

**Natural calamities****1. Earthquake**

An earthquake is a sudden vibration of the part of the earth caused by plate movements. It occurs along the plate boundaries. The place inside the earth where an earthquake originates is focus. The point on the earth's surface above the called a focus is called an epicentre. The damage caused by the earthquake is the highest near the epicentre. The earthquake is measured by an instrument called a Seismograph. It is recorded in Richter scale.

**If in a moving vehicle**

1. Stop as quickly as safety permits. Avoid stopping near or under buildings, trees, overpasses and utility wires.
2. Proceed cautiously once the earthquake has stopped. Avoid roads, bridges or ramps that might have been damaged by the earthquake.

**2. Landslide**

A landslide is defined as the movement of a mass of rock debris down a slope. Landslides are caused by the direct influence of gravity. Landslides can be caused by rainfall, snowmelt, stream erosion, flood, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors.

Landslides cause property damage, injury and death and adversely affect a variety of resources. For example, water supplies, fisheries, sewage disposal systems, forests, dams and roadways can be affected.

**During a Landslide**

1. Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together.
2. Should be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly.
3. Be alert especially when driving. Embankments along roadsides are particularly susceptible to landslides.
4. Disconnect the power supply in the areas of landslide.

**After the Landslide**

1. Stay away from the slide area. There may be danger of additional slides
2. Check for injured and trapped persons near the slide, without entering the direct slide area.
3. Direct rescuers to their locations.

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4. Listen to local radio or television for the latest emergency information
5. Watch for flooding, which may occur after a landslide or debris flow.

### 3. Cyclone

A low-pressure area which is encircled by high pressure wind is called a cyclone.

#### Effects of cyclone

The main effects of tropical cyclone include heavy rain, strong wind, large storm surges near landfall and tornadoes.

"Severe cyclonic storm Gaja crossed the coasts of Tamilnadu and Puducherry around Vedaranyam and Nagapattinam in the early hours of November 10, 2018 Friday with wind speed gusting of around 120 (Kmph)" reported the Indian Meteorological Department.

### 4. Flood

Flood destructions have always brought miseries to numerous people, especially in rural areas. Flood results in the outbreak of serious epidemics, specially malaria and cholera. Simultaneously, scarcity of water also arises. It has a drastic effect on agricultural produce. Sometimes, water remains standing over large areas for long span of time hampering the Rabi crops.

India is one of the most flood prone country in the world. The principal reasons for flood lie in the very nature of natural ecological systems in this country, namely, the monsoon, the highly silted river systems and the steep highly erodible mountains, particularly those of the Himalayan ranges. The average rainfall in India is 1,150 mm with significant variation across the country. The annual rainfall along the western coast and the Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2,500 mm. Twenty-three of the states (29) and union territories (7) in the country are subject to floods and 40 million hectares of land, roughly oneeighth of the country's geographical area, is prone to floods. The National Flood Control Program was launched in the country in 1954.

#### Do's before flood

1. Keep furniture and electrical appliances on beds and tables
2. Put sandbags in the toilet bowl and cover all drain holes to prevent sewage back flow.
3. Keep your mobile charged
4. Listen to radio or watch television for the latest weather bulletin and flood warnings.

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5. Keep strong ropes, a lantern, battery operated torches, extra batteries ready.
6. Keep umbrellas and bamboo sticks with you.

#### 5. Drought

Drought is a period of time (months or years) during which a part of the land has shortage of rain, causing severe damage to the soil, crops, animals, and people. It sometimes causes even death. During drought high temperature is experienced. Such conditions may affect our health.

The primary cause of drought is deficiency of rainfall and in particular, the timing, distribution and intensity.

In India around 68 percent of the country is prone to drought. Of the entire area 35 percent receives rain falls between 750 mm to 1,125 mm which is considered drought prone while 33 percent areas receive rainfalls less than 750 mm is considered to be chronically drought prone.

#### Rules of action before, during and after Drought

##### Before drought:

1. Rainwater harvesting should be followed.
2. Sewage water should be recycled and used for domestic purpose.
3. Building canals or redirecting rivers for irrigation.
4. Utilise water economically.

##### During drought:

1. Wear cotton clothing and a hat.
2. In case of overheating, immediately move to a shady area.
3. Consume adequate amounts of water stay.

##### After drought:

1. If anyone faints after sunstroke, emergency medical measures should be taken.
2. Contact local government agencies to receive information about disaster and assistance for the population.

