

## Water Pollution

Water pollution is **the contamination of water sources by substances which make the water unusable for drinking, cooking, cleaning, swimming, and other activities**. Pollutants include chemicals, trash, bacteria, and parasites. ... Land pollution can seep into an underground stream, then to a river, and finally to the ocean.

**There are two types of water pollution:**

1. Organic pollution due to microorganisms - bacteria and viruses - present in the water, generated by excrement, animal and vegetable waste

2. Chemical pollution generated by the nitrates and phosphates of pesticides, human and animal drugs, household products, heavy metals, acids and hydrocarbons used in industries

### Causes

Water Pollution Causes

What are the **sources of water pollution**? Unsurprisingly, human activity is primarily responsible for water pollution, even if natural phenomenon - such as landslides and floods - can also contribute to degrade the water quality.

### SEWAGE AND WASTEWATER

Inadequate sewage collection and treatment are sources of water pollution. According to the United Nations, more than 80% of the worldwide wastewater goes back in the environment without being treated or reused.



## **URBANIZATION AND DEFORESTATION**

Even though it does not have a direct impact on water quality, urbanization and deforestation have a lot of indirect effects. For instance, cutting down trees and concreting over large areas generates an acceleration of flows which does not give enough time for water to infiltrate and be purified by the ground.



## **AGRICULTURE**

Agriculture has an impact on water pollution due to the use of chemicals such as fertilizers, pesticides, fungicides, herbicides or insecticides running off in the water, as well as livestock excrement, manure and methane (greenhouse effect). Regarding aquaculture, pollution is directly in the water, as excess food and fertilizers are causing dystrophication.



## **INDUSTRIES**

Industries produce a lot of waste containing toxic chemicals and pollutants. A huge amount of the industrial waste is drained in the fresh water which then flows into canals, rivers and eventually in the sea. Another source of water pollution is the burning of fossil fuels, causing air pollution like acid rain which then flows to streams, lakes, and other stretches of water.



## **MARINE DUMPING**

Everyday, garbage such as plastic, paper, aluminum, food, glass, or rubber are deposited into the sea. These items take weeks to hundreds of years to decompose, and thus they are a major cause for water pollution.



## **RADIOACTIVE WASTE**

Generated - among others - by power plants and uranium mining, radioactive waste can linger in the environment for thousands of years. When these substances are released accidentally or disposed improperly, they threaten groundwater, surface water, as well as marine resources.



## **Effects of Water Pollution**

### **(A) ON THE ENVIRONMENT**

Water pollution truly harms biodiversity and aquatic ecosystems. The toxic chemicals can change the color of water and increase the amount of minerals - also known as eutrophication - which has a bad impact on life in water. Thermal pollution, defined by a rise in the temperature of water bodies, contributes to **global warming** and causes serious hazard to water organisms.

## **(B) ON HUMAN HEALTH**

Water pollution has very negative effects on public health. A lot of diseases result from drinking or being in contact with contaminated water, such as diarrhea, cholera, typhoid, dysentery or skin infections. In zones where there is no available drinking water, the main risk is dehydration obviously.

### **Prevention**

#### **1. Wastewater treatment**

Wastewater treatment consists of removing pollutants from wastewater through a physical, chemical or biological process. The more efficient these processes are, the cleaner the water becomes.

#### **2. Green agriculture**

Globally, agriculture accounts for 70% of water resources, so it is essential to have climate-friendly crops, efficient irrigation that reduces the need for water and energy-efficient food production. Green agriculture is also crucial to limit the chemicals that enter the water.

#### **3. Stormwater management**

Stormwater management is the effort to reduce runoff of rainwater or melted snow into streets, lawns and other sites and the improvement of water quality” according to the US Environmental Protection Agency (EPA). It is important to avoid pollutants from contaminating the water and helps to use water more efficiently.

#### **4. Air pollution prevention**

**Air pollution** has a direct impact on water contamination as 25% of human induced CO2 emissions are absorbed by oceans. This pollution causes a rapid acidification of our oceans, and threatens marine life and corals. Preventing air pollution is the best way to prevent this from happening.

## 5. Plastic waste reduction

80% of plastic in our oceans is from land sources. In order to reduce the amount of plastic entering our ocean, we need to both reduce our use of plastic globally, and to improve plastic waste management.

## 6. Water conservation

Without water conservation, we won't go very far. It is central in making sure the world has better access to clean water. It means being aware that **water is a scarce resource**, taking care of it accordingly, and managing it responsibly.

# Air Pollution

## What is Air Pollution?

Air pollution refers to any physical, chemical or biological change in the air. It is the contamination of air by harmful gases, dust and smoke which affects plants, animals and humans drastically.

There is a certain percentage of gases present in the atmosphere. An increase or decrease in the composition of these gases is harmful to survival. This imbalance in the gaseous composition has resulted in an increase in earth's temperature, which is known as global warming.

## Types of Air Pollutants

There are two types of air pollutants:

### Primary Pollutants

The pollutants that directly cause air pollution are known as primary pollutants. Sulphur-dioxide emitted from factories is a primary pollutant.

## Secondary Pollutants

The pollutants formed by the intermingling and reaction of primary pollutants are known as secondary pollutants. Smog, formed by the intermingling of smoke and fog, is a secondary pollutant.

## Causes of Air Pollution

Following are the important causes of air pollution:

### Burning of Fossil Fuels

The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

### Automobiles

The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

### Agricultural Activities

Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

### Factories and Industries

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons and chemicals. These are released into the air, degrading its quality.

### Mining Activities

In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

## Domestic Sources

The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

## Effects of Air Pollution

The hazardous effects of air pollution on the environment include:

### Diseases

Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma. Many people die every year due to the direct or indirect effects of air pollution.

### Global Warming

Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming. This has resulted in the melting of glaciers and an increase in sea levels. Many areas are submerged underwater.

### Acid Rain

The burning of fossil fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic and fall as acid rain which damages human, animal and plant life.

### Ozone Layer Depletion

The release of chlorofluorocarbons, halons, and hydro chlorofluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.



### Effect on Animals

The air pollutants suspend on the water bodies and affect the aquatic life. Pollution also compels the animals to leave their habitat and shift to a new place. This renders them stray and has also led to the extinction of a large number of animal species.

### Air Pollution Control

Following are the measures one should adopt, to control air pollution:

#### Avoid Using Vehicles

People should avoid using vehicles for shorter distances. Rather, they should prefer public modes of transport to travel from one place to another. This not only prevents pollution, but also conserves energy.

#### Energy Conservation

A large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you can save the environment at the individual level. Use of energy-efficient devices such CFLs also controls pollution to a greater level.

