**Date of Report:** January 15, 2004
**EPA Agreement Number:** R82806001-0
**Title:** PM2.5 Technology Assessment and Characterization Study in New York State (PMTACS-NY)
**Investigators:** Kenneth L. Demerjian, PI, with G. Lala, J. Schwab, V. Mohnen, and U. Roychowdhury, ASRC, University at Albany; P. Galvin, R. Gibbs, D. Felton and T. Lanni, New York State Department of Environmental Conservation; C. Kolb, M. Zahniser, and D. Worsnop, Aerodyne Research, Inc.; S. Herring, Aerosol Dynamics, Inc.; L. Newman, Brookhaven National Laboratories; P, Hopke, Clarkson University; W. Brune, Penn State University; L. Husain, N. Kim, X. Zhou, NYS Department of Health; J. Zamurs, NYS Department of Transportation; H. Patashnick, Rupprecht and Patashnick Co., Inc.
**Institution:** Atmospheric Sciences Research Center, University at Albany
**Cost Sharing Partners:** New York State Energy Research and Development Authority (NYSERDA) and New York State Department of Environmental Conservation (NYSDEC)
**Research Category:** Particulate Matter EPA "Supersites" Program
**Sorting Code:** 99-NCERQA-X1
**Project Period:** October – December 2003

**Objective of Research:**

As a result of recent clinical and epidemiological studies (NRC, 1998) associating adverse health effects in humans and fine particle mass, a new National Ambient Air Quality Standard for $PM_{2.5}$ mass (15 $\mu g/m^3$ annual and 65 $\mu g/m^3$ 24-hr average) has been promulgated in the United States (Federal Register, 1997). Significant scientific and technical issues surrounding the mitigation of the warm season PM2.5 /co-pollutant complex and its interdependence with $O_3$ air quality through coupled photochemical pathways, common precursors, and similar dependencies upon meteorology must be addressed if effective control strategies are to be implemented.

The long-term monitoring of the PM2.5/co-pollutant complex and its precursors at urban and regional representative sites provides the opportunity to track the impact of emission controls and their effectiveness on air quality. These data can to be used to verify that implemented PM2.5 primary and secondary precursor (including ozone precursor) emission controls are performing according to specifications and verify that PM2.5 and ozone air quality has responded to the emission changes achieved as expected. Without adequate monitoring systems to track the progress and effectiveness of implemented control programs, the air quality management approach remains unaccountable.

The PMTACS-NY Supersite program provides a unique and unparalleled opportunity to enhance our understanding of ozone/$PM_{2.5}$-precursor relationships and track progress in current precursor emission control programs and assess their effectiveness in achieving expected air quality responses. The impact of this research is highly significant, providing a sound scientific basis for informed effective decisions in the management of air quality in New York and will benefit its citizens both environmentally and economically.

The PMTACS-NY is designed around three major objectives and addresses a series of science policy relevant questions related to hypotheses to be tested using measurement data collected under the program. The subject quarterly reports provide highlights on the overall program status, the progress made in the context of the specific tasks associated with the three program objectives, identification of outstanding issues, project schedule and completion status by task, and a budget analysis.

**Progress Summary/Accomplishments:**

**Objective I.** Measure the temporal and spatial distribution of the PM2.5/co-Pollutant complex including: $SO_2$, CO, VOCs/Air Toxics, NO, $NO_2$, $O_3$, NOy, $H_2CO$, $HNO_3$, HONO, PM2.5 (mass, $SO4^{=}$, $NO_3^-$, OC, EC, Trace Elements), single particle aerosol composition, CN, OH and $HO_2$ to support regulatory requirements to develop cost effective mitigation strategies PM2.5 and its co-pollutants and to establish trends in the relevant precursor concentrations to assess the impact of recent and future emission reductions in terms of emission control effectiveness and air quality response.

Measurements at our two rural sites Whiteface Mountain and Pinnacle State Park and at our two urban sites IS 52 in the South Bronx and PS219 in Queens operated during this quarter as outlined in Table 1 of the QAPP.

Upon learning that the construction of the NYS DEC's Queens College permanent monitoring facility would not be completed in time to host the PMTACS-NY winter intensive field study, we met with Queens College administrators to review potential alternate deployment options on the campus. During a site visit in October, the possibility of using recently vacated office space on the east side of the parking lot from where we were located at during summer 2001 field intensive was raised. Local campus officials were supportive of the idea, but required approval by the CUNY central administration, as they had plans to move these temporary office units to another campus. Letters were written to Queens and CUNY central administration seeking approval to use the facilities from January – February of 2004 for the winter intensive field study (WIFS). After several iterations we received approval to use the facilities on December 4. In anticipation of this approval, we had scoped out the placement of the various instrumentation systems to be deployed in the facility and identified electrical modifications and upgrades and facility modifications that were needed to support our operation. Timing is critical in performing these alterations. We have received exceptional support and cooperation from Queens College personnel and anticipate meeting our January 5, 2004 deadline. A listing of instrumentation to be deployed is provided in Table1.

