

Environmental diseases

Environmental Diseases

- These are conditions caused by exposure to harmful environmental agents.
- The environment includes all external factors impacting human health, such as air, water, soil, radiation, and industrial chemicals.
- Environmental diseases are typically **non-communicable** and may be **acute** or **chronic**.



Common environmental factors include:

- Air pollutants
- Industrial chemicals
- Radiation (e.g., UV, ionizing radiation)
- Occupational exposures (e.g., asbestos, silica)
- Climate factors (e.g., extreme heat)

Air Pollution and Smoking

Air Pollution

- Air pollution refers to the presence of harmful or excessive substances in the atmosphere that negatively affect human health, ecosystems, and the climate.
- It can be **outdoor (ambient)** or **indoor** and arises from both **natural** and **human-made** sources.

Common Sources

- Fossil fuel combustion (e.g., vehicles, power plants)
- Industrial emissions
- Household cooking using biomass fuels



- Wildfires
- Agricultural burning

Types of Air Pollutants

A. Particulate Matter (PM):

- Solid or liquid particles suspended in air (e.g., PM_{2.5}, PM₁₀)
- Capable of penetrating deep into the lungs and bloodstream

B. Gaseous Pollutants:

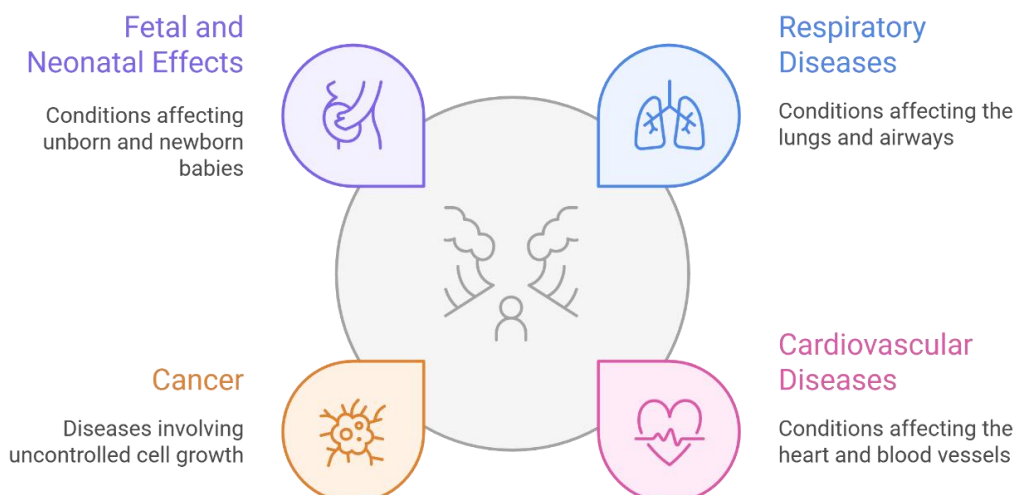
- Sulfur dioxide (SO₂)
- Nitric oxide (NO)
- Nitrogen dioxide (NO₂)
- Carbon monoxide (CO)

These pollutants may act individually or together to cause health issues.

Smoking as an Air Pollution Source

- Cigarette smoke is a major source of indoor air pollution and a complex mixture of over 7,000 chemicals, including:
 - CO (carbon monoxide)
 - NO and NO₂
 - Volatile organic compounds (e.g., benzene)
 - Heavy metals (e.g., cadmium, lead)
 - Particulate matter
 - Carcinogens (e.g., nitrosamines, polycyclic aromatic hydrocarbons)
- Smoking contributes directly to pollutant exposure and second-hand smoke affects non-smokers in indoor environments.

Health Effects of Pollutant Exposure (Air Pollution & Smoking)



A. Respiratory Diseases

- Chronic Obstructive Pulmonary Disease (COPD), including chronic bronchitis and emphysema
- Asthma

B. Cardiovascular Diseases

- Atherosclerosis
- Myocardial infarction (heart attack)

C. Cancer

- Lung cancer
- Cancers of the oral cavity, esophagus, bladder, etc.

