Particle Pollution
Health Effects & Sources

MWAQC

September 22, 2004

Overview

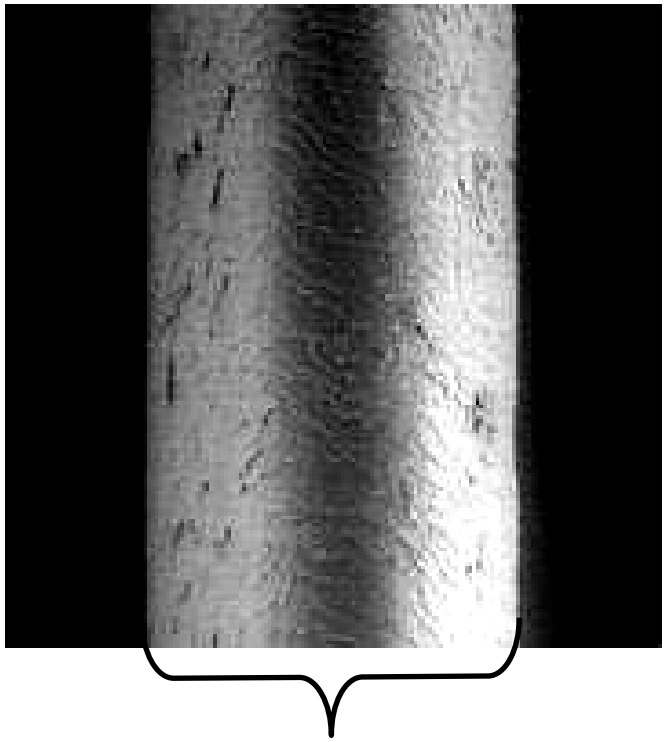
- What is Particle Pollution
- Particle Sources
- Particle Composition and Seasonal Variations
- Health Effects

Particle Pollution

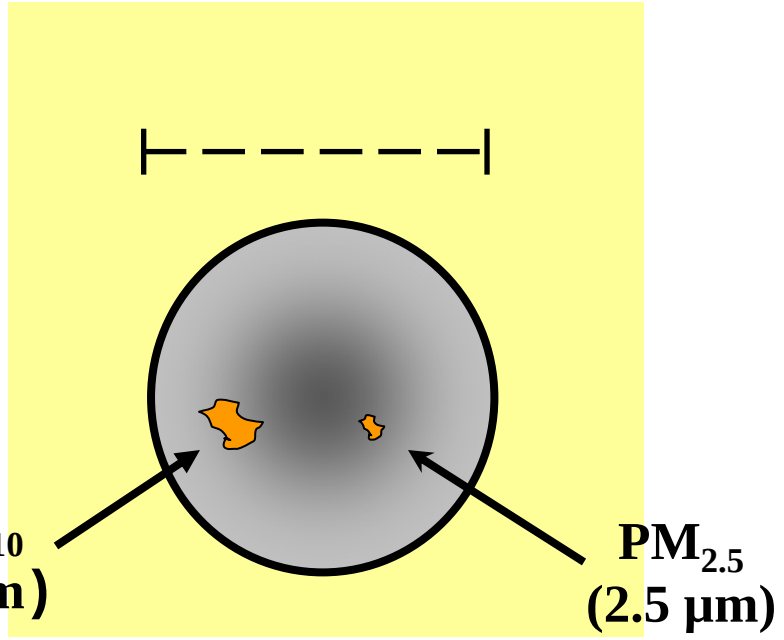
- Mixture of microscopic solid and liquid particles suspended in air.
- Particles vary in size.
- The size of the particles is directly linked to their potential for causing health problems.
- Particle pollution can occur year-round.

How Fine is Fine?

