

**1. AIR POLLUTION**

**ENVIRONMENTAL POLLUTION**

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.

***Common air pollutants sources & their effects:***

<b>Substance</b>	<b>Nature</b>	<b>Sources</b>	<b>Health effects</b>	<b>Environmental effects</b>
Carbon monoxide (CO)	Colourless, odourless, poisonous gas. Formed during incomplete combustion of fuels $2C + O_2 \rightarrow 2CO$	Cigarette smoking, incomplete burning of fuels, motor vehicle exhaust	Causes headaches, anemia, coma, irreversible brain cell damage & death	Increases the globe temperature
Nitrogen dioxide (NO <sub>2</sub> )	Reddish-brown irritating gas & gives photochemical smog, Can be converted to nitric acid $NO_2 + \text{Moisture} \rightarrow HNO_3$	Fuels burning in vehicles, industrial plants	Lung irritation & damage	HNO <sub>3</sub> acid deposition damage trees, soils, & aquatic life. It corrode metals, stones on buildings, statues, monuments etc.
Sulphur dioxide (SO <sub>2</sub> )	Colourless, irritating gas. Formed by combustion of coal & oil. Can be converted to sulphuric acid in atmosphere	Burning of coal, industrial process	Breathing problems	Reduce visibility, acid deposition on trees, soils & aquatic life
Suspended particulate matter (SPM)	Includes variety of particles & droplets (aerosols).	Burning coal in industries, diesel in vehicles, agriculture, unpaved roads, etc	Nose & throat irritation, lung damage, bronchitis, asthma, cancer	Reduce visibility, acid deposition, H <sub>2</sub> SO <sub>4</sub> droplets damage trees, soils & aquatic life
Ozone (O <sub>3</sub> )	Highly reactive irritating, unpleasant odour gas. A major component of photochemical smog.	Nitrogen oxides, chemical reaction with volatile organic compounds	-	Moderates the climate
Photochemical smog	Brownish smoke formed during automobile traffic	Formed due to chemical reaction among nitrogen oxides & hydrocarbon	Breathing problems, cough, eye, nose & throat irritation, heart diseases,	Damage plants & trees. Smog reduce visibility
Lead (Pb)	Solid toxic metal	Paint, smelters, lead manufacture, storage batteries, leaded petrol	Brain & nervous system damage, mental retardation in children, digestive & other health problems, cause cancer	Can harm wild life
Chromium	Solid toxic metal ,	Paint, smelters, chromium manufacture, chromium plating	Perforation of nasal septum, chrome holes, ulcer, central nervous system disease, cancer.	

### *Sources of air pollution*

- Natural pollution - volcanic eruptions, forest fires, biological decay.
- Man – made activities – Thermal power plants, agricultural activities.

### *Classification*

- *Primary pollutant* – these are those emitted directly in the atmosphere in harmful form like CO, NO.
- *Secondary pollutant* – these may react with one another or with the basic components of air to form new pollutants.

### *Control Measures*

#### **1. Source control**

- ❖ Use only unleaded petrol
- ❖ Use 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.
- ❖ Houses, schools, restaurants & park should not be located on busy street

#### **2. Control measures in Industrial centers**

- ❖ Emission rates should be restricted to permissible levels
- ❖ Air pollution control equipments must be made mandatory
- ❖ Continous monitoring of the atmosphere to know the emission level

### *Equipments used to control air pollution:*

Mechanical devices such as scrubbers, cyclone separator, bag houses & electro-static precipitators, reducing particulate pollutants.

## **2. ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION**

- Plant more trees
- Help more in pollution prevention than pollution control
- Use water, energy and other resources efficiently
- Purchase recyclable, recycled and environmentally safe products
- Reduce deforestation
- Remove NO from motor vehicular exhaust
- Use of eco friendly products.
- Use CFC free refrigerators
- Use natural gas than coal
- Use machines in well ventilated areas
- Use less polluting substances for cleaning agents, paints & other products
- Increase use of renewable resources
- Don't use polystyrene cups that have chloro fluoro carbon (CFC) which destroy ozone
- Use rechargeable batteries which will reduce metal pollution
- Use organic manure instead of inorganic fertilizers
- Reduce garbage by recycling & reuse, Slow population growth

## **3. WATER POLLUTION**

It may be defined as “the alteration in physical, chemical and biological characteristics of water which may

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cause harmful effects on human and aquatic life.

