2009

ANNUAL MONITORING NETWORK PLAN

New York State Ambient Air Monitoring Program

Bureau of Air Quality Surveillance
Division of Air Resources
New York State Department of Environmental Conservation

Table of Contents

Section **Page**

Table of Contents (continued)

List of Tables

List of Figures

List of Acronyms and Abbreviations

AIRS	Aerometric Information Retrieval System
AQI	Air Quality Index
AQS	Air Quality System
ARM	Approved Regional Method
ASRC	Atmospheric Sciences Research Center
BAQS	Bureau of Air Quality Surveillance
CAMR	Clean Air Mercury Rule
CCNY	City College of New York
CFR	Code of Federal Regulations
CMSA	Consolidated Metropolitan Statistical Area
CO	Carbon Monoxide
Cr	Chromium
CTDEP	Connecticut Department of Environmental Protection
DNPH	2,4-Dinitrophenyl hydrazine
EAC	Early Action Compact
EC	Elemental Carbon
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GC	Gas Chromatography
GCMS	Gas Chromatography/Mass Spectrometry
HAPs	Hazardous Air Pollutants
HPLC	High Performance Liquid Chromatography
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
IMPROVE	Interagency Monitoring of Protected Visual Environments
NAAQS	National Ambient Air Quality Standards
NATTS	National Air Toxics Trends Stations
NCore	National Core
NESCAUM	New England States Coordinated Air Use Management
NJDEP	New Jersey Department of Environmental Protection
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NO_y	Sum of reactive nitrogen oxides
NSR	New Source Review
NYC	New York City
NYCRR	New York State Codes, Rules and Regulations
NYSERDA	New York State Energy Research and Development Authority
O_3	Ozone

List of Acronyms and Abbreviations (continued)

OC	Organic Carbon
ORD	Office of Research and Development (EPA)
PAHs	Polycyclic Aromatic Hydrocarbons
PAMS	Photochemical Assessment Monitoring Stations
Pb	Lead
PM	Particulate Matter
PM_{10}	Particulate Matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter of 2.5 microns or less
PMTACS	$PM_{2.5}$ Technology Assessment and Characterization Study
ppb	Parts per billion
ppm	Parts per million
PUF	Polyurethane Foam
SADCA	State Acid Deposition Control Act
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur dioxide
SOAP	Speciation of Organics for Apportionment of $PM_{2.5}$
SO_x	Sulfur oxides
SPM	Special Purpose Monitors
STN	Speciation Trends Network
SUNY	State University of New York
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulate
UV	Ultra Violet
VOCs	Volatile Organic Compounds

1. Introduction

The U.S. Environmental Protection Agency (EPA) finalized amendments to the ambient air monitoring regulations on October 17, 2006. The amendments revise the technical requirements for certain types of sites, add provisions for monitoring of $PM_{10-2.5}$, and reduce certain monitoring requirements for criteria pollutants. Monitoring agencies are required to submit annual monitoring network plans, conduct network assessments every 5 years, perform quality assurance activities, and, in certain instances, establish NCore sites by January 1, 2011.

Starting in July 2007, each State, or where applicable local, agency is required to "adopt and submit to the Regional Administrator an annual monitoring network plan which shall provide for the establishment and maintenance of an air quality surveillance system that consists of a network of SLAMS monitoring stations including FRM, FEM, and ARM monitors that are part of SLAMS, NCore stations, STN stations, State speciation stations, SPM stations, and/or, in serious, severe and extreme ozone nonattainment areas, PAMS stations, and SPM monitoring stations." This document is prepared and submitted as part of the fulfilment to these new requirements.

1.1 Background

New York State began a concerted effort to control the air pollution problem back in 1957, when the State Legislature enacted one of the nation's first comprehensive air pollution control laws. An Air Pollution Control Board was established to develop and direct a public information program for monitoring contaminant levels, and to conduct area studies and inventories outlining major problems. In December 1964, New York State developed air quality standards to protect its citizens against adverse health effects. These standards provided a long-range planning tool and established numerical air quality limits for the following contaminants: particulates, sulfur dioxide, carbon monoxide, oxidants, hydrogen sulfide, fluoride, beryllium and sulfuric acid mist.

In 1966 the Legislature responded to the increasing pollution levels by restructuring the administrative authority into the Department of Health, under which the Division of Air Resources was created. Major legislation was also introduced to provide increased efficacy of rules and regulations. That year also marked the severe New York City Thanksgiving holiday air pollution episode brought upon by a temperature inversion that lasted through the weekend.

By the time when the first Earth Day was held in 1970, it had become apparent that pollution abatement strategies in place were inadequate, and air quality—along with water quality and solid waste—became cornerstones of the emerging U.S. environmental conscience. The 1970 Clean Air Act Extension, along with the establishment of the U.S. Environmental Protection Agency in that same year, were defining moments in the history of air quality in this country.

Another development which has had a major effect on air pollution control in New York State was the creation of the Department of Environmental Conservation in 1970. The Division of Air Resources was transferred to the new Department and its administrative functions restructured and streamlined. Nine new regional offices were established to carry out responsibilities relating to pollution control of sources within their respective part of the State.