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



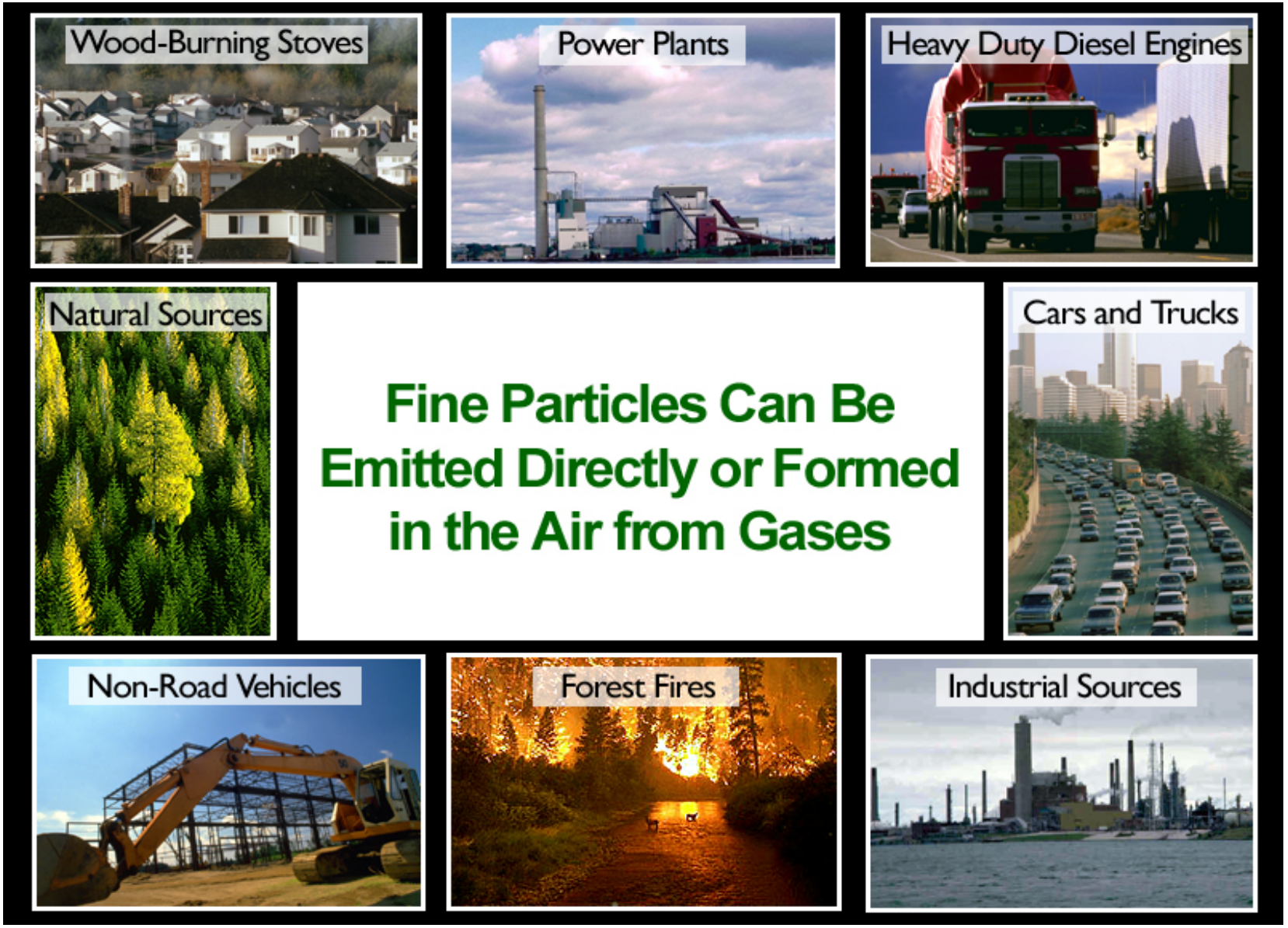
Human Hair (70 µm diameter)



Hair cross section (70 µm)