### Types, effects and sources of water pollution

#### 1. Infectious agents:

**Example:** Bacteria, viruses, protozoa and parasitic worms.

**Sources:** Human and animal wastes.

**Effects:** Variety of diseases.

#### 2. Oxygen demanding wastes:

**Example:** Animal manure and plant debris that can be decomposed by aerobic bacteria.

**Sources:** Sewage, paper mills, and food processing facilities.

**Effects:** Wastes can degrade quality by depleting water of dissolved oxygen, make aquatic life to die

#### 3. Inorganic Chemicals:

**Example:** Water soluble inorganic chemicals. Compounds of toxic metals such as lead, arsenic and selenium. Salts such as NaCl in water.

**Sources:** Surface runoff, industrial effluents, household cleansers

**Effects:** skin cancers & neck damage  
Damage nervous system, liver & kidneys  
Lower crop yields, Harm fish & other aquatic life  
Accelerate corrosion of metals

#### 4. Organic Chemicals:

**Examples:** Oil, gasoline, plastics, pesticides, cleaning solvents, detergents

**Sources:** Industrial effluents, household cleansers, runoff from farms

**Effects:** Causes nervous system damage, cancer, harm fish & wild life.

#### 5. Radio active materials:

**Example:** radioactive isotopes of iodine, radon, uranium, cesium, and thorium

**Sources:** Nuclear power plants, mining, nuclear weapons production.

**Effects;** genetic mutation, birth defects, and certain cancers.

#### 6. Point and non-point sources of water pollution

**Point sources:** These are discharged pollutants at specific locations through pipes, ditches or sewers  
eg: factories, sewage treatment plants

**Non-point sources:** They are usually large areas or air shed that pollute water by runoff

**Eg:** runoff of chemical from cropland to surface water.

**Testing of river water:**

Dissolved oxygen (DO) = It is the amount of oxygen dissolved in a given quantity of water at a particular pressure & temperature.

Biochemical Oxygen Demand (BOD) = It is the amount of oxygen required for the biological decomposition of organic matter present in the water

Chemical Oxygen Demand (COD) = It is the amount of oxygen required for chemical oxidation of organic matter using oxidizing agent like  $K_2Cr_2O_7$  &  $KMnO_4$

**Control measures of water pollution**

- The administration of water pollution should be in the hand of state or central government.
- Scientific techniques are needed to control pollution in river, ponds or streams.
- Industrial plants should be based on recycling operations.
- The national goal should be “conservation of forests” and campaign should be “plant more trees”.
- Highly qualified and effective persons should be consulted for effective control of water pollution.
- Awareness to public through radio, tv etc>
- Suitable laws, standards and practices should be framed to regulate pollution.
- Basic and applied research in public health engineering be encouraged.
- The possible of reuse or recycling of waste material should be encouraged.
- Companies should not discharge any type of waste either treated or untreated into rivers, lakes, ponds etc.

**4.BHOPAL GAS TRAGEDY:**

On night of 3<sup>rd</sup> December 1984 in Bhopal city of Madhya Pradesh

At Union carbide India Ltd, which manufacture carbonate pesticides using methyl isocyanate (MIC)

Due to failure of coolant, the reactor got exploded & 40 tons of MIC leaked over 40 sq.km area.

**Nature of MIC:** It is a toxic gas, affects lungs, eyes & causes irritation in skin. Remove oxygen from lungs & cause death.

**Effects in Bhopal:** About 5000 persons died, 1000 became blind, 65,000 people suffered from eye, respiratory, neuromuscular problems.

**CHERNOBYL NUCLEAR DISASTER:(Nuclear pollution)**

In April 26 1986, melt down of the Chernobyl nuclear reactor in Russia, has leaked out the radioactive rays & radioactive materials.

**Effects:** about 2000 persons died, more suffered due to degeneration of cells, severe bleeding, anaemia, skin cancer, animal's plants was also affected more.

**4.SOIL POLLUTION**

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It may be defined as “the contamination of soil by human and natural activities which may cause harmful effects on living beings”.

### *Types*

#### **1. Industrial wastes**

**Sources:** Pulp and paper mills, chemical industries, oil refineries, sugar factories, tanneries, textile, steel, fertilizers etc.

**Effects:** Affect and alter the chemical and biological properties of soil.

Hazardous chemicals enter into human food chain from the soil and finally lead to serious effects.

#### **2. Urban wastes**

**Sources and effects:** Plastics, Glasses, metallic cans, fibers, papers, rubbers, street sweepings, and other discarded manufactured products. These are also dangerous.

#### **3. Agricultural practices**

**Sources and effects:** Huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, are reported to cause soil pollution.

#### **4. Radioactive pollutants**

**Sources and effects:** These are resulting from explosions of nuclear dust and radio active wastes penetrate the soil and accumulate there by creating land pollution.