In 1977, the first set of Clean Air Act amendments was adopted because many states failed to meet mandated targets. One of the most effective of these was the New Source Review (NSR), which addresses older facilities that had been "grandfathered" by the original law. In 1990, additional amendments to the Clean Air Act included provisions for attainment and maintenance of national ambient air quality standards, mobile sources, air toxics, acid deposition control, permits, stratospheric ozone and global climate protection, enforcement; visibility improvement near National Parks, and other provisions relating to research, development and air monitoring.

In 1997, EPA announced more strict national ambient air quality standards (NAAQS) for ground-level ozone, the primary constituent of smog. After a lengthy scientific review process, including extensive external scientific review, EPA determined that these changes were necessary to protect public health and the environment. The new standard was intended to be more protective of the health of children and adults who play and work outdoors in the summer. In establishing the 8-hour standard, EPA set the standard at 0.08 parts per million (ppm) as an average over an 8-hour period and defines the new standard as a "concentration-based" form, specifically the 3-year average of the annual 4th-highest daily maximum 8-hour ozone concentrations. EPA also added new standards, using $PM_{2.5}$ as the indicator for fine particles (with $PM_{2.5}$ referring to particles with a nominal mean aerodynamic diameter less than or equal to 2.5 µm), and retained PM_{10} standards for the purpose of regulating the coarse fraction of PM10 (referred to as thoracic coarse particles or coarse-fraction particles, generally including particles with a nominal mean aerodynamic diameter greater than 2.5 µm and less than or equal to 10 µm, or $PM_{10\text{-}2.5}$). EPA established two new $PM_{2.5}$ standards: an annual standard of 15 $\mu g/m^3$ based on the 3-year average of annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors; and a 24-hour standard of 65 $\mu g/m^3$, based on the 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations at each population-oriented monitor within an area. These new standards were challenged by industry and in May of 1999 the U.S. Court of Appeals for the District of Columbia Circuit Court ruled that U.S. EPA must reconsider the new 8-hr ozone and fine particulate standards. The court did not throw out the standards, but ruled that U.S. EPA could not enforce them. On February 27, 2001, the Supreme Court substantially reversed the ruling of the lower court. The Supreme Court remanded the case to the Court of
Appeals for resolution of any remaining issues that had not been addressed in that court's earlier rulings. In March 2002, the Court of Appeals rejected all remaining challenges to the standards.

In December 2006, EPA issued the final rule revising the NAAQS for PM to provide increased protection of public health and welfare, respectively. EPA revised the level of the 24-hour $PM_{2.5}$

standard to 35 micrograms per cubic meter (μg/m^3) and retained the level of the annual $PM_{2.5}$ standard at 15μg/m^3. With regard to PM_{10}, the 24-hour standard was retained, but the annual PM_{10} standard was revoked.

After the most recent review of the ozone NAAQS, EPA revised the 8 hr ozone standard to 0.075 ppm, to be effective May 27, 2008.

Through the years, ambient monitoring has always been an important and integral part of the overall effort to manage our environmental resources. The Bureau of Air Quality Surveillance, which was originally established in the Division of Air Resources under the Department of Health in 1966, has been performing ambient air monitoring since.

1.2 Topography and Climate of New York State

New York State contains 49,576 square miles, inclusive of 1,637 square miles of inland water, but exclusive of the boundary-water areas of Long Island Sound, New York Harbor, Lake Ontario, and Lake Erie. The Adirondacks cover most of the northeast and occupy about one-fourth of the state's total area. The Appalachian Highlands, including the Catskill Mountains and Kittatinny Mountain Ridge (or Shawangunk Mountains), extend across the southern half of the state, from the Hudson River Valley to the basin of Lake Erie. Between these two upland regions, and also along the state's northern and eastern borders, lies a network of lowlands, including the Great Lakes Plain; the Hudson, Mohawk, Lake Champlain, and St. Lawrence valleys; and the coastal areas of New York City and Long Island.

The climate of New York State is broadly representative of the humid continental type, which prevails in the northeastern United States, but its diversity is not usually encountered within an area of comparable size. The geographical position of the state and the usual course of air masses, governed by the large-scale patterns of atmospheric circulation, provide general climatic controls. Differences in latitude, character of the topography, and proximity to large bodies of water have pronounced effects on the climate.

The planetary atmospheric circulation brings a great variety of air masses to New York State. Masses of cold, dry air frequently arrive from the northern interior of the continent. Prevailing winds from the south and southwest transport warm, humid air, which has been conditioned by the Gulf of Mexico and adjacent subtropical waters. These two air masses provide the dominant continental characteristics of the climate. The third great air mass flows inland from the North Atlantic Ocean and produces cool, cloudy, and damp weather conditions. This maritime influence is important to New York's climatic regime, especially in the southeastern portion of the state, but it is secondary to that of the more prevalent air mass flow from the continent.

The prevailing wind is generally from the west in New York State. A southwest component becomes evident in winds during the warmer months while a northwest component is characteristic of the colder one-half of the year.

The climate of the state features much cloudy weather during the months of November, December, and January in upstate New York, especially those regions that adjoin the Great Lakes and Finger Lakes and include the southern tier of counties. From June through September, however, about 60 to 70 percent of the possible sunshine hours are received. In the Atlantic coastal region, the sunshine hours increases from 50 percent of possible in the winter to about 65 percent of possible in the summer.

