

QUARTERLY PROGRESS REPORT

Cooperative Agreement Number R 82806101-0

Date of report: June 4, 2000

Title: The Pittsburgh PM Supersite Program: A Multidisciplinary Consortium for Atmospheric Aerosol Research

Principal Investigators: Spyros Pandis, Cliff Davidson, and Allen Robinson

Institution: Carnegie Mellon University

Project Period: January 15, 2000 - April 14, 2000

Objectives: Characterization of the atmospheric aerosol in the Pittsburgh region. Development and evaluation current and next generation atmospheric aerosol monitoring techniques. Quantification of the impact of the various sources to the PM concentrations in the area. Elucidation of the links between PM characteristics and their health impacts. Quantification of the relationship between indoor and outdoor concentrations. Study of the responses of the PM characteristics to changes in emissions.

Work Status: The CMU team has met with representatives of the Pittsburgh City Planning Department to finalize the arrangements about the location and design of the central monitoring site. The selected location is in Schenley Park, roughly 50 meters past the end of a dead end street (Frew St.). This is a large grassy area adjacent to the CMU campus, several hundred meters from the nearest heavily traveled street (Forbes Avenue). There are no major sources within several hundred meters of the site. Schenley Park extends more than a kilometer to the south and west, the predominant upwind directions. The CMU team is currently finalizing the design of the structure that will be used for the sampling activities.

The design of the new CMU Air Quality Laboratory (an addition to the existing facilities) has been completed and renovation of the existing space will start during the summer of 2000. The new laboratory space is approximately 2500 square feet and will include two class-100 clean rooms. This Air Quality Laboratory will serve as the center for the preparation, maintenance, and calibration of the monitors. The laboratory is expected to be ready before the end of 2000.

The project team participated in meetings with the other six Supersites, the Eastern US Supersites and representatives of the corresponding states, and finally in a meeting with the principal investigators of other atmospheric aerosol measurement projects in the Western Pennsylvania area. The major outcome of these meetings is the better coordination of the various related activities. The results from the central sampling site will be augmented by measurements from a trend site (Lawrenceville, PA) and a speciation site (South Fayette, PA) operated by the Allegheny County Health Department, two speciation sites (Florence and Greensburg, PA) operated by the Pennsylvania DEP, one speciation site (Wheeling, WV) operated by the West Virginia DEP, one site in Athens OH, and also four sites in Steubenville OH. During the intensive periods the CMU team will collect and analyze daily samples for speciation in all of these sites. Additional sites that can be used during the intensive periods include Hazelwood and Holbrook in the Pittsburgh area.

The instrumentation for the real time aerosol size measurements (ultrafine and regular Scanning Mobility Particle Spectrometers and Aerosol Particle Sizer) has been received and is currently calibrated and tested. Two different approaches are evaluated for the ambient measurements. The first will measure the dry aerosol size and the second will measure the aerosol size at ambient relative humidity. The instruments will automatically switch between the two modes every few minutes. The set-up will be tested during the summer and winter of 2000.

We have started the construction and testing of the inorganic and organic speciation samplers for the Supersite. A number of alternative designs are currently tested in the laboratory for particle losses, gas absorption and particle evaporation artifacts. An OC/EC analyzer has been ordered from Sunset Labs and is expected to arrive in CMU in June.

The Colorado State group has been improving the automation of their cloud water and peroxide sampling systems.

PM composition measurements collected by the DOE-NETL Upper Ohio River Valley Project (UORVP) are analyzed by the Supersite team to provide insights into the PM characteristics in

the area. One of the surprising preliminary findings are the high concentrations of OC in a rural background site (Holbrook) located upwind of Pittsburgh. These results indicate that the background OC concentrations around the urban area represent, for at least these limited measurements, 80% or so of the urban OC concentrations. A pilot study is planned for the summer of 2000 to gather further information about OC in the area and to improve our sampling plan for the Supersite. If these preliminary results apply to the rest of the year it will be necessary to study in more detail than originally planned the characteristics of background carbonaceous particulate matter.

The overall project is proceeding according to the original schedule and the reported progress is consistent with the goals and objectives for the period of the report. The aims of the project have not changed from the original application.

Changes in Key Personnel Involved in the Project: Dr. Andrey Khlystov has been hired as the Supersite Manager. Dr. Khlystov has extensive experience in coordinating field campaigns, ambient aerosol measurements, and analysis of aerosol processes. He is responsible for overseeing the day to day operations of the project. Six Carnegie Mellon graduate students have been assigned to the Supersite project. Their responsibilities are shown in Table 1. Three of them (Cabada, Mandiro, and Takahama) have graduate fellowships and their tuition/stipend will not be charged to the project.

Table 1. Graduate Students Added to the Project Team

Name	Department	Expected Degree	Role
Charles Stainer	Chemical Eng.	Ph.D.	Aerosol size measurements, PM hygroscopic properties
Juan Cabada	Chemical Eng.	Ph.D.	OC/EC, primary and secondary organic aerosol
Mulia Mandiro	Chemical Eng.	M.S.	Aerosol size measurements
Satoshi Takahama	Civil Eng.	Ph.D.	Inorganic aerosol sampling and speciation
Subramanian Ramachandran	Mechanical Eng.	Ph.D.	Metals; Meteorology
Sarah Rees	Eng. and Public Policy	Ph.D.	Size-resolved PM measurements

Expenditures to Date: During the first three months of the project the Supersite team has used approximately 60% of the budget for the corresponding period. The project spending will be according to the original budget by the end of the first year of the project.