#### **5. Biological agents**

**Sources and effects:** Soil gets large quantities of human, animal and birds excreta which constitute the major source of land pollution by biological agents.

### ***Control measures of soil pollution (give explanation for each topic on your own)***

- ✓ Population growth
- ✓ Decrease of the available farm land due to urbanization
- ✓ Forestry and farm practices
- ✓ Proper dumping of unwanted materials
- ✓ Production of natural fertilizers
- ✓ Proper Hygienic condition
- ✓ Public awareness
- ✓ Recycling and Reuse of wastes
- ✓ Ban on Toxic chemicals.

## **5. MARINE POLLUTION**

It may be defined as “the discharge of waste substances into the sea resulting in harm to living resources hazards to human health, hindrance to fishery and impairment of quality for use of sea water”.

### **Source of marine pollution**

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### ***Dumping the wastes:***

Huge amounts of sewage, garbage, agricultural discharge, pesticides, heavy metals, plastics are dumped in sea. **Effects:** So many marine birds are affected by gastro-intestinal disorders.

### ***Oil pollution of Marine water:***

Caused by petroleum and its products.

**Effects:** Oil films inhibit photosynthesis & formation of oxygen.  
This inhibit the growth of marine plants

### **Effects of marine pollutants**

- Cause more damage in birds as thinning of eggshell and tissue damage of egg.
- Oil spilling causes low body temperature in birds resulting in hypothermia.
- Oil films decreases the rate of oxygen uptake by water.
- Cause damage to marine fauna & flora including algae, fish, birds, invertebrates
- Oil films inhibit photosynthesis & inhibit the growth of the plants
- Hydrocarbon & benzpyrene accumulate in fish & consumption of fish by man cause cancer.

### **Control measures of marine pollution**

- ❖ Plants for conserving marine biodiversity must be taken into account of human needs.
- ❖ People should be educated about marine ecosystems and the benefits offered by them.
- ❖ Local communities must be involved in protecting and managing their coastal resources.
- ❖ Social and economic incentives must be offered for conserving and sustainable use of marine resources.
- ❖ Governments must manage their own water while extending cooperation to the neighboring states.

## **6.NOISE POLLUTION**

It may be defined as “the unwanted, unpleasant or disagreeable sound that causes discomfort for all living beings”. Sound intensity is measured in decibel (dB).

### **Types of noise**

- Industrial noise (drilling sound, mechanical saws)
- Transport noise (bus, trucks, motors, scooters, rail traffic noise)
- Neighborhood noise (Musical instruments, TV, VCR, Radios, telephones, loudspeakers ets)

### **Effects of Noise pollution**

- ✓ This affects human health, comfort and efficiency.
- ✓ It causes muscles to contract leading to nervous breakdown, tension.
- ✓ It affects health efficiency and behavior.
- ✓ loss of hearing due to excessive noise,
- ✓ impulsive noise also causes psychological and pathological disorders.
- ✓ Brain is also adversely affected by loud and sudden noise as that of jet and aero plane noise.
- ✓ Ultrasound sound can affect the digestive, respiratory, cardio vascular system.

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- ✓ Rate of heart beat decrease or increase depending on the type of noise
- ✓ Blood is also thickened by excessive noises
- ✓ Optical system is also affected by noise pollution & lead to colour perception & loss of night vision

### Control and preventing measures

- ❖ *Source control* – acoustic treatment to machine surface, design changes, limiting the operational timings.
- ❖ *Transmission path intervention*- the source inside a sound insulating enclosure, construction of a noise barrier or provision of sound absorbing materials.
- ❖ *Oiling* – Proper oiling will reduce the noise from the machines.
- ❖ *Receptor control*: Protection of the receiver by altering the work schedule, by using ear plugs etc
- ❖ *Planting trees also act as effective noise barriers*
- ❖ *Different absorptive materials can be used to control interior noise.*

## 7.THERMAL POLLUTION

It may be defined as the “addition of excess of undesirable heat to water that makes it harmful to man, animal or aquatic life or otherwise causes significant departures from the normal activities of aquatic communities in water”

### Sources of thermal pollution

1. *Nuclear power plants* (drainage from hospitals, research institutes, nuclear experiments & explosions, emission from nuclear reactors)
2. *Coal fired power plants* (some thermal power plants use coal as fuel, condenser coil are cooled & discharge the hot water back to the nearby lake, & kills the fish & marine organisms)
3. *Industrial effluents* (Textile, paper, pulp, sugar industries discharge wastes)
4. *Domestic sewage* (Municipal sewage has higher temperature which decrease the dissolved oxygen content & result in foul & offensive smell in water)
5. *Hydro – electric power.*

### Effects of thermal pollution

- Reduction in dissolved oxygen
- Increase in Toxicity
- Interference with biological activities
- Interference with reproduction
- Direct mortality
- Food storage for fish.