The Atlantic Coastal Plain and lower Hudson Valley experience conditions of high temperature and high humidity with some frequency and duration during the summer. By comparison, such conditions occur less frequently in the broad interior of New York State where they are usually shortened by the arrival of cooler, drier air masses from the northwest.

1.3 Population and Demographics

The US Census Bureau data for 2000 provide the following information for the State and 13 Metropolitan Areas of New York. Also shown are the percentage of population considered to be sensitive to air pollution events. The New York portion of the NY--NJ--CT--PA CMSA population numbered 12,689,665, constituting 67% of the State's total residents.

Table 1.1 New York State 2000 Census Data

Metro Area	Population	% < 17 yr old	% > 65 yr old
New York	9,314,235	24.5	11.9
Nassau-Suffolk	2,753,913	25.5	13.4
Buffalo-Niagara Falls	1,170,111	24.3	15.8
Rochester	1,098,201	25.6	12.9
Albany-Schenectady-Troy	875,583	23.9	14.3
Syracuse	732,117	25.8	13.3
Newburgh	341,367	29.0	10.3
Utica-Rome	299,896	23.9	16.5
Dutchess County	280,150	25.0	12.0
Binghamton	252,320	23.9	15.7

Metro Area	Population	% < 17 yr old	% > 65 yr old
Jamestown	139,750	24.5	16.0
Glens Falls	124,345	24.3	14.6
Elmira	91,070	24.4	15.6
State Total	18,976,457	24.6	12.9

2. Chronology of Air Monitoring in New York State

Manual sampling programs began in 1958. Most of the early sampling stations measured suspended particulates, settleable particulates, and sulfation (an indicator of sulfur dioxide concentration). The early monitoring system employed high volume samplers, and for the first year, operated on a daily basis. Subsequently sampling was reduced to a 1-in-6 day schedule, after statistical analysis of the first year's data indicated that such sampling frequency would provide an adequate representation of particulate pollution. By 1964, the manual monitoring system had evolved to 104 full-time stations, 140 stations by 1970, and 250 by the mid 70's.

New York was among the first to install and operate a continuous air quality monitoring system. The parameters monitored in the early 70's included: sulfur dioxide, nitric oxide, nitrogen dioxide, ozone, carbon monoxide, total hydrocarbons, soiling, and meteorological data.

Trace metal analysis of high volume sampler filters was initiated in 1979. Historically the NYS Department of Health provided laboratory services until 2003, when the positions funded by our Department for the analysis work were eliminated due to a statewide workforce reduction. The lead analysis continued until 2005. The lack of formal funding mechanisms between the two state agencies precluded the continuation of laboratory analysis support. The necessary laboratory work is now provided by a contract laboratory.

In 1986, New York began measuring inhalable particulates using high volume air samplers with a 0-10 micron size selective inlet. In the same year the Acid Deposition Monitoring Network was also established. In 1987, EPA revised the PM standard to regulate PM_{10}.

In 1988, the NYS ambient monitoring networks consisted of 85 TSP sites, 16 PM_{10}, 15 carbon monoxide monitors, 27 sulfur dioxide sites, 20 ozone stations, 8 NO_x monitors, and 18 lead sampling sites. There were 17 operational acid deposition sites statewide, and the initial phase of the toxics network was completed with the establishment of six toxic monitors in Staten Island. By 1990, the networks had the following make up: 58 TSP, 60 PM_{10}, 25 SO_2, 16 CO, 26 ozone, 7 NO_x , 16 lead, 18 acid deposition, 10 toxics, and 8 trace metals sites, respectively.

In accordance with the 1990 Clean Air Act Amendments, in 1994 BAQS established the first of two ambient air monitoring sites for enhanced ozone monitoring called Photochemical Assessment Monitoring Stations (PAMS) to collect and report detailed data for volatile organic compounds, nitrogen oxides, ozone and meteorological parameters.

BAQS began implementing the $PM_{2.5}$ monitoring networks of FRM and TEOM monitors in 1998. At its peak, there were 46 FRM instruments deployed. After sufficient data were obtained for attainment determination, FRM sites were reduced and some sites were augmented with TEOM instruments in order to provide realtime inputs for EPA's AirNow website for Air Quality Index (AQI) reporting.

BAQS currently operates the following monitors: 34 ozone, 23 SO_2, 7 NO_x, 1 NO_y, 9 CO, 25 FRM $PM_{2.5}$, 27 TEOM $PM_{2.5}$, 7 FRM PM_{10}, 3 TEOM PM_{10}, 8 STN, 2 continuous PM speciation, 20 acid deposition, 4 lead, 2 trace metals, 5 methane/non-methane, 11 toxics, 8 carbonyls, 2 PAMS, and 25 meteorological stations. Figure 2.1 below shows the geographic locations of monitoring sites in all nine regions of the State.

