



## **Objectives:**

In this topic we are going to deal about different types of pollution and due to this types of pollution how our environment is facing disasters and calamities.

## **Introduction:**

Environmental pollution can be defined as “the unfavorable alteration of our surroundings”

## **Types of pollutants:**

Bio degradable pollutants -decompose rapidly by natural processes.

Non- degradable pollutants- do not decompose or slowly decompose in the environment.

Pollution are of different kinds

Air pollution

water pollution

soil pollution

marine pollution

noise pollution

thermal pollution and

Nuclear hazards

## **Air pollution:**

It may be defined as “the presence of one or more contaminants like dust, smoke, mist and odour in the atmosphere which are injurious to human beings, plants and animals.

**Definition:** Air pollution may be defined as the presence in the outdoor atmosphere one or more contaminants such as dusts, fumes, mist, odour smoke or vapour, or a combination of all in such quantities, in such a duration so as to be injurious to humans, plant or animal life or even property or which unreasonably interfere with the comfortable enjoyment of life or property or conduct of business.

## **Sources of air pollution:**

Natural pollution - volcanic eruptions, forest fires, biological decay, etc.

Man – made activities – Thermal power plants, agricultural activities etc.

## **Classification:**

Primary pollutant – these are those emitted directly in the atmosphere in harmful form like CO, NO etc

Secondary pollutant – these may react with one another or with the basic components of air to form new pollutants.

## **Major classes of air pollutants :**

1. Gaseous pollutants: Carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), sulphur trioxide (SO<sub>3</sub>), nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O)
2. Volatile Organic Compounds (VOCs): Methane (CH<sub>4</sub>), propane (C<sub>3</sub>H<sub>8</sub>), chlorofluorocarbons (CFCs)
3. Suspended Particulate Matter (SPM): Solid particles (dust, soot, asbestos, lead, nitrate and sulphate salts), liquid drops (sulphuric acid, PCBs, dioxins and pesticides)
4. Photochemical oxidants: Ozone, peroxyacyl nitrates (PANs), hydrogen peroxide, aldehydes
5. Radioactive Substances: Radon-222, iodine-131, strontium-90, plutonium-239
6. Hazardous Pollutants: (Which cause health effects such as cancer, birth defects, and nervous system problems) Carbon tetra chloride, methyl chloride, chloroform, benzene, ethylene bromide, formaldehyde.
7. Primary air pollutants : Primary air pollutants are chemicals that directly released from the source into the atmosphere.
  - Oxides of carbon, nitrogen and sulphur

- Hydrocarbons like methane and benzene
- Particulates like soot, sulphuric acid droplets and asbestos

8. Secondary air pollutants : Secondary air pollutants are produced in the atmosphere from primary air pollutants by chemical reactions.

- ✓ Ozone
- ✓ Sulphur trioxide
- ✓ Peroxyacyl nitrates (PANs)
- ✓ Hydrogen peroxide

### Gaseous Pollutants, Sources and Their Health Effects

Pollutant Gases	Major sources	Ill health effects
Carbon monoxide CO	Cigarette smoking, incomplete burning of fossil fuel, motor vehicle exhaust.	Reacts with hemoglobin in red blood and reduces the ability of blood to bring oxygen to body cells and tissues. This impairs perception and thinking; slows reflexes; causes headaches and drowsiness, dizziness, and nausea; can trigger heart attacks and angina; damages the development of fetuses and young children; and aggravates chronic bronchitis, emphysema and anemia. At high levels it causes collapse, coma, irreversible brain cell damage and death.
Nitrogen dioxide NO <sub>2</sub>	Product of combustion, automobile exhaust, sulphuric acid plants (catalyst in lead chamber process), nitric acid plants, fertilizer and explosives manufacturing plants. NO is oxidized to NO <sub>2</sub> by	Health Effects: Lung irritation and damage; aggravates chronic asthma and bronchitis; increases susceptibility to respiratory infection such as the flu and common colds
		Environmental effects: Reduces visibility; HNO <sub>3</sub> deposition can damage trees, soils, and aquatic life in lakes, corrode metals and eat away stone structures.

