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Environmental Pollution



Pollution Definition

- ▶ **Pollution** is the introduction of contaminants into the natural environment that cause adverse change
- ▶ The presence in or introduction into the environment of a substance which has harmful or poisonous effects
- ▶ Pollution can take the form of chemical substances or energy, such as noise, heat or light



History of Pollution

- ▶ Pollution started from prehistoric times when man created the first fires - humans burnt wood to cook food, the smoke emitted was pollution
- ▶ Metal forging a key turning point in the creation of significant air pollution levels outside the home
- ▶ But level of pollution low and absorbed by earth's natural systems – main pollution from animal waste, household waste, smoke and ash
- ▶ With Industrial Revolution, with the invention of machine from printing press to vehicles, the level and type of pollution rose sharply



Pollutant -- Definition

- ▶ A pollutant is a waste material that pollutes air, water or soil
- ▶ Substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource
- ▶ A pollutant may cause long- or short-term damage by changing the growth rate of plant or animal species, or by interfering with human amenities, comfort, health, or property values
- ▶ Pollutants may be classified by various criteria:
 - 1) By the origin: whether they are natural or man-made (synthetic).
 - (2) By the effect: on an organ, specie, or an entire ecosystem.
 - (3) By the properties: mobility, persistence, toxicity.
 - (4) By the controllability: ease or difficulty of removal.



Types of Pollutants

- ▶ Three factors determine the severity of a pollutant: its **chemical nature, the concentration and the persistence**
- ▶ Pollutants are generally grouped under two types:
- ▶ **Biodegradable pollutants** – Biodegradable pollutants are broken down by the activity of micro-organisms and enter into the biogeochemical cycles. Examples of such pollutants are domestic waste products, urine and faecal matter, sewage, agricultural residue, paper, wood and cloth etc.
- ▶ **Non- Biodegradable pollutants** – Non-biodegradable pollutants are stronger chemical bondage, do not break down into simpler and harmless products. These include various insecticides and other pesticides, mercury, lead, arsenic, aluminium, plastics, radioactive waste etc.



Types of Pollutants.....

- ▶ **Stock pollutants** -- Pollutants, towards which the environment has little or no absorptive capacity are called *stock pollutants* - e.g. persistent synthetic chemicals, non-biodegradable plastics, and heavy metals). Stock pollutants accumulate in the environment over time
- ▶ **Fund pollutants** -- Fund pollutants are those for which the environment has some absorptive capacity. Fund pollutants do not cause damage to the environment unless the emission rate exceeds the receiving environment's absorptive capacity (e.g. carbon dioxide, which is absorbed by plants and oceans)
- ▶ Another classification of pollutants is based on its harmful effects –
- ▶ Common Elements
- ▶ Toxic Elements
- ▶ Radioactive Elements



