Particulate Matter: What is It?

A complex mixture of extremely small particles and liquid droplets.

- Human Hair (70 µm diameter)
- PM$_{10}$ (10µm)
- PM$_{2.5}$ (2.5 µm)

M. Lipsett, California Office of Environmental Health Hazard Assessment
Fine Particles Can Be Emitted Directly or Formed in the Air from Gases
Fine Particles: Why You Should Care
Public Health Risks Are Significant

Particles are linked to:

- Premature death from heart and lung disease
- Aggravation of heart and lung diseases
  - Hospital admissions
  - Doctor and ER visits
  - Medication use
  - School and work absences
- And possibly to
  - Lung cancer deaths
  - Infant mortality
  - Developmental problems, such as low birth weight, in children
Particles Affect the Lungs and Heart

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

- **Cardiovascular system effects**
  - Heart attacks
  - Cardiac arrhythmias
  - Changes in heart rate and heart rate variability
  - Blood component changes
Some Groups Are More at Risk

- People with heart or lung 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
Research is Continuing

• **Particle Components**
  – Fine particles linked with serious health effects in many locations throughout the world, with different mixes of particle components
  – No components can be ruled out

• **Specific types of sources**
  – Diesel PM associated with lung cancer and other effects
  – Combustion sources associated with mortality in some studies
PM NAAQS Review Timeline

• Review was delayed due to concern about statistical technique used in some recent studies on air pollution and health effects
• 2003 reanalyses by Health Effects Institute still showed statistically significant mortality risk from PM exposure

2004
• Completion of Criteria Document (state of the science)
• Issue 2\textsuperscript{nd} revision of Staff Paper

2005
• Current schedule
  – Proposal: March 2005
  – Final: Dec. 2005
• Schedule is under negotiation with plaintiffs and likely to change
We Must Move Ahead

• Implementation of the fine particle standards is estimated to prevent:
  – Thousands of premature deaths from heart and lung disease every year
  – Tens of thousands of hospital admissions and emergency room visits
  – Millions of school and work absences due to aggravated asthma and other lung and heart diseases
Fine Particle Forecasting & Mapping
# The Air Quality Index for Particles

<table>
<thead>
<tr>
<th>Quality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Good</strong> (Green)</td>
<td>0-50</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Moderate</strong> (Yellow)</td>
<td>51-100</td>
</tr>
<tr>
<td>Unusually sensitive people should consider</td>
<td>reducing prolonged or heavy exertion.</td>
</tr>
<tr>
<td>reducing prolonged or heavy exertion.</td>
<td></td>
</tr>
<tr>
<td><strong>Unhealthy for Sensitive Groups</strong> (Orange)</td>
<td>101-150</td>
</tr>
<tr>
<td>People with heart or lung disease, older</td>
<td>adults and children should reduce prolonged or heavy exertion.</td>
</tr>
<tr>
<td>adults and children should reduce prolonged</td>
<td></td>
</tr>
<tr>
<td>or heavy exertion.</td>
<td></td>
</tr>
<tr>
<td><strong>Unhealthy</strong> (Red)</td>
<td>151-200</td>
</tr>
<tr>
<td>People with heart or lung disease, older</td>
<td>adults and children should avoid prolonged or heavy exertion. Everyone else should reduce</td>
</tr>
<tr>
<td>adults and children should avoid prolonged</td>
<td>prolonged or heavy exertion.</td>
</tr>
<tr>
<td>or heavy exertion.</td>
<td></td>
</tr>
<tr>
<td><strong>Very Unhealthy</strong> (Purple)</td>
<td>201-300</td>
</tr>
<tr>
<td>People with heart or lung disease, older</td>
<td>adults and children should avoid all physical activity outdoors. Everyone else should avoid</td>
</tr>
<tr>
<td>adults and children should avoid all</td>
<td>prolonged or heavy exertion.</td>
</tr>
<tr>
<td>physical activity outdoors.</td>
<td></td>
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</tbody>
</table>
Fine Particles Reduce Visibility

- Example: Chicago in the summer of 2000.
  - Left – a clear day: PM 2.5 < 5 µg/m³
  - Right – a hazy day: PM 2.5 ~ 35 µg/m³
Particles May Be Transported Long Distances And Impact Large Numbers Of People

Wind Direction

Fine Particle Level

Small City w/ Power Plant  Town  Large City  Facility  Large City  Town

--- 200-300 miles ---
Many Areas Are at Risk

- Fine particles
  - can be transported long distances
  - are a regional problem
  - are a year-round problem
  - can affect health, even in attainment areas

- Nonattainment: primarily California and the East
Fine Particles: A Significant Nonattainment Problem in California and the East
Fine Particles: A Significant Nonattainment Problem in California and the East

Note: in the West, one other violating monitor is located in Libby, MT.
PM2.5 Nonattainment Designations