#### 6. Lightning

Lightning is an atmospheric electrostatic discharge (spark) accompanied by thunder, which typically occurs during thunderstorms, and sometimes during volcanic eruptions or dust storms. Lightning generates 10-20 ampere current and it is therefore fatal. It is especially dangerous for people in an open area.

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Lightning strikes often have fatal consequences. On an average, 2000 people die from lightning in the world every year. Lightning mostly strikes tall things, such as trees that break down and catch fire or it may strike power transmission lines and antennas fastened on roofs and buildings which causing fire. The air temperature, when lightning occurs, is as hot as 9982.2 °C.

Thunder is the sound caused by lightning. A charged, superheated lightning bolt creates a “resonating tube” as it travels. The air in the tube rapidly expands and contracts causing vibrations that we hear as the rumble of thunder.

Lightning strikes can explode a tree. Imagine 15 million volts of electricity hitting a tree branch. The heat travels through the tree, vaporizing its sap and creating steam that causes the trunk to explode.

#### **Before lightning**

1. If you are planning to go to the countryside, check the weather forecast.
2. If a thunderstorm is expected it is better to postpone the trip.
3. It is good if you can estimate the distance to the front line of a thunderstorm. In order to do this you must check the time interval from the moment you see the lightning until you hear thunder. Lightning always precedes thunder. We know that the sound speed travels on average about 1km every 3 seconds. Reduction of the time interval between the sight of lightning and the resulting thunder means that the danger is approaching and protective measures must be taken. If there is no interval between lightning and thunder means, it means that the cloud is already over your head.

#### **During Lightning:**

1. If you are in a building it is necessary to close windows, doors, ventilation pipes and chimneys.
2. It is necessary to turn off the telephone, TV set, and other electrical equipments because lightning may strike electrical cables and pass through wiring.
3. Do not take a shower because both water and metal conduct electricity.
4. Do not light the fireplace because the heat coming from the chimney may attract lightning.
5. It is better to stay away from electric wires, lightning rods, water pipes, antennas and windows.
6. If you are in an open area during a thunderstorm, do not stand under a tall tree. Lightning is most damaging for tall trees. It is better to stay 30-40

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meters away from them. Avoid trees that are standing separately. Remember that lightning does not strike bushes.

7. If the area is open, it is better to find a lower place or a cavity and squat there. It is dangerous to stand or lie down on the ground, because this increases the exposure area.
8. It is necessary to get rid of metal items such as a bicycle, coins etc.
9. Do not stand under an umbrella.
10. Do not run during the occurrence of lightning; move slowly towards a shelter because the air flow may attract lightning;
11. If you are in a car, do not get out. It is better to close the windows and turn off the antenna. Do not park your car under tall trees or any structures that may fall down and hit you.
12. If there is an injured person next to you, remember that the victim may lose consciousness. It is necessary to provide first aid.
13. Cover your mouth with a wet cloth in order to protect your lungs.

#### 7. Tsunami

A tsunami can kill or injure people and damage or destroy buildings and infrastructure as waves come forth and recede. A tsunami is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids. Tsunamis can travel 700-800 km per hour, with waves 10-30 meter high. It causes flooding and disrupts transportation, power, communications, and water supply.

Tsunami refers to huge ocean waves caused by an earthquake, landslide or volcanic eruption. It is generally noticed in the coastal regions and travel between 640 and 960 km/h. Tsunami pose serious danger to the inhabitants of the coastal areas.

#### Effects

It causes flooding and disrupts transportation, power communication and water supply

#### 4. Flood

Sudden overflow of water in a large amount caused due to heavy rainfall, cyclone, melting of snow, Tsunami or a dam burst.

#### Effects

1. Loss of life and property
2. Displacement of people

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3. Spread of contagious diseases such as Cholera and Malaria etc.,

#### **8. Stampede**

The term stampede is a sudden rush of a crowd of people, usually resulting in injuries and death from suffocation and trampling. It is believed that most major crowd disasters can be prevented by simple crowd management strategies. Human stampedes can be prevented by organization and traffic control, such as barriers, following queues and by avoiding mass gathering.

#### **9. Riot**

Though riot may seem dramatic, an angry mob can be just as dangerous and unpredictable as just about any natural disaster. Thousands of people are killed in riots all over the world each year, and these riots erupt from a number of racial, religious, economic, political, or social causes that cannot be predetermined. As per Pew Research Center analysis of 198 countries on April 11, 2015. Syria tops in riot in the world followed by Nigeria, Iraq and India.

