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CLEAN **AIR** RESEARCH PROGRAM

# AIR POLLUTION RESEARCH IMPROVES UNDERSTANDING OF MULTIPOLLUTANT IMPACTS ON HUMAN HEALTH

## Issue:

People are exposed to mixtures of air pollutants throughout life. Clear advances have been made in understanding and minimizing the risks associated with some air pollutants with known singular toxicity risk, but the impacts of mixtures of low levels of air pollutants are still uncertain.

Historically, outdoor air research has largely focused on individual air pollutants like particulate matter (PM), ozone, or priority hazardous air pollutants (HAPs). This research has been critical for the development and implementation of clean air standards by the U.S. Environmental Protection Agency. As a result, air quality in the United States has improved.

To further advance air quality management, EPA is adding a multipollutant component. This "one atmosphere" approach takes into account that humans and ecosystems are exposed to many air pollutants at the same time, and that there exist many atmospheric processes and conditions that underlie this mix of pollutants.

Currently, each pollutant is assessed separately and controlled by independent measures. A multipollutant approach offers an opportunity to more effectively target air pollutants at their sources and reduce more than a single pollutant with control measures. The desired outcome is to have a broader impact on outdoor air pollutant levels and reduce the cost of pollution control.

Multipollutant approaches to environmental decision making require new science to understand and appreciate the complexities of co-pollutant interactions (chemical and biological). More advanced scientific methods, models and tools are needed.

In response, the Clean Air Research Program in EPA's Office of Research and Development is shifting toward a multipollutant approach to air research. This research emphasis is based on recommendations by science advisory groups, including the National Research Council, Science Advisory Board, and Board of Scientific Counselors, which have encouraged EPA to transition from individual pollutant control and regulation to an air quality management theme that includes multipollutants.

## Scientific Objective:

The Clean Air Research Program has developed a three-pronged strategy to address multipollutant issues that builds on earlier scientific contributions in this area. The strategy integrates the

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many scientific disciplines that advance knowledge about air pollution. These disciplines include the study of sources and atmospheric processes, the study of how people are exposed, and subsequent health implications.

The strategy includes:

- Conducting laboratory studies to evaluate controlled source emissions and health effects. Conducting laboratory studies of artificial mixtures that test hypothetical interactions that may be driving more generalized atmospheric exposure mixtures.
- Conducting real-world studies in cities where emission, exposure, and health data can be collected or integrated on multipollutant exposures that may impact human health.

Areas of scientific focus include:

- Understanding the relationships between sources of air pollutants and atmospheric transformation (secondary) air pollutant products.
- Understanding the health risks posed by mixtures of air pollutants.
- Advancing atmospheric and exposure modeling of multipollutants.
- Developing methods and controls for sources or air pollutants that impact health relevant emissions or products.
- Determining a hierarchy of sources and related emission components regarding relative health risks.

As part of this effort, there is an initial emphasis directed to near-road exposures since mobile sources emit a complex mix of gases, vapors, and particles.

## Application and Impact

The Clean Air Research Program has already made significant contributions to our understanding of multipollutants. Work has revealed how multipollutants are generated as primary emissions as well as secondary transformation byproducts. Scientists have also expanded the capabilities to measure multipollutants.

There also have been advances in our understanding of how people are exposed and impacted by mixtures of pollutants.

The research program has led the way in multipollutant assessments. The atmospheric model called the Community Model for Air Quality (CMAQ) has recently been expanded beyond just predicting ozone pollution to include PM and a host of air toxics or hazardous air pollutants as well. This model is used by states and local air quality managers to develop implementation plans to meet EPA's air quality standards and is used by other researchers conducting epidemiology studies.

### REFERENCES

Office of Air Quality Planning and Standards: The Multi-pollutant Report: Technical Concepts & Examples
http://www.epa.gov/air/airtrends/studies.html

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**JANUARY 2009**