**Table 1. PMTACS-NY Queens College Winter 2004 Field Intensive January 8 - February 12**

| Instrument | Operator | Parameter | QC Rm# & ~ Size | Placement |
|---|---|---|---|---|
| **Aerosol Mass Spec.** | **UA - Weimer et al.** | **PM Org, SO4, NO3, NH4** | Rm#300 9.5'x11' Shar. | rack |
| **TDLAS** | **UA - Li** | **NH3, HNO3** | RM#314 8.5'x11' | bench |
| **GATHOS** | **PSU - Brune et al** | **OH/HO2, OH loss** | Rm# 317/ 16'x11' | deck/scaffd |
| **PILS** | **UA - Rhoads** | **PM2.5 anions & cations** | Rm#301 / 8'x11' | bench |
| **R&P 8400N** | **UA/DEC Rattigan, Hogrefe** | **PM2.5 NO3** | Rm#302 / 8'x11' Shar. | floor/bench |
| **R&P 8400S** | **UA/DEC Rattigan, Hogrefe** | **PM2.5 SO4** | Rm#302 / 8'x11' Shar. | floor/bench |
| **SMPS** | **UA - Lala, Hogrefe** | **PM size distribution** | Rm#303 / 8'x11' Shar. | bench |
| **Nano SMPS** | **UA - Lala, Hogrefe** | **PM size distribution** | Rm#303 / 8'x11' Shar. | bench |
| **APS** | **UA - Lala, Hogrefe** | **PM size distribution** | Rm#303 / 8'x11' Shar. | bench |
| **CPC 3022** | **UA - Lala, Hogrefe** | **Particle number** | Rm#303/ 8'x11' Shar. | bench |
| **CPC Water based** | **AD - S. Hering** | **Particle number** | Rm#303 /8'x11' Shar. | |
| **a H2CO** | **UA - Schwab** | **formaldehyde** | Rm#308 / 8'x11' | rack/bench |
| **TEOM FDMS** | **R&P - Ambs** | **PM2.5 mass** | Outdoor (Shelter) | deck |
| **TEOM** | **UA -** | **PM2.5 mass** | Rm#304 8'x11' Shar. | |
| **SOAP Sampler** | **DEC-UA-Rutgers** | **PM Organic Species** | outdoor | deck |
| **Photolytic NO2** | **UA - DEC Schwab/Felton** | **NO2** | Rm#308 / 8'x11' | rack |
| **NOy** | **UA - DEC Schwab/Felton** | **NOy** | Rm#308 / 8'x11 | rack |
| **LiCor CO2** | **UA - Li** | **CO2** | Rm#314 | bench |
| **TECO NOx** | **DEC** | **NOx** | DEC8x8 trailer | rack |
| **TECO Pulsed Fluor** | **DEC** | **SO2** | DEC8x8 trailer | rack |
| **TECO O3** | **DEC** | **O3** | DEC8x8 trailer | rack |
| **Horiba THC** | **DEC** | **THC/NMHC/CH4** | DEC8x8 trailer | rack |
| **PE Auto GC** | **DEC** | **C2-C12 hydrocarbons** | Rm#329 / 15'x11' | bench |
| **Cyclone Samplers** | **DOH - Husain et al.** | **6-hr PM2.5 Composition** | Deck | outside |
| **HPLC - HONO/HNO3** | **DOH - Zhou et al.** | **HONO & HNO3** | Rm#313 /8'x11' Shar. | bench |
| **NH3 & PM_NH4** | **DOH - Zhou et al.** | **NH3 & PN_NH4** | Rm# 313 /8'x11' Shar. | bench |
| **UV MFRSR** | **UA/DEC Schwab/Felton** | **solar irradiance** | PS 219 | outside |
| **Nephelometer Optec** | **UA-DEC Schwab/Felton** | **b-scat** | Rm#303 / 8'x11 | |
| **AMS + TOFMS** | **Mainz/Aerodyne _ Drewnicl** | **Size resolved PM Org, SO4** | Rm#300 9.5'x11' Shar. | rack |
| **Sunset Labs EC/OC** | **Clarkson - Hopke et al.** | **EC/OC** | Rm#310 /8'x11' | |
| **ATOFMS** | **Clarkson - Hopke et al.** | **Single Particle Compos.** | Rm#306 /8'x11' | rack |
| **Aerosol Peroxides** | **Clarkson - Hopke et al.** | **MOUDI** | Rm#312 /8'x11' | |
| **TEOM FDMS** | **DEC** | **PM2.5 mass** | PS 219 | |
| **Accu Sampler** | **UA/DEC/DOH - Husain et a** | **PM2.5 metals & SO4=** | PS219 | |
| **STN PM Compos.** | **DEC/UA -Schwab** | **PM2.5 Composition** | PS 219 | |
| **PM2.5 FRM** | **DEC** | **PM2.5 mass** | PS 219 | |
| **R&P5400** | **DEC** | **PM2.5 carbon** | PS 219 | |
| **BAM** | **DEC** | **PM2.5 mass** | PS 219 | |
| **Toxic/PAMS Cannister** | **DEC** | **Toxics/C2-C12 nmhc** | PS 219 | |
| **ELPI** | **DEC - Lanni et al.** | **PM_mass/size** | Rm#304 8'x11' Shar. | |
| **nano SMPS** | **DEC - Lanni et al.** | **PM size distribution** | Rm#304 8'x11' Shar. | |
| **EAD - Model 3070** | **DEC - Lanni et al.** | **Total Aerosol Length** | Rm#304 8'x11' Shar. | |
| **Nano MET - DC** | **DEC - Lanni et al.** | **Aerosol Surface Area** | Rm#304 8'x11' Shar. | |

