

Particulate Matter & Health:

*Science partnership is the basis for
sound decisions*

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Assistant Administrator

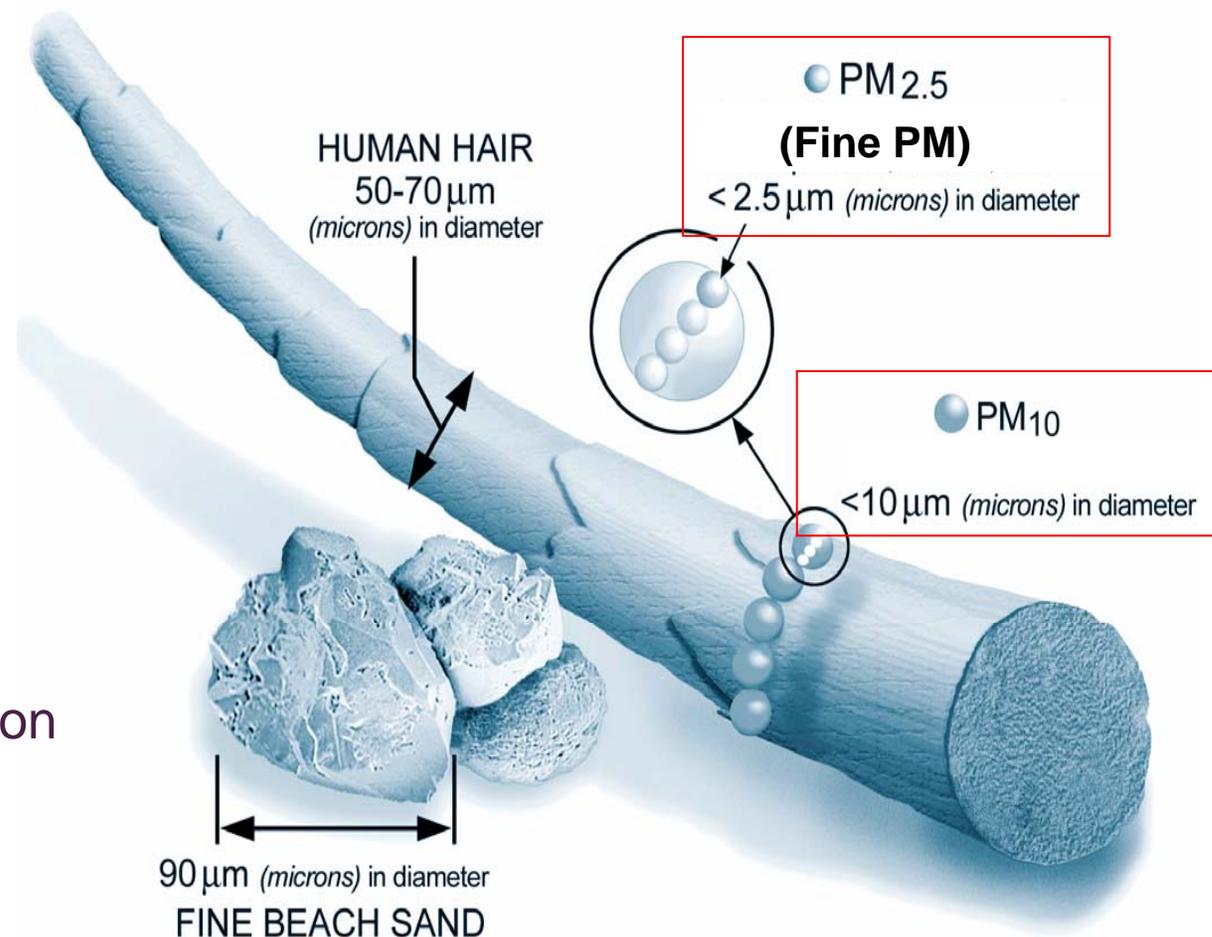
EPA Research and Development

PM Centers Directors Meeting

September 27, 2004

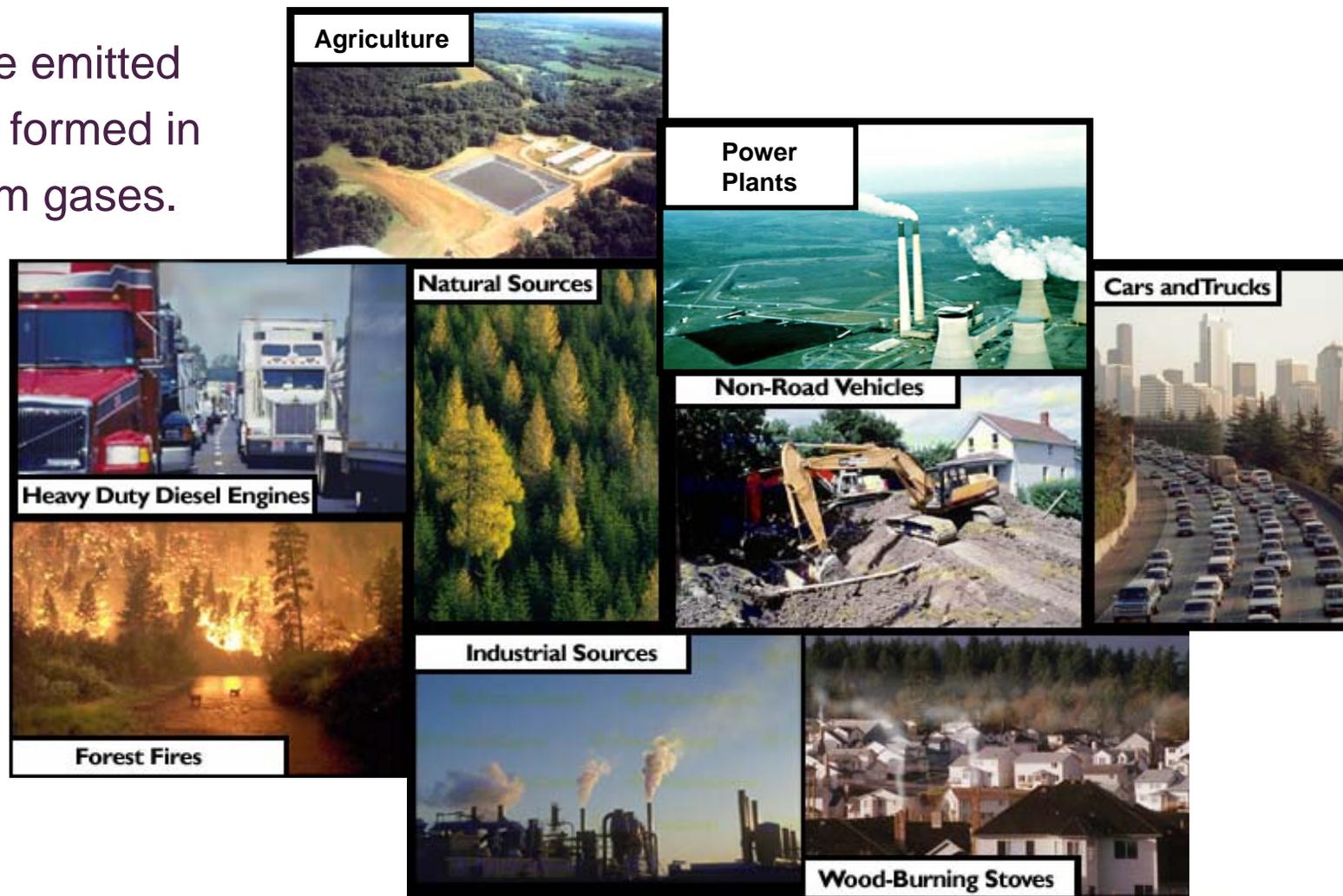
What is Particulate Matter (PM)?

- PM is a complex mixture of solid, semi-volatile and aqueous materials of various sizes found in the air.
- When inhaled, smaller particles generally penetrate more deeply into the lung.
- The size and composition of PM have important implications regarding health outcomes.



Ambient PM is Derived from Varied Sources

PM can be emitted directly or formed in the air from gases.



