



Particle Pollution Health Effects & Sources

MWAQC Technical Advisory Committee

September 10, 2004



Overview

- What is Particle Pollution
- Sources and Composition
- Transport
- Health Effects

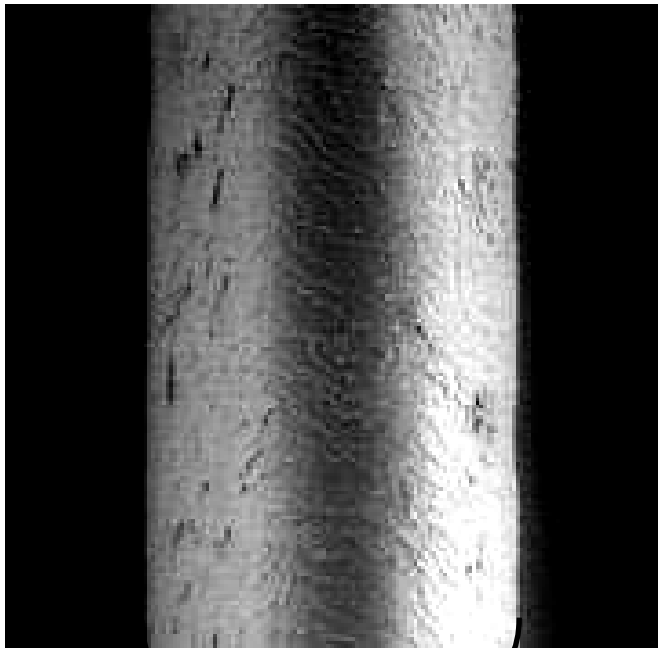
Particle Pollution

- Mixture of microscopic solid and liquid particles suspended in air.
- Particles vary in size.
- The size of the particles is directly linked to their potential for causing health problems.
- Particle pollution can occur year-round.

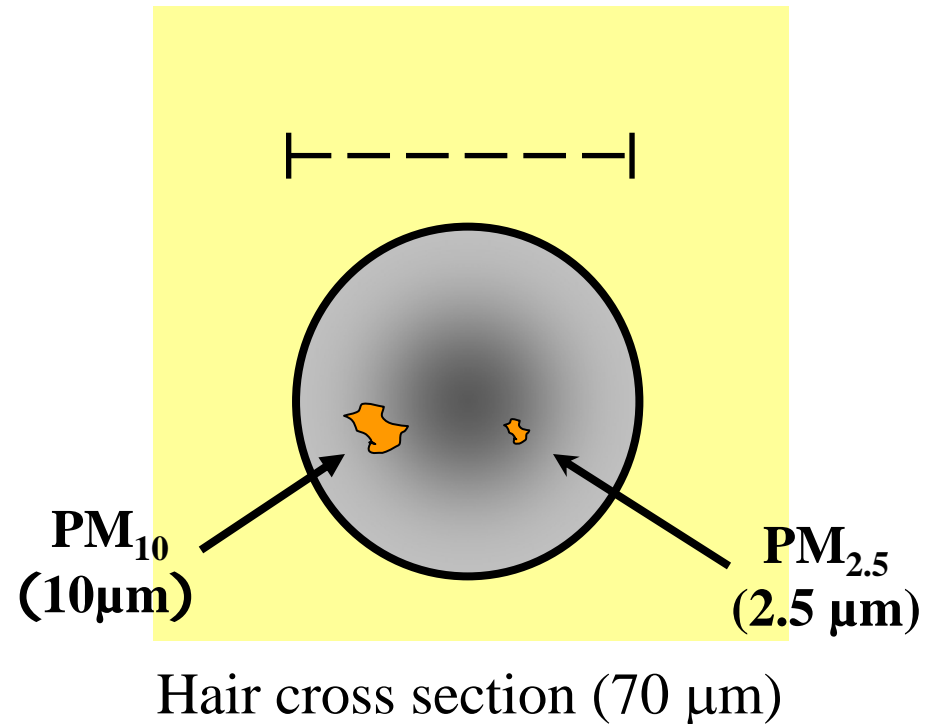


How Fine is Fine?

