

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

AIRBORNE FINE PARTICULATE MATTER (PM) RESEARCH PROGRAM

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FINE PARTICULATE MATTER WEB SITE

[www.netl.doe.gov/products/
power/enviro/pm25/](http://www.netl.doe.gov/products/power/enviro/pm25/)

NETL WEBSITE

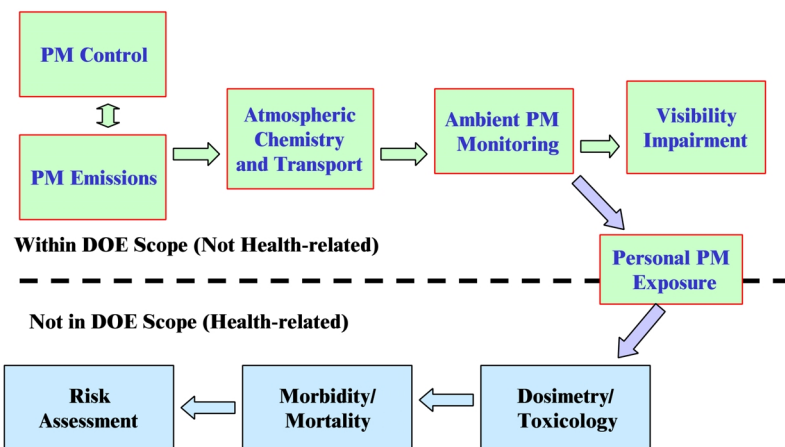
www.netl.doe.gov

Background

In response to growing concerns over fine particulate matter (PM) emitted into the atmosphere from anthropogenic sources, the Department of Energy's National Energy Technology Laboratory (DOE-NETL) is pursuing a major research program to clarify the options for reducing the PM contribution from energy production, especially from coal fired power plants. The program was initiated in 1998 when Congress appropriated funds to the DOE Office of Fossil Energy (DOE-FE) to be directed to NETL for this purpose. Improved scientific knowledge of atmospheric PM is especially urgent in light of the Environmental Protection Agency's (EPA's) recently adopted National Ambient Air Quality Standard (NAAQS) for PM_{2.5} (particles with aerodynamic mean diameters at or below 2.5mm). EPA has scheduled these standards, first adopted in 1997, for review in 2002.

Description

The DOE program builds on a history of air pollution emission control development and previous investigations of source-receptor relationships between power plant emissions and ambient air quality. Particular emphasis is given to the upper Ohio River valley region because it has a major concentration of coal fired power plants, and is upwind of the largest regional complex of urban areas in the United States. Projects supported by the DOE program are limited to those that do not involve the study of human health effects; while the results of health-based research are critical to the future direction of the DOE program, and the DOE program contains key links to health-based studies, the research itself is being pursued by other agencies, especially EPA.



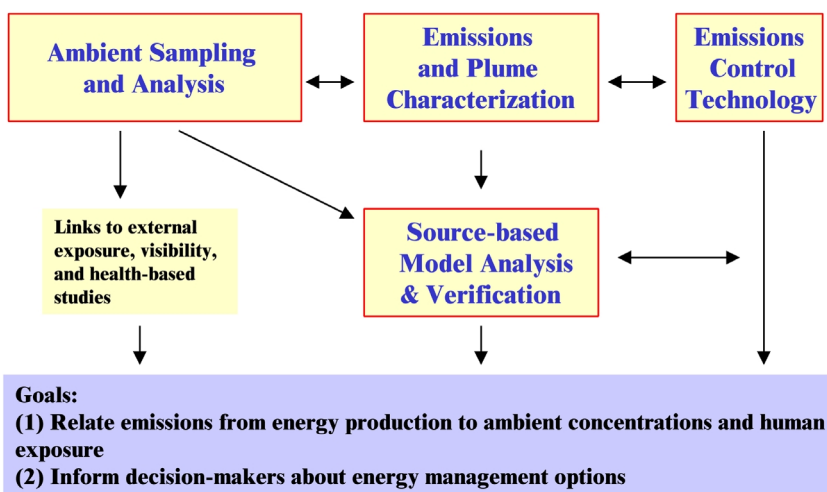
Specific Goals of the NETL 5-year PM Program

- Relate emissions from energy production to ambient concentrations and human exposure
- Inform decision-makers about energy management options for achieving PM_{2.5} and related air quality standards

The overall goals of the NETL fine PM program are to: (1) provide the applied science needed to quantitatively relate the emissions from energy production to ambient air PM concentrations and human exposure at downwind receptors; and (2) inform decision makers about management options applicable to coal fired power generation to achieve the national PM standards. To address these two goals, the NETL program has been organized into four components:

