

# **LIGHTNING PROTECTION**

## **SECTION 3**

### **PRECAUTIONS FOR PERSONAL SAFETY**

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#### **EXTRACT FROM:**

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**Australian/New Zealand Standard™**  
**Lightning protection**

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## SECTION 3 PRECAUTIONS FOR PERSONAL SAFETY

### 3.1 SCOPE OF SECTION

This Section provides guidance for personal safety during thunderstorms.

Measures for the protection of persons, which should be incorporated in LPSs for buildings and structures, are outlined in other sections.

For shelters designed for the protection of persons during storm activity, reference should be made to Clause 6.9.1.

### 3.2 NEED FOR PERSONAL PROTECTION

A hazard to persons exists during a thunderstorm. Each year a number of persons are struck by lightning, particularly when outdoors in open space such as an exposed location on a golf course, or when out on the water. Between six and ten people are killed by lightning in Australia each year. This is equivalent to a probability of about  $5 \times 10^{-7}$  per year for an individual being killed by lightning in Australia.

Lightning strikes to a person, or close by, may cause death or serious injury. A person touching or close to an object struck by lightning may be affected by a side-flash, or receive a shock due to step, touch or transferred potentials. There is a significant risk of side-flash for people in small, public structures such as picnic shelters, particularly those with unearthed metallic roofs. In built-up areas protection is frequently provided by nearby buildings, electricity supply service lines or street lighting poles.

Persons within a substantial structure are normally protected from direct strikes, but may be exposed to a hazard from conductive electrical services entering the structure or from conductive objects within the structure that may attain different potentials.

The first recorded 'electrical accident' involving the use of a telephone occurred in 1860 and was caused by lightning being conducted through the telephone system. Telephone related injuries include acoustic and/or electric shock. About 10% of injuries are severe. No telephone related deaths have been reported in Australia. This is probably because of warnings not to use the telephone, except in an emergency, during a lightning storm and the use of SPDs on telephone installations in lightning prone areas. Around 80% of incidents involve a lightning strike to or close to a building or a strike to the electricity supply service line all of which result in a rise of the local earth potential rather than surges on the telecommunications service line. This rise in local earth potential can result in a breakdown between the person and the telephone, (which is connected to a nominal remote earth via the telecommunications service line).

In some workplaces employees who work within larger buildings may be unaware of the changing outside weather conditions, and may not be aware that it may be unsafe to use telephone systems. Where modern fixed line telephonist headsets are used, this increases the risk of human injury through external transients being conducted through to those wearing the headsets.

When moderate to loud thunder is heard, persons out of doors should avoid exposed locations and should seek adequate shelter. Persons indoors should avoid using the telephone and contacting metallic structures. These warnings apply particularly if thunder follows within 15 s of a lightning flash (corresponding to a distance of less than 5 km).

### **3.3 PERSONAL CONDUCT**

#### **3.3.1 General**

The threat to personal safety is greatest if a person is out of doors when the thunderstorm is local. In the absence of specific information from weather radar, a lightning location system or a specialized lightning warning device, the '30/30' safety guideline (Paragraph G2, Ref. 1) should be used. An approaching thunderstorm is treated as local when the time interval between seeing a lightning flash and hearing the thunder is less than 30 s and then the appropriate safety measures described in Clause 3.3.2 should be implemented. A receding local thunderstorm is no longer a threat when more than 30 min have elapsed after the last thunder is heard.

#### **3.3.2 Outdoors**

When outdoors, some of the measures for reducing the risk of injury that may be caused by lightning strikes to ground during a local thunderstorm are as follows:

- (a) Seek shelter in a substantial building with at least normal headroom or within a totally enclosed, metal-bodied vehicle such as car or truck with metallic roof. If in a car, close the windows and avoid contact with metallic parts and remove any hands-free mobile telephone attachments from the body. Avoid driving the car as a strike to the car may blow out the tyres. Do not stay in open vehicles such as tractors, beach buggies, or any other type of open or enclosed vehicle without a metallic roof. Conventional fabric tents offer no protection; small sheds offer uncertain protection.
- (b) Do not ride or sit on horses, bicycles or motorcycles, or otherwise elevate the body above the surroundings.
- (c) Do not shelter under trees, particularly an isolated tree. If surrounded by trees, seek a position outside the foliage and crouch, keeping the feet together.
- (d) Do not shelter in small sheds, pagodas, walkways etc. with low unearthed metallic roofs supported on wooden or other electrically insulating materials.
- (e) Do not touch or stand close to any metallic structures, including wire fences and clothes lines. Do not stand on or under bridges or other elevated structures. Do not carry metallic objects such as umbrellas or golf clubs and remove metallic chains and other jewellery, particularly from the head and upper parts of the body.
- (f) If on open field or on the beach and remote from any shelters, keep as low and as small a profile as possible, i.e. crouch keeping the feet together and do not touch any objects or people near you. A dry ditch, valley or any depression in the ground is safer than an elevated or flat terrain. Do not lie on the ground as this could cause dangerous voltage to develop across the body by earth currents generated by a nearby strike. Footwear or a layer of non-absorbing, insulating material, such as plastic sheets, can offer some protection against earth voltages.
- (g) Do not swim or wade in the sea, lake, river, pool or any other body of water.  
Exit the water and move to a safe place.
- (h) If on a boat deck, keep a low profile and avoid contacts with or being close to masts, rails, stay wires or any other metallic objects. Avoid unnecessary contacts with communication or navigation equipment. Do not enter the water, and in general avoid contact with water. Additional protection may be gained by anchoring under relatively high objects such as jetties and bridges, provided that direct contact is not made with them. Isolated buoys and pylons should be avoided.

