

Environmental Issues

Air Pollution and Global Warming

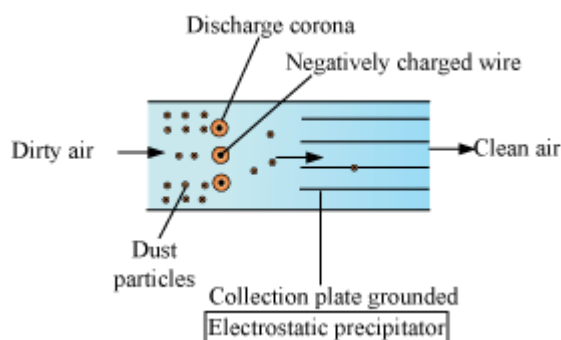
Pollution is the undesirable change brought about by chemical, particulate matter, or biological materials to air, water, or soil.

Air Pollution

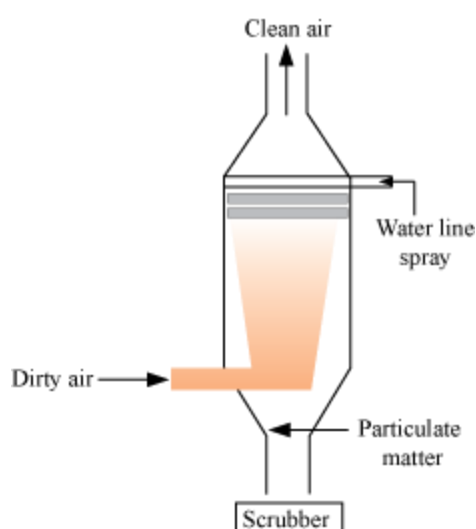
- Air is a complex, dynamic natural entity, which is essential for supporting life on earth.
- Air pollutant is a substance that causes harm to the humans and other living organisms.
- Some of the common pollutants of air:
 - Nitrogen dioxide
 - Sulphur dioxide
 - Carbon monoxide and carbon dioxide
 - Volatile organic compounds
 - Particulate matter

Control of Air Pollution

- Air pollution causes severe respiratory disorders in humans and other animals and also affects plants. It can be controlled by the following ways:
- Fitting smokestacks and smelters, with **filters** to separate pollutants from the harmless gases
- Particulate matter can be removed by using an **electrostatic precipitator**. It contains electrode wires maintained at several thousand volts, which produce electrons. These electrons cling on to dust particles and give them a net negative charge and are attracted by collecting plates, which are grounded. The velocity of air passing through the plates should be low enough to allow the dust to fall.



- A **scrubber** can be used to remove gases such as SO_2 wherein the exhaust passes through a spray of water or lime.



- Vehicular pollution can be reduced by using less polluting fuels such as **CNG**, which is more efficient and less costly as compared to petrol or diesel. In 2002, all the buses were switched to CNG in Delhi and this has indeed led to a fall in pollution levels in the city.
- Vehicles can be fitted with **catalytic converters** that have metals such as platinum, palladium, and rhodium as catalysts. These catalysts carry out the following conversions:

Unburnt hydrocarbons $\rightarrow \text{CO}_2$ and H_2O

Carbon monoxide $\rightarrow$ Carbon dioxide

Nitric oxide $\rightarrow$ Nitrogen gas

Unleaded petrol must be used with catalytic converters as presence of lead in the petrol inactivates the catalyst.

Greenhouse Effect

- It is a natural phenomenon that keeps the earth's atmosphere warm.
- Without this phenomenon, the temperature of the earth would become too cold for living beings to survive.
- The greenhouse gases (CO₂, methane, etc.) absorb the heat of sun and the earth and emit it back to the earth's surface.
- Thus, these gases prevent a part of heat rays from escaping into atmosphere.
- This cycle is repeated many times to maintain the earth's temperature to an optimum 15°C.
- The concentration of these gases has increased due to increased industrialisation, leading to the heating up of the earth's surface (global warming).
- This has increased the overall temperature of the earth, resulting in changes in the earth's climate. During the last century, the temperature of earth has increased by 0.6°C.
- This increase in temperature is ultimately believed to cause the melting of polar ice caps, rise in the sea level, and submerging of the coastal areas.
- Greenhouse effect can be controlled by reducing the use of fossil fuels, which produce greenhouse gases on burning, afforestation, efficient energy usage, etc.

Water Pollution

Water Pollution

- Water is very essential for the maintenance of life on earth.
- Due to human activities, water bodies have become polluted all over the world.
- Some of the common pollutants and their sources are:
 - **Domestic sewage** – It mainly contains organic matter, which is biodegradable. Microorganisms involved in their degradation consume a lot of oxygen and the BOD of the water body increases leading to the death of fishes and other aquatic life. Sewage also contains many pathogenic microbes, which may cause the outbreak of many diseases such as typhoid, jaundice, etc.
 - **Industrial Effluents** – Industrial effluents contain inorganic toxic substances, which may undergo **biomagnification** (increase in concentration of a toxin at successive trophic levels). The toxin gets accumulated in the body of an organism and is passed on to the next level. For example, DDT and other heavy metals such as mercury, cadmium, etc.
 - **Oil Spills** - The accidental discharge of petroleum in water bodies is called oil spill. This results in the death of a lot of marine lives.