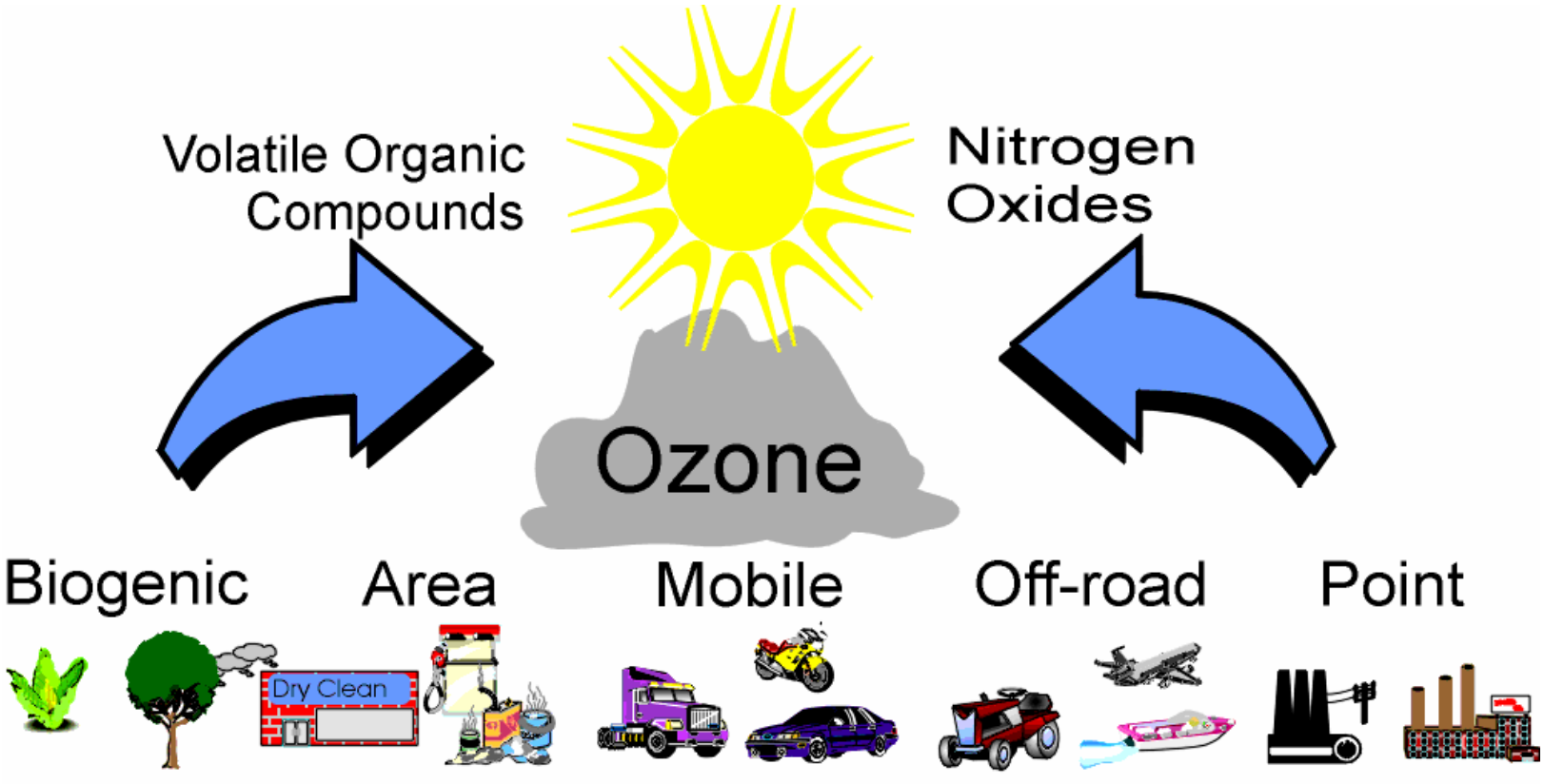
Source: EPA

Types of Particle Pollution

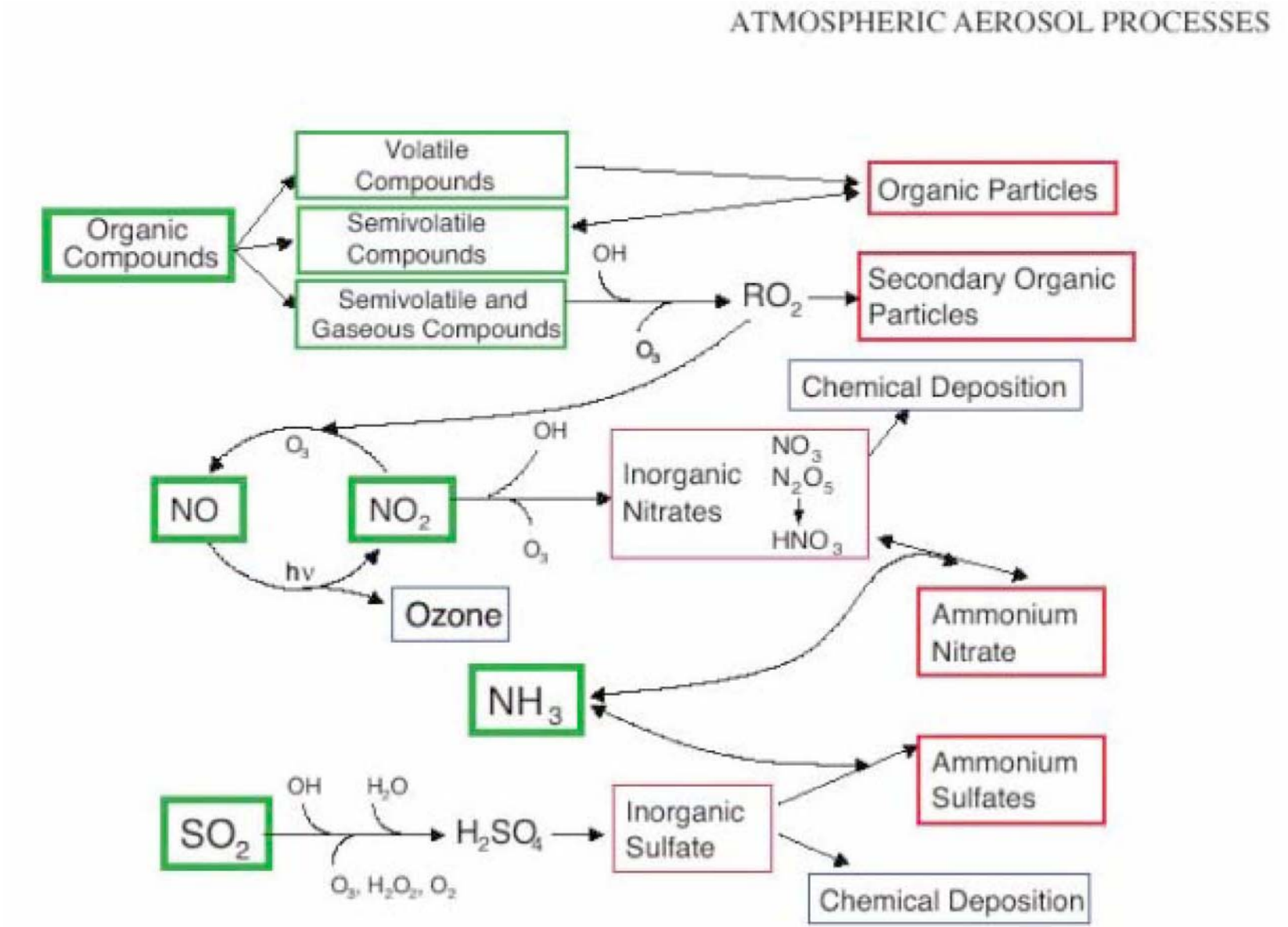