#### Control or Use of Clean Energy Resources

The use of solar, wind and geothermal energies reduce air pollution at a larger level. Various countries, including India, have implemented the use of these resources as a step towards a cleaner environment.

Other air pollution control measures include:

1. By minimizing and reducing the use of fire and fire products.
2. Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled or treated at the source itself to reduce its effects. For example, if the reactions of a certain raw material yield a pollutant, then the raw materials can be substituted with other less polluting materials.

3. Fuel substitution is another way of controlling air pollution. In many parts of India, petrol and diesel are being replaced by CNG – Compressed Natural Gas fueled vehicles. These are mostly adopted by vehicles that aren't fully operating with ideal emission engines.
4. Although there are many practices in India, which focus on repairing the quality of air, most of them are either forgotten or not being enforced properly. There are still a lot of vehicles on roads which haven't been tested for vehicle emissions.
5. Another way of controlling air pollution caused by industries is to modify and maintain existing pieces of equipment so that the emission of pollutants is minimized.
6. Sometimes controlling pollutants at the source is not possible. In that case, we can have process control equipment to control the pollution.
7. A very effective way of controlling air pollution is by diluting the air pollutants.
8. The last and the best way of reducing the ill effects of air pollution is tree plantation. Plants and trees reduce a large number of pollutants in the air. Ideally, planting trees in areas of high pollution levels will be extremely effective.

## Soil Pollution

### What is Soil Pollution?

*“Soil pollution refers to the contamination of soil with anomalous concentrations of toxic substances.”*

It is a serious environmental concern since it harbours many health hazards. For example, exposure to soil containing high concentrations of benzene increases the risk of contracting leukaemia. An image detailing the discolouration of soil due to soil pollution is provided below.

It is important to understand that all soils contain compounds that are harmful/toxic to human beings and other living organisms. However, the concentration of such substances in unpolluted soil is low enough that they do not pose any threat to the surrounding ecosystem. When the concentration of one or more such toxic substances is high enough to cause damage to living organisms, the soil is said to be contaminated.



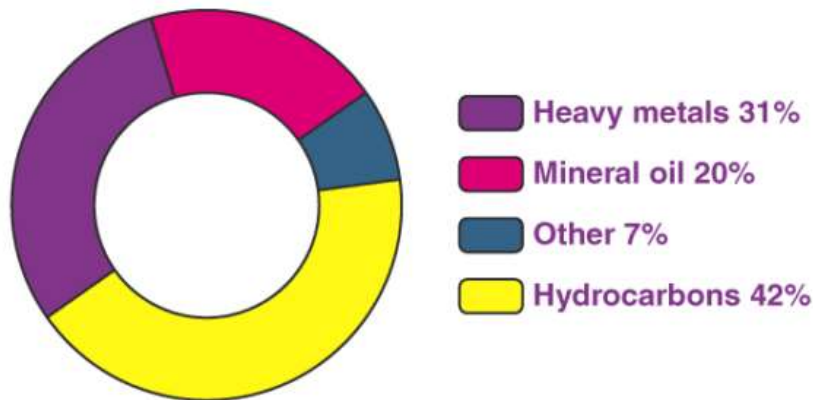
The root cause of soil pollution is often one of the following:

- Agriculture (excessive/improper use of pesticides)
- Excessive industrial activity
- Poor management or inefficient disposal of waste

The challenges faced in soil remediation (decontamination of soil) are closely related to the extent of soil pollution. The greater the contamination, the greater the requirement of resources for remediation.

### **What are the Pollutants that Contaminate Soil?**

Some of the most hazardous soil pollutants are xenobiotics – substances that are not naturally found in nature and are synthesized by human beings. The term ‘xenobiotic’ has Greek roots – ‘Xenos’ (foreigner), and ‘Bios’ (life). Several xenobiotics are known to be carcinogens. An illustration detailing major soil pollutants is provided below.



The different types of pollutants that are found in contaminated soil are listed in this subsection.

### Heavy Metals

The presence of heavy metals (such as lead and mercury, in abnormally high concentrations) in soils can cause it to become highly toxic to human beings. Some metals that can be classified as soil pollutants are tabulated below.

<b>Toxic Metals that Cause Soil Pollution</b>		
Arsenic	Mercury	Lead
Antimony	Zinc	Nickel
Cadmium	Selenium	Beryllium
Thallium	Chromium	Copper

These metals can originate from several sources such as mining activities, agricultural activities, electronic waste (e-waste), and medical waste.

## Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (often abbreviated to PAHs) are organic compounds that:

1. Contain only carbon and hydrogen atoms.
2. Contain more than one aromatic ring in their chemical structures.

Common examples of PAHs include naphthalene, anthracene, and phenalene. Exposure to polycyclic aromatic hydrocarbons has been linked to several forms of cancer. These organic compounds can also cause cardiovascular diseases in humans.

Soil pollution due to PAHs can be sourced to coke (coal) processing, vehicle emissions, cigarette smoke, and the extraction of shale oil.

## Industrial Waste

The discharge of industrial waste into soils can result in soil pollution. Some common soil pollutants that can be sourced to industrial waste are listed below.

- Chlorinated industrial solvents
- Dioxins produced from the manufacture of pesticides and the incineration of waste.
- Plasticizers/dispersants
- Polychlorinated biphenyls (PCBs)

The petroleum industry creates many petroleum hydrocarbon waste products. Some of these wastes, such as benzene and methylbenzene, are known to be carcinogenic in nature.

## Pesticides

Pesticides are substances (or mixtures of substances) that are used to kill or inhibit the growth of pests. Common types of pesticides used in agriculture include:

- Herbicides – used to kill/control weeds and other unwanted plants.
- Insecticides – used to kill insects.
- Fungicides – used to kill parasitic fungi or inhibit their growth.

However, the unintentional diffusion of pesticides into the environment (commonly known as ‘pesticide drift’) poses a variety of environmental concerns such as water pollution and soil pollution. Some important soil contaminants found in pesticides are listed below.

#### *Herbicides*

- Triazines
- Carbamates
- Amides
- Phenoxyalkyl acids
- Aliphatic acids

#### *Insecticides*

- Organophosphates
- Chlorinated hydrocarbons
- Arsenic-containing compounds
- Pyrethrum

#### *Fungicides*

- Mercury-containing compounds
- Thiocarbamates
- Copper sulfate

These chemicals pose several health risks to humans. Examples of health hazards related to pesticides include diseases of the central nervous system, immune system diseases, cancer, and birth defects.

