferences. Regardless of preference, the question must be asked: how do you address or avoid SPOF within your emergency lighting system?

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Failure of Simple Tactics

Often, a simple tactic to deliver emergency lighting is to use an onsite generator - when normal power is lost, the generator kicks on and provides a dedicated source of AC power to the facilities emergency lighting fixtures. Anyone can immediately pinpoint the SPOF exposure in such a system, but in truth, the potential for failure extends beyond the generator itself.

One of the most harrowing examples of this occurred during the World Trade Center bombing of 1993. When terrorists intending to collapse the North Tower of the WTC detonated a bomb within the parking structure, the resulting explosion collapsed several steel-reinforced concrete floors. Power was lost to the building, but the generator remained intact. The problem occurred when water mains that were broken by the blast flooded the switching mechanism responsible for delivering the generator power to the emergency lighting system.

Even though the generator was functioning, thousands of people needed to be evacuated from the building in utter darkness—a process that took hours to complete.

The need to address SPOF became apparent in this situation. Restoration of the World Trade Center, as well as subsequent construction of the Freedom Tower at One World Plaza, implemented a different solution for providing emergency egress lighting in the stairwells. Instead of relying on a generator system (or the attached switchgear) for emergency illumination, individual battery backup units, commonly referred to as emergency ballasts, were installed within existing fixtures along the paths of egress to create a system of almost infinite redundancy.

Miniature Emergency Systems

The emergency ballasts remain in a charged state, ready to deliver auxiliary power to the individual fixture when a power loss occurs.

The advantages of such a system become clear: emergency illumination is no longer dependent on a single supply source. Each equipped lighting fixture became its own miniature emergency system, detached from the risks of SPOF of the larger, centralized system.

Obviously, each individual fixture contains its own inherent points of failure (what if the lamp is 'burned out,' the fixture electronics are faulty, or the emergency battery fails to charge?) but as a whole, paths of egress remain illuminated even if one or two fixtures don't perform. An additional benefit is that integral emergency battery systems utilize existing light fixtures, eliminating the need for extra wall or ceiling mounted hardware.

To be fair, there are additional challenges and responsibilities incumbent when eliminating SPOF with this type of arrangement: diligence must be taken when applying the technology to ensure compatibility as well as adequate performance, and Life Safety code dictates regular testing of each individual unit to make sure it performs properly during an emergency.

Emergency Ballasts and Drivers

Many facility owners, however, find the gain in system confidence well worth the extra effort. From a cost standpoint, emergency ballasts and drivers are significantly less than the investment required for larger generator or UPS systems—not only in regard to initial installation but also in system maintenance and replacement expense.

A trade-off will always exist between balancing simplicity with eliminating SPOF. Other options for emergency egress lighting exist, such as unit inverter equipment, that strike a middle ground between generators (one solution with higher SPOF risk) and individual battery systems (multiple units with perceived infinite redundancy.)

Unit inverters remove the emergency supply from the lighting fixture itself and reside between the distribution panel and the emergency lighting fixture(s) to operate a limited number of fixtures during an emergency power situation. Unit inverters offer their own advantages such as full light output and wider load compatibility but with the caveats of increase in cost.

SPOF: Real but Avoidable Threat

Regardless of how emergency lighting is supplied, SPOF is a real and unavoidable threat that must be taken into consideration for any Life Safety system. Even though a single-point-of-failure is a bit simpler to fix after the problem has occurred, that is little or no consolation to building occupants stranded in darkness at an inopportune, or possibly even critical, moment.

Take the time to recognize SPOF in both your normal and Life Safety systems, and challenge yourself to ask the question "Can the intended occupants in this facility afford a SPOF?" This will help your system to not only avoid an unwanted emergency event, but also be prepared when failures—and squirrels—happen.

ABOUT THE AUTHOR: Daren Hatfield heads Marketing Projects for IOTA, a leader in emergency lighting innovation for commercial and public spaces. Since 1999, he has worked alongside multiple manufacturers to deliver Life Safety solutions in a continually-shifting technical industry. He can be reached at hatfield@iotaengineering.com.

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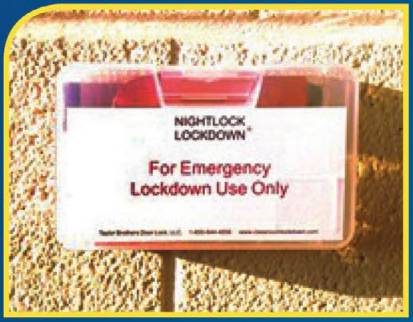

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