Six Common Pollutants



Major Types of Pollution

- ▶ Air pollution
- ▶ Water
- ▶ Land
- ▶ Noise
- ▶ Marine

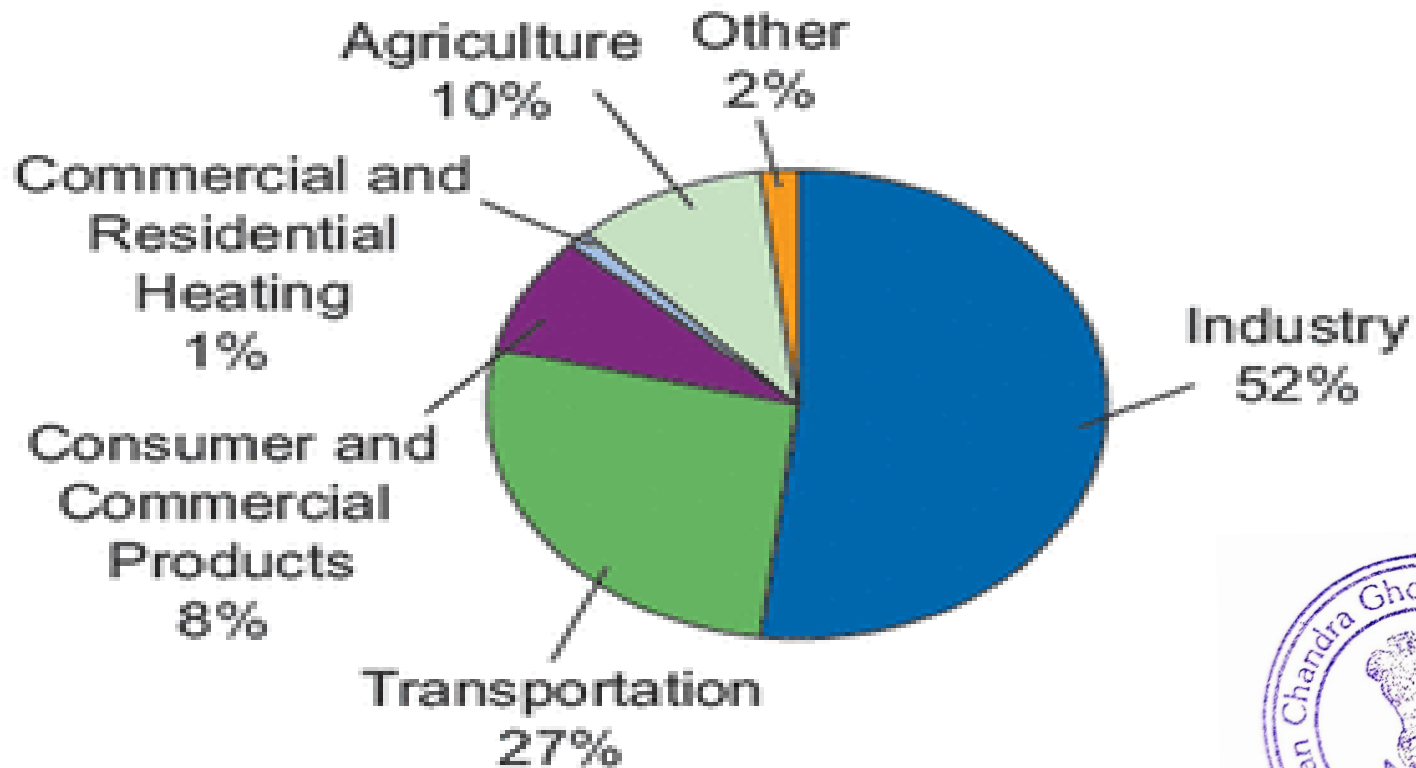


Air Pollution

- ▶ Air Pollution by far the most harmful form of pollution in our environment
- ▶ The pollutants for air pollution are divided into two categories
- ▶ The first type of pollutants known as **primary pollutants** are those which are produced from a certain process like the smoke emitted from the vehicles
- ▶ The second type of pollutants are termed as the **secondary pollutants** and these are the ones which are generated due to the reaction of primary pollutants with natural air



Sources of Emissions of Air Pollutants



Types of Air Pollutants

Types of Pollutants

- **Primarily air pollutants** can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants
- **Secondary pollutants** are the ones that are caused by the inter mingling and reactions of primary pollutants. [Smog](#) created by the interactions of several primary pollutants is known to be as secondary pollutant.



Pollutant Standard Index (PSI)

- ▶ The **Pollutant Standards Index**, or **PSI**, is a type of air quality index, which is a number used to indicate the level of pollutants in air.
- ▶ The **PSI** considers six air **pollutants** - sulphur dioxide , particulate matter , fine particulate matter , nitrogen dioxide , carbon monoxide and ozone
- ▶ PSI range: 0-50 is good; in Delhi in November 2016 PSI crossed 200 which is very unhealthy; above 300 is hazardous



Effects of Air Pollution

- ▶ Acid rain (formed in the air) destroys fish life in lakes and streams.
- ▶ Chlorofluorocarbons (CFC), released from refrigerators, air-conditioners, deodorants and insect repellents cause severe damage to the Earth's environment. This gas has slowly damaged the atmosphere and depleted the ozone layer leading to global warming
- ▶ Excessive ultraviolet radiation coming from the sun through the ozone layer in the upper atmosphere which is eroded by some air pollutants, may cause skin cancer in wildlife.
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Water Pollution

- ▶ **Water pollution** is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater)
- ▶ This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds.
- ▶ Water pollution affects the entire biosphere



Water Pollution – Control Measures

- ▶ 1) Sewage Treatment -- In urban areas of developed countries, domestic sewage is typically treated by centralized sewage treatment plants
- ▶ 2) Industrial Wastewater treatment – Effluent treatment plants



Marine Pollution

- ▶ **Marine pollution** occurs when harmful, or potentially harmful, effects result from the entry into the ocean of chemicals, particles, industrial, agricultural and residential waste, noise, or the spread of invasive organisms
- ▶ Marine pollution includes a range of threats including from land-based sources, oil spills, untreated sewage, heavy siltation, eutrophication (nutrient enrichment), invasive species, persistent organic pollutants (POP's), heavy metals from mine tailings and other sources, acidification, radioactive substances, marine litter, overfishing and destruction of coastal and marine habitats
- ▶ Air pollution is also a contributing factor by carrying off pesticides or dirt into the ocean