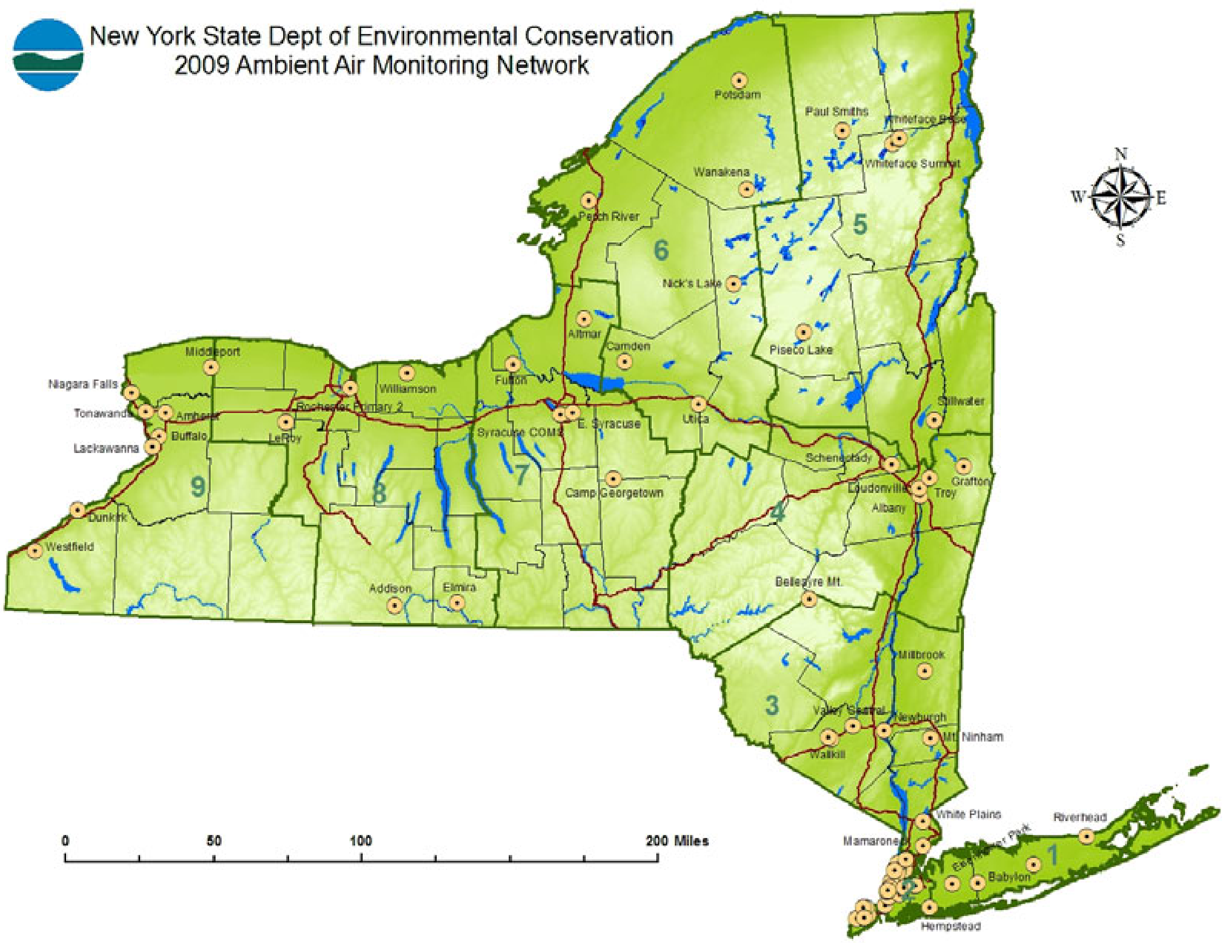

Figure 2.1 Location Map of Ambient Air Monitoring Sites in New York State

2.1 Monitoring Related Research and Investigations

In addition to the routine monitoring work, bureau staff collaborate with researchers from other agencies and academic institutions on a multitude of air pollution related studies. Over the years we have participated in research projects with the following partners: New York State Department of Health, New Jersey Department of Environmental Protection, Connecticut Department of Environmental Protection, State University of New York, Albany, Clarkson University, Massachusetts Institute of Technology, Rutgers University, Drexel University, University of Rochester Medical Center, Desert Research Institute, Rensselaer Polytechnic Institute, City University of New York, and Columbia University. These endeavors provided valuable data for the regulatory, scientific, and health research communities. Study findings are communicated through journal publications, as well as presentations at technical meetings and conferences. Listings of peer-reviewed scientific articles and oral/poster presentations resulting from recent BAQS monitoring activities are provided below.

2.1.1 Publications

Dirk Felton, Is it Time to Upgrade the $PM_{2.5}$ Federal Reference Method? Air & Waste Management EM Magazine, February, 2009.

Haider A. Khwajaa, Pravin P. Parekha, Adil R. Khana , Daniel L. Hershey , Ronaq R. Naqvie, Abdul Malikf , Khalid Khanf, In-Depth Characterization of Urban Aerosols Using Electron Microscopy and Energy-Dispersive X-ray Analysis, CLEAN, accepted for publication, 2009.

Valerie B Haley, Thomas O Talbot and Henry D Felton, Surveillance of the Impact of Air Pollution on Cardiovascular Disease in New York State, Environmental Health, submitted for publication, 2009.

Oliver V. Rattigan, H. Dirk Felton, Min-Suk Bae, James J. Schwab and Kenneth L. Demerjian, Multi-year hourly PM2.5 carbon measurements in New York: Diurnal, day of week and seasonal patterns, Atmospheric Environment, submitted for publication, 2009.