## What are the Processes that Cause Soil Pollution?

Soil pollution can be broadly classified into two categories –

- Naturally caused soil pollution
- Anthropogenic soil pollution (caused by human activity)

### Natural Pollution of Soil

In some extremely rare processes, some pollutants are naturally accumulated in soils. This can occur due to the differential deposition of soil by the atmosphere. Another manner in which this type of soil pollution can occur is via the transportation of soil pollutants with precipitation water.

An example of natural soil pollution is the accumulation of compounds containing the perchlorate anion ( $\text{ClO}_4^-$ ) in some dry, arid ecosystems. It is important to note that some contaminants can be naturally produced in the soil under the effect of certain environmental conditions. For example, perchlorates can be formed in soils containing chlorine and certain metals during a thunderstorm.

### Anthropogenic Soil Pollution



Almost all cases of soil pollution are anthropogenic in nature. A variety of human activities can lead to the contamination of soil. Some such processes are listed below.

- The demolition of old buildings can involve the contamination of nearby soil with asbestos.

- Usage of lead-based paint during construction activities can also pollute the soil with hazardous concentrations of lead.
- Spillage of petrol and diesel during transportation can contaminate soils with the hydrocarbons found in petroleum.
- Activities associated with metal casting factories (foundries) often cause the dispersion of metallic contaminants into the nearby soils.
- Underground mining activities can cause the contamination of land with heavy metals.
- Improper disposal of highly toxic industrial/chemical waste can severely pollute the soil. For example, the storage of toxic wastes in landfills can result in the seepage of the waste into the soil. This waste can go on to pollute groundwater as well.
- Chemical pesticides contain several hazardous substances. Excessive and inefficient use of chemical pesticides can result in severe soil pollution.
- Sewage produced in urbanized areas can also contaminate soil (if not disposed of correctly). These wastes may also contain several carcinogenic substances.

Other forms of waste that can pollute soil include nuclear waste, e-waste, and coal ash.

### **What are the Negative Consequences of Soil Pollution?**

Soil pollution harbours a broad spectrum of negative consequences that affect plants, animals, humans, and the ecosystem as a whole. Since children are more susceptible to diseases, polluted soil poses a greater threat to them. Some important effects of soil pollution are detailed in this subsection.

#### **Effects on Human Beings**

Soil contaminants can exist in all three phases (solid, liquid, and gaseous). Therefore, these contaminants can find their way into the human body via several channels such as direct contact with the skin or through the inhalation of contaminated soil dust.

The short term effects of human exposure to polluted soil include:

- Headaches, nausea, and vomiting.
- Coughing, pain in the chest, and wheezing.



- Irritation of the skin and the eyes.
- Fatigue and weakness.

A variety of long-term ailments have been linked to soil pollution. Some such diseases are listed below.

- Exposure to high levels of lead can result in permanent damage to the nervous system. Children are particularly vulnerable to lead.
- Depression of the CNS (Central Nervous System).
- Damage to vital organs such as the kidney and the liver.
- Higher risk of developing cancer.

It can be noted that many soil pollutants such as petroleum hydrocarbons and industrial solvents have been linked to congenital disorders in humans. Thus, soil pollution can have several negative effects on human health.

### Effects on Plants and Animals

Since soil pollution is often accompanied by a decrease in the availability of nutrients, plant life ceases to thrive in such soils. Soils contaminated with inorganic aluminium can prove toxic to plants. Also, this type of pollution often increases the salinity of the soil, making it inhospitable for the growth of plant life.

Plants that are grown in polluted soil may accumulate high concentrations of soil pollutants through a process known as bioaccumulation. When these plants are consumed by herbivores, all the accumulated pollutants are passed up the food chain. This can result in the loss/extinction of many desirable animal species. Also, these pollutants can eventually make their way to the top of the food chain and manifest as diseases in human beings.

### Effects on the Ecosystem

- Since the volatile contaminants in the soil can be carried away into the atmosphere by winds or can seep into underground water reserves, soil pollution can be a direct contributor to air and water pollution.

- It can also contribute towards acid rain (by releasing huge quantities of ammonia into the atmosphere).
- Acidic soils are inhospitable to several microorganisms that improve soil texture and help in the decomposition of organic matter. Thus, the negative effects of soil pollution also impact soil quality and texture.
- Crop yield is greatly affected by this form of pollution. In China, over 12 million tons of grain (worth approximately 2.6 billion USD) is found to be unfit for human consumption due to contamination with heavy metals (as per studies conducted by the China Dialogue).

### **How can Soil Pollution be Controlled?**

Several technologies have been developed to tackle soil remediation. Some important strategies followed for the decontamination of polluted soil are listed below.

- Excavation and subsequent transportation of polluted soils to remote, uninhabited locations.
- Extraction of pollutants via thermal remediation – the temperature is raised in order to force the contaminants into the vapour phase, after which they can be collected through vapour extraction.
- Bioremediation or phytoremediation involves the use of microorganisms and plants for the decontamination of soil.
- Mycoremediation involves the use of fungi for the accumulation of heavy metal contaminants.

# Noise Pollution

## What is Noise Pollution?

The word noise is derived from a Latin word 'Nausea' which means sickness in which one feels the need to vomit. Noise is the unpleasant and undesirable sound which leads to discomfort in human beings. **The intensity of sound is measured in decibels (dB).** The faintest sound which can be heard by the Human ear is 1 Db. Due to increasing noise around the civilizations, noise pollution has become a matter of concern. Some of its major causes are vehicles, aircraft, industrial machines, loudspeakers, crackers, etc. Some other appliances also contribute to noise pollution like television, transistor, radio, etc. when used at high volume.

## Types of Noise Pollution

Following are the three types of pollution:

- Transport Noise
- Neighbourhood Noise
- Industrial Noise



## Transport Noise

It mainly consists of traffic noise which has increased in recent years with the increase in the number of vehicles. The increase in noise pollution leads to deafening of older people, headache, hypertension, etc.

## Neighbourhood Noise

The noise from gadgets, household utensils etc. Some of the main sources are musical instruments, transistors, loudspeakers, etc.

## Industrial Noise

It is the high-intensity sound which is caused by heavy industrial machines. According to many researches, industrial noise pollution damages the hearing ability to around 20%.

## Causes and Sources of Noise Pollution

Following are the causes and sources of noise pollution:

- **Industrialisation:** Industrialisation has led to an increase in noise pollution as the use of heavy machinery such as generators, mills, huge exhaust fans are used, resulting in the production of unwanted noise.
- **Vehicles:** Increased number of vehicles on the roads are the second reason for noise pollution.
- **Events:** Weddings, public gatherings involve loudspeakers to play music resulting in the production of unwanted noise in the neighbourhood.
- **Construction sites:** Mining, construction of buildings, etc add to the noise pollution.

