Overview of Particle Air Pollution ($PM_{2.5}$ and PM_{10})

Air Quality Communication Workshop

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What is Particle Air Pollution?

- Particulate matter (PM), also called particle pollution, is a general term for extremely small particles and liquid droplets in the atmosphere
- $PM_{2.5}$ (fine particles): $d \leq 2.5$ μm
- PM_{10} (coarse particles): $d \leq 10$ μm
- **Primary** sources:
  - Incomplete combustion
  - Automobile emissions
  - Dust
  - Cooking
- **Secondary** sources:
  - Chemical reactions in the atmosphere

Wood-Burning Stoves

Forest Fires

Diesel Engines

Natural Sources

There are many sources of particle pollution

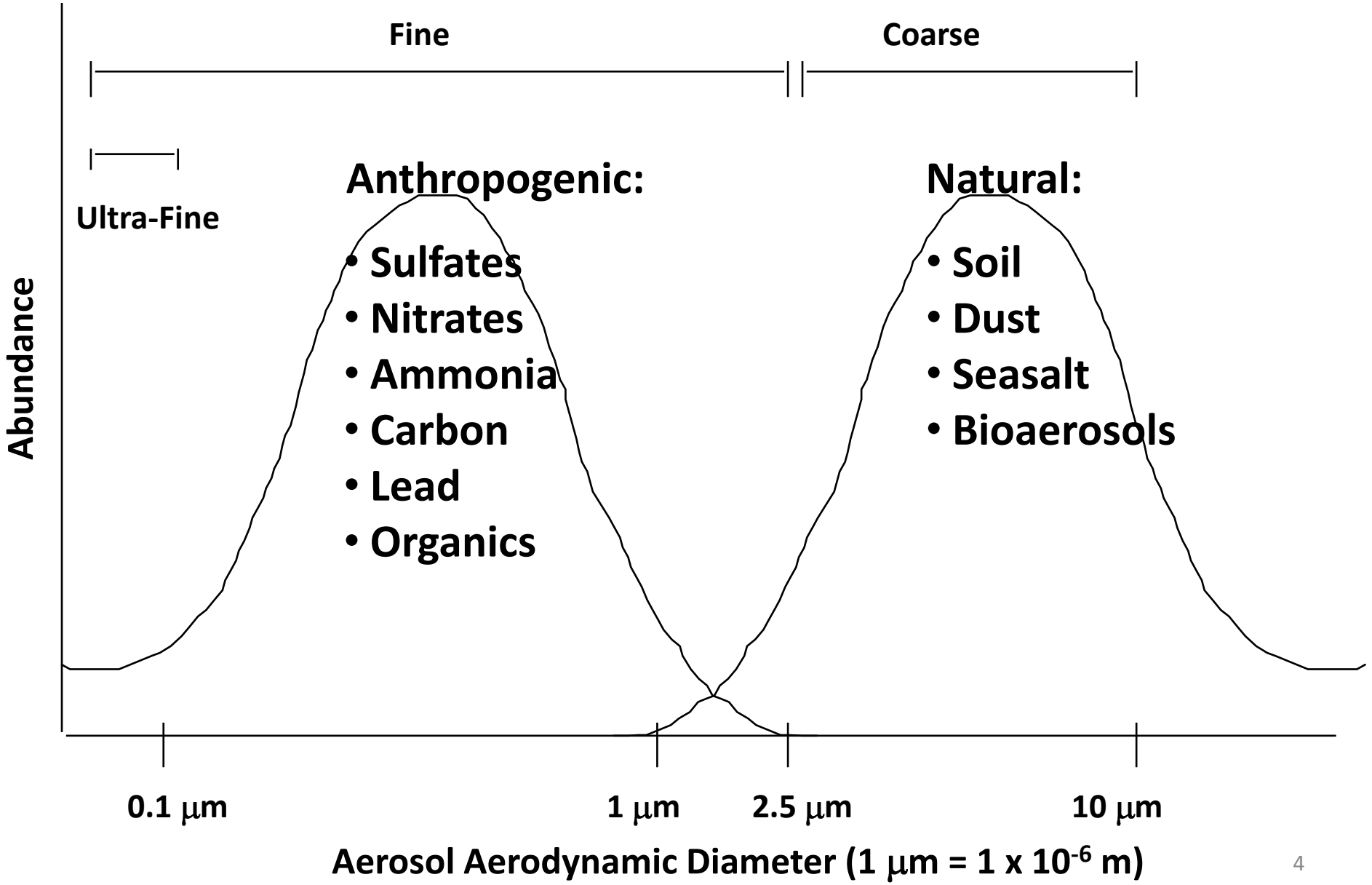
Cars and Buses

Non-Road Vehicles

Agricultural Burning

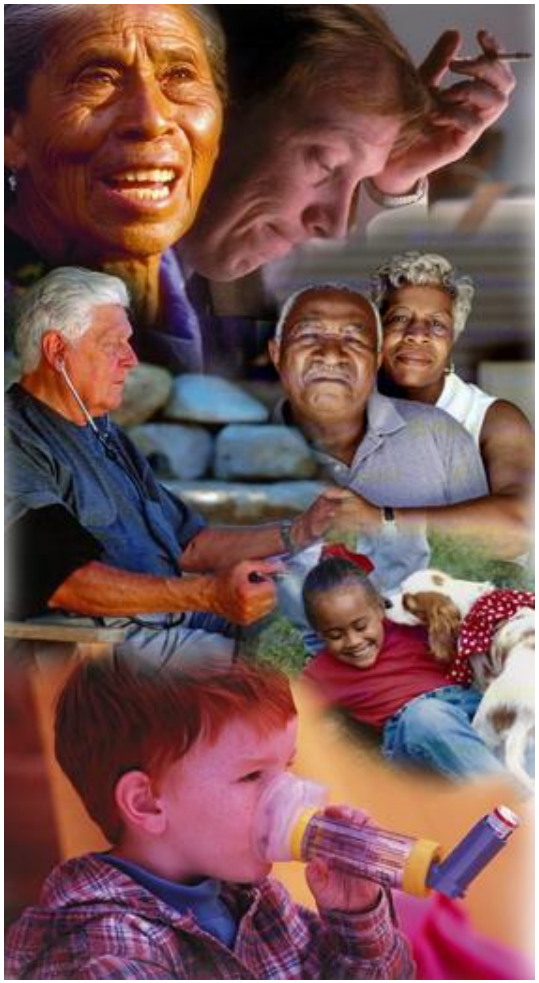
Industry

Sizes and Composition of Particulate Matter



Why Is it Important to Communicate Information about Particle Pollution to the Public?

- Exposure to particle pollution is a public health hazard
- When inhaled, particle pollution can travel deep into the lungs and cause or aggravate heart and lung diseases
