



CLEAN AIR RESEARCH PROGRAM

EPA DEVELOPS AND APPLIES NEW TECHNOLOGIES AND DATA TO CHARACTERIZE AIR POLLUTANT EMISSIONS

Issue:

Profiling or characterizing the many sources of air pollutants is critical to advancing pollution control and mitigation efforts. The data collected can be used to improve understanding of the risks of exposure to human health and the environment, and to support the development of risk management strategies.

To accurately evaluate air pollutants and their unique characteristics, new testing methodologies, models, and data are required. These tools support efforts by the U.S. Environmental Protection Agency and states to improve inventories of air pollution emissions. The inventories are important, because they help to advance air pollution abatement strategies and enhance forecasting of the impact of these strategies on air quality.

Scientific Objective:

EPA's Clean Air Research Program in the Office of Research and Development (ORD) is a leader in developing and applying a wide array of sophisticated emissions detection and analysis technologies to more accurately characterize air pollution. These technologies offer faster and more accurate data, including real-time data.

ORD research is currently focused on:

- Light-duty diesel vehicles using conventional and alternative fuels
- Industrial sectors, including oil and gas production as well as distribution
- Large area sources, e.g. landfills
- Aircraft and other off-road vehicles and engines

- Emissions from wild and prescribed fires
- Emissions from gases released by vegetation
- Ammonia sources
- Geographic allocated emissions

ORD scientists are measuring ammonia (a major precursor to fine PM_{2.5}) from a variety of sources such as animal farms and congested roadways. High-tech emission characterization methods like Fourier Transform Infrared Spectroscopy (FTIR) and diode lasers are being used to measure methane emissions from landfills. Likewise, ultraviolet spectra technology is being used to determine mercury emissions from power plants.

ORD's laboratory and field capabilities for emissions characterization are extensive. Field test equipment for sampling emissions includes a dilution

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sampler testing facility, a mobile field test laboratory, and several types of open-path optical remote sensing units.

ORD has also developed a portable laboratory for field testing of PM_{2.5} and gaseous emissions. Equipment in this laboratory trailer samples and analyzes emission plumes from a number of sources, including jet engines and locomotives.

The research program has developed a facility in EPA's research laboratories in Research Triangle Park, N.C., to reproduce real-world emissions of a wide variety of trucks, using diesel and alternative fuels. With this capability, scientists can characterize emission profiles under a variety of driving patterns and artificial environmental conditions.

Application and Impact:

The Clean Air Research Program provides the scientific tools needed by air quality managers and regulators to improve the fundamental information regarding emission profiles from a wide variety of sources, from

diesel trucks to landfills. This information is incorporated into air quality models and management decisions to control air pollutants.

For example, research incorporating flow visualization, tracer gas measurements, and computational fluid dynamics modeling has improved characterizations of diesel exhaust plume dispersion.

Research has also led to:

- Updated data on air emissions from municipal landfills
- Development of improved emission factors for prescribed forest burns
- New physical and chemical methods to identify and quantify components of PM and develop emission profiles for important sources of PM and air toxics

These improved methods allow EPA to identify sources of air pollution that pose significant exposure and human health risks.

Ultimately, this research will help to develop improved emissions-measurement systems that:

- Profile air pollution sources
- Develop enhanced models to estimate emissions and pollutant concentrations
- Understand exposure and health impacts
- Lead to better management approaches

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