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Purpose of this Meeting

- **Highlight the progress made and challenges ahead in understanding the impact of ambient particulate matter (PM) on human health.**
- **Underscore the contributions to sound decision-making through the integration of science from the five EPA PM Centers with the EPA intramural PM Program.**

The Problem: An Historical Perspective

London Smog 1873

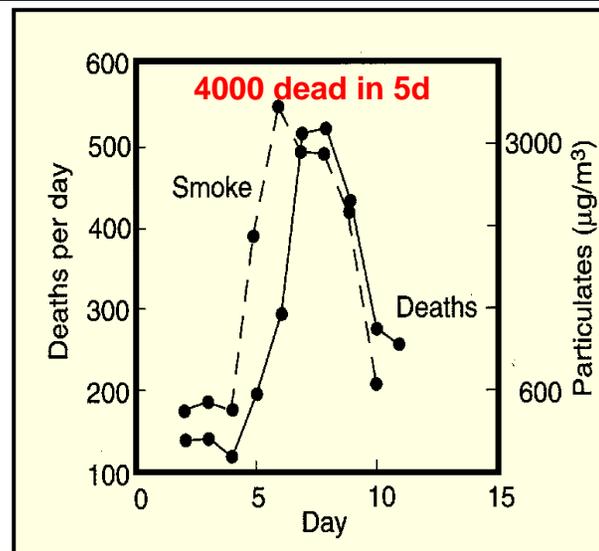


Houses of Parliament, Claude Monet



London Smog 1952, 10:30am.

Bus escorted by conductor with a lantern.

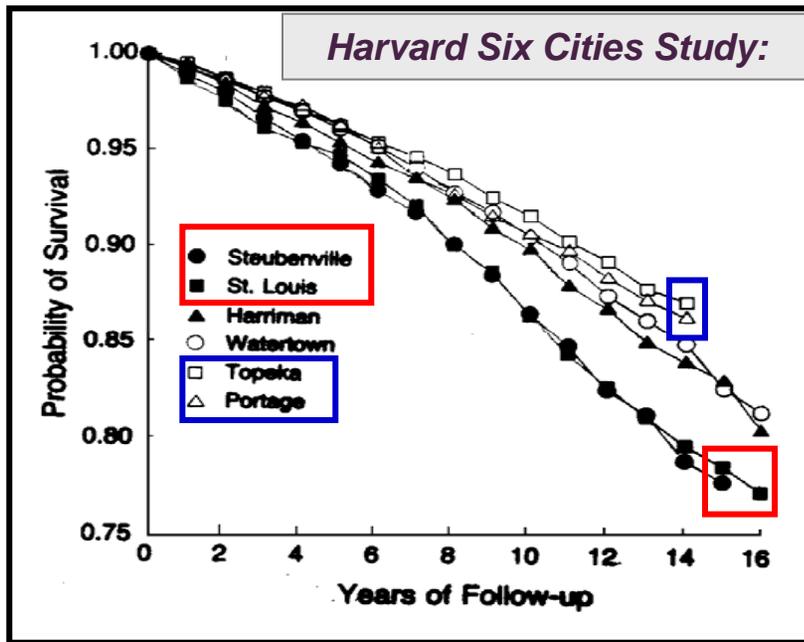


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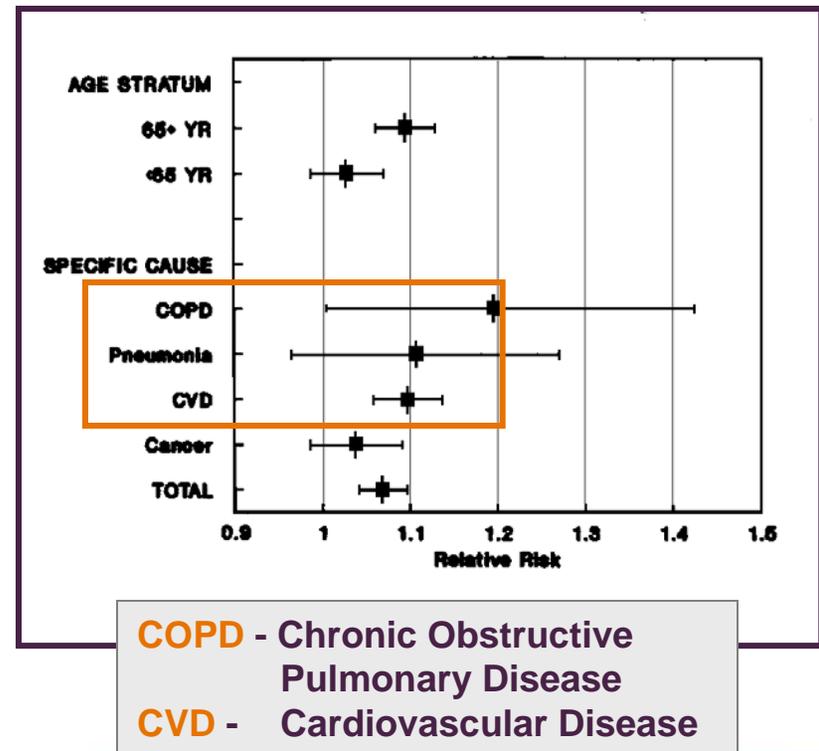
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1997: Compelling Epidemiology, But with Uncertainties

Long-term exposure to PM appears associated with 'life-shortening' - those in dirty cities lost about ~2 years of life over a 15-18 year period.