If you've found yourself in the middle of a riot, you may not be able to run away immediately, but you can take some measures to protect yourself from harm. If you want to know how to survive a riot, just follow these steps.

#### **10. Fire**

Wildfires occur when vegetated areas are set alight and are particularly common during hot and dry periods. They can occur in forests, grasslands, bush and deserts, and with blowing wind, can spread rapidly.

Fires can lead to the destruction of buildings, wooden bridges and poles, power, transmission and telecommunication lines, warehouses containing oil products and other fuel. It causes injury to people and animals.

The most common causes of fires are lightning strikes, sparks during arid conditions, eruption of volcanoes and man-made fires arising from deliberate arson or accidents.

A side-effect of wildfires which also threatens inhabited areas is smoke. Fires create large quantities of smoke, which can be spread far by wind and poses a respiratory hazard.

On an average, in India, every year, about 25,000 persons die due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about 42 females and 21 males die every day in India due to fire.

### 11. Industrial Disasters

Industrial hazards consist of four principle hazards. The hazards encountered are fire, explosion, toxic release and environmental damage. This is because industries engage in different processes involving a wide range of different raw materials, waste products and final products. Danger originates from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities. It may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

**Fire:** This is the most frequent hazard. Fire can also produce toxic fumes like Acrolein, Carbon monoxide and Cyanides. Physical structures can be damaged either by the intensity of the heat or combustion. It may also have an effect on essential services like power and instrumentation.

**Explosion:** Explosions is the result of a shock wave. This overpressure can kill people but usually the indirect effects of collapsing buildings, breaking of glasses and falling of debris causes far more loss of life and severe injuries. There are different types of explosions which include gas explosions and dust explosions. Gas explosions occur when a flammable gas mixes with air. Dust explosions occur when flammable solids, especially metals, in the form of fine powders are intensively mixed with air and ignited.

**Chemical release:** Sudden release of toxic vapours has the potential to cause death and severe injuries several kilometres from the release point. They are carried by water and air. Their release into public sewage systems, rivers, canals and other water courses, either directly or through contaminated water used in fire fighting can result in serious threat to public. The number of casualties depends on the weather conditions, population density in the path of the cloud and the effectiveness of the emergency arrangements.

**Environmental Damage:** Release of other substances, not directly toxic to humans can cause major pollution problems. It is becoming increasingly recognized that damage to natural resources such as plant and animal life can have serious long term consequences. E.g. destruction of trees is increasing the effect of global warming and extinction of animals are severely disrupting food webs and causing an increase in pests.

**Means of reducing the industrial hazards**

1. **Process of Safety Management:** Reliability assessment of process equipment, incorporating safety tips, scrubbing system, etc, should be done before effecting major process changes.
2. **Safety Audits:** Periodical assessment of safety procedures, performance of safety systems and gadgets along with follow up measures should be carried out.
3. **Emergency Planning:** A comprehensive risk analysis indicating the impact of consequences and practiced emergency procedures should be done. This can be done by communities as well as national or regional corporation authorities.
4. **Training:** Proper training of employees and protective services should be done.

**12. Road accident**

It is estimated that 1.34 million people are killed in the road accidents every year. Road accident is the 8th leading cause of death globally. Every year, up to 50 million people suffer serious, life-altering injuries which, in many low- and middle-income countries.

**Primary road safety risk factors in low and middle-income countries include:**

1. Speeding
2. Drink-driving
3. Non-use, or improper use of helmets, and
4. Non-use, or improper use of seatbelts

Strengthening the capability of the road traffic police to enforce traffic laws is fundamental to deterring road users from violating the laws, to reduce harm and to reduce inappropriate and unsafe behaviors on the roads.

**13. Types of Hazards**

Some hazards occur frequently and threaten the people. Hazards are classified in different ways.

**I. Based on their causes of occurrence**

Hazards can be broadly classified into three types: natural, human-made and socio-natural hazards.

1. **Natural hazards:** These are the results of natural processes and man has no role to play in such hazards. The main examples of natural hazards are



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earthquakes, floods, cyclonic storms, droughts, landslides, tsunamis and volcanic eruptions.