	oxygen and rapidly by ozone,	
Sulphur dioxide SO <sub>2</sub>	Volcanoes, sulphuric acid manufacturing plants, coal fired power plants, petroleum industry and sulphide ore dressing.	Health Effects: Lung irritation and damage; aggravates chronic asthma and bronchitis
		Environmental effects: Reduces visibility; H <sub>2</sub> SO <sub>4</sub> deposition can damage trees, soils, and aquatic life in lakes, corrode metals and eat away stone structures. SO <sub>2</sub> can damage paint, paper and leather
Hydrogen Sulphide H <sub>2</sub> S	Volcanic eruptions, sewers, decaying of animal and vegetable matter under anaerobic conditions, viscose rayon plants, oil refineries,	Bad smelling poisonous gas, irritation to throat, nose and eyes; aggravates chronic asthma and bronchitis In large doses it can cause edema(excessive watery fluid in tissues) and emphysema(damage of air sacs of lungs) and pneumonia, nausea and death. Environmental effects: Corrode metals
Hydrocarbons including CFC	Organic chemical industries, petroleum industries, Freon industries,	Carcinogenic effects, lachrymatory ( irritation of the body) effects
Oxidants including ozone O <sub>3</sub>	Photochemical reactions in the atmosphere between organic compounds with NO and NO <sub>2</sub>	Irritation of eyes, respiratory tract and lungs, accumulation of fluids in lungs
Radioactive gases and dusts	Nuclear tests, use and test of artificial and natural radio-isotope tracers -	Cancers, leukemia, cataracts, genetic effects and reduction in life efficiency.

## **Suspended Particulate Matter (SPM)**

**Definition:** Air-borne small solid particles and liquid droplets are commonly known as particulates or aerosols. According to their increasing molecular dimensions they can be classified as large, giant and settleable ones.

**Sources:** Burning coal in power and industrial plants, burning diesel and other fuels in vehicles, plowing and burning of agriculture fields, road construction.

**Health Effects:** Nose and throat irritation, lung damage and bronchitis; aggravates chronic asthma and bronchitis; shortens life; toxic particulate can cause mutations, reproductive problems and cancer. Brain and other nervous system damage and mental retardation are Also caused by SPM.

**Environmental effects:** Reduces visibility;  $H_2SO_4$  deposition can damage trees, soils, and aquatic life in lakes, corrode metals and eat away stone structures.  $SO_2$  can damage paint, paper and leather.

### **Examples of Suspended Particulate Matter:**

**a) Smoke:** Consists of solid and liquid particles (0.1 to 1  $\mu m$ ), which are formed during incomplete combustion of carbonaceous material like coal, wood etc.

**b) Dust:** consists of fine particles (1 to 200  $\mu m$ ), which are formed during mechanical process of grinding, crushing or blasting etc of any material. E.g. Sandblasting, ore-crushing, stone grinding.

**c) Fumes:** Consists of fine solid particles (0.1 to 1  $\mu m$ ) formed by condensation of vapour on solid materials. They are odourous vapours released during chemical or metallurgical processes.

**d) Mist:** Consists of liquid droplets ( $<10\ \mu\text{m}$ ) formed by condensation of vapour in the atmosphere or release from industries (sulphuric acid mist)

**e) Fog:** If the mist is made up of water droplets whose concentration is high or dense enough to obscure vision, then the mist is called fog.

**f) Lead:** (Particulate lead and its compounds) paint, smelters, lead manufacture, storage batteries and leaded gasoline.

### **Air Quality Standards**

Ambient air quality standards are acceptable concentrations of pollutants in the atmosphere. E.g, Primary standards:  $\text{NO}_2$  (1 hr) = 2ppm,  $\text{CO}$  (1 hr) = 35 ppm &  $\text{SO}_2$ (24 hrs) = 0.14 ppm

MAK values are the limits of concentration to which a person can be exposed for 8 hrs a day for 6 days per week without any harmful effects. Ex.  $\text{CO}$  = 100 ppm &  $\text{SO}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NO}_2$  = 5 ppm

### **Control Measures:**

#### **Source control:**

Use only unleaded petrol

Use petroleum products and other fuels that have low sulphur and ash content

Plant trees along busy streets because they remove particulates and carbon monoxide and absorb noise.

Industries and waste disposal sites should be situated outside the city centre .

Use catalytic converters to help control the emissions of carbon monoxide and hydrocarbons.

#### **Control measures in Industrial centers :**

Emission rates should be restricted to permissible levels

Incorporation of air pollution control equipments like Electrostatic Precipitator, Baghouse Filter, Venturi scrubber, Cyclonic separators in the industries