Stephen R. McDow, Monica A. Mazurek, Min Li, Lee Alter, John Graham, H. Dirk Felton, Thomas McKenna, Charles Pietarinen, Alan Leston, Steve Bailey, Sania W. Tong Argao, Speciation and Atmospheric Abundance of Organic Compounds in $PM_{2.5}$ from the New York City Area. I. Sampling Network, Sampler Evaluation, Molecular Level Blank Evaluation. Aerosol Science and Technology, 42:50–63, 2008.

Vincent A. Dutkiewicz, Sumizah Qureshi, Adil R. Khan, Liaquat Husain, James J. Schwab and Kenneth L. Demerjian, Field test data for 42 liter per minute $PM_{2.5}$ aerosol sampler used during the PMTACS-NY intensives held at Queens College, Queens, NY, Atmospheric Environment,

Volume 40, Supplement 2, 2006, Pages 182-191.

Sumizah Qureshi, Vincent A. Dutkiewicz, Adil R. Khan, Kamal Swami, Karl X.Yang, Liaquat Husain, James J. Schwab and Kenneth L. Demerjian, Elemental composition of $PM_{2.5}$ aerosols in Queens, New York: Solubility and temporal trends, Atmospheric Environment, Volume 40, Supplement 2, 2006, Pages 238-251.

Vincent A. Dutkiewicz, Sumizah Qureshi, Liaquat Husain, James J. Schwab and Kenneth L. Demerjian, Elemental composition of $PM_{2.5}$ aerosols in Queens, New York: Evaluation of sources of fine-particle mass, Atmospheric Environment, Volume 40, Supplement 2, 2006, Pages 347-359.

Min-Suk Bae, Kenneth L. Demerjian and James J. Schwab, Seasonal estimation of organic mass to organic carbon in $PM_{2.5}$ at rural and urban locations in New York state, Atmospheric Environment, Volume 40, Issue 39, December 2006, Pages 7467-7479.

Oliver V. Rattigan, Olga Hogrefe, H.D. Felton, James J. Schwab, Utpal K. Roychowdhury, Liaquat Husain, Vincent A. Dutkiewicz and Kenneth L. Demerjian, Multi-year urban and rural semi-continuous $PM_{2.5}$ sulfate and nitrate measurements in New York state: Evaluation and comparison with filter based measurements, Atmospheric Environment, Volume 40, Supplement 2, 2006, Pages 192-205.

Xinrong Ren, William H. Brune, Jingqiu Mao, Michael J. Mitchell, Robert L. Lesher, James B. Simpas, Andrew R. Metcalf, James J. Schwab, Yongquan Li, Kenneth L. Demerjian, Henry D. Felton, Garry Boynton, Allen Adams, Jacqueline Perry, Yi He, Xianliang Zhou, and Jian Hou, Behavior of OH and HO_2 in the Winter Atmosphere in New York City, Atmospheric Environment, Volume 40, Supplement 2, 2006, Pages 252-263.

Liming Zhou, Philip K. Hopke and Prasanna Venkatachari, Cluster analysis of single particle mass spectra measured at Flushing, NY, Analytica Chimica Acta, Volume 555, Issue 1, 5 January 2006, Pages 47-56.

Schwab J.J., Felton H.D., Rattigan O.V., Demerjian K.L., New York State Urban and Rural Measurements of Continuous $PM_{2.5}$ Mass by FDMS, TEOM and BAM, Journal Air & Waste Management Assoc. 2006, Volume 56:372-383.

Schwab, J.J., O. Hogrefe, K. L. Demerjian, V. A. Dutkiewicz, L. Husain, O. V. Rattigan, and H. D. Felton, Field and Laboratory Evaluation of the Thermo Electron 5020 Sulfate Particulate Analyzer, Aerosol Science & Technology, 2006, 40, S1, 36-44.

Venkatachari P., Zhou L., Hopke P.K., Felton D., Rattigan O.V., Schwab J.J., Demerjian K.L., Spatial and Temporal Variability of Black Carbon in New York City, Journal of Geophysical

Research, 2006, Vol 111, D10S05, 1-9.

Venkatachari P., Zhou L., Hopke P.K., Schwab J.J., Demerjian K.L., Weimer, S., Hogrefe O., Felton D., Rattigan O.,., An Intercomparison of Measurement Methods for Carbonaceous Aerosol in the Ambient Air in New York City, Aerosol Science & Technology, 2006, 40, 788-795.

Nenad Aleksic, Garry Boynton, Gopal Sistla, Jacqueline Perry, Concentrations and Trends of Benzene in Ambient Air over New York State during 1990-2003 Atmospheric Environment Volume 39 (2005) 7894-7905

Zheng Li, Philip K. Hopke, Liaquat Husain, Sumizah Qureshi, Vincent A. Dutkiewicz, James J. Schwab, Frank Drewnick and Kenneth L. Demerjian, Sources of fine particle composition in New York city, Atmospheric Environment, Volume 38, Issue 38, December 2004, Pages 6521-6529.

Drewnick, F., J. J. Schwab, J. T. Jayne, M. Canagaratna, D.R. Worsnop, and K.L. Demerjian, Measurement of ambient aerosol composition during the PMTACS-NY 2001 campaign using an aerosol mass spectrometer. Part I: Mass concentrations, Aerosol Science and Technology, 38(SI), 92-103, 2004.