Marine Pollution Causes

- ▶ **3 main types of inputs of pollution into the ocean:** direct discharge of waste into the oceans, runoff into the waters due to rain, and pollutants that are released from the atmosphere
- ▶ When pesticides , toxic metals are incorporated into the marine ecosystem, they quickly become absorbed into marine food webs
- ▶ Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs), found in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment
- ▶ Deep sea mining



Marine Eutrophication

- ▶ Effect of eutrophication on marine life
- ▶ Eutrophication is an increase in chemical nutrients, typically compounds containing nitrogen or phosphorus, in an ecosystem
- ▶ It can result in an increase in excessive plant growth and decay of the ecosystem due to lack of oxygen
- ▶ Results in severe reductions in water quality, fish, and other animal populations



Marine Pollution : Acidification

- ▶ The oceans are normally a natural carbon sink, absorbing carbon dioxide from the atmosphere
- ▶ Because the levels of atmospheric carbon dioxide are increasing, the oceans are becoming more acidic
- ▶ Oceans and coastal ecosystems play an important role in the global carbon cycle and have removed about 25% of the carbon dioxide emitted by human activities between 2000
- ▶ Rising ocean temperatures and ocean acidification means that the capacity of the ocean carbon sink will gradually get weaker



Land Pollution

- ▶ **Land pollution** is any type of destruction of the Earth
- ▶ It can either occur naturally or as a result of human activities, such as industrial development, agricultural development, coal mining, deforestation and overcrowded landfills
- ▶ Natural factors: The natural factors that **cause soil** erosion includes volcanic eruptions, changes in rainfall pattern, earthquakes, topographic changes, wind and glacier movements.



Land Pollution....

- ▶ Humans produce vast quantities of waste
- ▶ Domestic waste
- ▶ Toxic Waste
- ▶ Radioactive waste
- ▶ Industrial waste - mining
- ▶ Agricultural waste



Effects of Land Pollution

- ▶ Soil Erosion
- ▶ Low yields
- ▶ Desertification
- ▶ Less land for cultivation



Noise Pollution

- ▶ **Noise pollution** or **noise disturbance** is the disturbing or excessive noise that may harm the activity or balance of human or animal life
- ▶ Noise pollution is a major problem in India. The government of India has rules & regulations against firecrackers and loudspeakers, but enforcement is extremely lax
- ▶ It is measured in the units of decibels and is denoted by the dB. The noise which is more than 115 dB is intolerant
- ▶ The industrial limit of sound in the industries must be 75 dB according to the world health organization. A type writer can produce a sound at 60 dB



Causes of Noise Pollution

- ▶ Industrial activity
- ▶ Poor Urban Planning
- ▶ Transportation and Construction
- ▶ Social Events
- ▶ Household Gadgets