- Exposure to particle pollution causes increases in:
  - Doctor and emergency room visits
  - Hospital admissions
  - Use of prescription medication
  - Absences from work and school



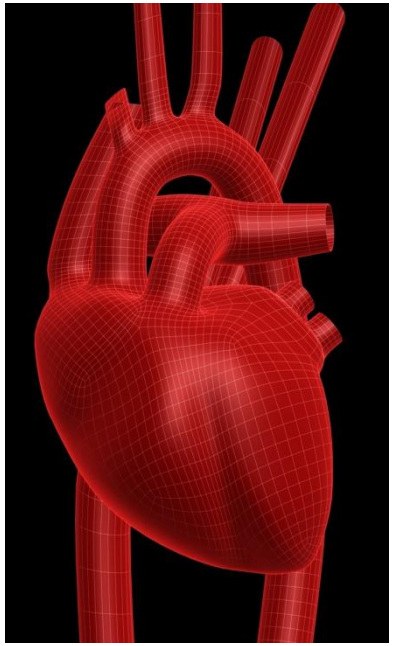
Particle Pollution Affects the Lungs

- People are exposed to particle pollution when they breathe
- Effects of **short-term (acute)** exposure:
  - Coughing
  - Shortness of breath
  - Tightness of the chest
  - Irritation of the eyes

- Effects of **long-term (chronic)** exposure:
  - Reduced lung function
  - Development of respiratory diseases in children
  - Aggravation of existing lung diseases
  - Premature death of people with lung disease

Particle Pollution Affects the Heart

- Inhaled particles can pass from the lungs into the bloodstream and affect the cardiovascular system
- Effects of **short-term (acute)** exposure:
  - Irregular heart beat
  - Nonfatal heart attacks
- Effects of **long-term (chronic)** exposure:
  - Aggravation of existing heart diseases
  - Premature death of people with heart disease