2. **Human-made hazards:** these are caused by undesirable activities of human. It can be the result of an accident, such as an industrial chemical leak or oil spill, or an intentional act. Such hazards can disturb the safety, health, welfare of people and cause damage or destruction to property. The following are the examples of human-made hazards. They are explosions, hazardous wastes, pollution of air, water and land, dam failures, wars or civil conflicts and terrorism.
3. **Socio-natural hazards (Quasi-natural hazards):** these are caused by the combined effect of natural forces and misdeeds of human. Some of the examples are:
  - The frequency and intensity of floods and droughts may increase due to indiscriminate felling of trees, particularly in the catchment areas of the rivers.
  - Landslides are caused by natural forces and their frequency, and impact may be aggravated as a result of construction of roads, houses etc., in mountainous areas, excavating tunnels and by mining and quarrying.
  - Storm surge hazards may be worsened by the destruction of mangroves.
  - Smog is a serious problem in most big urban areas. The emissions from vehicles and industries, combustion of wood and coal together combined with fog leads to smog.

## II. Based on their origin

Hazards can be grouped into eight categories

1. **Atmospheric hazard** – Tropical storms, Thunderstorms, Lightning, Tornadoes, Avalanches, Heat waves, Fog and Forest fire.
2. **Geologic/Seismic hazard** – Earthquakes, Tsunami, Landslide and Land subsidence.
3. **Hydrologic hazard** – Floods, Droughts, Coastal erosion and Storm surges.
4. **Volcanic hazard** – Eruptions and Lava flows.
5. **Environmental hazard** – Pollution of soil/ air/water, Desertification, Global warming and Deforestation.
6. **Biological hazard** – Chickenpox, Smallpox, AIDS [HIV] and Killer bees.

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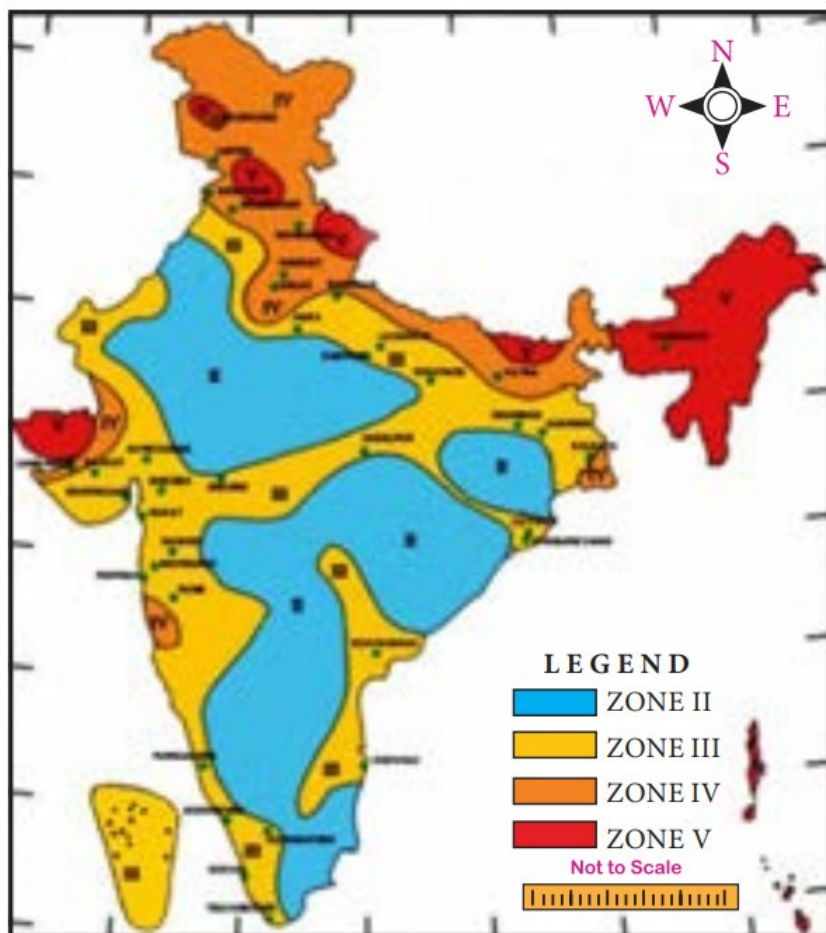
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7. **Technological hazard** – Hazardous material incidents, Fires, Infrastructure failures [Bridges, Tunnels, Dams, Nuclear and Radiological accidents].
8. **Human-induced hazard** – Terrorism, Bomb blast, War, Transportation accidents and civil disorder.