If someone has a preexisting heart or lung problem, research suggested that they may be at greater risk from exposure to PM.



1997: What was Known about PM Exposure and Human Health Effects?

- Adverse health effects, including premature death were associated with PM
- Correlations appeared stronger with PM_{2.5} (fine)
- Long-term exposure associated with shortened life-span
- Controversy: 'biologic plausibility' was uncertain with major questions about personal exposures and effects
- Findings were Compelling: EPA revised the PM National Ambient Air Quality Standards (NAAQS)

Key Research Questions in 1997

- Could low concentrations of PM actually cause such marked effects by themselves?
- Who is susceptible, and why?
- How are ambient PM and actual personal exposure linked?
- What are the effects of chronic PM exposure?
- Are specific sources or PM attributes linked to adverse effects?
- How do we know what sources to control to reduce public health risks?

PM Program Directive in 1998

- Congress increased the EPA PM Program budget of \$27.8 million by \$22.4 million per year. A mandate was made to EPA:
 - Seek guidance from NAS / NRC expert panel on research priorities
 - Redirect & expand intramural program
 - Expand STAR PM Grants Program
 - 5 PM Centers
 - Develop RFA's to pressing science issues
 - Coordination:
 - OAR Super-Sites Program
 - Federal agencies (Committee on Environment and Natural Resources
 - Air Quality Research Subcommittee)
 - Other funding organizations and stakeholders – Health Effects Institute, Electric Power Research Institute, etc.

EPA - NRC Collaboration on the PM Research Program

- In three reports, the NAS National Research Council identified important PM research priorities to strengthen and expand the scientific understanding of the links between ambient PM and adverse health effects.
- EPA's research program is aligned with the NRC recommendations.
- A fourth NRC report has been delivered to EPA addressing progress to date and future research needs.



EPA PM Research Program



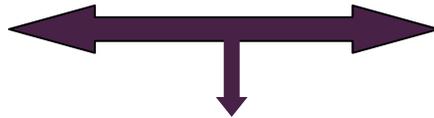
Epidemiology



Molecular

Clinical and Animal
Toxicology Studies

Intramural Program



EPA STAR Program
(PM Centers)

EPA Partners:

- Other Federal Agencies
- Health Effects Institute
- National Research Council
- Academia
- Industry laboratories

Emission Source
Characterization



Exposure, Atmospheric
Measurement and
Models



Supersites and EPA
Monitoring Network

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Why the PM Centers?

1998: EPA established five university-based PM Research Centers

- To help address the most pressing unanswered questions associated with PM
- To bring together multidisciplinary expertise needed to tackle the complex problems associated with PM and its public health implications
- To bring together experts who can contribute unique and independent perspectives to the PM problem

EPA Leadership in Particulate Matter Research

- EPA's PM research program is a model of science leadership

Internationally recognized EPA intramural research program

- The diverse intramural expertise of the EPA "Center" is coordinated with the extramural PM Centers to enhance the Program's strength

Harvard Center for Ambient Particle Health Effects

New York University Particulate Matter Research Center

Northwest Research Center for Particulate Air Pollution and Health

Southern California Particle Center and Supersite

University of Rochester Particulate Matter Research Center

- EPA PM research also coordinates with the national air monitoring network, including Supersites

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Five Years of Progress by EPA and its Partners

- Research has strengthened our confidence that PM causes adverse health effects – “biologic plausibility”
- Improved understanding of the importance of PM characteristics on human health
- Broadened focus from pulmonary effects to cardiovascular system effects
- Emphasis on susceptibility issues (e.g. dosimetry)
- Demonstrated that the PM_{2.5} ambient monitoring system is valid for use in epidemiology studies
- Developed new tools to support state implementation of NAAQS.