Drewnick, F., J.T. Jayne, M. Canagaratna, D.R. Worsnop and K.L. Demerjian, Measurement of ambient aerosol composition during the PMTACS-NY 2001 campaign using an aerosol mass spectrometer. Part II: Chemically speciated mass distribution, Aerosol Science and Technology, 38(SI):104-117, 2004.

Dutkiewicz, V. A., S.Qureshi, A.R. Khan, V. Ferrara, J. Schwab, K. Demerjian, and L. Husain , Sources of fine particulate sulfate in New York". Atmos. Environ., 38, 3179-3189, 2004.
10. Hogrefe, O., F. Drewnick, G.G. Lala, J. J. Schwab, and K.L. Demerjian , Development, operation and applications of an aerosol generation, calibration and research facility, new instruments and data inversion methods, Aerosol Science and Technol.ogy, 38(SI): 196-214, 2004.

Hogrefe, O., J. Schwab, F. Drewnick, K. Rhoads, G.G. Lala, H.D. Felton, O.V. Rattigan, L. Husain, V.A. Dutkiewicz, S. Peters, and K.L. Demerjian , Semi-continuous $PM_{2.5}$ sulfate and nitrate measurements at an urban and a rural location in New York: PMTACS-NY Summer 2001 and 2002 campaigns., J. Air & Waste Manage. Assoc. 54, 1040-1060, 2004.

Schwab, J.J., H.D. Felton, and K.L. Demerjian, Aerosol chemical composition in New York state from integrated filter samples: Urban/rural and seasonal contrasts". J. Geophys. Res., 109, D16S05, doi:10.1029/2003JD004078, 2004.

Schwab, J.J., J. Spicer, K.L. Demerjian, J.L. Ambs, and H.D. Felton, Long-term field characterization of TEOM and modified TEOM samplers in urban and rural New York State locations". J. Air & Waste Manage. Assoc. 54, 1264-1280, 2004.

Schwab, J.J., O. Hogrefe, K.L. Demerjian, and J.L. Ambs, Laboratory characterization of modified TEOM samplers", J. Air & Waste Manage. Assoc. 54, 1254-1263, 2004.

Schwab, J.J., Y.-Q. Li, and K.L. Demerjian, Semi-continuous formaldehyde measurements with a diffusion scrubber/liquid fluorescence analyzer. In Symposium on air quality measurement methods and technology – 2004 [CD-ROM in press], Air and Waste Management Association, Pittsburgh, PA, USA., 2004.

Canagaratna, M. J., J. T. Jayne, D. Ghertner, S. Herndon, Q. Shi, J. L. Jimenez , P.J. Silva, P. Williams, T. Lanni, F. Drewnick, K. L. Demerjian, C. Kolb, D. Worsnop, Chase Studies of Particulate Emissions from inuse New York City Vehicles, Aerosol Science & Technology, 38, 555-573, 2004.

Li, Z., P.K. Hopke, L.Husain, S. Qureshi, V.A. Dutkiewicz, J.J. Schwab, F. Drewnick, and K.L. Demerjian, Sources of Fine Particle Composition in New York City, Atmospheric Environment, 38, 6521-6529, 2004.

Drewnick, F., J.J. Schwab, O. Hogrefe, S. Peters, L. Husain, D. Diamond, R. Weber, and K.L. Demerjian, Intercomparison and evaluation of four semi-continuous $PM_{2.5}$ sulfate instruments, Atmospheric Environment, 37, 3335- 3350, 2003.

Ren, X., H. Harder, M. Martinez, R.L. Lesher, A. Oliger, T. Shirley, J. Adams, J. B. Simpas, and W.H. Brune, J, HOx concentrations and OH reactivity observations in New York City during PMTACS-NY 2001, Atmospheric Environment, 37, 3627-3637, 2003.

Ren, X., H. Harder, M. Martinez, R.L. Lesher, A. Oliger, J. B. Simpas, W.H. Brune, J. J. Schwab, K.L. Demerjian, Y. He, X. Zhou, and H. Gao, OH and HO2 chemistry in the urban atmosphere of New York City, Atmospheric Environment, 37, 3639-3651, 2003.

Schwab, J.J., J. Spicer, H.D. Felton, J.A. Ambs, and K.L. Demerjian, Long-term comparison of TEOM, SES TEOM and FRM measurements at rural and urban New York sites, in Symposium on Air Quality Measurements and Technology – 2002I, VIP-115-CD, ISBN 0-923204-50-4, Air and Waste Management Association, Pittsburgh, PA, 2003.

Yu, F., T. Lanni, and B. Frank, Measurements of ion concentration in gasoline and diesel engine exhaust, Atmospheric Environment, 38, 10, 1417-1423, 2003.

Zhou, X., H. Gao, Y. He, G. Hung, S.B. Bertman, K. Civerolo, and J. Schwab, "Nitric acid photolysis on surfaces in low-NOx environments: Significant atmospheric implications". Geophys. Res. Lett., 30, 2217, doi:10.1029/2003GL108620, 2003.

2.1.2 Posters/Presentations

Aerosol Carbon Measurements Using Different Techniques in New York:Comparison of Total Carbon, Oliver Rattigan, Atmospheric Sciences Research Center Seminar, December 9, 2008.