Source: EPA

How is Ground-Level Ozone Formed?



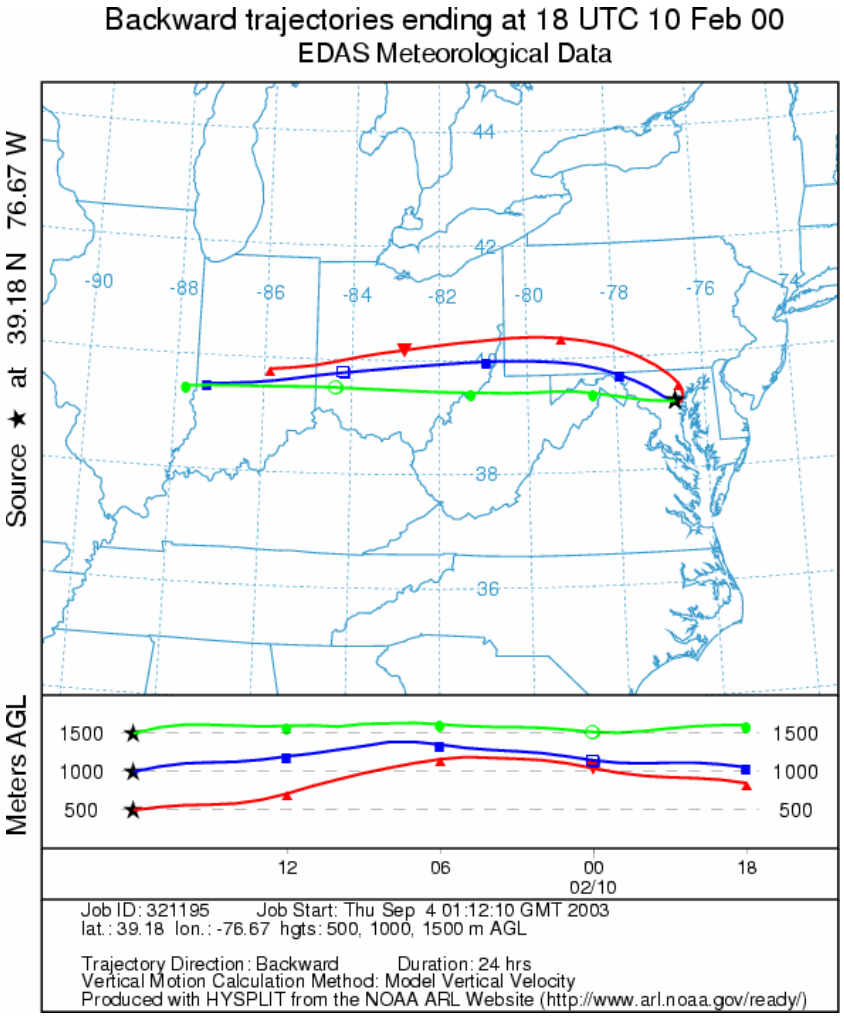
How is Particle Pollution Formed?