Quality Assurance Requirements: The Quality Assurance/Quality Control plans for the project are coordinated with the other six Supersites and EPA. The QAPP for the project will be sent to EPA in the fall of 2000. Dr. Cliff Davidson is currently managing the QA/QC activities of the project. The project team with the help of EPA is looking for a QA officer who will not be participating in the sampling activities.

Planned Activity for the Subsequent Reporting Period: Major activities planned for the second quarter of the project include:

- Central sampling site preparation.
- Beginning of the construction of the Air Quality Laboratory and the corresponding clean rooms.
- Installation, testing, and evaluation of the filter-based OC/EC analyzer
- Testing of the single particle mass spectrometer in the Houston Supersite by the University of Delaware group
- Testing and laboratory testing of the relative humidity control systems for the real time particle sizing instruments
- Pilot study in the central sampling location and a background site (Holbrook) to test the particle sizing instrumentation and also to improve our understanding of the OC/EC concentrations in the area. Selected samples will be speciated by the Rogge group
- Construction and characterization of the inorganic and organic speciation samplers

Assistance Agreement Quarterly Report Summary

Date of Report: June 4, 2000

EPA Agreement Number: R 82806101-0

Title: The Pittsburgh PM Supersite Program: A Multidisciplinary Consortium for Atmospheric Aerosol Research

Investigators: Spyros Pandis, Cliff Davidson, Allen Robinson (*Carnegie Mellon Univ.*), Anthony Wexler, Murray Johnston (*Univ. of Delaware*), Wolfgang Rogge (*Florida Intern. Univ.*), Mark Hernandez (*Univ. of Colorado*), Jeff Collett (*Colorado State Univ.*), Susanne Hering (*Aerosol Dynamics*), Jonathan Kahl (*Univ. Wisconsin*), Barbara Turpin (*Rutgers Univ.*), John Ondov, Steven Buckley (*Univ. of Maryland*), *RJ Lee, Inc.*, Kevin Crist (*Ohio University*), Antonio Miguel (*UCLA*), Delbert Eatough (*Brigham Young University*), Urs Baltensperger (*Paul Scherrer Inst.*), Jonathan Samet (*Johns Hopkins*), Richard Sextro (*LBNL*), William Aljoe (*DOE-NETL*).

Institution: Carnegie Mellon University

Research Category: Airborne Particulate Matter (PM) Supersites

Project Period: January 15, 2000 - April 14, 2000

Objective of Research: Characterization of the atmospheric aerosol in the Pittsburgh region. Development and evaluation current and next generation atmospheric aerosol monitoring techniques. Quantification of the impact of the various sources to the PM concentrations in the area. Elucidation of the links between PM characteristics and their health impacts. Quantification of the relationship between indoor and outdoor aerosol concentrations. Study of the responses of the PM characteristics to changes in emissions.

Progress Summary: The CMU team together with the Pittsburgh City Planning Department have finalized the arrangements about the location of the central monitoring site. The selected location is in a large grassy area in Schenley Park adjacent to the CMU campus. The design of the new CMU Air Quality Laboratory (an addition to the existing facilities) has been completed and renovation of the existing space will start during the summer of 2000. After a number of meetings with local, state air pollution authorities and DOE-NETL the satellite sites for the project have been selected. The results from the central sampling site will be augmented by measurements from a trend site (Lawrenceville, PA) and a speciation site (South Fayette, PA) operated by the Allegheny County Health Department, two speciation sites (Florence and

Greensburg, PA) operated by the Pennsylvania DEP, one speciation site (Wheeling, WV) operated by the West Virginia DEP, one site in Athens OH, and also four sites in Steubenville OH. During the intensive periods with the help of the CMU team daily PM samples will be collected and analyzed in all of these sites. Additional sites that can be used during the intensive periods include Hazelwood and Holbrook in the Pittsburgh area. The instrumentation for the real time aerosol size measurements (ultrafine and regular Scanning Mobility Particle Spectrometers and Aerosol Particle Sizer) is currently calibrated and tested. Two different approaches are evaluated for the ambient measurements. The first will measure the dry aerosol size and the second will measure the aerosol size at ambient relative humidity. The instruments will automatically switch between the two modes every few minutes. We have started the construction and testing of the inorganic and organic speciation samplers for the Supersite. A number of alternative designs are currently tested in the laboratory for particle losses, gas absorption and particle evaporation artifacts. The overall project is proceeding according to the original schedule and the reported progress is consistent with the goals and objectives for the period of the report. The aims of the project have not changed from the original application.

Future Activities: Major activities planned for the second quarter of the project include: central sampling site preparation; beginning of the construction of the Air Quality Laboratory and the corresponding clean rooms; installation, testing, and evaluation of the filter-based OC/EC analyzer; testing of the single particle mass spectrometer in the Houston Supersite by the University of Delaware group; laboratory testing of the relative humidity control systems for the real time particle sizing instruments; a pilot study in the central sampling location and a background site (Holbrook) to test the particle sizing instrumentation and also to improve our understanding of the OC/EC concentrations in the area; construction and characterization of the inorganic and organic speciation samplers.

Supplemental Key Words: Airborne particulate matter, aerosol, size distribution, ultrafine, fine and coarse particles, atmospheric chemistry, source-receptor, measurement error, study design, epidemiology, regional modeling, source/receptor analysis, Pittsburgh, Ohio River Valley, Western Pennsylvania, photochemistry, meteorology, trajectory modeling, peroxides.

Relevant Web Sites: homer.cheme.cmu.edu