#### 14. Earthquake-prone Zones of India

Seismic Zones	Level of Risk	Regions
Zone V	Very High	Comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands.
Zone IV	High	Covers remaining parts of Jammu and Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, northern parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan.
Zone III	Moderate	Comprises Kerala, Goa, Lakshadweep Islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Karnataka.
Zone II	Low	Covers remaining parts of country.

## Seismic Zones of India



### 15. Major flood prone areas of India

#### Floods

Flood is an event in which a part of the earth's surface gets inundated. Heavy rainfall and large waves in seas are the common causes of flood.

#### The major causes of floods are:

##### A. Meteorological factors

- i) Heavy rainfall
- ii) Tropical cyclones
- iii) Cloud burst

##### B. Physical factors

- i) Large catchment area
- ii) Inadequate drainage arrangement

##### C. Human factors

- i) Deforestation
- ii) Siltation
- iii) Faulty agricultural practices

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- iv) Faulty irrigation practices
- v) Collapse of dams
- vi) Accelerated urbanization

**16. Cyclonic Storms**

A cyclonic storm is a strong wind circulating around a low pressure area in the atmosphere. It rotates in anti-clockwise direction in Northern Hemisphere and clockwise in the Southern Hemisphere.

Tropical cyclones are characterised by destructive winds, storm surges and exceptional levels of rainfall, which may cause flooding. Wind speed may reach upto 200 km/h and rainfall may record upto 50 cm/day for several consecutive days.

A sudden rise of seawater due to tropical cyclone is called storm surge. It is more common in the regions of shallow coastal water.

**East coastal areas vulnerable to storm surges**

- i) North Odisha and West Bengal coasts.
- ii) Andhra Pradesh coast between Ongole and Machilipatnam.
- iii) Tamil Nadu coast (among 13 coastal districts, Nagapattinam and Cuddalore districts are frequently affected).

**West coastal areas vulnerable to storm surges**

The west coast of India is less vulnerable to storm surges than the east coast.

- i) Maharashtra coast, north of Harnai and adjoining south Gujarat coast and the coastal belt around the Gulf of Cambay.
- ii) The coastal belt around the Gulf of Kutch.

**17. India's Droughts Places**

Any lack of water to satisfy the normal needs of agriculture, livestock, industry or human population may be termed as a drought. Further, the drought could be classified into three major types as,

- i) Meteorological drought: it is a situation where there is a reduction in rainfall for a specific period below a specific level.
- ii) Hydrological drought: it is associated with reduction of water in streams, rivers and reservoirs. It is of two types, a) Surface water drought, and b) Groundwater drought.
- iii) Agricultural drought: it refers to the condition in which the agricultural crops get affected due to lack of rainfall.

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Droughts in India occur in the event of a failure of monsoon. Generally monsoon rainfall is uneven in India. Some areas receive heavy rainfall while other regions get moderate to low rainfall. The areas which experience low to very low rainfall are affected by drought.

**The major areas highly prone to drought are:**

- 1) The arid and semi-arid region from Ahmedabad to Kanpur on one side and from Kanpur to Jalandhar on the other.
- 2) The dry region lying in the leeward side of the Western Ghats.

### 18. India's Landslides Places

Landslide is a rapid downward movement of rock, soil and vegetation down the slope under the influence of gravity. Landslides are generally sudden and infrequent. Presence of steep slope and heavy rainfall are the major causes of landslides. Weak ground structure, deforestation, earthquakes, volcanic eruptions, mining, construction of roads and railways over the mountains are the other causes of landslides.

About 15% of India's landmass is prone to landslide hazard. Landslides are very common along the steep slopes of the Himalayas, the Western Ghats and along the river valleys. In Tamil Nadu, Kodaikanal (Dindigul district) and Ooty (The Nilgiris district) are frequently affected by landslides.

### 19. Hazardous Wastes

The wastes that may or tend to cause adverse health effects on the ecosystem and human beings are called hazardous wastes.

**The following are the major hazardous wastes**

- i) **Radioactive substance:** tools and unused fuel pipe of nuclear power plants.
- ii) **Chemicals:** synthetic organics, inorganic metals, salts, acids and bases, and flammables and explosives.
- iii) **Medical wastes:** hypodermic needles, bandages and outdated drugs.
- iv) **Flammable wastes:** organic solvents, oils, plasticisers and organic sludges.
- v) **Explosives:** the wastes resulting from ordnance manufacturing and some industrial gases.
- vi) **Household hazardous wastes:** pesticides, waste oil, automobile battery and household battery.