Source: EPA

Fine Particles - Regional or Local Problem?

- Primarily a regional problem in the East.
- Regional sources include power plants, mobile sources and others.
- Local sources include traffic, cement plants, fugitive dust, fires, and lots more.
- How much is being transported into our area?
  - Reasonable guess is approximately 50-70%.



Source: MDE

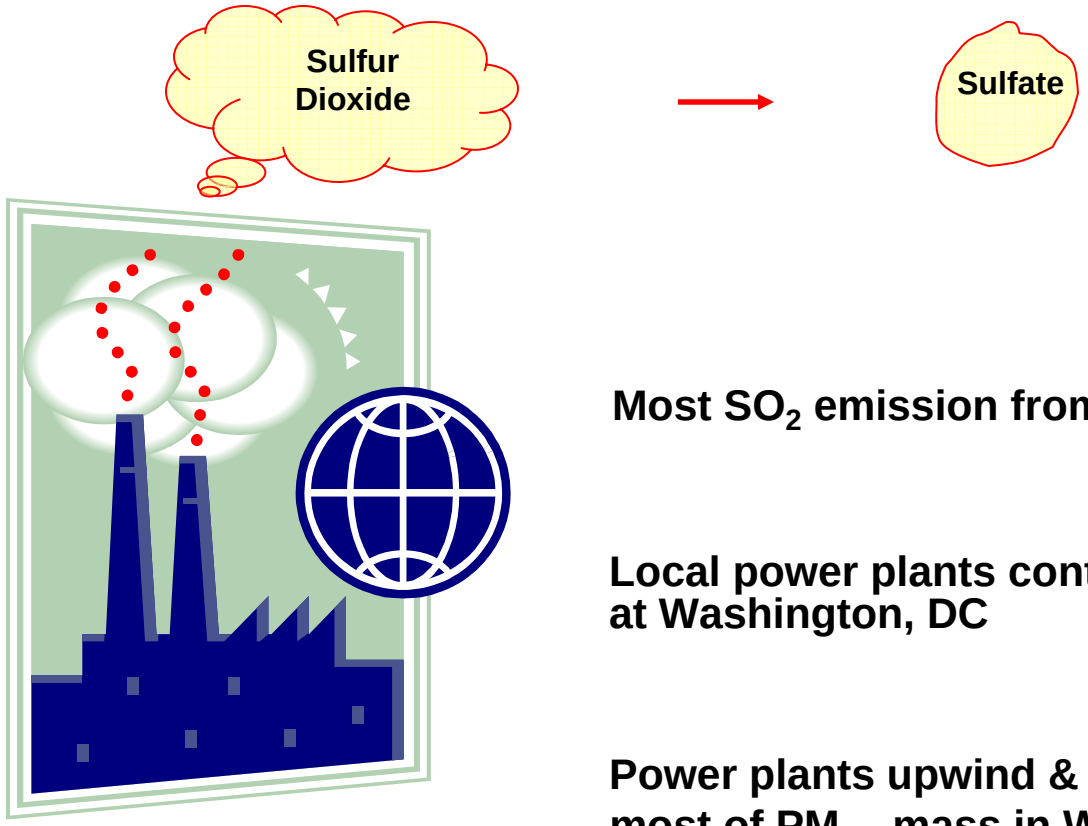
Fine Particle Sources in the Washington Region