• Summary of State Recommendations
  – 116 nonattainment (NA) counties
  – 8 partial NA counties
  – 21 counties in OH and MD recommended as NA in “options” under consideration
  – Total population of these 145 counties = 82 million

• Presumptive metro areas associated with these counties
  – 310 counties in 45 areas with 105 million population

• Website – [www.epa.gov/pmdesignations](http://www.epa.gov/pmdesignations)
  – State recommendation letters, technical info, and EPA responses when sent out this summer
PM 2.5 In Ambient Air: A Complex Mixture

Primary Particles (Directly Emitted)
- Elemental Carbon
- Condensed Organics
- Other

Secondary Particles (From Precursor Gases)
- VOC
- Secondary Organics
- Ammonium Sulfate
- Ammonium Nitrate
- SO2
- NH3
- NOx

June 2000 / tgp
Particle Composition Varies
EPA’s Role: Protecting and Improving Air Quality

- EPA set national air quality standards for fine particles in 1997
- New standards withstood all legal challenges, including U.S. Supreme Court
- Moving forward to implement standards
Reducing Fine Particles

• Approach must include national, regional and local strategies
• National efforts under way:
  – Existing programs such as Acid Rain program, NOx SIP call, and heavy duty diesel rule & limits for sulfur in fuel
  – Rules not yet in effect, such as Interstate Air Quality Rule and rule to control emissions from non-road vehicles & equipment
Interstate Air Quality Rule

- Addresses contribution of transported SO2 and NOx to PM2.5 and ozone nonattainment problems
- Geographic scope: for SO2, 28 eastern states + DC
- Proposes a **two-phase program** with declining emission caps
  - SO2: 3.9 million tons in 2010 and 2.7 million in 2015
  - NOx: 1.6 million tons in 2010 and 1.3 million in 2015
- Cap and trade program with State flexibility
- Significant annual public health benefits: $82.4 billion in 2015
  - Reasonable annual costs: $3.7 billion in 2015
- **Schedule**
  - Proposal: Dec. 2003
  - Supplemental proposal: April/May 2004
  - Final: Dec. 2004
Example Local Reduction Programs

- Diesel retrofits (trucks, school buses, stationary engines)
- Diesel idling (trucks, trains, port equipment, etc.)
- Programs to reduce emissions from poorly maintained vehicles
- New or improved direct PM and precursor controls on stationary sources
- Year-round operation of seasonal stationary source NOx controls
- Increase use of alternative fuel, hybrid vehicles
- Buy-back programs for small engines (boats, vehicles, equipment)
- Year-round measures to reduce VMT (Commuter Choice, carpooling incentives, etc.)
- Open burning laws and better enforcement
- Programs to reduced emissions from residential wood combustion and back yard barrel burning
- Smoke management plans
- Improved monitoring techniques and more frequent monitoring on sources with control devices
- Reducing emissions of volatile aromatic compounds (surface coatings, gasoline, solvents, etc.)
- PM Action Days ??

** We have provided grant funding to STAPPA to develop a PM2.5 “Menu of Options” document. Target date for completion is late 2004.
## PM\textsubscript{2.5} Implementation Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 2004*</td>
<td>State designation recommendations due to EPA</td>
</tr>
<tr>
<td>April 2004</td>
<td>Implementation rule to OMB</td>
</tr>
<tr>
<td>July 2004</td>
<td>EPA proposes implementation rule</td>
</tr>
<tr>
<td>July-Aug 2004</td>
<td>EPA letters to States responding to PM2.5 designation recommendations</td>
</tr>
<tr>
<td>Dec. 2004*</td>
<td>EPA finalizes designations</td>
</tr>
<tr>
<td>Late 2004-Early 2005</td>
<td>EPA finalizes implementation rule</td>
</tr>
</tbody>
</table>

*Dates codified in Consolidated Appropriations Bill of FY2004. SIP due dates for PM2.5 and regional haze are 3 years from effective date of PM2.5 designations.
Nonattainment Area Boundaries

- Presumption: Metropolitan areas & counties
- Factors to consider:
  - Location and magnitude of emissions within or near the area
  - Traffic and commuting patterns
  - Expected growth
  - Meteorology
  - Geography and topography
  - Jurisdictional boundaries
  - Level of emission control on existing source
PM$_{2.5}$ Implementation Rule Issues

- Attainment dates
- Classifications
- Reasonably available control technology
- Reasonably available control measures
- Reasonable further progress
- New Source Review
- Transportation conformity
- Contingency measures
- General conformity
Fine Particles: Summary

• Linked to serious health effects
  – Premature death, heart and lung disease

• A complex problem
  – Many types of pollutants from multiple emission sources

• EPA encourages early reductions

• EPA is committed to working with States and Tribes to meet the fine particle standards and to protect public health