



CLEAN AIR RESEARCH PROGRAM

RESEARCH CHARACTERIZES PARTICULATE MATTER (PM) AND IMPROVES MONITORING AND POLLUTION CONTROL

Issue:

Under the Clean Air Act, states are required to operate and maintain air monitoring networks to determine if they are meeting the federal standards for high-priority air pollutants, known as criteria pollutants. One of these pollutants, particulate matter (PM), offers unique challenges to monitoring and regulation because it is the only criteria pollutant that is not defined by its chemical composition.

Unlike an ozone molecule, which is the same wherever it is measured across the country, PM's characteristics vary greatly. Airborne PM comes in many different sizes, ranging from the size of the smallest viruses to larger than the diameter of a human hair. It also comes in a variety of chemical "flavors," meaning chemical properties vary from one particle to the next.

PM's qualities are also defined by the source of the pollutant such as an automobile or industry, and by the changes of seasons, geographic location, or even local meteorological conditions. As a result, particle pollution is different depending on where you live.

Research to better characterize PM is needed by the U.S. Environmental Protection Agency and others to more accurately identify and define the many different types of PM across the country and to advance the technology to measure, monitor, and control the pollutant.

Scientific Objective:

Scientists in the Clean Air Research Program in EPA's Office of Research and Development (ORD) are working to understanding the chemical composition, size, and concentration of PM at different

locations across the country. They are also studying the origin of the source of PM which will assist state governments with regulating the pollutant and developing more targeted control measures.

While some pollutants can be studied in a laboratory, researchers studying the many characteristics of PM must conduct research in outdoor settings across the country to assess the many unique and differing factors that contribute to the creation of particle pollution.

Key questions being addressed include:

- What air pollutants need to be routinely monitored and controlled to protect public health?
- What methods are needed to ensure sufficient measurement accuracy and precision of air

continued on back

CLEAN AIR RESEARCH PROGRAM

continued from front

monitors for each regulated pollutant?

- What testing requirements and measurement criteria are needed to ensure methods used to obtain data from monitors are accurate?

Research is under way to:

- Develop and evaluate methods that characterize coarse PM, i.e., particles ranging in size from 2.5-10 micrometers (μm) in diameter.
- Develop and evaluate methods for fine $\text{PM}_{2.5}$ and coarse $\text{PM}_{10-2.5}$ to enable PM measurement with high-time resolution of periods of one hour or less.
- Develop, evaluate, and apply advanced air monitoring methods to identify air pollution sources contributing to non-attainment of the air quality standards in certain areas of the country.

Application and Impact:

The Clean Air Research Program is uncovering the secrets of PM by defining the many different properties and qualities of the pollutant. Research has led to

improved understanding of the characteristics of PM at different locations across the country and is providing critical regulatory support to implement the national air quality standards for PM.

Health researchers can use the discoveries about the characteristics of PM to study in more detail how the pollutant causes adverse heart and lung effects. In this way, the Clean Air Research Program is providing a source-to-health outcome approach to protecting the public from air pollutants.

Accomplishments:

- ORD science supported the adoption of testing specifications and acceptance criteria for $\text{PM}_{2.5}$ and $\text{PM}_{10-2.5}$ monitors.
- ORD developed a method for use by EPA's regulatory programs to measure coarse PM.
- Since 2003, ORD science has supported the designation of 19 monitor types that can be used by states to determine if their air is in compliance with federal standards.

- ORD science led to the designation of new test methods and equivalent methods for $\text{PM}_{2.5}$ and $\text{PM}_{10-2.5}$ monitoring instruments.

REFERENCES

Vanderpool, R.; Hanley, T.; Dimmick, F.; Solomon, P.; McElroy, F.; Murdoch, R.; Natarajan, S., Multi-Site Evaluations of Candidate Methodologies for Determining Coarse Particulate Matter ($\text{PM}_{10-2.5}$) Concentrations: August 2005 Updated Report Regarding Second-Generation and New $\text{PM}_{10-2.5}$ Samplers.

<http://www.epa.gov/ttn/amtic/files/ambient/pm25/casac/att2casac.pdf>

CONTACT

Robert Vanderpool, National Exposure Research Laboratory, EPA's Office of Research and Development, 919-541-7877, vanderpool.robert@epa.gov.

JANUARY 2009