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%

Source: Kim & Hopke, Battelle & Sonoma

Fine Particle Sources in the Washington Region

Source of Sulfate



Most SO_2 emission from power plants – Local & Far-off

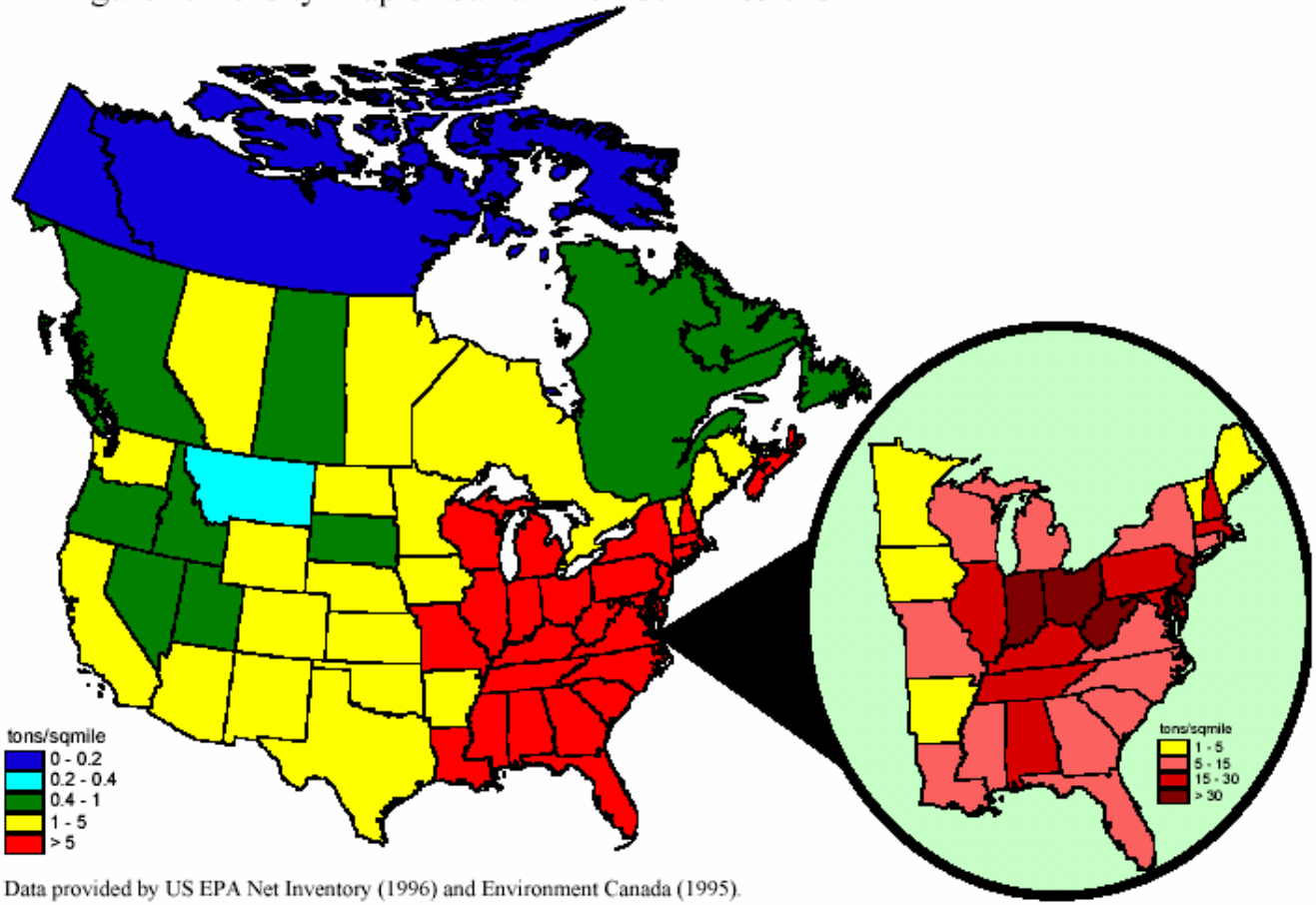
Local power plants contribute 5% - 6% of $PM_{2.5}$ levels at Washington, DC

Power plants upwind & far-off places contribute most of $PM_{2.5}$ mass in Washington, DC area

Source: Levy et. al.