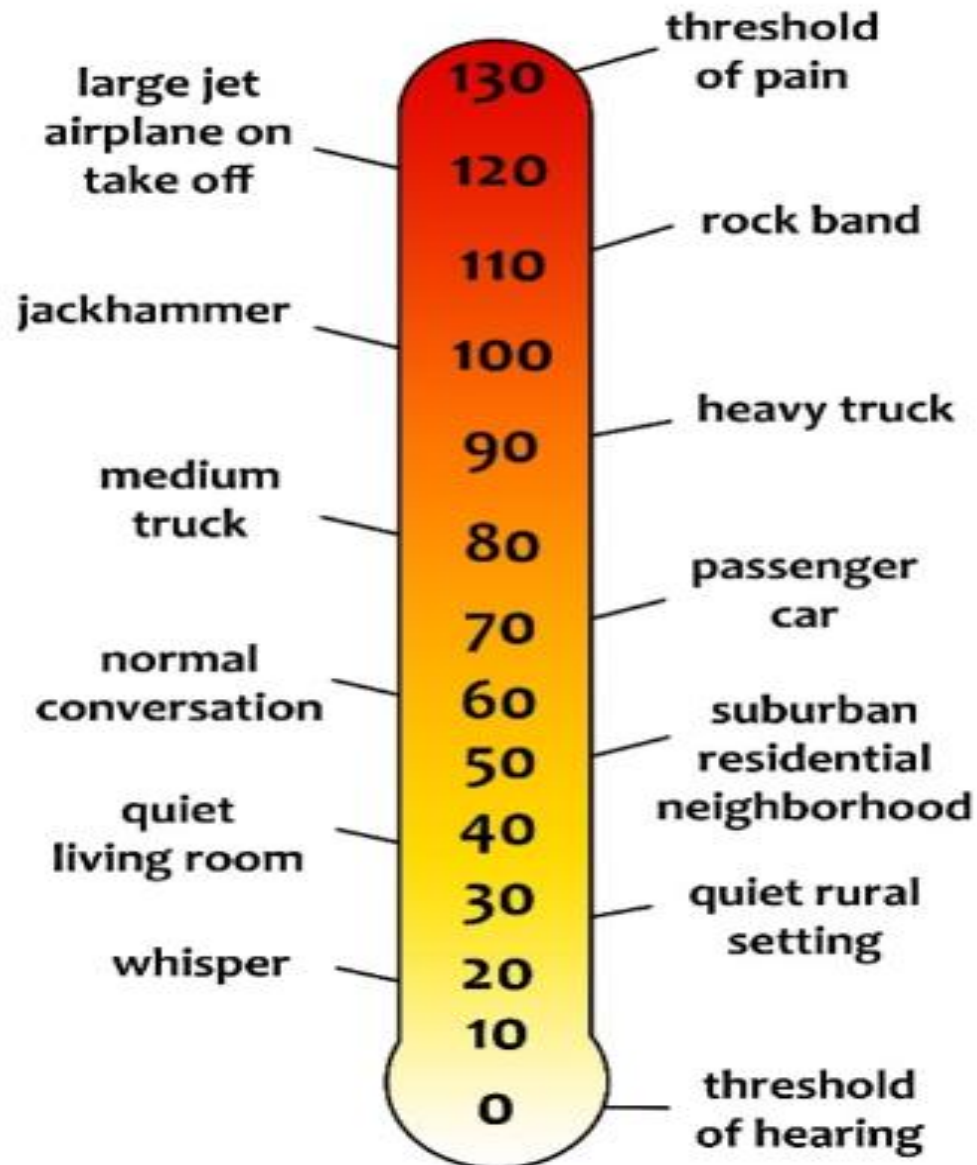


Effects of Noise Pollution

- ▶ Hearing Problems
- ▶ Sleeping Disorders
- ▶ Cardiac problems
- ▶ Effect on Wild life



Decibel Scale (dBA)



Pollution Control

- ▶ Pollution control is a term used in environmental management
- ▶ It means the control of emissions and effluents into air, water or soil
- ▶ Pollution prevention and waste minimization are more desirable than pollution control
- ▶ **Pollution Control Practices :**
- ▶ Recycling
- ▶ Reusing
- ▶ Waste minimisation
- ▶ Mitigating
- ▶ Preventing
- ▶ Compost



Polluter Pays Principle

- ▶ Around 300 BC, **Kautiliya** in his *Arthasastra* prescribed different levels of financial penalties for causing harm to the environment
- ▶ *If anyone intentionally spoils the water of another... let him not only pay damages, but purify the stream or cistern which contains the water.* **Plato, Greek Philosopher**
- ▶ The '**polluter pays principle**' is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment
- ▶ The polluter pays principle underpins environmental policy such as an **ecotax**, which, if enacted by government, deters and essentially reduces greenhouse gas emissions
- ▶ The **Precautionary Principle** is a strategy to cope with possible risks where scientific understanding is yet incomplete, such as the risks of nano technology, genetically modified organisms and systemic insecticides.



Precautionary Principle

- ▶ In simple terms, the PP conveys the common-sense based advice – to err on the side of caution. The principle intends to prevent harm to humans, environment, and eco-system at large.
- ▶ Dioxin is a general term used to describe a group of hundreds of chemicals that are highly persistent in the environment. Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons
- ▶ The major sources of dioxin in the environment include waste-burning, paper mills that use chlorine bleaching, production of polyvinylchlorine (PVC) plastics, and chlorinated chemicals like pesticides
- ▶ Dioxin is very toxic and has been measured throughout the globe and its persistence, both in humans and the environment, means that future generations will be exposed to dioxin produced today
- ▶ Harm caused by dioxin to humans and ecosystems is likely to be irreversible, or reversible only over decades



Central Pollution Control Board

- ▶ The **Central Pollution Control Board** (CPCB) of India is a statutory organisation under the Ministry of Environment, Forest and Climate Change;
- ▶ Established in 1974
- ▶ CPCB conducts environmental assessments and research. It is responsible for maintaining national standards under a variety of environmental laws, in consultation with zonal offices, tribal, and local governments
- ▶ It has responsibilities to conduct monitoring of water and air quality, and maintains monitoring data

