TECHNICAL BULLETIN

Lightning and Metal Roofing

We live in an electronic age, with computers and other sensitive electrical and electronic equipment present not only in every workplace, but also in most households. The element of personal safety notwithstanding, more and more people are considering lightning protection for their home or business. When a metal roof is employed on a project, it seems to heighten people's awareness of lightning and some questions whether or not the use of metallic roofing increases the risk of lightning strike. Metal roofing does not in any way increase this risk.

Lightning is a flow of electrical current between earth and sky. The result of this electrical flow can be millions of volts. There is still much that is not known about lightning, but most experts agree that a path of ionization is the beginning of, and establishes the route for, a lightning strike. The more dramatic part of the strike occurs when electrons race upward from earth to sky along this route. This is the flash of light with which we are all familiar. It is also the phase of the strike that poses the threat of damage. As is the case with any flow of electrical current, lightning will follow the path of least resistance. If the electrical charge is strong enough, it will also arc from one substance or another. It is the resistance to the flow of this electricity that generates heat energy and can cause explosions, fires, and other damage.

In assessing the risk involved with lightning striking any structure, two different subject areas should be analyzed. The first has to do with the *probability* of a strike; the second has to do with *consequence* of the strike. There is no measure known that can lessen the probabilit6y of a lightning strike, except, perhaps, physically moving the location of a structure. The use of lightning protection systems may, however, lessen consequence of a strike, should one occur.

The probability of a lightning strike is determined by a number of factors:

1. Topography in the area of the subject facility. The probability of a strike is higher if the project is located on a mountaintop or hilltop as opposed to a field.
2. Size and height of the subject structure. A tall building or one covering large ground area is more likely to be struck than a short or small building. A tall, slender structure (such as a steeple or lighthouse) is also a more likely target for a lightning strike.
3. Relative location of the subject structure with respect to nearby larger and taller structures. The presence of a very tall structure in proximity to a small, short building will tend to further reduce the likelihood of a strike to the small building.
4. Frequency and severity of thunderstorm activity in the geographic area of the project.

As can be appreciated by reviewing the above factors, the probabilities of a strike to a metal-roofed structure are no more or less than any other kind of structure, as these probabilities have to do with height and size of the structure and its surroundings rather than its construction materials.

In order to adequately assess risks involved with lightning events, the consequence of a strike must also be studied. In other words, what if lightning does strike a subject building? What will happen? Obviously, there is a potential threat to human life associated with a lightning strike in addition to the threat of damage to either the contents of the building, the building itself, or both. These threats are affected by the following factors:

1. Construction materials used for both framing and roof coverings. If these materials are (electrically) conductive, the threat of fire and explosion are both reduced, also reducing the threat to human life. If these materials are noncombustible, the threat of damage to them is reduced, and they will not contribute a fuel source to any fire resulting from a lightning strike.
2. Physical contents of a building. If contents are flammable or explosive, risks of the perils of fire are obviously increased. If contents are highly sensitive electronic or other equipment, highly valuable or irreplaceable items, then the consequence of loss is intensified.
3. Human occupancy. Buildings that are heavily occupied are considered to be at a higher risk than unoccupied or sparsely occupied buildings. Also, the type of occupancy has a bearing. If a fire results from a lightning strike, the risk to human life is greater if occupants are disabled or nonambulatory and cannot be quickly evacuated.
4. Remoteness of the building. If the building is remote with respect to fire fighting and medical emergency response, the risks of physical loss due to fire as well as human perils are increased.

Because metal roofing is both and electrical conductor and a noncombustible material, the risks associated with its use and behavior during a lightning even make it the most desirable construction available.

This face notwithstanding, and in view of the many variables that contribute to lightning risk, it may, in some cases, be prudent to consider lightning protection. A lightning protection system provides for a continuous conductor from earth to sky (and vice versa) so that the electrical charge is furnished an obvious path through which to flow, thereby reducing the risk to (electrically) resistive construction materials and human life.

For additional information, see NFPA 780 *Standard for the Installation of Lightning Protection Systems.* 2014 edition. National Fire Protection Association, Quincy, MA.

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- Research to develop improved metal construction products
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