

M. G. Constantini
Health Effects Institute
Cambridge
USA

4

Particle Emissions Characterization and Health Effects Research

Particle Emissions Characterization and Health Effects Research

Maria G. Costantini, Ph.D.
Health Effects Institute
955 Massachusetts Avenue
Cambridge, MA 02090
617-767-6700
mcostantini@healtheffects.org

Researchers investigating the health effects of particulate matter have suggested that certain particle characteristics may be toxicological important. However, given that particles differ by size, composition, shape, and morphology depending on source and location, there is yet no consensus as to which specific parameter may be responsible for causing health effects. At a recent PM meeting (the 3rd Particle Colloquium, June 1999), researchers discussed which particle characteristics may be important in causing health effects and provided some evidence supporting various hypotheses. Researchers also pointed to the difficulty of this type of work as there many more components of PM than one could test experimentally, the available technologies for characterizing particles have limitations, and it is necessary to consider the interaction of components in the particle-phase as well as in the particle-phase.

This presentation provides an overview of the particle parameters scientists involved in health effects research have suggested it would be useful to measure to inform the interpretation of toxicological studies and of emission characterization studies. It also describes briefly one of the Health Effects Institute research goals HEI to evaluate the possible health effects associated with the introduction of new technologies, fuels, and fuel additives.

Particle Emissions Characterization and Health Effects Research

Maria G. Costantini, Ph.D.
Health Effects Institute

Presentation at the third ETH- Workshop on Nano-Particle Measurements,
Zurich, August 10-11, 1999

Overview

- Perspectives on particle characterization from the 3rd Particle Colloquium
- HEI current and future research program on PM

Critical issues

Perspectives from the 3rd PM Colloquium

- We can measure more components of PM than we can test for relevance (Jonathan Samet)
- What can we measure versus what should be measured (Erich Wichmann)
- We need to consider interactions among constituents (Jonathan Samet)

HEI

Critical issues

Perspectives from the 3rd PM Colloquium (cont)

- Metal content may be important. It would be useful to determine which particles contain the metals of interest (Ann Aust)
- There is a need for standardized, well characterized particles to facilitate comparison of results (Joe Brain)

Which particle characteristics should be measured?

Perspectives from the 3rd PM Colloquium

- Size distribution.
- Surface area and chemistry
- Chemical composition
- Acidity
- Presence of gas-phase components on surface
- Chemical form of metals
- Bioavailability of components
- Oxidative potential

HEI

Which particle characteristics should be measured?

Necessary

- Particle size distribution → Deposition depends on size. Ability of cells to react with particle may depend on size
- Surface area and chemistry → Cells react with components on surface first
- Chemical composition → Important in order to determine role of particle composition

HEI

Which particle characteristics should be measured? (cont)

Necessary

- Acidity → May affect particle toxicity
- Presence of gas-phase compounds → May be carried in the deep lung and cause effects. (Example NO and peroxide)

HEI

Which particle characteristics should be measured?

May be useful (but need to know more)

- Chemical form of metal → A metal in a certain chemical state may be more reactive. Which metals are important?
- Bioavailability/solubility of particle components → Which components? How do we measure it?
- Oxidative potential → Certain chemical species have the potential of generating reactive oxygen species that damage cells. How do we measure it?

HEI current program on PM

- Research: Epidemiological and Experimental Studies addressing:
 - Can adverse effects of PM be observed in experimental studies?
 - What disease or conditions affect susceptibility to PM
 - What particle attributes are most involved in toxicity?
 - How does personal exposure to PM relate to ambient measures?
 - Do co-pollutants interact with PM in causing health effects
- Reanalysis: Time-Series and Long-Term Studies

HEI

HEI's future research goal

HEI is interested in evaluating possible health effects associated with the introduction of new technologies, fuels, and fuel additives

HEI

Possible HEI future research topic

Fuel additives to reduce particle mass

Effects of using cerium or other additives on:

- particle composition and size distribution
- generation of new compounds
- health outcomes

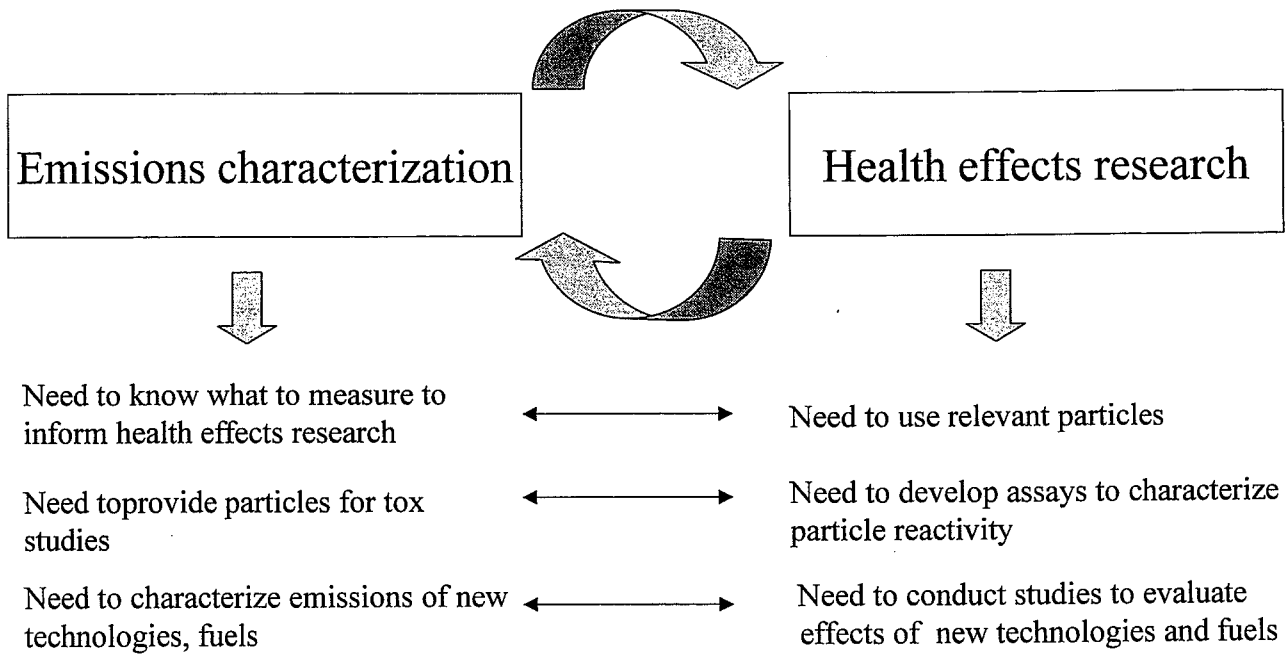
HEI

Fuel additives: What is known?

- Which fuel additives are likely to be used (cerium, ferrocene, urea)?
- What information is available on their effects on emissions composition and particle size distribution?

Please send information to mcostantini@healtheffects.org or mrichmond@healtheffects.org

Relationship Between Disciplines



HEI