D. Fetal and Neonatal Effects

- Intrauterine growth retardation
- Low birth weight
- Preterm birth

Combined Effects and Public Health Relevance

- Simultaneous exposure to air pollution and cigarette smoke can lead to **additive or synergistic health effects**, particularly affecting the **lungs** and **cardiovascular system**.
- **Vulnerable groups** include:
 - Children
 - Elderly
 - Individuals with pre-existing health conditions

Preventive Strategies

- Emission regulation (e.g., Clean Air Acts)
- Public smoking bans
- Promotion of clean energy (e.g., electric vehicles, solar power)
- Improved indoor ventilation
- Health education and anti-smoking campaigns
- Use of personal protective equipment (in occupational settings)

Harmful Gases in Air Pollution

Sulfur Dioxide (SO₂)

Sources

- Burning of fossil fuels (coal, oil) in power plants, refineries, and industrial boilers.
- Smelting of metal ores that contain sulfur.
- Volcanic activity (natural source).
- Tobacco smoke contains trace amounts.

Properties

- Colorless gas with a sharp, choking odor.
- Highly soluble in water, forming **sulfurous acid** (H_2SO_3).

Mechanism of Damage

- Upon inhalation, SO_2 dissolves in the mucous membranes of the respiratory tract forming acids.
- Causes **inflammatory response**, **mucosal irritation**, and **bronchoconstriction**.

Health Effects

- **Acute Exposure:**
 - Irritation of eyes, nose, and throat.
 - Bronchospasm especially in **asthmatics**.
 - Reflex coughing and mucus secretion.
- **Chronic Exposure:**
 - Exacerbates **chronic bronchitis** and **asthma**.
 - Long-term exposure may cause **airway remodeling** and reduced lung function.
- **Children and elderly** are more sensitive.

Environmental Effects

- Combines with water in the atmosphere to form **acid rain** (H_2SO_4), damaging crops, aquatic systems, and infrastructure.

Nitric Oxide (NO) and Nitrogen Dioxide (NO₂)

- These are collectively referred to as **nitrogen oxides (NO_x)**, with NO₂ being more toxic.

Sources

- Emissions from vehicles and power plants.
- Cigarette smoke.
- Combustion of natural gas.

- Indoor sources: gas stoves, unvented space heaters.

Properties

- **NO**: Colorless, relatively inert gas that oxidizes to NO_2 in air.
- **NO_2** : Reddish-brown toxic gas with a strong odor; more reactive and damaging.

Mechanism of Damage

- Penetrates deep into the lungs due to low solubility.
- Generates **reactive oxygen species (ROS)** leading to **oxidative stress**.
- Damages **alveolar epithelium**, increasing susceptibility to infections.

Health Effects

- **Acute Exposure**:
 - Irritation of lower respiratory tract.
 - **Pulmonary edema** at high concentrations.
 - Shortness of breath, cough, wheezing.
- **Chronic Exposure**:
 - Increases risk of **chronic obstructive pulmonary disease (COPD)**.
 - Impaired lung growth in children.
 - Exacerbates **asthma** and **respiratory infections**.
- Strong association with **urban air pollution** and **vehicular emissions**.

Environmental Effects

- Contributes to **ground-level ozone (O_3)** formation and **photochemical smog**.
- Promotes **acid rain (HNO_3)**.
- Greenhouse gas implications.

Carbon Monoxide (CO)

Sources

- Incomplete combustion of carbon-containing fuels (wood, coal, gasoline).
- Vehicle exhausts in enclosed or poorly ventilated spaces.
- Indoor sources: poorly ventilated stoves, fireplaces, water heaters.
- **Tobacco smoke** is a major source for smokers and passive smokers.

Properties



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