Particles are only a fraction of the size of a human hair



Human Hair (70 μm diameter)



Sources of Particle Pollution

Wood-Burning Stoves



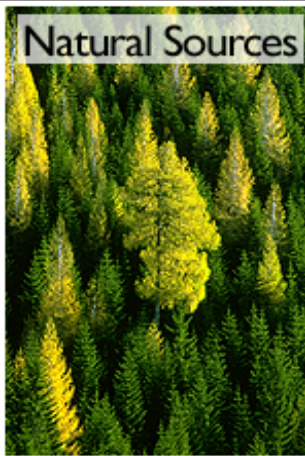
Power Plants



Heavy Duty Diesel Engines



Natural Sources



Fine Particles Can Be Emitted Directly or Formed in the Air from Gases

Cars and Trucks



Non-Road Vehicles



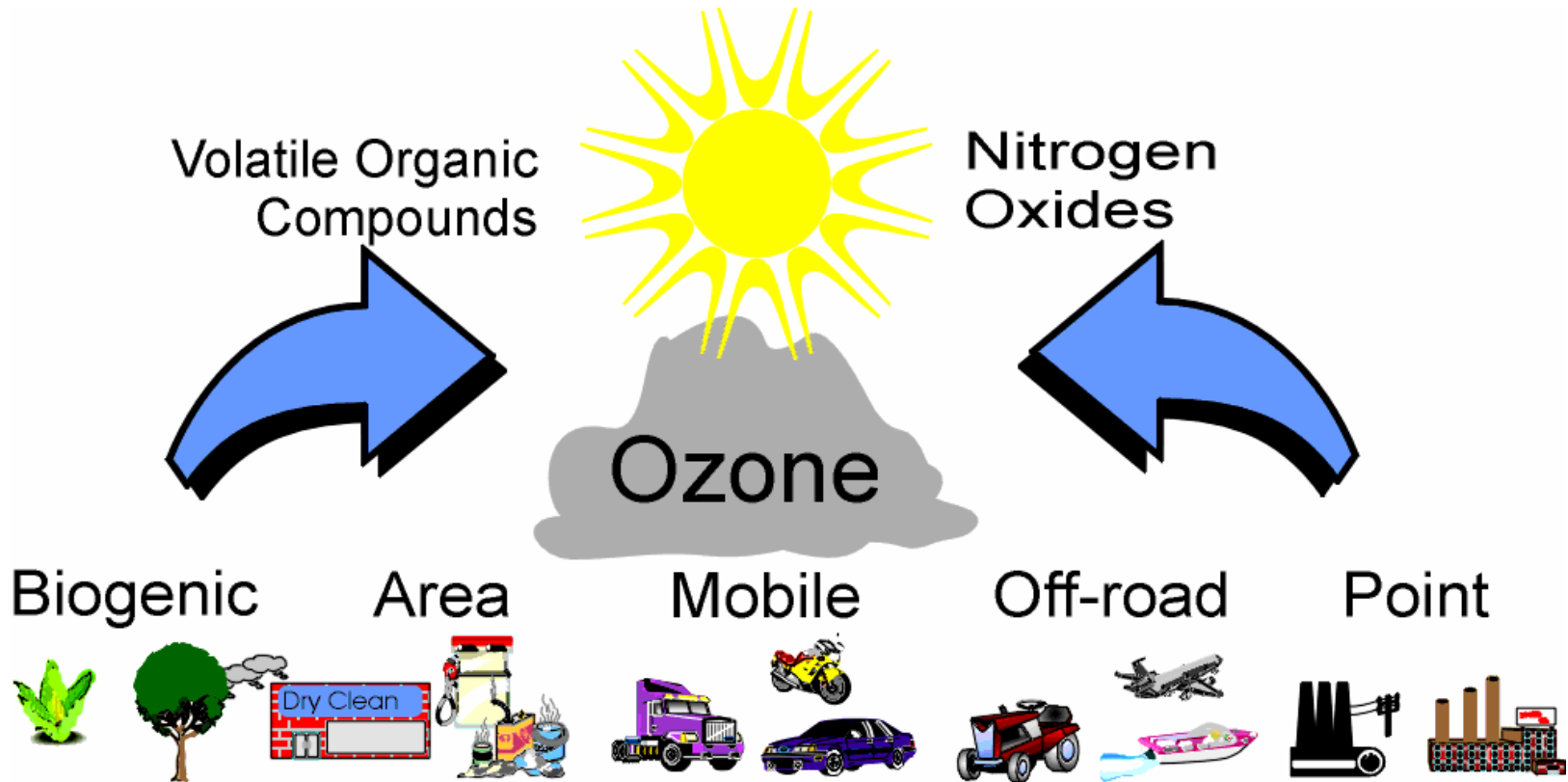
Forest Fires



Industrial Sources

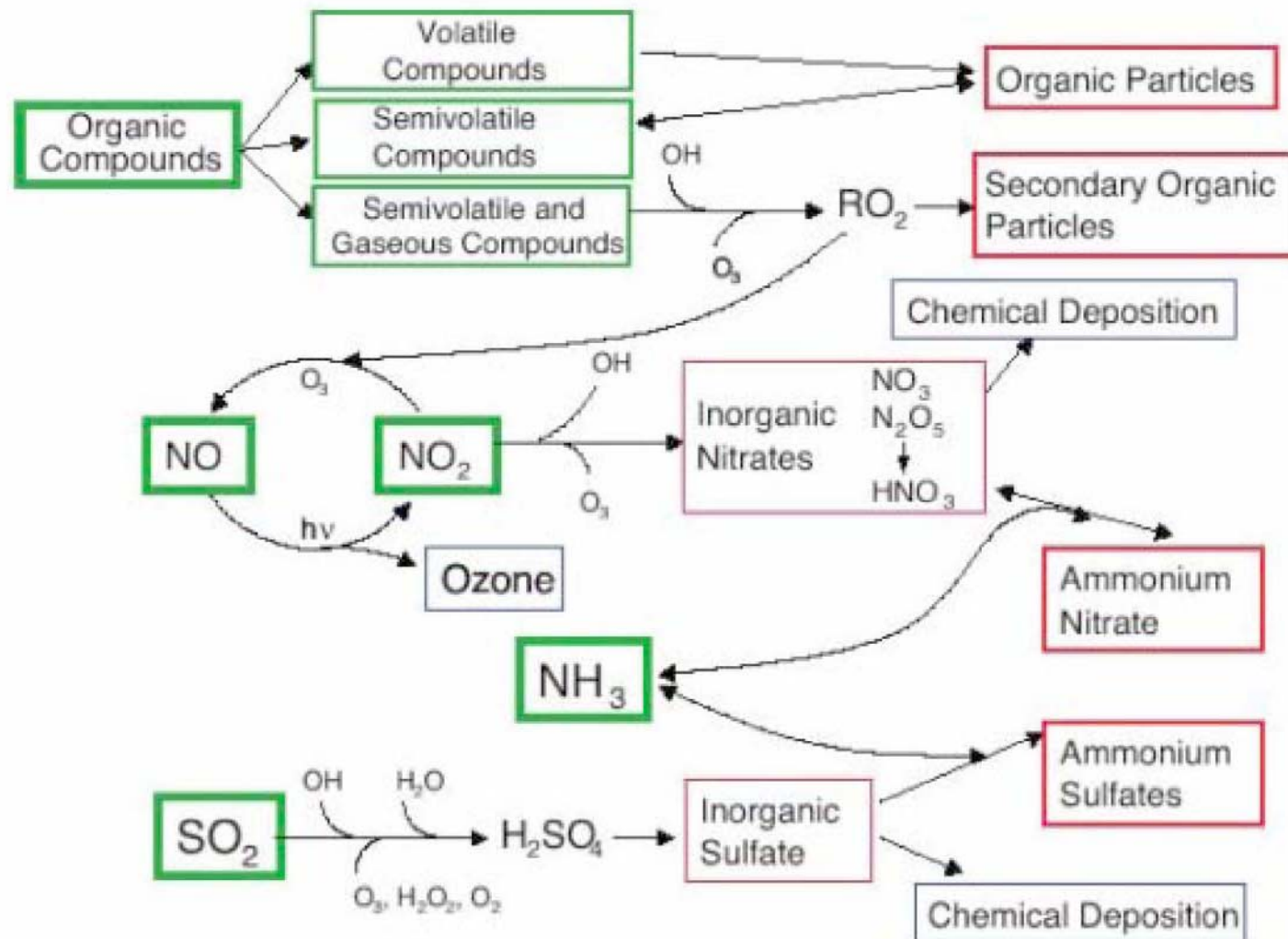


How is Ground-Level Ozone Formed?



