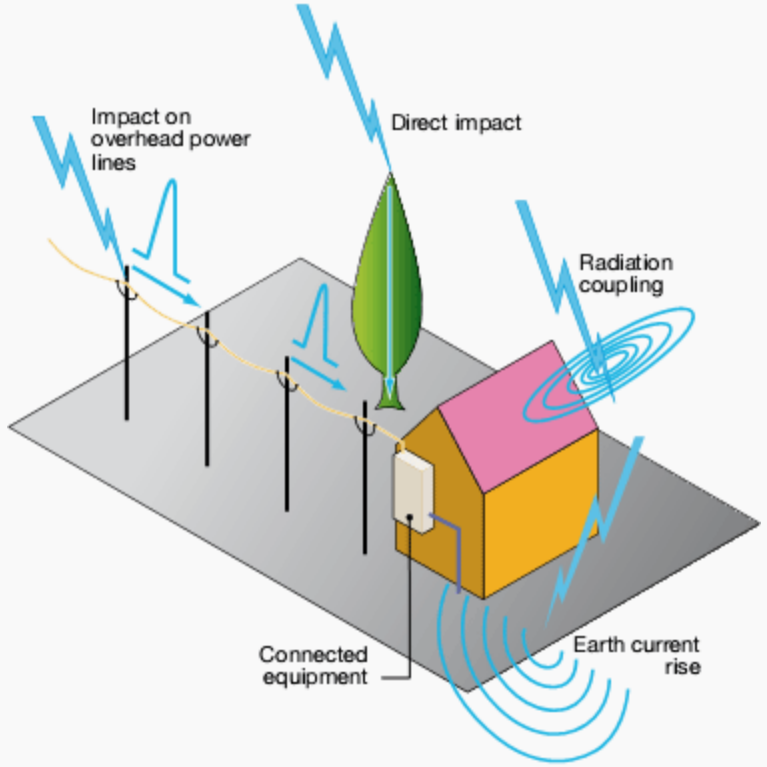
Overvoltages Caused by Lightning

Overvoltages Caused by Lightning (on photo: Lightning over Bangkok, taken from State Tower on the 57th floor.)

The Impacts of Lightning

Overvoltages of ***atmospheric origin*** arise from uncontrollable sources and their severity for the load depends on many parameters that are determined according to where the lightning strikes and the structure of the electrical network.
The impact of lightning on a structure produces spectacular results, but nevertheless is very localised. Protection against the effects of a ***direct lightning strike*** is provided by***lightning conductors***.
A **lightning strike** creates overvoltages that propagate along ***any type of electrical cabling*** (*electrical distribution mains, telephone connections, communication bus, etc.*), metallic wiring systems or conducting elements of significant length.

The consequences of lightning, i.e. the overvoltages created on the installations and equipment, can be appreciable over a radius of 10km.



Lightning impacts

Such overvoltages can be classified according to their point of impact:

1. Direct,
2. Near (indirect) or
3. Distant lightning strikes.

For **direct lightning strikes**, the overvoltages are caused by the ***flow of lightning current in the structure concerned and its earth connections***. For **near lightning strikes**, overvoltages are created in the loops and are in part linked to rises in earth potential due to the flow of lightning current.

For ***distant lightning strikes***, the overvoltages are limited to those created in the loops. The occurrence of overvoltages due to lightning and their characteristics are statistical in nature and much data remains uncertain.

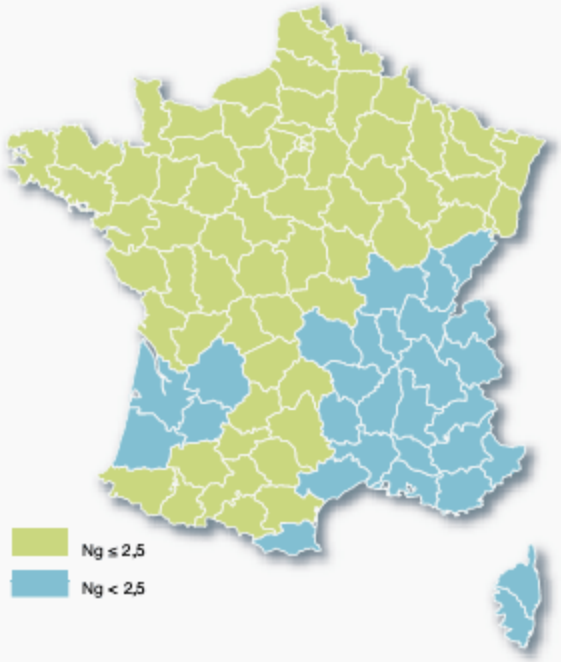
All regions are not equally exposed and for each country there generally exists a ***map that indicates the density of lightning strikes***.

