

BY MICHAEL CHUSID & JENNIFER MORGAN

# Standing Ready

## *Lightning protection for hospital rooftop gardens, terraces*

From the ground, it can be difficult to see slender air terminals (lightning rods) mounted on a roof. Locating air terminals out of reach from the ground also helps protect them against damage or vandalism. If, instead, a person is on a rooftop terrace or landscaped garden, only inches away from the air terminals, it is appropriate to consider both the appearance and damage resistance of air terminals.

Fortunately, there is an alternative to the vertical metal points used as air terminals; permanent metal parts of a structure — such as railings, sculptures, signage, light poles and trellises — can also be used as “strike termination devices” in compliance with nationally recognized standards. Strike termination devices provide a place for lightning to attach to a building; they are located at strategic, high locations on the roof and rooftop equipment and 20 feet apart around the roof’s perimeter and then connected to ground via large metal cables or other metallic conductors of proper size and construction.

This design option is especially important at hospitals with rooftop gardens and terraces that provide therapeutic places of respite to patients, staff and guests. Vertically installed air terminals can be antithetical to the serene aesthetics usually desired. They



Mercy, Patrick Ross, Dillon Lightning Protection Services, Inc. ; Kendall: Bonded Lightning Protection Systems



## STRIKE TERMINATION DEVICE REQUIREMENTS

National Fire Protection Association (NFPA) 780 - Lightning Protection Systems, paragraph 4.6.1.4 reads, "Metal parts of a structure that are exposed to direct lightning flashes and that have a metal thickness of 3/16 in. (4.8 mm) or greater shall only require connection to the lightning protection system..." to be used in lieu of a vertical air terminal.

Paragraph 4.9.3.2 allows metal thickness to be reduced to 0.064 in. (1.63 mm) for permanent handrails and ladders.

are also exposed to inadvertent damage or vandalism.

Another benefit is using metallic structural elements as strike termination devices avoids the expense of purchasing and installing separate copper or aluminum air terminals and conductors, plus the associated fittings and fasteners.

### Risk assessment

Lightning protection systems are vital to hospitals' safety and risk-reduction programs. Lightning can occur

**STRIKE ZONE** At Mercy Medical Center in Baltimore, Maryland (top), both the open-air pavilion in this rooftop garden and the metal handrails (on the right in photo) are used as strike termination devices in accordance with nationally recognized standards. The railing is elevated above the parapet so lightning will attach to it instead of the masonry. > Kendall Regional Hospital in Florida has, perhaps, a more typical hospital roof. Yet even this "garden" of equipment has to be made part of the lightning protection system. Since the guardrails on this raised platform rise above the equipment, they are bonded to the lightning protection cable seen around the perimeter of the platform and used as strike termination devices.

anywhere; a strike to or near a medical building can cause structural damage, ignite fire, destroy mission critical electronic equipment and damage essential building services including security, life safety, communications, IT and HVAC systems. Of even greater consequence is injury or death to patients and others in a building.

National Fire Protection Association (NFPA) 780 - Installation of Lightning Protection Systems, Annex L provides protocols for lightning risk assessment for buildings; conducting the assessment is the standard of care for design professionals and facility managers.

It makes clear that a facility is at increased risk if it:

- > Is of high value
- > Contains flammable gases or liquids
- > Contains sensitive electronic, digital and other devices
- > Is difficult to evacuate or has a risk of panic
- > Requires continuity of service

Many hospitals have all these risk factors; their impacts can be magnified when lightning storms accompany floods, hurricanes and tornados that create increased demand for hospital services. NFPA's Simplified Risk Assessment can be performed online at [nfpa.org](http://nfpa.org).

### Outcomes

NFPA 780 risk assessment is mandated by the University of Virginia Facility Design Guidelines, which also recommends use of vegetative roofs. When the University Hospital was expanded, a green roof was installed so that patients gazing out of their windows are greeted by what appears to be a flowing river winding through a landscape of

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picturesque mountains and idyllic farmland.

Conventional air terminals could be used because patients do not have access to the roof. On some of the parapet walls, however, a steel railing was used as a strike termination device. Copper conductor cables are used as jumpers between sections of railing to create electrical continuity. Other conductors interconnect all components of the lightning protection system; they were laid on the roofing membrane, and then covered with the green roof.

In another project, many people actually visit the roof gardens and terrace at Mercy Medical Center in Baltimore, Maryland. It is built on three levels and includes a shade structure made from steel. Masonry parapets at each roof level are topped with a stainless steel handrail that has been made electrically continuous with ground. The shade structure also serves as a strike termination device and is connected to ground.

Utilitarian structures on regular roofs can also be used as strike termination devices — either for convenience or cost savings. At Kendall Regional Hospital in Florida, for example, a metal walkway was installed as a platform for servicing rooftop equipment. The railings around the walkway are interconnected



with the lightning protection system and grounded.

### Ounce of prevention

When lightning struck the Regional Medical Center Bayonet Point in Hudson, Florida in 2016, the resulting fire and loss of power required evacuation of 209 patients in the dark of the night. In addition, an approaching hurricane was whipping up winds and placing other demands on first responders.

Incidents like this need not happen. Lightning protection systems meeting national standards are a proven technology, are inexpensive compared to many other healthcare interventions and can last the lifetime of a structure with little maintenance.

Lightning protection elements on a rooftop garden are only effective as part of a total lightning protection system for the entire building. Consult a lightning protection specialist prior to specifying or

**GROUND DOWN** At University of Virginia Hospital, steel railings are made electrically continuous and connected to lightning protection cables that lead to ground. Conventional air terminals are also used at the top of the landscaped “mountains” and on the rest of the building where it was not practical to use railings as strike termination devices. (Below) Mounted on a masonry parapet around the vegetated roof, the railings were bonded to the lightning protection grounding system. Copper jumper cables were utilized between sections to make the span electrically continuous.

installing lightning protection. Visit [lightning.org](http://lightning.org) for a list of certified master installers or master installer/designers. They should also be engaged for periodic inspections and maintenance of the lightning protection system.

Finally, the National Weather Service advises, “When thunder roars, go indoors.” Lightning can travel 10 or more miles before striking, so it is dangerous to wait outside until the storm is directly overhead. A roof garden or terrace must be evacuated and closed if lightning is detected — even if the sky is still

clear. At a minimum, warning signage should be posted on doors to the roof; if possible, a security guard should clear the roof.

To stand ready to treat people injured by lightning, a healthcare facility must first protect itself and everybody inside the building.

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