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CLEAN **AIR** RESEARCH PROGRAM

EPA ADVANCES TECHNOLOGY TO MORE EFFECTIVELY MEASURE AIR POLLUTION SOURCES

Issue:

Technological advances in measurement methods provide state-of-the-art capabilities to support both the research and outdoor (ambient) monitoring needed to protect public health and the environment.

New methodologies developed by the U.S. Environmental Protection Agency enable air quality managers and regulators to measure pollutants in the air we breathe in real time; track pollutants as they move across continents and oceans using global positioning technology; and detect diffuse sources such as pollutants from landfills and wastewater lagoons.

Research is needed to improve the detection limits, response-time, and versatility of existing measurement technologies. For example, most standard methods approved by EPA for detecting emissions of air pollutants provide accurate results, but they do not provide real-time data. The data are integrated over a period of measurement that may be hours or days old. Relating these data to rapidly changing pollutant levels, emission profile changes, or short- term health outcomes is difficult and complex.

In addition, the lack of real-time information prevents process-control adjustments to emission and exhaust systems that might improve efficiency and reduce pollution.

Science Objective:

The Clean Air Research Program in EPA's Office of Research and Development (ORD) strives to advance emission and air measurement and monitoring technologies as well as improve emissions control or prevention capabilities. ORD's research addresses both technology and methodologies that enhance sensitivity and selectivity for the many types of particulate and gaseous materials that end up in the air.

In recent years, technological advances have produced real-time (or near real-time) emission-detection methods and instrumentation that are highly accurate and yield improved datasets for use in various assessments. The field application of these technologies ranges from point sources, such as smokestacks, to non-point (diffuse) sources, such as industrial leaks and animal farm waste lagoons.

Among these advanced methods are both instruments and analysis systems, For example:

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- Jet Resonance Enhanced Multi-Photon Ionization-Time-of-Flight Mass Spectrometry (Jet REMPI-TOFMS), developed in collaboration with SRI International. This instrument allows for real-time and highly accurate measurements of individual particles and their composition.

- Geospatial Monitoring of Air Pollution (GMAP). This mobile monitoring capability uses networked fast-response instruments and a precise global positioning system to yield a map of air pollution patterns surrounding a source.

- An area source measurement method, called OTM 10, uses Vertical Radial Plume Mapping (VRPM) and Horizontal Radial Plume Mapping (HRPM) for rapid analysis of optical measurements of emissions from non-point sources.

Application and Impact:

Measurement technologies developed by EPA scientists offer air quality managers and risk assessors more reliable and useful tools to control and prevent air pollution. The methods noted above (Jet REMPI-TOFMS and OTM 10) have significantly advanced the control of air pollution sources. They have:

- Supported the development of more advanced and efficient combustion systems
- Improved the ability to characterize sources of air pollution, including non-point sources
- Improved air quality models and emissions inventories

Jet REMPI-TOFMS has been used to measure the exhaust gas streams of several on-site combustion systems, including a municipal waste incinerator and specialized mobile vehicles used by the U.S. Department of Defense. The technology has been applied to identify air toxics associated with diesel generators, aircraft turbines, and industrial boilers.

The technology has also proven to be an exceptional instrument for studies to determine sources of air toxics from roadway vehicles and is being used in EPA's studies on air pollution near roadways. Likewise, the new GMAP program has been used in a number of field studies to assess air pollution spatial patterns in close proximity to major roadways.

The EPA method OTM 10 has similarly been used successfully for numerous monitoring efforts, including:

- Emissions from landfills
- Animal feeding operations, industrial facilities
- Highways
- Agricultural fields sprayed with biosolids as fertilizer
- Contaminated site remediation
- Homeland security research

New measurement technologies help to protect human health and the environment by providing the data required to develop and implement sound pollution control strategies.

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MARCH 2009