- **Thermal wastewater discharge** – Heated water flowing out of the thermal power plants increase the temperature of the water body. It eliminates the cold water species and promotes the warm water species. In the long run, it causes damage to the indigenous biodiversity of the water body.
- **Eutrophication**
 - It is the ageing of a water body due to nutrient enrichment of its water. It can be natural or artificial.
 - The natural process takes thousands of years, but due to human activities, this process has got accelerated (accelerated/cultural eutrophication).
 - Release of nutrient rich sewage and industrial effluents lead to introduction of nutrients such as nitrogen and phosphorus and increase in temperature and BOD of the water body, causing increased biological activity, thereby leading to algal blooms. This results in the loss of indigenous flora and fauna.
 - In some cases, large masses of floating plants (bog) develop, finally converting the water body into land.

Control of Water Pollution

- Raw sewage can be treated using biological and other means to remove the solid, suspended, and inorganic materials before it is released back into the environment.
- Nitrogenous fertilizers can be denitrified using microbes, which can convert nitrate and nitrite into gaseous nitrogen by a process called de-nitrification.
- **Stonefly**, belonging to phylum Arthropoda, is a good biological indicator of water pollution as it requires highly oxygenated water for respiration.
- **Integrated wastewater management** as practised in Arcata, California- In this approach, the water is first treated by conventional means such as filtration, sedimentation, and chlorine treatment, followed by bioremediation. (Marshes having appropriate plants, bacteria, fungi, and algae were seeded, which assimilate dangerous pollutants such as heavy metals)

Solid Wastes

Solid Waste

- Consists of all the unwanted undesired materials thrown into the dustbin
- It may be composed of biodegradable or non-biodegradable wastes.
- Open dumps used for disposing solid waste serves as breeding ground for rats and flies. Therefore, sanitary landfills are used as a substitute for these.
- Biodegradable wastes can be either aerobically or anaerobically broken down using microbes. The non-biodegradable waste can be recycled, reused, or dumped in landfills.
- Hospital wastes also contain hazardous materials, which have to be disposed properly. Hospital wastes are generally incinerated.

- Irreparable computers and other electronic goods make up e-wastes, which are either dumped in land fills or are incinerated. E-waste can be recycled also to recover metals such as copper, iron, silicon, gold, etc.
- To use the plastic waste in an efficient way, **polyblend**, a fine powder of recycled modified plastic, has been developed. When polyblend is mixed with bitumen, it can be used to lay roads with greater water repellent capacity and greater life.

Agrochemicals and Radioactive Wastes

Agrochemicals

- The increased use of pesticides, fertilizers for increasing the produce has led to eutrophication and biomagnifications in water sources.
- In order to check this, the concept of organic farming is increasingly becoming popular. In this technique, instead of using chemical fertilizers and pesticides, natural materials and techniques such as organic manure (cow dung manure), compost, biological pest control, and crop rotation are used. This leads to a balanced soil, which does not cause soil infertility, but causes the rejuvenation of the soil.

Radioactive Wastes

- Nuclear energy is a non-polluting energy except the threats posed by accidental leakage and difficult disposal of radioactive waste.
- Radioactive substances cause severe damages such as mutations and cancer in lower doses and higher doses can be lethal.
- Radioactive wastes should be suitably pre-treated in shielded containers buried under rock surfaces about 500 m under the earth's surface.

Improper Utilisation of Resources

- Natural resources can get degraded by their improper use.
- **Soil erosion and desertification** – Over-cultivation, overgrazing, deforestation, and poor irrigation techniques lead to soil erosion and desertification.
- **Water logging and soil salinity** - Lack of proper drainage leads to water logging, which affects the crops and also leads to increase in the salinity of the soil.

Ozone Depletion

Ozone Depletion

- The ozone layer is found in the upper part of the stratosphere.
- It protects the earth from the harmful UV rays of the Sun. High energy UV rays break the bonds within the molecules such as DNA and proteins.
- Ozone is formed by the action of UV rays on oxygen molecule and its thickness is measured in **Dobson units (DU)**.
- The ozone layer is getting depleted by the action of **chlorofluorocarbons (CFCs)** found in refrigerants and perfumes.
- The CFCs are acted upon by UV rays in the stratosphere, liberating the Cl atoms, which act as catalysts to degrade ozone into molecular oxygen.
- The ozone depletion is particularly greater in Antarctica, resulting in the formation of a large thinned ozone layer commonly known as **ozone hole**.
- The UV rays of shorter wavelength cause skin cancers, mutations in the cellular DNA, snow-blindness, cataract, etc.
- To check this ozone depletion, **Montreal Protocol** was passed in 1987 to control the use of substances that cause ozone depletion.

Deforestation

Deforestation

- It is the unlimited cutting of trees and conversion of forests into cultivable land.
- In the beginning of 20th century, India had 30% of its area under forests, which was reduced to just 19.4% by the end of 20th century.
- Deforestation is a result of a number of human activities such as increased population and the demand for land.
- Trees are cut for timber, fuel, and also for **Slash and burn agriculture**, also called Jhum cultivation. In this, trees are cut and plant remains in the forest are burned since the ash acts as a fertilizer.
- Some of the major effects of deforestation are the increase in carbon-dioxide levels, loss of habitat for wild animals, soil erosion, and consequent desertification.
- Deforestation can be controlled by reforestation and afforestation.
- In 1980s, the concept of **Joint Forest Management** was introduced by the government of India. In this, support of local communities was taken for conservation of forests and in return, the local people were free to use the products obtained from the forests.