How is Particle Pollution Formed?

ATMOSPHERIC AEROSOL PROCESSES



PM_{2.5} Composition in the Washington Region

- Annual Average PM_{2.5} Concentration:
 - Sulfate = 49%
 - Organic compound = 22%
 - Nitrate = 10%
- High PM_{2.5} Concentration:
 - Sulfate = 80%
 - Carbonaceous material = 20%
- Source of Sulfate – SO₂ emission from Ohio power plants

PM2.5 Sources in the Washington Region

Sources

Contribution Range

Coal combustion

= 49% – 66%

Motor vehicle

= 10% – 29%

(Gas+Diesel)

(8+2) - (23+6)

Sea salt

= 7% - 9%

Incinerator

= 5%

Oil combustion

= 4%

Soil

= 2% - 9%

Forest fires

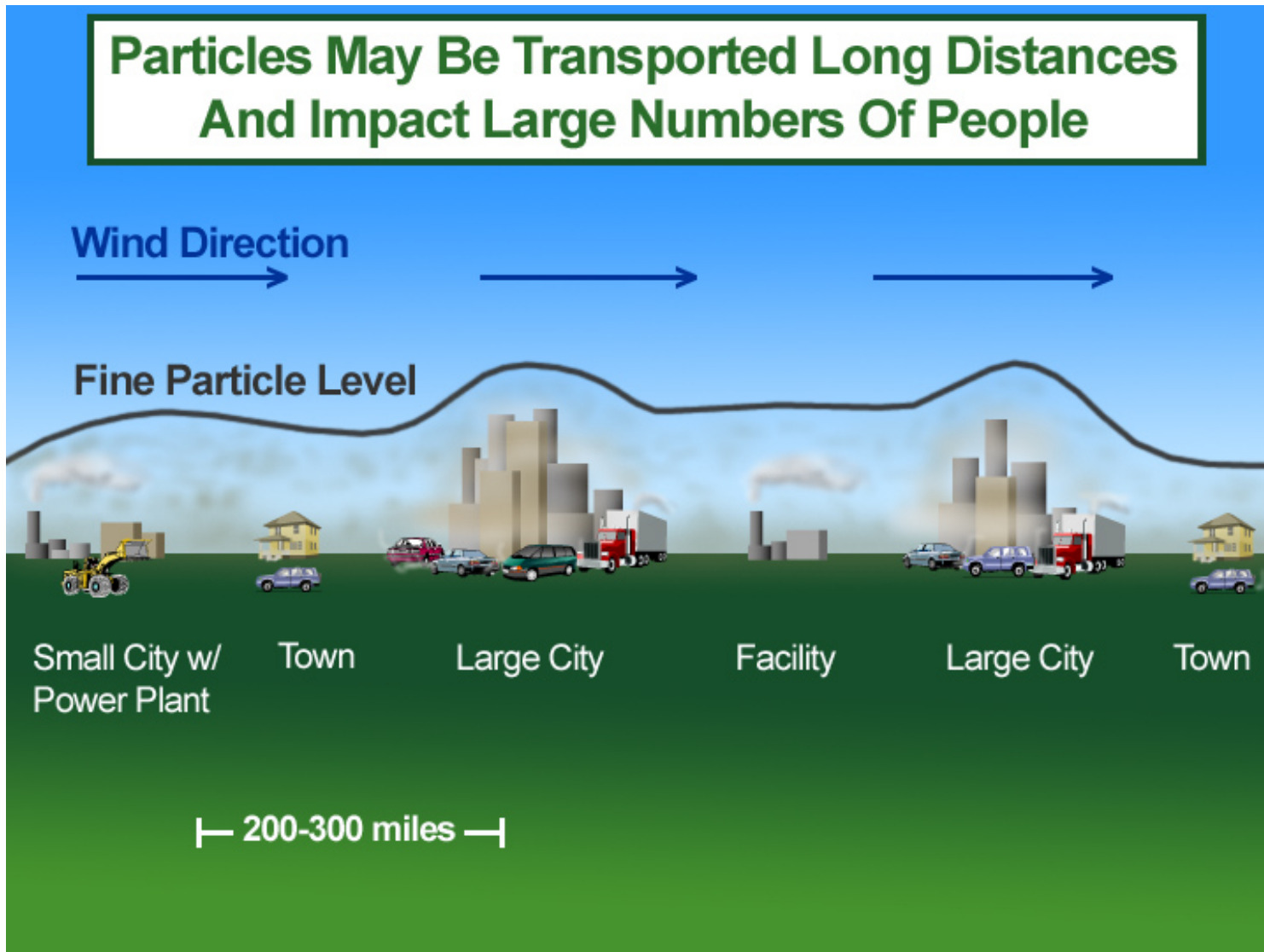
= 7%

Vegetative burning &

Fireworks

= 3%

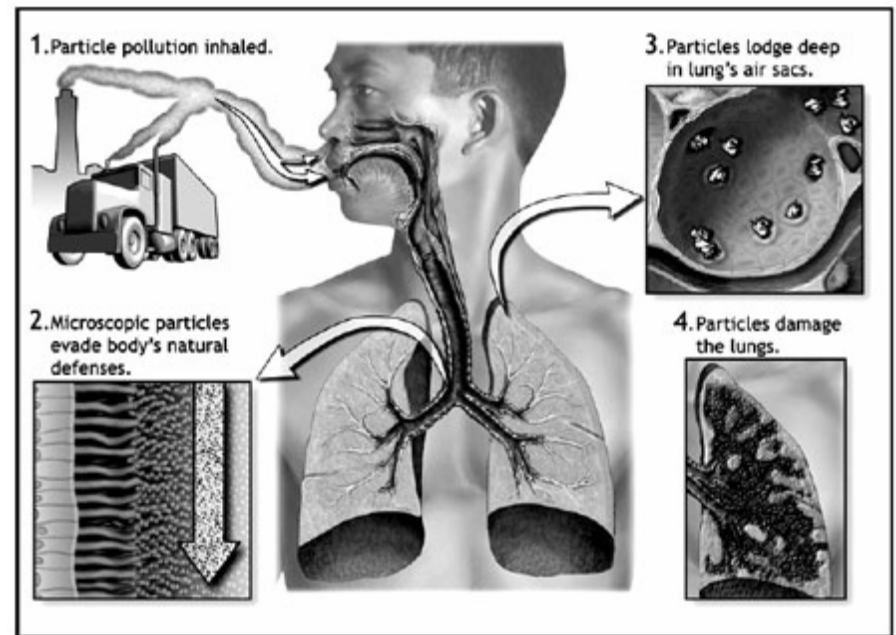
Transport of Particles



Health Effects of Particle Pollution

Respiratory System Effects

- Chronic bronchitis
- Asthma attacks
- Respiratory symptoms (cough, wheezing, etc.)
- Decreased lung function
- Airway inflammation



Health Effects of Particle Pollution

Cardiovascular System Effects

- Heart attack
- Cardiac arrhythmia
- Premature death
- Changes in heart rate and heart rate variability



The American Heart Association has concluded that exposure to fine particle pollutants increases the risk of heart attack, stroke and cardiovascular disease.

Some Groups are at Greater Risk



- People with lung or heart disease
 - Conditions make them vulnerable
- Older adults
 - Greater prevalence of heart and lung disease
- Children
 - More likely to be active
 - Breathe more air per pound
 - Bodies still developing

References

www.epa.gov

STAPPA/ALAPCO Air Web

www.4cleanair.org

Source Apportionment of Fine Particles in Washington, DC Utilizing
Temperature Resolved Carbon Fractions

Kim and Hopke, Clarkson University

Journal of A&WMA, July 2004

Eight-Site Source Apportionment of PM_{2.5} Speciation Trends Data

Prepared by Battelle and Sonoma Technology

For EPA, 9/24/03