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science in ACTION
BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

CLEAN AIR RESEARCH PROGRAM

RESEARCH IMPROVES UNDERSTANDING OF CHEMICAL CHARACTERISTICS AND SOURCES OF PARTICLE POLLUTION

Issue:

Research to understand the chemical characteristics and different sources of air pollutants is important to the U.S. Environmental Protection Agency in developing effective policies and standards to protect the public and environment.

The science of source characterization involves measuring emissions from a pollution source, such as a diesel truck or other man-made or natural source, and determining the chemical properties of these emissions. Techniques commonly used to perform these analyses include gas chromatography, X-ray fluorescence, and ion chromatography.

While these tools are adequate for many purposes, more accurate emission-analysis methods are required to fully assess airborne particulate matter (PM), provide needed data to chemical emissions inventories, improve air toxics modeling, accurately determine the health risks from exposure, and better understand how to control and reduce emissions.

As new technologies are developed for engine design, industrial production, and even the combustion fuels themselves, advances in methods to evaluate and analyze their emissions are critical. High-tech source characterization methods that provide real-time feedback and results are needed during short, transitional events such as engine startups, changes in power level, and changes in combustion output. New methods with enhanced sensitivities are also required when analyzing sources that emit minute amounts of air pollutants over wide dispersion areas, such as motor vehicles.

Scientific Objective:

Scientists in the Clean Air Research Program in EPA's Office of Research and Development are dedicated to advancing the science to understand sources of air pollutants through the development of new technology and other tools. Research is focused on:

- Developing improved emissions measurement systems
- Characterizing and profiling air pollution sources
- Developing enhanced models to quantify and estimate emissions, concentrations, exposures, and health impacts.

Research objectives are to:

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- Characterize emissions from open burning.
- Develop and apply optical, remote-sensing technology for petroleum refineries, oil and gas fields, mobile emissions, and waste operations, among other sources.
- Improve methods to characterize ammonia (including ammonia nitrate and ammonia sulfate) from natural sources.
- Improve characterization of PM and air toxic emissions from aircraft engines.
- Develop an enhanced chemical composition database from sources contributing to air pollutants.
- Characterize emissions from light-duty vehicles powered with ethanol and other alternative fuels.

This and other related research will enable EPA to determine the "chemical fingerprints" of PM from emissions sources that include commercial jet engine turbines, on- and off-road diesel/biodiesel engines, and industrial-scale and residential oil-fired boilers.

In addition, more advanced source characterization methods will enable detailed analysis of particulate matter in the 2.5-micrometer size range, known as $PM_{2.5}$. All of these results will further EPA's goal to determine which air pollution sources pose the greatest exposure risks and threats to human health.

Application and Impact:

The Clean Air Research Program has advanced understanding of source characterization by providing new data and technology for use by EPA, states, and tribes to determine which sources of air pollution pose the greatest exposure risks and most severely impact human health.

The use of more technologically advanced source characterization techniques has:

- Improved emissions inventories for air pollutants.
- Advanced computer models for predicting airborne aerosol dispersion, PM source/receptor relationships, and air quality impacts.
- Improved the ability to assess air toxicity levels.
- Provided critical knowledge to advance health effects studies.
- Assisted the development and implementation of rules and regulations of air pollutants.

REFERENCES

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