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Final NRC Report (IV) – Program Review and Adjustments

- Good progress made, esp. in exposure & dosimetry
- Program integration – responsive collaborative approaches that make full use of Program resources
- Encouraged greater interdisciplinary, ‘systematic’ approaches
- Recommended more structured approach to identification of hazardous components & attributes
- Recommended further emissions inventory and air quality model work

US EPA Science Advisory Board: 2002 Interim Review of the Particulate Matter (PM) Research Centers

"The Centers have been and promise to continue being an important part of the PM research portfolio of the Agency."

- "The PM Centers program a) has produced benefits beyond those normally found in individual investigator-initiated grants and b) is likely to continue to provide such benefits..."
- "The PM Centers program has allowed for the development of a critical mass in interdisciplinary research at individual Centers..."
- "Have the Centers made a difference in the conduct of epidemiologic research? The answer is clearly -Yes"

OMB Benefits Analysis

September 2003

- ... estimated that the health and social benefits of enforcing clean-air regulations from October 1992 to September 2002 were between \$120 billion and \$193 billion - *five to seven times greater than the costs of compliance.*
- Benefits include: reductions in hospitalization and emergency room visits, premature deaths and lost workdays.
- Regulation of PM accounts for a significant majority of the public health benefit estimated for all federal regulation.

Great Strides -- Significant Questions Remain

The National Research Council

Research Priorities for Airborne Particulate Matter: IV. Continuing Research Progress (2004)

“Much has been learned from the research investment in 1998, and evidence gained by the investment is already being used in decision-making, which will continue even in the face of uncertainty. However, much is still to be learned... Continued enhancement of [this] air pollution and health research effort will undoubtedly yield substantial benefits for years to come...in [the] effort to improve air quality and public health.”

Where Do We Go From Here?

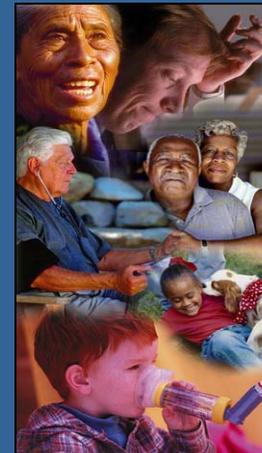
Address NRC Report IV recommendations

- Need for responsive Program management
 - Refined to provide more agile adjustment to the evolving PM research agenda, including integration with the PM Centers
- Develop a systematic, directed approach to “Hazardous Components”
 - Intramural program and PM Centers adjustments to link:
 - PM attributes to sources to health effects**
- Need for studies of long-term health impacts
 - \$30M grant for prospective epidemiology study
 - 5 retrospective epidemiology studies
- Support OAR, state/tribal implementation of standards
 - PM Centers recompete (integrate implementation issues)
 - Program integration from PM sources to health to improve decision-making

PM Research is Science Foundation for EPA Decision-Making Process

- PM research has significant regulatory benefits and impacts:
 - Indicates that fine PM standards are important to protect public health (accounts for majority of regulatory benefits – OMB)
 - Strengthens confidence in the scientific basis for the PM standards
- EPA's science program has produced critically important findings included in the *PM Air Quality Criteria Document* used in the current review of the *PM National Ambient Air Quality Standards*

Clean Air -- EPA Goal 1:



“Protect and improve the air so it is healthy to breathe and risks to human health and the environment are reduced.”

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Today's Agenda: An Update on PM Science

- **Topic 1: Addressing uncertainties in the PM epidemiologic studies**
Joel Schwartz, Harvard University
Sally Liu, University of Washington
- **Topic 2: Biological explanations for how PM is causing premature mortality and who is most susceptible to PM effects**
Mark Utell, University of Rochester
Robert Devlin, EPA National Health & Environmental Effects Research Lab
- **Providing Regulatory Context**
Jeffrey Holmstead, Assistant Administrator, EPA Office of Air and Radiation
- **Topic 3: Ambient particles, their toxic components, sources and how they impact health**
John Froines, University of California, Los Angeles
Morton Lippmann, New York University

Today's Agenda: An Update on PM Science

- **Panel Discussion on PM Research Challenges Ahead**

John Bachmann, U.S. EPA (moderator); Mark Utell, University of Rochester; Jonathan Samet, Johns Hopkins University; Petros Koutrakis Harvard University, Philip Hopke, Clarkson University; Carol Henry, American Chemistry Council; Tad Aburn, Maryland Department of Environment, Michael Lipsett, California Department of Health Services

- **PM Research: What We Know and Where We're Headed**

Daniel S. Greenbaum, President, Health Effects Institute