

**Monthly E-Risk Newsletter to
"Manage your Risks Profitably"**

From
Cholamandalam MS Risk Services Ltd.

**Lightning & Surges
Myths & Facts**

Lightning & Hazards

The effects of lightning strikes are disastrous, whether it is direct or indirect. So are the effects of surges & transients. Lightning storms are on the increase globally – including United Kingdom where more than 420,000 lightning strikes to ground were recorded in 1994. Industry's reliability on sensitive electronic instrumentation, enterprise application software (SCM CRM, ERP), computers, & communication networks depends on effective LP systems.

Lightning is a natural phenomenon where the charge generated (due to cloud / air movement and other turbulent atmospheric conditions) in the atmosphere gets to the earth through a conductive path. Although the thermal effect of lightning is minimal due to the very short time duration (milliseconds), the high current (in the range of several thousands of kilo amperes) passing through structures or equipment or humans could be disastrous / fatal. The conductive path the lightning strike choose could be a building, structure, equipment, tree, car or a human being. The indirect effects of lightning, known as surges (temporary rise of equipment. voltage for a very short duration) could destroy equipment and other sophisticated electronic equipment.

Since the lightning cannot be avoided, the logical way to avert the risks of lightning strike is to provide a conductive path (with a lesser electrical resistance) as per standards & guidelines. The standards, IS 2309 & NFPA 780 provides reliable guidelines on the following lightning protection aspects for buildings & structures. BS 6651 (British Standard for Lightning Protection) identifies two distinctive forms of lightning protection. One standard is designed to protect the building structure and a second to protect sensitive equipment inside the building. Since the 1750's the most popular methods of LP have involved sharp vertical rods (Franklin Rods), horizontal and vertical conductors (Faraday's Cage or Mesh) or a combination of both. Only if air terminals are placed in the optimal location on the structure, it is possible to achieve an efficient & reliable lightning protection system.

Surges & Hazards

Surges as defined earlier, are momentary increases in the normal working voltage of a system. Sometimes referred to as ‘spikes’, ‘over-voltages’ or ‘transients’, these surges can affect power cables, data / telephone cables and instrumentation wiring, causing anything from data loss to the total destruction of equipment. These are indirect effects of lightning that destroy sophisticated equipment, especially the sensitive electronic equipment. Typical causes include fluorescent light switching, blown fuses and nearby lightning activity. The effects of these surges & transients are not always visible. Burnt / charred Printed Circuit Boards (PCBs) or malfunctioning software, etc. are indications of the effect of surge / transients. It is estimated that 70 to 85% of all transients are generated internally within one’s own facility.

According to the Insurance Information Institute, NY, Lightning and over-voltage transients cause damage to property, electrical, electronic and communications equipment estimated to be more than US\$1.2 billion dollars per year in the US alone. This represents approximately 5% of all insurance claims in the US. Surge Protection Devices (SPDs), as they are popularly called cannot protect equipment against direct lightning strikes.

Lightning Protection (LP) Risk Assessment

Lightning Protection standards (IS 2309, BS 6651, etc.) provides the methodology to assess the lightning protection requirement for structures and buildings based on the following 5 weighting factors.

- *Lightning Protection Risk Assessment (LPRA)*
 - *Use of Structure*
 - *Type of Construction*
 - *Contents*
 - *Degree Of Isolation*
 - *Type of Terrain*

Based on the above weighting factors, area of structure / building and the lightning intensity in the area, the overall lightning risk factor (Lightning Risk Exposure Index) is calculated. This index is compared against the defined threshold lightning risk index and the lightning protection requirement is assessed.

‘Furse StrikeRisk v2.0’ is a lightning Risk Assessment tool developed by **Furse** (Lightning Protection manufacturers) engineers based on BS 6651. This simple tool enables the user to carry out the lightning protection risk assessment within minutes.

Lightning Protection System- Installation & Maintenance

Various national & international standards on lightning protection provide details on installation and maintenance of lightning protection system. The essential guidelines that are outlined in IS 2309 are given below.

- Selection & Design of LP system (based on Zone / Cone Of Protection)
 - *Air Termination (vertical, horizontal)*
 - *Down conductor (Number & routing to avert side flashing)*
 - *Earth Pits*
- LP system for metallic storage tanks (floating roof & fixed roof types)
 - *Inherently protected metallic tanks (depending on shell thickness)*
 - *Number of earth connections = Tank Perimeter / 30*
 - *Floating roof tanks to have sliding steel shoes*
- Maintenance of LP System
 - *Tests on earthing system*
 - *Inspection of air terminations*
 - *Down conductors*

No LP system is maintenance-free. Every type of LP system whether it is surge diverters installed on power lines or Franklin rods atop buildings or surge protection devices installed to protect electronic equipment, needs to be maintained based on applicable standards. Monitoring the surge counter reading would give an idea of the local lightning activity in your area. Earthing plays an important role in the efficacy of LP system.

As per API Recommended Practice (RP) 2003, artificial earthing of metal storage tanks (storing petroleum products) neither decreases or increases the probability of the tanks being struck, nor does it reduce the possibility of ignition of the tank contents.

New Concepts in Lightning Protection

There are various other LP systems that are being discussed around (early streamer emission, controlled streamer emission, etc.) in the market, which are yet to be proven & approved (in

principle & technically) by national or international bodies such as National Fire Protection Association (NFPA), National Lightning Safety Institute (NLSI), etc. These new technology LP systems are at present categorized as '*Junk Science*' by reputed international LP bodies. Like any other innovative concept, where acceptance comes late, these new LP systems might get approved someday!