$\mathbf{N_g}$ = Annual number of lightning strikes on earth per km^2

$\mathbf{N_K}$ = Isokeraunic level

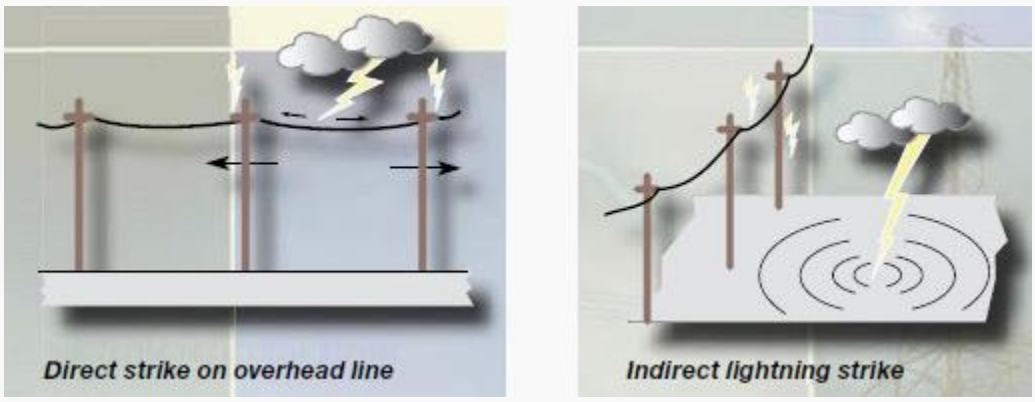
$$N_g = Nk/10$$

In France, the number of lightning strikes on earth is ***between 1 and 2 million***. Half of these lightning strikes that reach earth have ***amplitude of under 30 kA***, and ***less than 5% exceed 100 kA***.

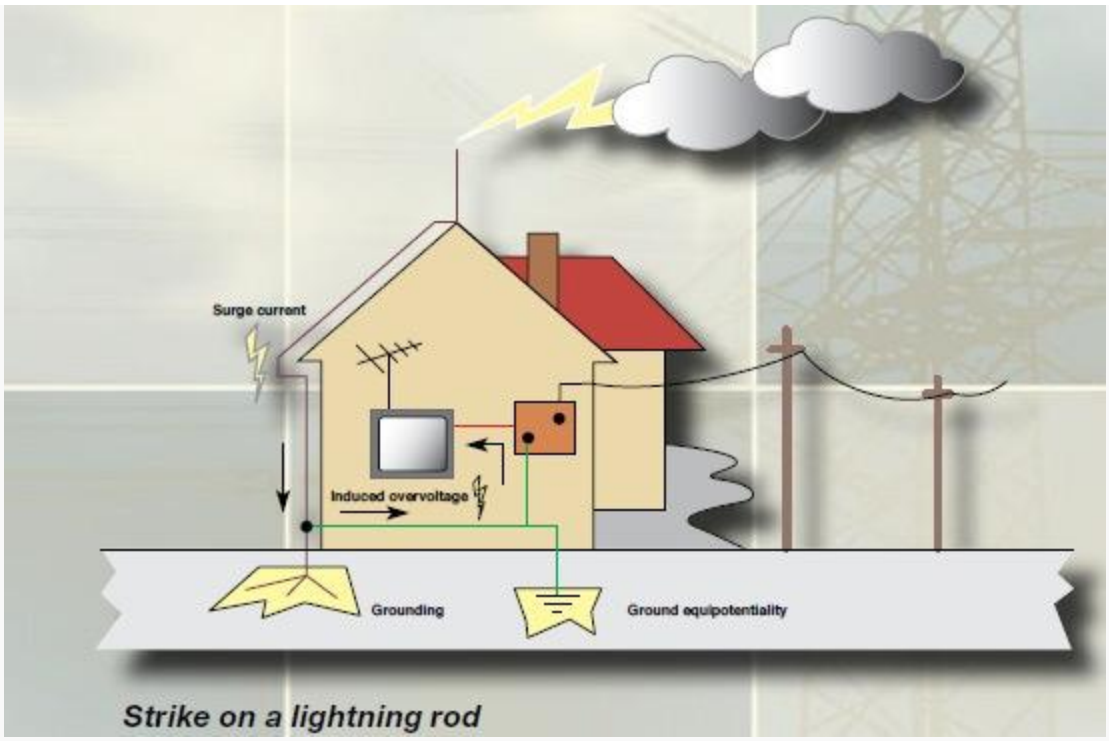


Lightning density Ng in France

Protection against the effects of direct lightning strikes



Left: Direct lightning strike on overhead line; Right: Indirect lightning strike on ground



Lightning strike on lightning rod

The protective principle is to attempt control of the point of impact by ***attracting the lightning on to one or several specified points*** (*the lightning conductors*) that are placed away from the places to be protected and by letting the pulse current flow to earth.
Several lightning conductor technologies exist and can be of the following types: stem, meshed cage, taut wire or even priming device. The presence of lightning conductors on a facility increases the risk and amplitude of pulse currents in the earthing network.

The use of SPD‘S is therefore necessary to avoid increasing damage to the installation and equipment.

Protection against indirect effects by SPD

Socomec SPD - Type SURGYS

SPD provides ***protection against transient overvoltages*** as well as protection against the effects of indirect lightning strikes.

Conclusion

Irrespective of statistical considerations for lightning and the corresponding recommendations set out in ever-changing installation standards, ***protection against overvoltages by SPD is today systematically demanded*** for any type of industrial or service activity.
For the latter, the electrical and electronic equipment is strategic and expensive, and not ponderable as certain domestic appliances might be.

Resource: *Industrial switching & protection systems 2011 – SOCOMEC*

Source:

http://electrical-engineering-portal.com/overvoltages-caused-by-lightning