Regional Sulfur Dioxide Emissions

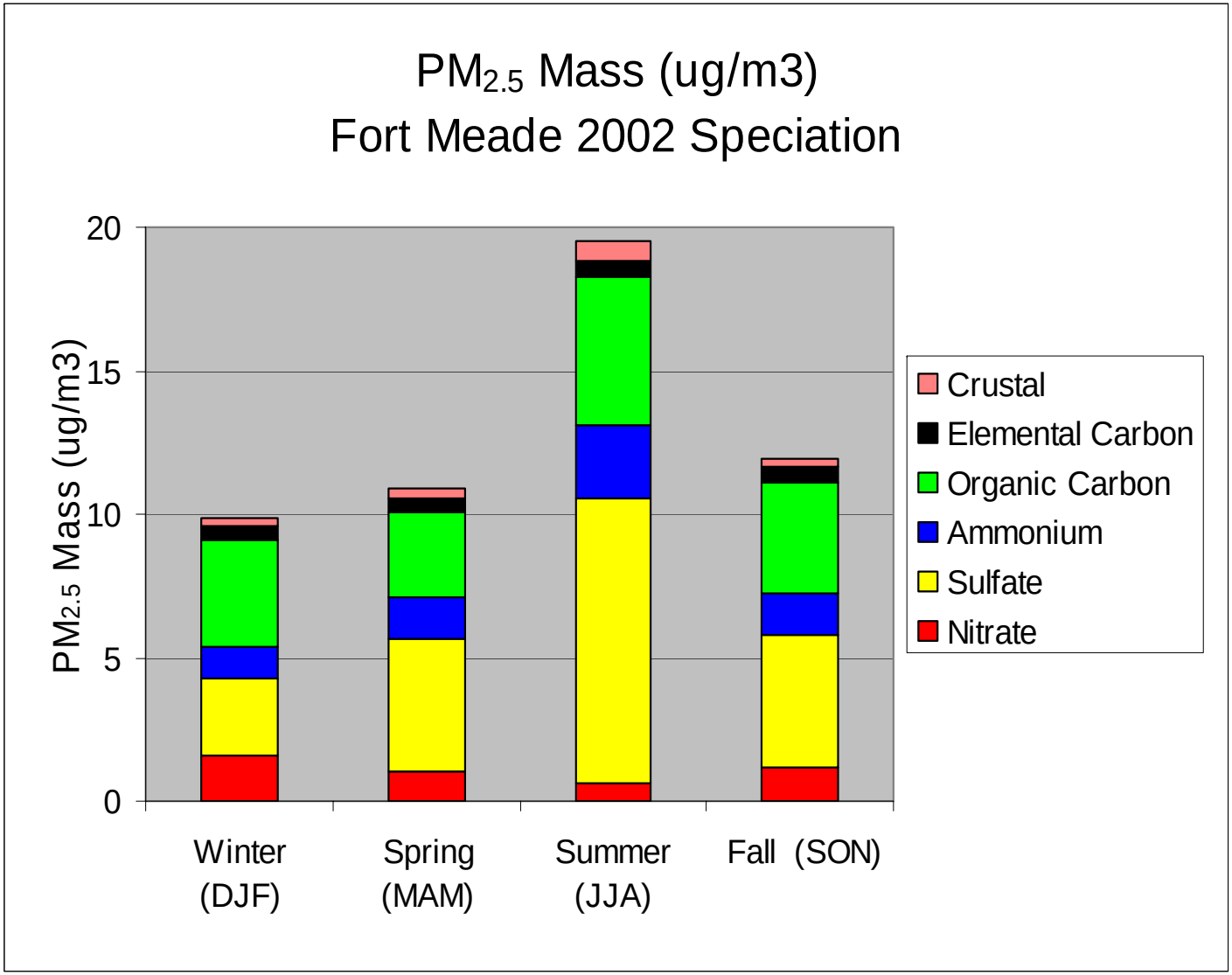
Figure 2. Density Map of Sulfur Dioxide Emissions



Data provided by US EPA Net Inventory (1996) and Environment Canada (1995).