Certain Groups Are Most at Risk from Exposure to Particle Pollution

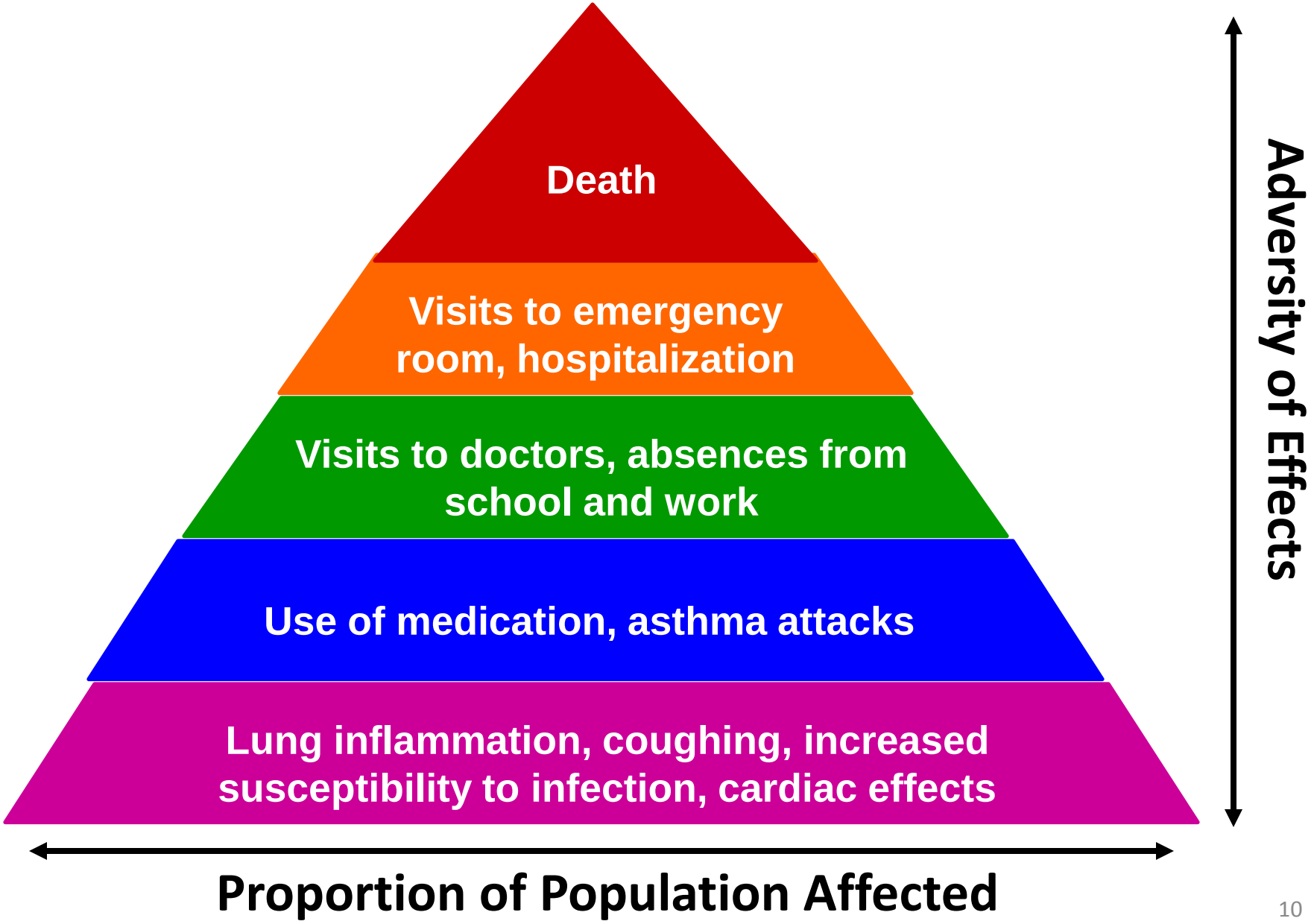
- Children
  - Lungs are still developing
  - Spend more time at high activity levels
- Senior citizens
  - May have undiagnosed heart or lung diseases
- People with existing heart or lung diseases
  - Particle pollution aggravates these diseases
- People who exercise or work outdoors
  - Breathe faster and deeper than sedentary adults

Famous Particle Air Pollution Episodes

Denora, Pennsylvania, USA
October 26-31, 1948
air pollution kills 20 people

London, England
December 4-9, 1952
air pollution kills 4000 people

Pyramid of Health Effects from Air Pollution



Communicating Health Effects

- Morbidity
  - Increased frequency of chronic bronchitis, respiratory hospital admissions, restricted activity days, etc.
- Disability-Adjusted Life Year (DALY)
  - Indicates how a disease can alter the ability of people to live a normal life compared to those with no disease
  - Expresses years of lost life
- Mortality (number of deaths)

Examples of Health Effects for Europe

- Air pollution causes 1.8 – 6.4% of deaths of European children age 0-4 years
- Air pollution causes 100,000 deaths and 725,000 years of lost life (DALY) in European cities
- $PM_{2.5}$ pollution caused 350,000 premature deaths in 2000
- European citizens have a decrease in average life expectancy of 9 months due to air pollution

Annual Impacts of Air Pollution in the U.S.

- Human exposure to outdoor air pollution costs between $40 to $50 billion
- 50,000 to 120,000 premature deaths are associated with exposure to air pollution
- People with asthma experience more than 100 million days of restricted activity
- Costs associated with treating asthma exceed $4 billion
- About 4,000 people die of asthma

Summary

- Particulate matter (PM) is a general term for very small solid and liquid particles in the atmosphere
- There are many different sources of PM, including natural and anthropogenic (man-made) sources
- PM is hazardous to human health – it causes acute and chronic effects to the respiratory and cardiovascular systems
- PM causes a variety of human health and economic impacts each year (e.g., mortality, morbidity, DALYs, lost income from work absences, costs of health care)