## Noise Pollution Examples

Following are the examples of noise pollution:

- Unnecessary usage of horns
- Using loudspeakers either for religious functions or for political purposes
- Unnecessary usage of fireworks

- Industrial noise
- Construction noise
- Noise from transportation such as railway and aircraft

### **Effects of Noise Pollution on Human Health**

Noise pollution can be hazardous to human health in the following ways:

- **Hypertension:** It is a direct result of noise pollution which is caused due to elevated blood levels for a longer duration.
- **Hearing loss:** Constant exposure of human ears to loud noise that are beyond the range of sound that human ears can withstand damages the eardrums, resulting in loss of hearing.
- **Sleeping disorders:** Lack of sleep might result in fatigue and low energy level throughout the day affecting everyday activities. Noise pollution hampers the sleep cycles leading to irritation and an uncomfortable state of mind.
- **Cardiovascular issues:** Heart-related problems such as blood pressure level, stress and cardiovascular diseases might come up in a normal person and a person suffering from any of these diseases might feel a sudden shoot up in the level.

### **Prevention of Noise Pollution**

Some noise pollution preventive measures are provided in the points below.

- Honking in public places like teaching institutes, hospital, etc. should be banned.
- In commercial, hospital, and industrial buildings, adequate soundproof systems should be installed.
- Musical instruments sound should be controlled to desirable limits.
- Dense tree cover is useful in noise pollution prevention.
- Explosives should be not used in forest, mountainous and mining areas.

# Radioactive Pollution

## What is Radioactive Pollution / Radioactive Contamination?

Radioactive contamination is defined as the deposition or introduction of radioactive substances into the environment, where their presence is unintended or the levels of radioactivity are undesirable. Such type of pollution is harmful to life due to the emission of ionizing radiation. This type of radiation is potent enough to cause damage to tissues and DNA in genes.

## How Is Radioactive Pollution Caused?

Radioactivity can occur in one of two ways:

- Naturally occurring radioactivity
- Man-made radioactivity

Natural radioactivity, as the name suggests, occurs naturally in our environment. Some radioactive elements such as uranium and thorium are present in rocks and soil, albeit in trace quantities. Interestingly, humans and all other living organisms contain nuclides such as carbon-14, which are created by cosmic rays.

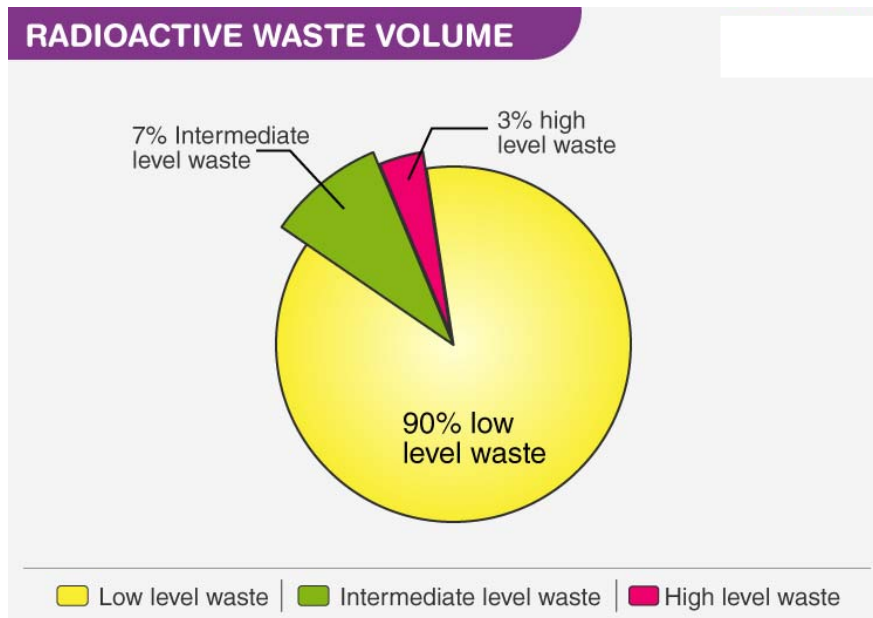
Man-made radioactivity is the result of nuclear weapon discharge or a nuclear reactor containment breach. In such scenarios, all living organisms in the vicinity of the nuclear event will become contaminated by fission products and remnants of nuclear fuel. This can be in the form of radioactive dust, or even particles that are found on various surfaces.

## Examples of Radioactive Pollution

One of the most infamous cases that resulted in radioactive pollution was the Chernobyl disaster. Other examples include:

- Fukushima Daiichi Nuclear Disaster
- Nuclear fallout (after atmospheric nuclear explosions)
- Criticality accidents

## Types of Radioactive Wastes



### Exempt waste or Very low-level waste

The least harmful wastes are called very low-level waste (VLLW). Examples of the VLLW would be the demolished materials like concrete, plaster, brick, metals, valves, piping etc that may have produced while rehabilitation projects or demolition projects.

Low-Level wastes: Are usually generated from the wastes emerging out of hospitals and industries. Consists of paper, rags, tools, clothes, cotton, filters etc. they contain short-lived radioactivity. It is often incinerated or burned before disposal.

### Intermediate level waste

This type of wastes contains a high level of radioactivity and requires burial. They contain chemical sludge's, metal fuel and resins. The nonsolids are sometimes converted to bitumen for disposal.

### High-Level Waste

Emerges from the burning of uranium fuel in a Nuclear Reactor. They are highly radioactive and hot, they require cooling and shielding.

## **Implications of Radioactive Wastes**

The good news is the harmful effects of radioactive wastes diminish over time depending on the waste type and the radioactive isotope. If isolated and stored properly for the required time, the ill effects diminish eventually.

Clearly, there's some bad news here. The only known ways to dispose of nuclear waste is to bury the contained waste in uninhabited areas deep within the ground or in oceans floor. For high energy level waste, transmutation of a radioactive isotope is performed.

With the isolation of radioactive waste in appropriate disposal facilities for sufficient amounts of time, the waste is no longer treated. However, the issue is under constant discussion and investigation, therefore, the waste generation amounts and its management is periodically reviewed by bodies like International Atomic Energy Agency, Joint Convention on Safety of Spent on the Fuel Management and also Safety of the Radioactive Waste Management.

## **Firework Pollution**

Fireworks generate huge concentrations of pollutants **from colorants and explosives** as well as from the metals and fuses that make up the firework itself. PM pollutant concentrations can be up to eight times higher than normal in the hours right after a fireworks show.

### **What are fireworks made of?**

Every firework relies on a series of chemical reactions to achieve a certain size, color, or loudness. These chemicals are packed into a tube called an aerial shell that's packed with chemicals and explosives.

Here's the ingredient list for a typical firework.