**Objective II.** Monitor the effectiveness of new emission control technologies [i.e. Compressed Natural Gas (CNG) bus deployment and Continuously Regenerating Technology (CRT)] introduced in New York City and its impact on ambient air quality, thorough remote open path roadside, mobile platform, and fixed site measurements of $CO_2$, CO, NO, $H_2CO$, HONO, CN and aerosol chemical composition.

There were no further measurements planned or performed with this technology during this quarter. A manuscript describing aircraft emissions measurements made with the Aerodyne mobile platform during the Summer 2001 field intensive at Kennedy International Airport is in final preparation.

**Objective III.** Test and evaluate new measurement technologies and provide tech-transfer of demonstrated operationally robust technologies for network operation in support of the development of process science and observation based analysis tools and health based exposure assessments.

FDMS, BAM, TEOM-50°, and FRM field measurement evaluation and intercomparison study continues at Queens College. With the resolution of operation issues associated with the outdoor enclosure for the FDMS system, we anticipate having a complete annual data set by the 2nd quarter of 2004 that will allow seasonal performance evaluations of the systems. In addition, a duplicate suite of instruments deployed in April 2003 at the PMTACS-NY Pinnacle State Park rural site (with the exception of BAM system planned but not yet deployed) to evaluate and intercompare these systems under cleaner and more aged aerosol conditions than observed in the city.

**Presentations and Publications:** 1) NYSERDA EMEP conference October 7-8, presentation "New York PM Supersite Update:What Have We Learned/Where Do We Need to Go?", K.L. Demerjian; conference poster presentations: Intercomparison of Semi-Continuous Particulate Sulfate and Nitrate Measurement Technologies at a New York State Urban and Rural Location, Olga Hogrefe, F. Drewnick, J. J. Schwab, K. Rhoads, S. Peters and K. L. Demerjian; Semi-Continuous $PM_{2.5}$ Sulfate and Nitrate Measurements In New York City and Whiteface Mountain, Oliver V. Rattigan, D. H. Felton, J. J. Schwab, U.K. Roychowdhury and K. L. Demerjian; Aerosol Size Distributions: A Comparison of Measurements From Urban and Rural Sites, G. Garland Lala, O. Hogrefe and K. L. Demerjian; Measurements of Carbon Particulate Matter in the Adirondack Region of Upstate New York, U. K. Roychowdhury, D. H. Felton, J. Schwab and K. L. Demerjian; Aerosol Laboratory Evaluations of PM2.5 Measurement Technologies, Olga Hogrefe, J.J. Schwab, G.G. Lala, O. V. Rattigan, J. Ambs and K.L. Demerjian; Recent Developments in the Field Evaluation of TEOM Based PM2.5 Monitoring Technologies, James J. Schwab, D. H. Felton, J. Ambs, J. Spicer and K.L. Demerjian; and 2) 3rd annual Environmental Symposium at Syracuse, October 27-28 presentation "Characterization of PM2.5 Air Quality and Sources in New York", K.L. Demerjian.

**Future Activities and Outstanding Issues:** 1) implementation of 2004 winter intensive field study; 2) participation in the Supersite PI's meeting January 25-27, 2004 Las Vegas, NV.

**Supplemental Keywords:** ambient air, atmospheric aerosols, ozone, particulate matter, metals, nitrogen oxides, sulfates, organics, atmospheric chemistry, monitoring, measurement methods, northeast air quality.
**Relevant Web Sites: http://www.asrc.cestm.albany.edu/pmtacsny/**