### Control measures of thermal pollution

- Cooling towers - This is used as a coolant wet cooling tower, dry cooling tower.
- Cooling ponds and spray ponds.
- Artificial lakes – The heated effluents can be discharged into the lake at one end and the water for cooling purposes from the other end.

## 8.NUCLEAR HAZARD:

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The radiation hazard in the environment comes from ultraviolet, visible, cosmic rays & microwave radiation which produce genetic mutations in man

### *Sources of Nuclear Hazards:*

Natural sources: Space which emits cosmic rays, soil, rocks, air, water, food, radioactive radon-222 etc. Man-made sources: Nuclear power plants, X-rays, nuclear accidents, nuclear bombs, diagnostic kits etc.

### *Effects of Nuclear Hazards:*

#### **WATER ACT 1974:**

This act provides for maintaining & restoring the source of water Provides for preventing & controlling water pollution.

#### *Objectives:*

- To protect water from all kinds of pollution
- To preserve the quality of water
- Establishment of Central & State Boards for preventing water pollution
- Restrain any person for discharging sewage/effluent into any water body
- Any contravention of the standards leads to prison for 3 to 6 months
- Requires permission to set up an industry which discharges effluent.

#### *State pollution Control Board:*

- Take step to establish any industry, disposal system, extension/addition in industry, discharge of effluent into river
- Use any new / altered outlet for discharge of sewage
- Begin to make any new discharge of sewage.

***Punishment:*** Stoppage of supply of electricity, water / any other services Imprisonment for 1½ years to 6 years & Rs. 5000/- fine.

#### **AIR ACT 1981:**

Enacted in the Conference held at Stockholm in 1972.  
Deals with problems related to air pollution, quality of air etc.

#### *Objectives of air act:*

To prevent, control & abatement of air pollution To maintain the quality of air

#### *Important features of air pollution:*

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- The Central Board settle disputes between state boards, provide technical assistance & guidance to State board.
- The State Board verify the emissions of air pollutants from industrial / automobile units
- The State Board Collect information about air pollution
- SB examine the standards of manufacturing process & control equipment
- SB can advise State Government to declare the heavily polluted areas & advice to avoid burning of waste products.
- Operation of industrial unit is prohibited in a heavily polluted areas
- Violation of law is punishable with imprisonment & Fine

### **FOREST ACT 1980:**

Provides conservation of forests & related aspects. Arrest deforestation

#### ***Objectives:***

To protect & conserve the forest

To ensure judicious use of forest products

#### ***Important Features of Forest Act:***

Forests are not diverted without the prior permission of the Central Government Land registered for forest may not be used for non-forest purposes

Any illegal activity in a forest area can be stopped immediately Clearance of forest land for re-forestation is forbidden

One who violates the forest law is punishable.

### **Wildlife Act 1972:**

Aimed protect & preserve wildlife.

Wildlife refers to all animals & plants

It is declining due to human actions for wildlife's skins, furs, feathers, ivory etc.

#### ***Objectives:***

To maintain ecological process & life supporting system To preserve biodiversity

To ensure a continuous use of species.

#### ***Important Features:***

Covers the right & non-rights of forest dwellers

Provides restricted grazing in sanctuaries & prohibits in national parks Prohibits the collection of non-timber forest.

**Environment Act 1986:**

It is a general legislation law to rectify the gaps & laps in above acts.

This act empowers the Central Govt. to fix the standard of quality of air, water, soil & noise.

***Objectives:***

To protect & improvement of the environment

To prevent hazards to all living creatures & property

To maintain peaceful relationship between humans & their environment

***Important Features of Environment Act:***

Empowers safeguard measures to Prevent accidents which cause pollution. Gives remedial measures if accident occurs.

The Govt. has authority to close or prohibit or regulate any industry & its operation One who violates the act will be punishable with fine upto one lakh

If the violation continues, an additional fine of Rs. 5000/- per day is imposed

The act empowers the officers of Central Government to inspect the site / plant / machinery for preventing pollution. Collects samples of air, water, soil or other material from any factory / its premises for testing.

**14. PUBLIC AWARENESS**

Our environment is presently degrading due to many activities like pollution, deforestation, overgrazing, rapid industrialization and urbanization.