

## QUARTERLY PROGRESS REPORT

**Cooperative Agreement Number** R 82806101-0

**Date of report:** June 15, 2002

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

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**Institution:** Carnegie Mellon University

**Project Period:** February 16, 2002 – May 15, 2002

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**Objectives:** Characterization of the atmospheric aerosol in the Pittsburgh region; development and evaluation of 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; study of the responses of the PM characteristics to changes in emissions.

**Work Status:** Baseline ambient monitoring in the central site was continued during these three months without any significant problems. Three special experiments took place during this period to investigate specific hypotheses:

(1) A SMPS system was added to the Florence satellite site for the whole period. Florence, Pennsylvania, is approximately 45 km upwind of Pittsburgh in a rural area. The results from the Florence site suggest that the nucleation events that are often observed in the central site in Pittsburgh

are regional, and therefore will influence particle counts and size distributions at least throughout Western Pennsylvania and may be in an even wider area.

(2) The chemical composition of freshly nucleated particles was investigated combining the UC Davis/U. Delaware Single Particle Spectrometer (RSMS-III) with the ultrafine particle concentrator of Costas Sioutas (U. Southern California). The RSMS-III can analyze the chemical composition of single particles as small as 20 nm, but the sampling rate is relatively low. To increase the number of particles analyzed, the ultrafine particle concentration was added in front of the single particle spectrometer during two weeks in March 2002. Three nucleation events occurred during that period. Preliminary results indicate that all 20-30 nm during the nucleation burst contained organics and only some of them contained detectable amounts of sulfate and nitrate. These results strongly indicate that condensation of organic vapors is responsible for at least part of the growth of the fresh nuclei from their initial size (a few nm) to 20 nm and above. The role of sulfuric acid remains uncertain because of the small sensitivity of the ionization mass spectrometers to sulfate.

(3) A calibration experiment was run for the single particle mass spectrometer. In this experiment sets of three MOUDI impactor samples (one for inorganic ions, one for metals, and one for OC/EC) were collected daily during two weeks. The measurements from these impactors will be used for the calibration of the RSMS-III. The dependence of this calibration on chemical composition, season, etc., will be tested with additional samples that will be collected during the summer and fall.

The analysis of the collected samples is proceeding very well. The PAQS team has analyzed the majority of the samples (filters, steam-sampler) collected during the first year of the study. We are almost up-to-date in the analysis of the major inorganic ions (CMU Speciation Sampler, PC-BOSS), the OC and EC (three CMU samplers and PC-BOSS), the mass concentrations (FRM, Dichotomous Sampler, and MOUDI impactor). There is a small backlog only for the analysis of the metals (due to problems with the ICP/MS that have been now resolved), the bio-aerosols (the laboratory was used for analysis of suspected anthrax samples and other bio-terrorism related problems), and the organic speciation (because of the labor-intensive nature of the analysis). Most of the data have been loaded to the PAQS database and are currently undergoing QA/QC. The data are in the NARSTO format.

The analysis of the data is also underway. As an example, the PAQS team will give 14 presentations in the upcoming AAAR meeting in October. Additional presentations of the first set of results are planned for the International Aerosol Meeting (Taiwan, September 2002), the International Global Atmospheric Chemistry conference (Greece, September 2002) and the AGU meeting (San Francisco, December 2002). We are currently writing papers for inclusion in the first Supersite special issue.

The PAQS team has obtained access to a number of sources in the Pittsburgh region. We have obtained approval to sample in the Squirrel Hill Tunnel (a tunnel on Interstate 376 located ~ 2 miles from the central monitoring site), the Bellefield Boiler (a coal-fired steam generator located ~ 0.5 miles from the central monitoring site). We will also conduct fence line monitoring next to a large steel mill and a large coke production facility. We are also collecting dust samples from various locations around Pittsburgh, and samples of the biomass that is representative of Southwestern PA. The source characterization phase of PAQS started in May 2002 and it will continue for 6-9 months.

## **Publications**

1. J. C. Cabada, S. N. Pandis, and A. L. Robinson (2002) Sources of atmospheric particulate matter in Pittsburgh, Pennsylvania, *JAWMA*, 52, 732-741.
2. C. O. Stanier, A. Khlystov, and S. N. Pandis (2002) Chemical processes and long-range transport of aerosols: Insights from the Pittsburgh Air Quality Study, in *Long Range Transport of Air Pollution*, Kluwer.

## **Presentations**

1. "Seasonal composition of  $PM_{2.5}$  and performance of the Federal Reference Method in Pittsburgh",  $PM_{2.5}$  and Electric Power Generation, Pittsburgh, April 2002 (S. L. Rees, S. Takahama, A. L. Robinson, A. Khlystov, and S. N. Pandis).
2. "Continuous measurements of ammonia, sulfate, and nitrate in Pittsburgh: Implications for  $PM_{2.5}$  control strategies",  $PM_{2.5}$  and Electric Power Generation, Pittsburgh, April 2002 (B. Wittig, A. Khlystov, S. Takahama, C. Davidson, A. Robinson, S. Hering, and S. N. Pandis).
3. "The contribution of long-range transport and secondary organic aerosol to  $PM_{2.5}$  in Pittsburgh",  $PM_{2.5}$  and Electric Power Generation, Pittsburgh, April 2002 (J. C. Cabada, R. Subramanian, S. N. Pandis, A. L. Robinson, W. Tang, N. J. Anderson, T. Raymond, and C. I. Davidson).

4. "The Dry-Ambient Size Spectrometer: A new technique for the automatic on-line measurement of the atmospheric aerosol water size distribution", Annual Meeting of American Geophysical Union, San Francisco, December 2001 (A. Khlystov, C. O. Stanier, S. N. Pandis).
5. "The July 2001 intensive of the Pittsburgh Air Quality Study", Annual Meeting of AAAR, Portland, Oregon, October 2001 (C. I. Davidson, A. L. Robinson, and A. Khlystov, S. N. Pandis).
6. "Sources of atmospheric carbonaceous particulate matter in Pittsburgh", Annual Meeting of AAAR, Portland, Oregon, October 2001 (J. Cabada, S. N. Pandis and A. L. Robinson).
7. "Automated measurements of dry and wet ambient aerosol distributions", Annual Meeting of AAAR, Portland, Oregon, October 2001 (A. Y. Khlystov, W. R. Chan, C. O. Stanier, M. Mandiro, and S. N. Pandis)
8. "Continuous measurements of ammonia and ammonium in ambient air", Annual Meeting of AAAR, Portland, Oregon, October 2001 (A. Khlystov, J. Sauser, R. Otjes, and S. N. Pandis).

**Changes in Key Personnel Involved in the Project:** None.

**Expenditures to Date:** During the first nine quarters of the project the Supersite team has used the entire budget for the corresponding period.

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

- Continuation of the baseline measurements
- July 2002 intensive. Addition of: daily samples in satellite sites, semi-continuous VOC measurements, semi-continuous metals measurements, PC-BOSS.
- Continued analysis of the collected samples by the CMU team and its collaborators.
- Continuation of the source sampling and characterization experiments
- QA/QC of the 2001 data. Submission of the data files to EPA.

**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](http://homer.cheme.cmu.edu)