Aerosol Optical Properties Obtained from Continuous Mass, Composition and Scattering Measurements, James J. Schwab, Min-Suk Bae, Olga Hogrefe, Qi Zhang, G. Garland Lala, Ken Demerjian and Oliver Rattigan, American Association for Aerosol Research Annual Conference, Orlando, FL, October 20-24, 2008.

Effect of Particle Properties on Determination of Mean Particle Size Using the Electrical Aerosol Detector, Brian P. Frank, Olga Hogrefe, Daniel Hershey, American Association for Aerosol Research 27th Annual Conference, Orlando, FL, October 20-24, 2008.

Aerosol Carbon Measurements Using Different Techniques in New York, Oliver Rattigan, Dirk Felton, James Schwab, Min-Suk Bae and Kenneth Demerjian, American Association for Aerosol Research Annual Conference, Orlando, FL, October 20-24, 2008.

Continuous $PM_{2.5}$ Speciation Measurements in New York, Oliver V. Rattigan, H. Dirk Felton, James J. Schwab and Kenneth L. Demerjian, Extended Abstract # 524, Air & Waste Management Association Annual Conference, Portland, OR, June 24-27, 2008.

Ambient Air Quality Monitoring and Health Research Workshop to Discuss Key Issues, Session 1: Elemental and Organic Carbon Measurements, Chemical Speciation Network: Carbon Issues, Eastern and Western Perspectives on Air Quality Monitoring, Dirk Felton, EPA – RTP, April 16-17, 2008

Air Quality Monitoring in New York State, Northeast/New England Regional Air Quality Conference, Dirk Felton, April, 2008.

Why continuous $PM_{2.5}$ FEM III data may not be appropriate for attainment demonstrations, National Air Quality Conference, Dirk Felton, Portland, OR, April 6-9, 2008

Results of $PM_{2.5}$ Continuous Speciation Measurements in New York, Oliver Rattigan, NYSDEC PE Seminar, March 11, 2008.

Air Quality Data Summit, Session: Inventory of Data Systems, Data provider perspectives, Dirk Felton, RTP, NC, February 12-13, 2008

Highlights of $PM_{2.5}$ Continuous Speciation Measurements in New York,
Oliver, V. Rattigan, AAAR 26th Annual Conference, Reno, NV, Sept 25, 2007.

$PM_{2.5}$ Carbon Measurements in New York; Comparison of Techniques and Seasonal, Weekday and Diurnal Patterns, Oliver V. Rattigan, Air & Waste Management Association Symposium on Air Quality Measurement Methods and Technology, San Francisco, May 2, 2007.

Multi-Year Measurements of Black Carbon at two Urban Locations in New York: Comparison with Elemental Carbon, Oliver V. Rattigan, H. (Dirk) Felton, James J. Schwab and Kenneth L. Demerjian, AAAR 2006

Speciated PMcoarse by Difference: A look at a year of XRF data in New York City and in Niagara Falls, New York , Dirk Felton, Kevin Civerolo and Oliver Rattigan, EPA National Monitoring Conference, 2006

Semi-Continuous Measurements of $PM_{2.5}$ Carbon at the South Bronx, NY: Comparison with Filter Measurements, Oliver Rattigan, EPA National Monitoring Conference, 2006

Concentrations of $PM_{2.5}$ and Selected Trace Metals Across the NYC Metropolitan Region, Kevin Civerolo, EPA National Monitoring Conference, 2006

Modifying 50 ºC TEOM Data to be more "FRM like" for AQI Reporting using a Non-linear Correction based on the Julian Day, Dirk Felton, Oliver Rattigan, EPA National Monitoring Conference, 2006

Multiyear Evaluations of PMcoarse by Difference Utilizing Low and High Volume Samplers and Collocated 50 Deg. C TEOMs, Dirk Felton, Oliver V. Rattigan, Robert Baker and Paul Sierzenga, EPA National Monitoring Conference, 2006

Level 1 Data Validation - Validation at the Grass Roots Level, Paul Sierzenga, EPA National Monitoring Conference, 2006

Measurement of Ambient Aerosol Composition Using an Aerodyne Aerosol Mass Spectrometer in New York City: Winter 2004 Intensive Study, Silke Weimer, Frank Drewnick,, James J. Schwab, Kevin Rhoads,, Douglas Orsini,, Kenneth L. Demerjian, Douglas R. Worsnop, Qi Zhang, Jose J. Jimenez, Dirk Felton, AAAR, 2005

Continuous Sulfate, Carbon, and $PM_{2.5}$ Mass at Addison, NY during the Summer 2004 NEAQS/ITCT Field Intensive, James J. Schwab,John Spicer, Olga Hogrefe, Oliver V. Rattigan, H. D. Felton, Kevin Rhoads, Silke Weimer, Yongquan Li, G. Garland Lala, and Kenneth L. Demerjian, AAAR, 2005

Measurement Uncertainty in the Determination of Fine Particle Mass, Sulfate, and Selected Transition Metals, James J. Schwab, H. D. Felton, Liaquat Husain, and Kenneth L. Demerjian, AAAR, 2005

Urban and Rural Chemical Composition of Fine Particulate Matter in New York State, James J. Schwab, H. D. Felton,Kevin Civerolo, Liaquat Husain, and Kenneth L. Demerjian, AAAR, 2005