Source: MARAMA

Seasonal Variation in Fine Particle Composition

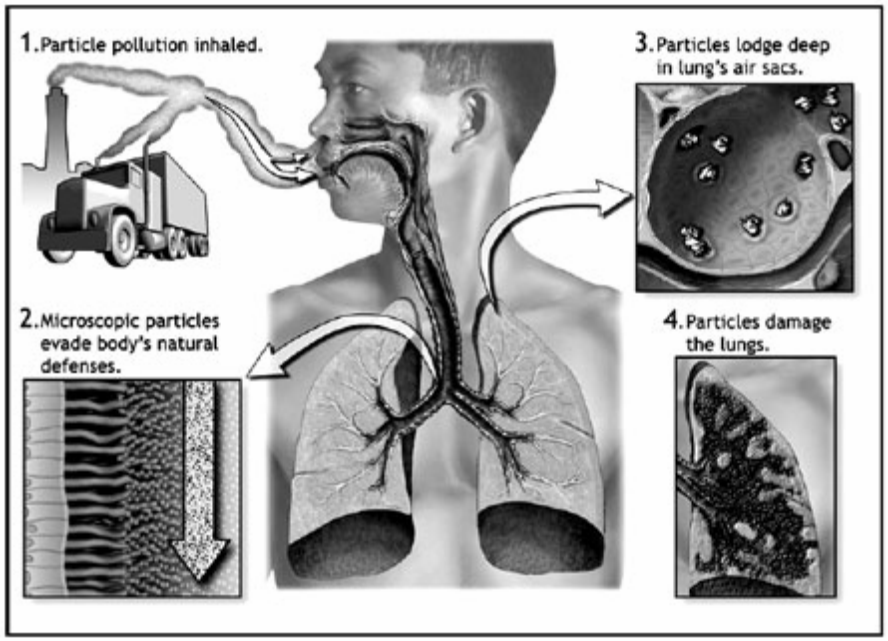


Source: MDE

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

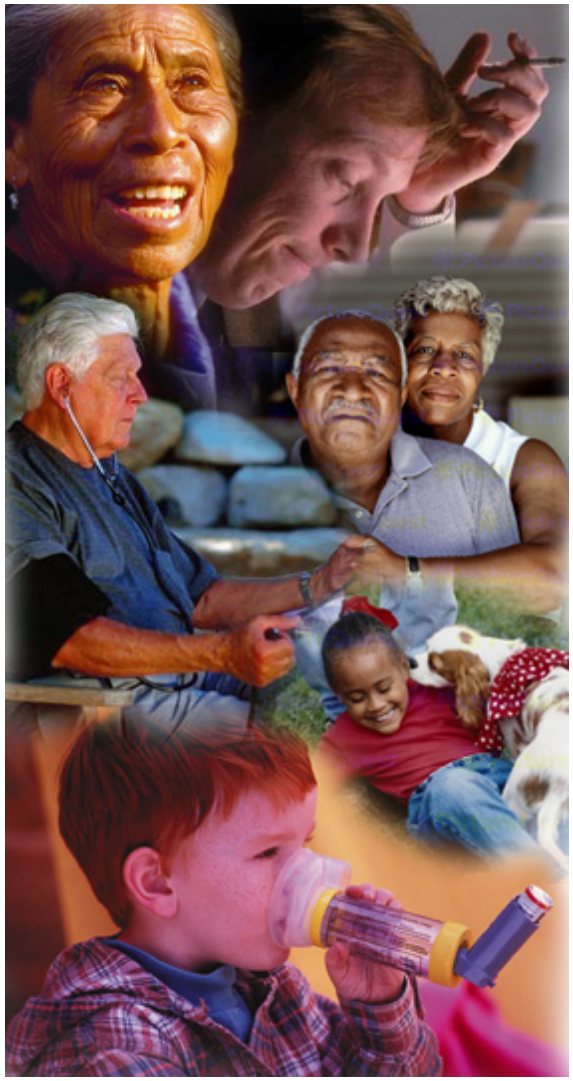
Cardiovascular System Effects

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

American Heart Association®
Learn and Live℠

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

Sources of Information

Maryland Department of the Environment

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 PM2.5 Speciation Trends Data
Prepared by Battelle and Sonoma Technology
For EPA, 9/24/03

The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC
Jonathan I. Levy, Susan L. Greco, and John D. Spengler, Harvard University
Journal of Environmental Health Perspective (October 2002)