### **Black powder**

Sometimes called gunpowder, black powder helps the firework get into the air and blow up.



Black powder is a mixture of sulfur, charcoal, and potassium nitrate (also called saltpeter). It's used in two important parts of the firework process:

- Gunpowder blows up below the firework and propels it into the air.
- A fuse that's designed to delay until the firework's in the air ignites the gunpowder, resulting in the explosion that creates the firework display.

### Colorants

These are chemicals that help give fireworks their wide range of colors. Fireworks achieves certain colors and shades by applying heat to chemical compounds:

- **Red:** strontium, lithium
- **Orange:** calcium, calcium chloride
- **Yellow:** sodium, sodium chloride (salt)
- **Green:** barium, chlorine
- **Blue:** copper, chlorine
- **Purple:** mixture of copper (blue) and strontium (red)

### “Stars”

These are the small concentrations of explosives in a firework that blow up and fly in many directions when ignited.

Notice how a firework looks like a bunch of long, bright light rockets? Each light results from a single “star” in the firework shell.

Stars can also be arranged in shapes inside the aerial shell so that they look like happy faces, hearts, or other shapes when they explode.

### Do fireworks cause bad air quality?

Remember that fireworks are basically explosions of chemicals in solid form. Millions of combustion particles and gases are released into the air during these splashes of color on the sky. Many are also blown around for miles in atmospheric wind currents.

The most notable fireworks pollutant, particulate matter (PM), includes three distinct types of particles:

- **PM10**: coarse particles ranging from 2.5–10 microns in diameter, such as dust, mold, and pollen
- **PM2.5**: fine particles ranging from 0.3–2.5 microns in diameter, such as those created from combustion in vehicle engines or factory emissions
- **Ultrafine particles (UFPs)**: tiny particles smaller than 0.3 microns in diameter – UFPs make up over 90% of all airborne particle pollution and are by far the most dangerous PM pollutant
- **Volatile organic compounds (VOCs)**: airborne vapor or gaseous compounds responsible for odors that are produced by chemical reactions in combustion, manufacturing, or industrial processes.

### **Does fireworks air pollution cause health problems?**

If you have a respiratory condition like asthma, chronic obstructive pulmonary disorder (COPD), or chemical sensitivity, you probably already know the kind of symptoms that chemicals from a fireworks show can cause – shortness of breath, coughing, and chest pain.

But fireworks can be harmful even if you don't have any existing respiratory issues. Some of the symptoms you might experience because of poor air quality caused by fireworks include:

- headaches
- anxiety from nervous system effects
- sore or swollen throat
- airway inflammation
- laryngitis
- having trouble breathing
- high blood pressure
- irregular heartbeat
- reduced lung function

- pneumonia
- heart attacks

### **How do I protect myself from fireworks air pollution?**

The good thing about fireworks is that they're usually temporary and can be easily avoided. Here are some tips for protecting yourself from the air pollution caused by fireworks:

- **Use safe alternatives to traditional fireworks.** Some of the world's biggest buyers of fireworks, such as the Walt Disney Company, have received thousands of complaints about air pollution caused by their infamously theatrical nighttime shows at their theme parks in Anaheim, Orlando, and Hong Kong. In response, the company introduced fireworks that use compressed air instead of gunpowder.<sup>9</sup> Some cities, like Aspen, Colorado and Shanghai, China are also seeking to use drones equipped with colored lights to create formations that are visually similar to fireworks to vastly reduce air pollution during holiday celebrations.<sup>10,11</sup>
- **Voice your concerns to officials.** Live near a major source of fireworks? Some governments make concessions to businesses that host regular fireworks shows because they're a big source of local revenue. Share your experiences and concerns with lawmakers regarding health effects of fireworks. Get others involved who may be experiencing the same issues. This can help change policy by limiting fireworks shows or ending them altogether.
- **Shut your windows and doors.** If you're at home and live close to an area that has regular fireworks shows, close windows, doors, and any other openings in your home right before the fireworks start. Don't open them again for a few hours, as fireworks pollution can linger and travel many miles for hours after the show ends.
- **Purify the indoor air.** Airborne pollutants from fireworks shows can still seep into your home even with everything closed up. Filter the air to capture any particulate and gas pollution that gets into your home, deliver fresh air into your indoor environment, and keep your indoor air quality safe. This Help Me Choose can help you find the right air purifier for your needs.

## Solid Waste Management

*“Solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects.”*

### Categories of Waste

1. **Organic waste:** Kitchen waste, waste from food preparation, vegetables, flowers, leaves, fruits, and market places.
2. **Combustibles:** Paper, wood, dried leaves, packaging for relief items etc. that are highly organic and having low moisture content.
3. **Non-combustibles:** Metal, Tins, Cans, bottles, stones, etc.
4. **Toxic waste:** Old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.
5. **Recyclables:** Paper, glass, metals, plastics.
6. **Ashes or Dust:** Residue from fires that are used for cooking.
7. **Construction waste:** Rubble, roofing, broken concrete etc.
8. **Hazardous waste:** Oil, battery acid, medical waste, industrial waste, hospital waste.
9. **Dead animals:** Carcasses of dead livestock or other animals.
10. **Bulky waste:** Tree branches, tires etc.
11. **Soiled waste:** Hospital waste such as cloth soiled with blood and other body fluids.

### Various Sources of Solid Waste

Every day, tonnes of solid waste are disposed of at various landfill sites. This waste comes from homes, offices, industries and various other agricultural related activities.

These landfill sites produce foul smell if waste is not stored and treated properly. It can pollute the surrounding air and can seriously affect the health of humans, wildlife and our environment. The following are major sources of solid waste:

### 1. Residential

Residences and homes where people live are some of the major sources of solid waste. The garbage from these places includes food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items such as electronics, tires, batteries, old mattresses and used oil.

Most homes have garbage bins where they can throw away their solid wastes in and later, the bin is emptied by a garbage collecting firm or person for treatment.

### 2. Industrial

Industries are known to be one of the biggest contributors to solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants.

These industries produce solid waste in the form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes.

### 3. Commercial

Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities, in this case, refer to hotels, markets, restaurants, godowns, stores and office buildings.

Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes.

#### 4. Institutional

The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber waste, plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes.

#### 5. Construction and Demolition Areas

Construction and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites.

Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

#### 6. Municipal Services

The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the municipal services include street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas, including sludge.

#### 7. Treatment Plants and Sites

Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemical plants.

Among the wastes produced by these plants, there are industrial process wastes, unwanted specification products, plastics, metal parts, just to mention a few.

## 8. Agriculture

Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the wastes they produce are agricultural wastes, spoiled food, pesticide containers and other hazardous materials.