In addition, the following checks should be made when planning outdoor activities:

- (i) Check weather reports for likely thunderstorms.
- (ii) When engaged in outdoor activities, monitor the surroundings for indications of the onset of thunderstorms. These checks are particularly important when planning and undertaking activities involving groups and large numbers of people.

### **3.3.3 Indoor and outdoor swimming pools**

Certain locations are extremely hazardous during thunderstorms and should be avoided if at all possible. Statistics show that more than 10% of lightning-related injuries and deaths are water related (e.g. fishing, boating and swimming). Swimming pool facilities are connected to a large surface area via underground water pipes, gas lines, electric and telephone wiring, etc. Hence, lightning strikes to the ground anywhere on this metallic network may cause shocks elsewhere. Indoor and outdoor pools are treated the same with regard to lightning dangers.

The following swimming pool safety procedures are recommended:

- (a) A person should be designated as the pool's weather safety lookout. That person should keep an eye on the weather and use the appropriate means to obtain localized, advanced weather information.
- (b) Identify in advance safe/not safe places—
  - (i) Safe—dry areas inside large permanent buildings.
  - (ii) Not safe—near electrical conductors, electrical equipment, metal objects (lifeguard stands, ladders, diving board stanchions) and water, including showers.
- (c) When thunder and/or lightning are first noticed, use the '30/30 method' described in Clause 3.3.1. The pool should be evacuated in a time interval of less than 30 s and people should be directed to a safe shelter nearby.

### **3.3.4 Indoors**

When indoors, some of the measures for reducing the risk of injury that may be caused by lightning strikes to ground during a local thunderstorm are as follows:

- (a) Avoid unnecessary use of telephones particularly in suburban and rural dwellings during local thunderstorms. If unavoidable, keep it brief and try not to touch electrical appliances, personal computers, metal pipes, stoves, sinks, and any other metallic objects at the same time. Mobile and cordless telephones are safe to use indoors. Where headsets are used for a large percentage of the time, or where operators may be unaware of local lightning storms, the risk of injury from lightning can be dramatically reduced by the use of wireless headsets.
- (b) Do not take a bath or a shower and do not wash hands or dishes. Do not use personal computers and other electronic and electrical equipment, and avoid contacts with sinks, stoves, refrigerators, metallic pipes and other large metallic objects in the house.
- (c) Disconnect television sets, personal computers, video recorders and other electronic and electrical appliances from antennas, conductive telecommunication connections and electricity supply outlets to avoid damage to them. This should be done before the storm is local to minimize risk of personal injury.

#### **NOTES:**

- 1 Switching off an appliance does not disconnect neutral and earth wiring.
- 2 Switching off the electricity supply at the switchboard may also reduce the chances of damage to the electrical wiring and to permanently wired electrical appliances.

### **3.4 EFFECT ON PERSONS AND TREATMENT FOR INJURY BY LIGHTNING**

The severity of the injuries inflicted on a person by a lightning strike will depend upon the intensity of the strike and for any given strike, on the fraction of the current that flows over the skin outside the body and the fraction that flows through the body, and its path. The worst situation would arise when a person is struck on the head, in which case the current through the body could cause fatal injuries to the brain, the heart and the lungs. A less dangerous situation is where the person is subjected to step or touch potentials, and only a small fraction of the total current passes through the body, although the pathway taken by this fraction is still important.

The effects of lightning include burns to the skin, which are usually superficial, damage to various bodily organs and systems, unconsciousness and, most dangerously, cessation of breathing and cessation of heart beat. Independently of these electrically-related effects, temporary or permanent hearing impairment may be experienced as a consequence of the extremely high sound pressure levels associated with a nearby lightning strike.

In the first aid treatment of a patient injured by lightning, it is essential that breathing be restored by artificial respiration and blood circulation be restored by external cardiac massage, if appropriate. These procedures should be continued until breathing and heart beat are restored, or it can be medically confirmed that the patient is dead. It should also be noted that the usual neurological criteria for death may be unreliable in this situation. There is no danger in touching a person who has been struck by lightning.

Lightning strike victims are sometimes thrown violently against an object, or are hit by flying fragments of a shattered tree, so first aid treatment may have to include treatment for traumatic injury.

Subsequent treatment of a lightning strike patient is a specialized area with important differences from the treatment of injuries inflicted by electric power current. For example, the nature of the burns and the extent of damage to underlying muscle tissue tend to be severe with electric power current, but mild with lightning current. Neurological and cardiac injuries also are different, and follow different courses.

NOTE: For a more comprehensive treatment of the subject covered by this Clause—see Paragraph G2, Ref. 2.