1. Ambient Sampling and Analysis
2. Characterization of Emissions and Plumes
3. Source-Receptor Modeling and Evaluation
4. Emissions Control Technology R&D

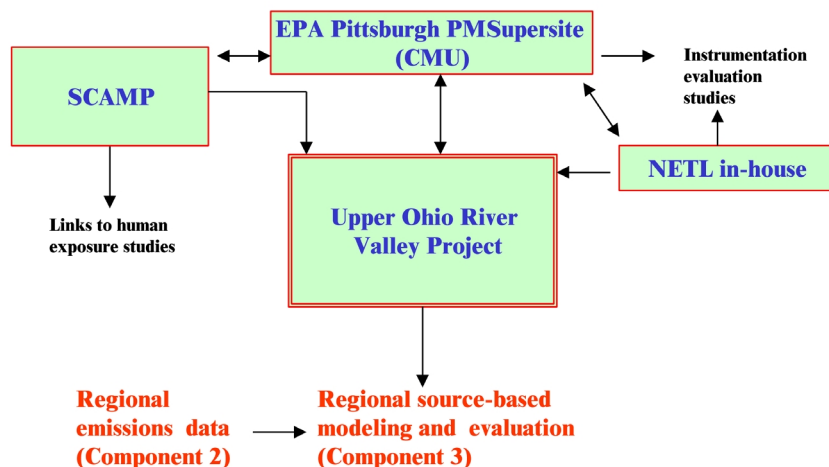
The major projects initiated by NETL thus far have focused on the ambient sampling and analysis component of the program. Early focus on this component was critical because it provides the foundation for the other three components of the program. As the program continues, more emphasis will be placed on the interpretation and application of the ambient air data, acquisition and characterization of emissions data and analysis of all the information via advanced modeling studies. The development of emission control technology options will be assessed, modified, and expanded or reduced as necessary to meet the needs identified in the modeling studies.



Ambient Sampling and Analysis Projects

The Upper Ohio River Valley Project (UORVP) was the first major project initiated by NETL, and forms the core around which the remainder of the program is developed. The UORVP is directly complemented by the Steubenville (OH) Comprehensive Air Monitoring Project (SCAMP) which investigates the linkage between ambient air conditions and human exposure to pollution in the region, and by the NETL in-house PM monitoring site, where a wide variety of ambient PM sampling devices are being evaluated. The UORVP, SCAMP, and NETL in-house teams have been cooperating

closely with researchers from Carnegie-Mellon University (CMU), which has been selected by EPA to develop a “Supersite” for ambient PM monitoring in Pittsburgh. In July, 2000, NETL expanded this cooperation to include a significant level of co-funding of the EPA-CMU Supersite.



The UORVP includes four sites that were all part of existing local and/or state air quality programs. The Lawrenceville (urban) and Holbrook (rural) sites constitute the primary site pair in the UORVP because both of these sites contain several types of PM monitoring equipment, continuous samplers for co-polluting gases (CO, SO₂, NO_x, NH₃, etc), and surface meteorological stations. “Satellite” sites (PM_{2.5} monitors only) are located near Morgantown, WV and Athens, OH. Preliminary analysis of the first year of monitoring data from the Lawrenceville and Holbrook monitoring sites has yielded the following observations and trends: (1) continuous monitoring equipment is performing as well as filter-based samplers in accounting for ambient PM_{2.5} levels; (2) the median values and seasonal trends in the PM_{2.5} levels is similar for Lawrenceville and Holbrook suggesting that the levels are impacted more by regional than by local effects; (3) sulfate is the dominant chemical species at both the Holbrook and the Lawrenceville sites during the winter months; and (4) PM_{2.5} levels are consistently higher in summer than in winter, with intermediate levels being observed in the fall. The UORVP will complete its planned measurements in the summer of 2001, and will enter its principal analysis and interpretation phase later that year

The objective of the Steubenville Comprehensive Air Monitoring Project (SCAMP) is to measure the concentrations of PM_{2.5} and other air pollutants at ambient monitoring stations in and around Steubenville, OH and relate them to the pollutant concentrations actually breathed by persons living in the area. SCAMP comprises two major components that are most easily identified by sampling location: “outdoor” and “indoor.” DOE is supporting the outdoor study, which includes daily measurements of PM_{2.5} mass and composition at a central urban site, four remote sites,