## 9. Biomedical

This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals, there are different types of solid wastes produced.

Some of these solid wastes include syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will cause a huge problem for the environment and the people in these facilities.

## **Effects of Poor Solid Waste Management**

### 1. Litter Surroundings

Due to improper waste disposal systems, particularly by municipal waste management teams, wastes heap up and become a menace. While people clean their homes and places of work, they litter their surroundings, which affect the environment and the community.

### 2. Impact on Human Health

Improper waste disposal can affect the health of the population living nearby the polluted area or landfills. The health of waste disposal workers and other employees involved with these landfill facilities are also at a greater risk.

Exposure to wastes that handled improperly can cause skin irritations, respiratory problems, blood infections, growth problems, and even reproductive issues.

### 3. Disease-causing Pests

This type of dumping of waste materials forces biodegradable materials to rot and decompose under improper, unhygienic and uncontrolled conditions.

After a few days of decomposition, a foul smell is produced, and it becomes a breeding ground for different types of disease-causing insects as well as infectious organisms. On top of that, it also spoils the aesthetic value of the area.

### 4. Environmental Problems

Solid wastes from industries are a source of toxic metals, hazardous wastes, and chemicals. When released to the environment, the solid wastes can cause biological and physicochemical problems to the environment that may affect or alter the productivity of the soils in that particular area.

### 5. Soil and Groundwater Pollution

Toxic materials and chemicals may seep into the soil and pollute the groundwater. During the process of collecting solid waste, hazardous wastes usually mix with ordinary garbage and other flammable wastes making the disposal process even harder and risky.

### 6. Emission of Toxic Gases

When hazardous wastes like pesticides, batteries containing lead, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics mixed up with paper and other non-toxic scraps are burned they produce dioxins, furans, polychlorinated biphenyls, and other gases. These toxic gases have the potential of causing various diseases, including cancer.

### 7. Impact on Land and Aquatic Animals

Our carelessness with our waste and garbage also affects animals, and they suffer the effects of pollution caused by improperly disposed of wastes and rubbish.



Consuming styrofoam and cigarette butts have been known to cause deaths in marine animals. Animals are also at risk of poisoning while consuming grasses near contaminated areas or landfills as the toxins seep into the soil.



## **Methods of Solid Waste Management**

There are different methods of solid waste management. The following are some of the recognized methods:

### 1. Sanitary Landfill

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam.

Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner, which is usually made of several layers of thick plastic and sand. This liner protects the groundwater from being contaminated because of leaching or percolation.

When the landfill is full, it is covered with layers of sand, clay, topsoil and gravel to prevent seepage of water.

**Advantage:** If landfills are managed efficiently, it is an ensured sanitary waste disposal method.

**Constraint:** It requires a reasonably large area.

## 2. Incineration

This method involves the burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes.

Incinerators that recycle heat energy through furnace and boiler are called waste-to-energy plants. These waste-to-energy systems are more expensive to set up and operate compared to plain incinerators because they require special equipment and controls, highly skilled technical personnel, and auxiliary fuel systems.

This method of solid waste management can be done by individuals, municipalities and even institutions. The good thing about this method is the fact that it reduces the volume of waste up to 20 or 30% of the original volume.

**Advantage:** The volume of combustible waste is reduced considerably by burning waste. In the case of off-site pits, it is an appropriate method to minimize scavenging.

**Constraint:** It can cause smoke or fire hazard and also emits gaseous pollutants.

## 3. Recovery and Recycling

Recycling or recovery of resources is the process of taking useful but discarded items for the next use. Plastic bags, tins, glass and containers are often recycled automatically since, in many situations, they are likely to be scarce commodities.

Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills. The most developed countries follow a strong tradition of recycling to lower volumes of waste.

**Advantage:** Recycling is environmentally friendly.

**Constraint:** It is expensive to set up, and in most emergencies, there is limited potential.

#### 4. Composting

Due to a lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting.

It is a biological process in which micro-organisms, specifically fungi and bacteria, convert degradable organic waste into substances like humus. This finished product, which looks like soil, is high in carbon and nitrogen. Good quality environmentally friendly manure is formed from the compost that is an excellent medium for growing plants and can be used for agricultural purposes.

**Advantage:** Composting is environmentally friendly as well as beneficial for crops.

**Constraint:** It requires intensive management and experienced personnel for large scale operation.

#### 5. Pyrolysis

This is a method of solid waste management whereby solid wastes are chemically decomposed by heat without the presence of oxygen. It usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue of carbon and ash and small quantities of liquid.

**Advantage:** This will keep the environment clean and reduce health and settlement problems.

**Constraint:** The systems that destroy chlorinated organic molecules by heat may create incomplete combustion products, including dioxins and furans. These compounds are highly toxic in the parts per trillion ranges. The residue it generates may be hazardous wastes, requiring proper treatment, storage, and disposal.

To summarize, proper solid waste management is an integral part of environmental conservation that should be observed by both individuals and companies globally.

# **Disaster Management**

## **What is a Disaster?**

A disaster is defined as a disruption on a massive scale, either natural or man-made, occurring in short or long periods. Disasters can lead to human, material, economic or environmental hardships, which can be beyond the bearable capacity of the affected society. As per statistics, India as a whole is vulnerable to 30 different types of disasters that will affect the economic, social, and human development potential to such an extent that it will have long-term effects on productivity and macro-economic performance.

## **What is Disaster Management?**

The Disaster Management Act of 2005 defines Disaster Management as an integrated process of planning, organizing, coordinating and implementing measures which are necessary for-

1. Prevention of threat of any disaster
2. Reduction of risk of any disaster or its consequences
3. Readiness to deal with any disaster
4. Promptness in dealing with a disaster
5. Assessing the severity of the effects of any disaster
6. Rescue and relief
7. Rehabilitation and Reconstruction

## **Flood**

A flood is an overflow of water on land. Sometimes a river might receive extra water, either from heavy rains or other natural disasters. When this happens, the water overflows from its normal path in the river bed and onto the dry land.

## **What are the causes of a flood?**

During a flood, people should move themselves and their most precious belongings to higher ground quickly. The process of leaving homes in search of a safe place is called evacuation. Floods occur at irregular intervals and vary in size, duration and the affected area.

Water naturally flows from high areas to low lying areas. This means low-lying areas may flood quickly before it begins to get to the higher ground.

Floods can also occur in rivers when the flow rate exceeds the capacity of the river channel, particularly at bends or meanders in the waterway. Floods often cause damage to homes and businesses if they are in the natural flood plains of rivers.

The following factors can lead to flooding:

### ***Rains***

Whenever there are more rains than the drainage system can take, they can cause floods.