Lightning –Myths & Facts

Sl. No.	Myth	Fact
1.	Lightning strikes the tallest object	Not necessarily. It generally



		hits the best conductor on the ground. The unpredictability aspect of lightning is truly amazing.
2.	Lightning never strikes a place / building / structure twice	Another myth. Unpredictability aspect again! <i>Empire State building was struck 25 times in one year!</i>
3.	If LP system is installed & maintained as per standards, lightning will not destroy building / structure	Cannot really say. Damage due to lightning strikes depends on many factors such as severity of lightning strike, point of strike, efficacy of LP system & earthing, etc. <i>In June 1998, 13 people were badly injured during a rock concert in Baltimore. This stadium was provided with LP!</i>
4.	You are safe inside a metal bodied car during lightning.	Not completely true! A direct strike to your car will flow through the frame of the vehicle and usually jump over or through the tires to reach ground. Most lightning incidents to CMSRSL result in one or more flat tires and damage to the electrical system, but no injury to the occupants. If lightning does hit your car, stop and abandon it immediately. It's not uncommon for a strike to ignite fuel and result in a fire or explosion. If you keep one leg inside the car & another outside, the potential difference will exist and you can be struck.

5.	If LP is installed for the building where electronic system is installed, separate Electronic System Protection (ESP) is not required.	Another common myth! ESP protection should be separate.
6.	All UPS systems has in-built surge / transient protection.	Not necessary. In fact, majorities of UPS equipment do not have Surge Protection Devices (SPDs).
7.	LP system once installed is virtually maintenance-free.	No. LP system for structures and buildings is to be tested every 12 months as per standards and after every lightning strike.
8.	TV aerial used as a lightning conductor.	No. The aerial should be within the zone of protection of the LP system. Additionally, the aerial should be bonded into the air termination network.
9.	Lightning never strikes a group of people	Not predictable. <i>At a Soccer match in Republic of Congo (October 1998), 11 team members were killed by lightning.</i>
10.	Ben Franklin was struck by lightning	No way! Contrary to popular school teachings, Mr. Franklin was very lucky to survive his experiment. The spark he saw was a product of the kite/key system being in a strong electric field. Had the kite/key actually been struck, Mr. Franklin would surely have been killed!

Lightning Risk Management Programme (LRMP)

Assess the risks due to lightning and surges against the kind of protection (like property or life, electronic equipment, application software, data reliability, etc.) you require. If the

calculated overall lightning risk index is lesser than the defined risk exposure threshold (defined in LP standards, IS 2309, BS 6651), then LP is required. The next logical step is to select and design the most appropriate LP installation / equipment for the structure / building / equipment to be protected.

Integrated & effective building & electronic system protection can reduce the disastrous effects of lightning and surges/transients to a considerable extent.

Internet Information on Lightning

Organisation	Web Site URL	Information Available
National lightning safety Institute (NLSI)	www.lightningsafety.com	<input type="checkbox"/> Lightning accidents <input type="checkbox"/> Photos <input type="checkbox"/> Myths & Facts <input type="checkbox"/> Personal Lightning Protection
FURSE	www.furse.com	<input type="checkbox"/> LP Risk Calculator, <i>StrikeRisk</i> <input type="checkbox"/> Technical information
ERICO	www.erico.com	<input type="checkbox"/> New LP concept <input type="checkbox"/> Technical information <input type="checkbox"/> User-friendly LP product search
Lightning Protection & Grounding Institute	www.lightning-protection-institute.com	<input type="checkbox"/> Information on lightning & grounding
	www.lightningeliminators.com	<input type="checkbox"/> New LP concept <input type="checkbox"/> Technical Library
National Weather Service	www.lightningsafety.noaa.gov/websites.htm	List of lightning-related web sites
West Virginia Lightning	www.wvlightning.com	<input type="checkbox"/> Storm chasing & lightning photography (video, audio) <input type="checkbox"/> Lightning myths
Lightning Protection Institute	www.lightning.org	Lightning Safety & Protection
Cholamandalam MS Risk Services Ltd.	www.cholarisk.com	<ul style="list-style-type: none"> • Free Professional Safety Advice • Risk Manager's Column • Safety Articles



Reference Standards on Lightning

IS: 2309, *Code Of Practice for Lightning protection of Structures & Buildings*
NFPA 780, *Standard for the Installation of Lightning Protection Systems*

BS 6651, *British Standard on Lightning protection of structures & Buildings*

API RP 2003, *Protection Against Ignitions Arising out of Static, Lightning, And Stray Currents*

IEC1024-1, *Protection of Structures Against Lightning, part I, 1992*

IEC 1662, *Assessment of the Risk of Damage Due to Lightning, First edition, 1995*

MTL, *Technical Application notes on surge protection (TAN 1001, 1002 & 1009)*

ERICO, *Product Manual*

Furse 'Electronic System Protection' Handbook

Furse Consultant's Handbook on 'Earthing & Lightning Protection'

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www.photolib.noaa.gov

Cholamandalam MS RISK Services Ltd.

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Cholamandalam MS Risk Services Ltd.,

Dare House 2nd Floor,

No 2, NSC Bose Road.,

Chennai-600 001.

Tel: - +91-44-30445400

Fax: - +91-44-30445550

Email:- inquiry@cholams.murugappa.com