Components of the NETL Program

- Ambient Sampling and Analysis
- Characterization of Emissions and Plumes
- Source-Receptor Modeling and Evaluation
- Emissions Control Technology R&D

PRIMARY PROJECT PERFORMERS

Upper Ohio River Valley Project Advanced Technology Systems, Inc.
Pittsburgh, PA

Steubenville Comprehensive Air Monitoring Project
CONSOL, Inc.
Library, PA

EPA-Pittsburgh PM “Supersite”
Carnegie-Mellon University
Pittsburgh, PA

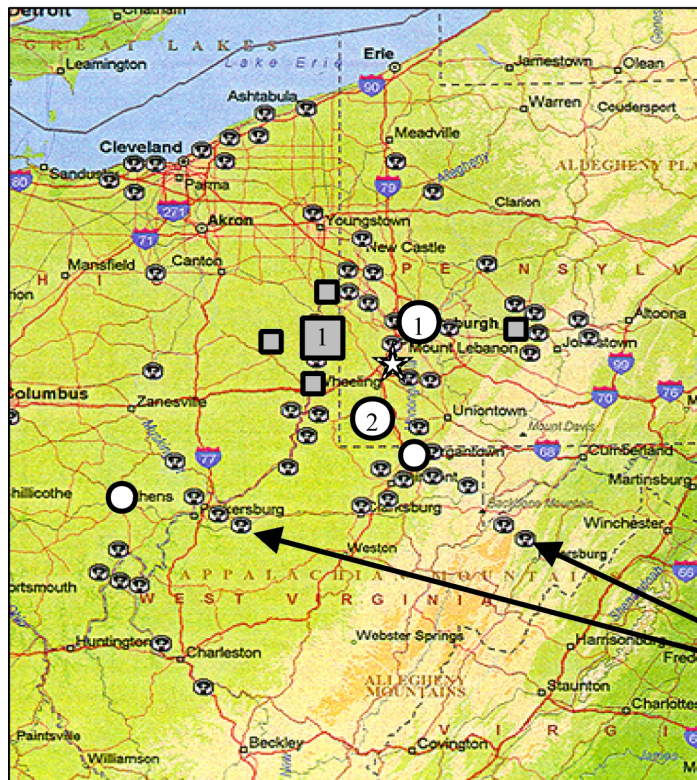
NETL-Pittsburgh In-house Monitoring Site
NETL Office of Science and Technology
Pittsburgh, PA

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and outside the homes of people who have agreed to participate in the research project. The indoor component of SCAMP is being performed mainly by the Harvard University School of Public Health under subcontract to CONSOL, and is supported by the Ohio Department of Development's Coal Development Office (OCDO) and a consortium of industry participants. The indoor study is measuring PM_{2.5} and co-pollutants inside the homes of participants, and will collect data from personal samplers worn by the participants.

In support of these regional ambient sampling and analysis activities, NETL's Office of Science & Technology (OST) is operating a comprehensive air monitoring station at its research facility about 15 miles south of Pittsburgh. This station includes a 10-meter meteorological tower, equipment to continuously monitor PM_{2.5} particulates containing carbon and polyaromatic hydrocarbons, and continuous monitors for gaseous pollutants O₃, SO₂, NH₃, NO_y, NO_x, CO, H₂S, and peroxide. Beginning in July, 2000, scientists from the Atmospheric Science and Applied Technology Division of Battelle in Columbus, Ohio will perform part of the EPA's Environmental Technology Verification Program (ETV), entitled "Verification of Ambient Air Fine Particulate Monitors" at the NETL-OST monitoring facilities. The purpose of the ETV Program is to provide objective and quality assured performance data on environmental monitoring equipment and technologies, so that users, developers, and consultants can make informed decisions about these technologies.

The CMU-EPA "Supersite," scheduled to begin operation in 2001, will feature a central monitoring station located near the CMU campus in the central Pittsburgh urban area and a set of satellite sites. Baseline monitoring is planned for an 18-month period that will include detailed characterization of PM size, surface, and volume distribution, PM chemical composition as a function of size and on a single particle basis. Three fourteen day long intensive sampling periods are planned to examine temporal variation and to collect detailed data for model testing and validation. A collaborative team of 20 research groups from 13 universities, 2 companies, a national laboratory, and a federal agency will participate in the project. Local and state air pollution agencies are also supporting the effort.



UORVP Sites

- ① - Lawrenceville
- ② - Holbrook
- - Satellites

SCAMP Sites

- ① - Primary
- - Satellites

★ - NETL In-house site

★ - Coal-fired power plants