### ***River overflow***

Rivers can overflow their banks to cause a flood. This can happen when there is more water upstream than usual, and as it flows downstream to the adjacent low-lying areas there is a burst and water gets into the land.

### ***Strong winds in coastal areas***

Seawater can be carried by massive winds and hurricanes onto the dry coastal lands and cause flooding. This is made worse if the winds carry rains with themselves. Sometimes water from the sea resulting from a tsunami can flow inland to cause damage.

### ***Dam breaking***

Dams are man-made structures mounted to hold water flowing down from a highland to a lowland. The power in the water is used to turn propellers to generate electricity. Sometimes, too much water held up in the dam can cause it to break and cause overflow in the area. Excess water can also be intentionally released from the dam to prevent it from breaking and that can also cause floods.

### *Ice and snow melts*

In cold regions, heavy snow over the winter usually stays unmelted for some time. Some mountains have an ice cap on them. Sometimes the ice suddenly melts when the temperature rises, resulting in massive movement of water into places that are usually dry. This is usually called a snowmelt flood

### *Urban Flooding*

Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers. Although sometimes triggered by events such as flash flooding or snowmelt, urban flooding is a condition, characterized by its repetitive and systemic impacts on communities, that can happen regardless of whether or not affected communities are located within designated floodplains or near any body of water

### **What are the effects of a flood?**

The most immediate effect of a flood is the catastrophic loss of life and destruction of buildings and other structures like bridges, sewerage systems, canals etc.

Floods also damage power transmission and sometimes power generation along loss of drinking water treatment and water supply. Lack of clean water combined with human sewage in the flood waters raises the risk of waterborne diseases, which can include typhoid, cholera and many other diseases depending upon the location of the flood.

- Flood waters typically inundate farm land, making the land unworkable and preventing crops from being planted or harvested, which can lead to shortages of food both for humans and farm animals.
- Entire harvests for a country can be lost in extreme flood circumstances. Some tree species may not survive prolonged flooding of their root systems.  
Secondary and long-term effects
- Economic hardship due to a temporary decline in tourism, rebuilding costs, or food shortages leading to price increases is a common after-effect of severe flooding.

## **Earthquake**

Earthquake is one of the major natural disasters. Every year it causes a huge loss of life and property all around the world. Proper strategies and awareness about [disaster management](#) is the need of the hour. This will protect us from the losses and help to cope up with these hazards. However, in order to reduce the destruction caused by these occurrences the disaster management committee has laid some safety measures.

### **What is an Earthquake?**

An earthquake is the shaking of the surface of the earth due to the sudden release of energy in the earth's crust. As a result, seismic waves (also known as S waves) are created. The seismic activities in an area determine the type and intensity of the earthquake.

### **What Causes an Earthquake?**

Earthquakes are caused due to sudden tectonic movements in the earth's crust. When the tectonic plates slide over one another, there is a cause of orogeny which results in earthquakes and volcanoes. These disturbances cause vibrations that spread in all directions. As there is a relative motion of these plates, there is stress built up, which breaks by releasing the stored energy known as shock waves.

### **What to do During an Earthquake?**

#### **Before the disaster:**

- Connections of gas lines and appliances must be made flexible.
- An earthquake readiness plan must be kept ready, including locating a shelter house, canned food and up to date first aid kit, gallons of water, dust masks, goggles, firefighting equipment, a torch, and a working battery-operated radio.
- Architects and structural engineers must be consulted before laying the foundation of buildings in earthquake-prone areas. Also the building must be manufactured as per the rules and regulations laid by the disaster management committee.

- Awareness must be spread among friends and family members about the above-mentioned measures.

### **Dos and Dont's:**

- One must stay indoors until the shaking stops and it's officially announced that it is safe to exit.
- One must stay away from bookcases, furniture, and heavy appliances that may fall.
- The shelter must be under a table or bed, and hold on to a post or any other fixture.
- If one is outdoors, the shelter must be taken in a clear spot away from buildings, trees, and power lines.

### **After the disaster:**

The following are the measures that must be undertaken after the calamity is over.

- First aid kits must be used to tend to persons with minor injuries such as bleeding and bruises. Whereas seriously injured individuals must not be moved until they are out of danger and proper medical help has arrived.
- If the person is not breathing, rescue breathing must be administered. If the person has no pulse, CPR must be given.
- Tumbling shelves and falling items must be taken care of and damaged walls made of bricks must be avoided.
- Main gas valves must be checked for leaks. The main power switch must be turned off if there is a possibility of damage. Broken appliances must be unplugged until the damage is repaired.
- One must stay away from downed power lines and any object or appliance in contact with it.



## What are the Effects of an Earthquake?

Following are the effects of the earthquake:

- Ground shaking: Surface waves that are near the epicenter are responsible for the earthquake. The intensity of ground shaking depends on the duration, local geology, and distance.
- Damage to a man-made structure.
- An outbreak of fire and spilling of hazardous chemicals.

## What is the difference between Seismograph and Richter scale?

Following is the table explaining the difference between Seismograph and Richter scale:

<b>Seismograph</b>	<b>Richter scale</b>
Used for measuring and recording the vibrations of earthquakes	Used for indicating the intensity of an earthquake
Used for measuring the motions related to the ground like seismic waves resulting in an earthquake and volcanic eruptions	Used for quantifying the energy that is released during an earthquake

## Cyclone

### **What Are Cyclones?**

Location, location, location! This is especially important when we're talking about ocean storms because the location of the storm determines what we call it. For example, if the storm occurs in the Atlantic Ocean and Northeast Pacific, it's called a hurricane. If the exact same type of storm occurs in the Northwest Pacific, this is a typhoon. And if we find those same storms in the South Pacific and Indian Ocean, these are called tropical cyclones.

**Cyclone** refers to any spinning storm that rotates around a low-pressure center. The low-pressure center is also referred to as the 'eye' of the storm, which is well known for being eerily calm compared with the areas under the spinning 'arms' of the storm. You could say that the eye is watching what's going on down below, so it needs a clear path, but the arms are where all the action happens because this is where the storm is throwing out all of its rain and wind.

### **Types of Cyclones**

The term 'cyclone' actually refers to several different types of storms. They occur in different places, and some occur over land while others occur over water. What they all have in common is that they are spinning storms rotating around that low-pressure center.

**Tropical cyclones** are what most people are familiar with because these are cyclones that occur over tropical ocean regions. Hurricanes and typhoons are actually types of tropical cyclones, but they have different names so that it's clear where that storm is occurring. Hurricanes are found in the Atlantic and Northeast Pacific, typhoons are found in the Northwest Pacific. If you hear 'tropical cyclone,' you should assume that it's occurring in the South Pacific or Indian Ocean, but for this lesson, we'll use it refer to all types of tropical ocean cyclones.

