Air quality and pollution Lecturer: Muthana Waad
Level 3
Lecture one

Introduction

Pure air is a fundamental requirement for human health and well-being. The Earth's atmosphere is a complex mixture of gases that provides the necessary environment for life. However, human activities have significantly altered this composition, leading to what we define as Air Pollution.

Air pollution: is the presence of substances (gaseous, liquid, or solid) released into the ambient air by human activity that are not part of the natural atmosphere, or exist at concentrations higher than natural levels for a sufficient time to cause environmental damage.

Atmospheric Composition

Under natural conditions, the dry atmosphere consists of a stable mixture of gases:

Nitrogen (N_2): 78.08%

Oxygen (O_2): 20.95%

Argon (Ar): 0.93%

Carbon Dioxide (CO_2): ~0.03%

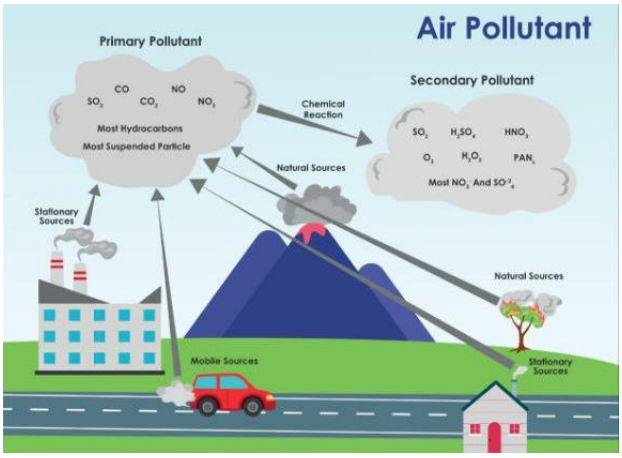
Water Vapour: Up to 4% depending on humidity.

Scales of Air Pollution

Micro-scale: Primarily concerns Indoor Air Pollution (e.g., radon, tobacco smoke, ventilation issues).

Meso-scale: Urban air pollution (city-wide) caused by industrial and mobile sources.

Macro-scale: Global impacts such as Acid Rain and Ozone Layer Depletion.



Classification of Air Pollutants

A. Based on Origin

Primary Pollutants: Emitted directly from sources (e.g., CO, SO_2, NO_x).

Secondary Pollutants: Formed through atmospheric reactions (e.g., Ground-level Ozone O_3).

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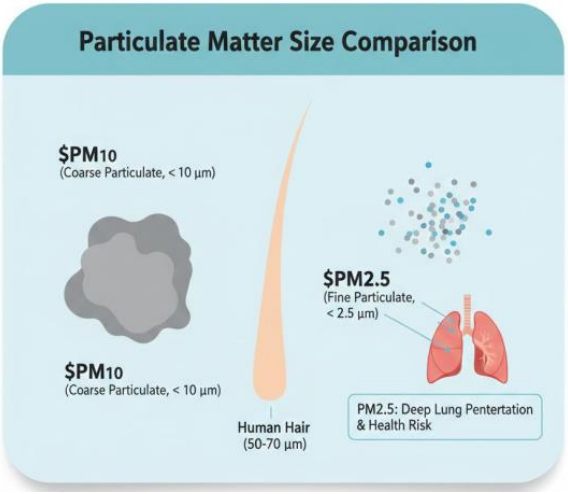
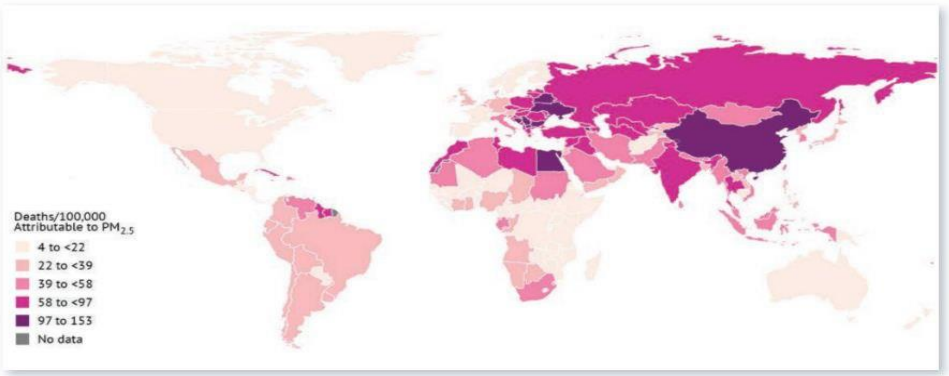
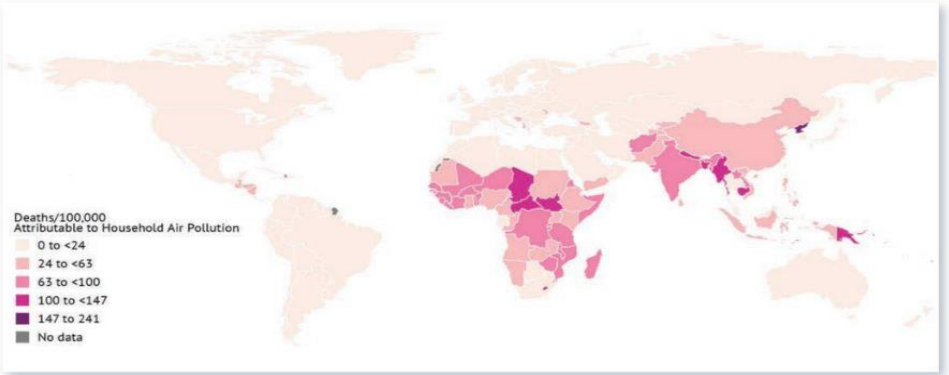
B. Based on Physical State

Particulate Matter (PM):

- PM10: Coarse particles.
- PM2.5: Fine particles (the most hazardous to human lungs).







In 2021, particulate matter air pollution (i.e., ambient and household $PM_{2.5}$) was the leading contributor to total DALYs followed by high blood pressure, smoking, low birth weight, and short gestation.

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Major Sources of Pollution

Stationary Sources: Industrial plants, power stations, and residential heating.

Mobile Sources: Vehicles, aircraft, and maritime transport.

Indoor Sources: Cooking with biomass, building materials, and mold.

Public Health and Global Impact

According to the World Health Organization (WHO), air pollution is responsible for approximately 7 million premature deaths annually. It is linked to:

Ischemic heart disease and strokes.

Chronic Obstructive Pulmonary Disease (COPD).

Lung cancer and acute respiratory infections in children.

Conclusion

Environmental Health professionals must understand the dynamics of air pollutants to implement effective control strategies. This involves monitoring ambient air quality and enforcing emission standards to protect public health.