We can also further describe tropical cyclones based on their wind speeds. They are called category 1, 2, 3, 4 or 5, increasing with intensity and wind speed as the number increases. A category 1 cyclone is the weakest, with wind speeds of 74-95 mph. A category 5 cyclone, on the other hand, is extremely dangerous and has the potential for major damage. Category 5 cyclones have wind speeds of 155 mph and above!

**Polar cyclones** are cyclones that occur in polar regions like Greenland, Siberia and Antarctica. Unlike tropical cyclones, polar cyclones are usually stronger in winter months. As you can see, these storms really do prefer the colder weather! They also occur in areas that aren't very populated, so any damage they do is usually pretty minimal.

A **mesocyclone** is when part of a thunderstorm cloud starts to spin, which may eventually lead to a tornado. 'Meso' means 'middle', so you can think of this as the mid-point between one type of storm and the other. Tornadoes all come from thunderstorm clouds, but not all thunderstorm clouds make tornadoes. In order for a tornado to occur, part of that cloud has to spin, and though you can't really see this happening, this is the intermediate, or 'meso' step from regular cloud to dangerous spinning cloud running along the ground.

### 3. What are the Effects of Cyclones?

To know the effects of cyclones, it is essential to understand what are the main causes of cyclones. As the cyclone causes tremendous wind and rainfall, it usually leads to the destruction of property and loss of lives in the areas where it occurs. The most characteristic feature of a cyclone is its extremely fast winds. Cyclones form into spiraling conical shapes much like a tornado. As a result, their sheer destructive power is immense. Cyclonic winds are capable of picking up entire vehicles, trees, heavy containers, and so on, and flinging them through the air with little effort. As a result, coastal areas that are susceptible to cyclones are always on high alert for any hint of the formation of a cyclone so that citizens can be evacuated immediately.

The effects of tropical cyclones include heavy rain, strong wind, large storm surges near landfall, and tornadoes. The destruction from a tropical cyclone, such as a hurricane or tropical storm, depends mainly on its intensity, its size, and its location.

#### **Causes of Cyclone**

Cyclones are caused by atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation. Cyclones are usually accompanied by violent storms and bad weather. The air circulates inward in an anticlockwise direction in the Northern

hemisphere and clockwise in the Southern hemisphere. Cyclones are classified as: (i) extra tropical cyclones (also called temperate cyclones); and (ii) tropical cyclones. The word Cyclone is derived from the Greek word Cyclos meaning the coils of a snake. It was coined by Henry Peddington because the tropical storms in the Bay of Bengal and the Arabian Sea appear like coiled serpents of the sea.

## Landslide

Landslides are a natural phenomenon, but it involves many human activities which lead to the mass movement of landmass. In recent times we find the causes of landslides increasing day by day and the primary cause is deforestation. To survive, one needs to keep a check on these human activities.

### **Types of Landslides**

They can occur because of various reasons. We can classify them into four categories which are mentioned below:

- **Falls Landslides**

It means falling of some material or debris or rocks etc., from a slope or a cliff which leads to a collection of this debris at the base of the slope.

- **Topple Landslides**

These can occur because of some fractures between the rocks and the tilt of the rocks because of gravity without collapsing. Here, we see the forward rotational movement of the material.

- **Slides**

It is a kind of landslide when a piece of the rock slides downwards and gets separated from it.

- **Spread**

It happens on flat terrain and gentle slopes and can occur because of softer material.

## **Causes of Landslide**

Landslides are caused by various factors, which are mentioned below:

- It can be caused because of heavy rain.
- Deforestation is also one of the main reasons for landslides because trees, plants, etc., keep the soil particles compact and due to deforestation, the mountain slopes lose their protective layers because of which the water of the rain flows with unimpeded speed on these slopes.
- It can be caused by earthquakes as well.

For example, in the Himalayas, the tremor occurred because earthquakes unstabilized the mountains, which led to landslides.

- Volcanic eruptions in specific regions can also cause landslides.
- Landslides often occur in mountain regions while making roads and construction; a large number of rocks has to be removed, which can cause landslides over there.
- In the regions of North East India, landslides occur because of shifting agriculture.
- Due to the increasing population, a large number of houses are being created, which leads to the creation of a large amount of debris which can cause landslides.

## **Effects of Landslide**

Let us look at the effects of landslides in points:

Landslides can disturb the social and economic environment with the number of other damages which are mentioned below:

## **Short Term Impacts**

- The natural beauty of the area is damaged.
- Loss of life and property
- Roadblocks
- Destruction of railway lines
- Channel blocking because of the falling of rocks.
- It leads to the diversion of river water, which can cause floods as well.

## **Long Term Impacts**

- Landscape changes can be permanent.
- The loss of fertile land or cultivation land.
- Erosion and soil loss can lead to environmental problems.
- Population shifting and migration.
- Effects on the sources of water.
- Some roads can be damaged or closed permanently.

## Prevention and Mitigation

The following measures can be taken in this regard:

- The country should identify the vulnerable areas and actions should be taken in this regard on a priority basis.
  - Early warning systems and monitoring systems should be there.
  - Hazard mapping can be done to identify the areas which are more prone to landslides.
  - Restriction on the construction in the risky areas should be imposed.
  - Afforestation programs should take place.
  - Restricting development in landslide areas and protecting the existing ones.
  - The country should specify codes or standards etc. For the construction of the buildings and other purposes in such areas of risk.
  - Insurance facilities should be taken by the people to deal with the loss.
- 
- Terrace farming should be adopted in hilly areas.
  - Response teams should be quick to deal with landslides if they occur.

### Landslides in India

It is one of the natural hazards in India, which affects 15% of the geographical area of our country. Due to several factors, India is divided into the following vulnerability zones, which are shown in the table below:

Very High Vulnerability Zones	Highly unstable areas, High rainfall, areas prone to earthquakes, and intense human activities. Such as the Himalayas, Andaman and Nicobar Islands, North Eastern region, Western Ghats, Nilgiris.
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High Vulnerability Zones	The areas of very high Vulnerability Zone are included here as well except the plains of Assam. The difference between the two is their intensity or frequency of various factors.
Moderate - Low Vulnerability Zones	Areas of less precipitation such as Trans Himalayan areas of Ladakh, Spiti of Himachal Pradesh, Aravalli mountains, rain shadow areas of western and eastern ghats, Deccan plateau, etc. Areas of mining activities such as Jharkhand, Odisha, Chhattisgarh, Maharashtra, Andhra Pradesh, Karnataka, Goa, etc.
Other Areas	It includes the remaining parts of India which are safe from landslides.