Continuous $PM_{2.5}$ Sulfate and Carbon at Addison in Rural New York State: Measurements from and Evaluations of the Thermo 5020 Sulfate and the Sunset Labs OCEC Instruments, James J. Schwab, Olga Hogrefe, Oliver V. Rattigan, H. D. Felton, Vincent Dutkiewicz, Liaquat Husain and Kenneth L. Demerjian, AAAR, 2005

Semi-continuous $PM_{2.5}$ Sulfate and Nitrate Measurements in New York: Routine Field Measurements and Intensive Field Campaigns, Olga Hogrefe, Oliver V. Rattigan, James J. Schwab, Frank Drewnick, Silke Weimer, Kevin Rhoads, Kenneth L. Demerjian, PM Supersites AAAR Conference, February 7-11, 2005, Atlanta, GA.

Intercomparison and Evaluation of Semi-Continuous PM-2.5 Nitrate and Sulfate Instruments During PMTACS-NY Summer 2001 Campaign in New York City, Olga Hogrefe, Frank Drewnick, James J. Schwab, Henry D. Felton, Kenneth L. Demerjian, AGU 2004
Semi-Continuous $PM_{2.5}$ Sulfate and Nitrate Measurements in New York: Routine Field Measurements and Intensive Field Campaigns, Olga Hogrefe, Oliver V. Rattigan, James J. Schwab, Utpal Roychowdhury, Frank Drewnick, Silke Weimer, Kevin Rhoads and Kenneth L. Demerjian, AAAR 2005.

Real-time $PM_{2.5}$ Black Carbon Measurements at Rochester and the South Bronx, NY, O. V. Rattigan, H. D. Felton and K. L. Civerolo, EMEP, NYSERDA, October 25, 2005.

New York State Urban and Rural Measurements of Continuous $PM_{2.5}$ Mass by FDMS TEOM and BAM: Evaluation and Comparisons with the FRM, D. Felton, O.V. Rattigan, K.L. Demerjian, J.J. Schwab,.AAAR 2005, February 7-11, 2005.

Air Quality and Related Health Research: Particulates (PM) and Co-Pollutants: What is in Ambient Particulate Matter?, Dirk Felton, NYSERDA EMEP Conference, 2005

A Review and Update of PM-2.5 Mass and Species Monitoring in New York State, Dirk Felton, NYSDOH Division of Environmental Health Assessment, 2005

Measurements of $PM_{2.5}$ Carbon in New York City, Oliver V. Rattigan and H. D. Felton, James J. Schwab and Kenneth L. Demerjian, Organic Speciation Workshop, Las Vegas, 2004.

Semi-Continuous Measurements of $PM_{2.5}$ Sulfate, Nitrate and Co-Pollutants at an urban and a

rural location.Oliver V. Rattigan, Olga Hogrefe, D.H. Felton, James J. Schwab, and Kenneth L. Demerjian, AAAR 2004.

R&P 8400S and R&P 8400N Ambient Particulate Sulfate and Nitrate Monitors: Performance during PMTACS-NY Intensive Field Campaigns and Routine Measurements, O. Hogrefe, O.V. Rattigan, James J. Schwab, Frank Drewnick, Kevin Rhoads, Silke Weimer, Douglas Orsini, Kenneth L. Demerjian, EMEP NYSERDA Conference, 2004.

FDMS Instrument Evaluation, Dirk Felton, National Supersite Data Review Meeting, 2004

Particulate Sampling Issues: Why does the Division of Air have to do scientific research above and beyond EPA particulate sampling requirements?, Dirk Felton, NYSDEC Commissioner Briefing, 2004

NY Metals Analysis: Method Comparison, Dirk Felton, EPA & NESCAUM Toxics Methods Meeting, 2003

Semi-continuous $PM_{2.5}$ Sulfate and Nitrate Measurements in New York City and Whiteface Mountain, O. V. Rattigan, D. H. Felton, J. J. Schwab, U.K. Roychowdhury and K. L. Demerjian, EMEP Conference, NYSERDA, Oct 2003.

PM-2.5 Monitoring in New York State: Speciation Data, TEOM / FRM Comparisons, PM Coarse, Dirk Felton, MARAMA Air Monitoring Committee Meeting, 2002

NY Discussion of Issues: TEOM Correlations, Quebec Smoke, PM-2.5 Speciation Data, PMcoarse, Dirk Felton, EPA SAMWG Meeting, 2002

3. Monitoring Sites

The Bureau's tasks and responsibilities are carried out by staff in four Sections. While the field operators are stationed throughout the State, the managers are physically located in the Central Office in Albany (Northern Monitoring, Network Operations), our Region 2 Office in Long Island City (Southern Monitoring), and the SUNY East Campus in Rensselaer (Monitoring Support). Functionally, the Northern Monitoring Section is responsible for ambient air monitoring sites in upstate New York north of and including the counties of Rockland and Putnam. The Southern Monitoring Section is responsible for ambient air monitoring sites in the counties of Westchester, Nassau, Suffolk, and those counties comprising the City of New York. Currently there are 76 active sites statewide. Figures 3.1 and 3.2 show respective monitoring site locations of the two monitoring operations.

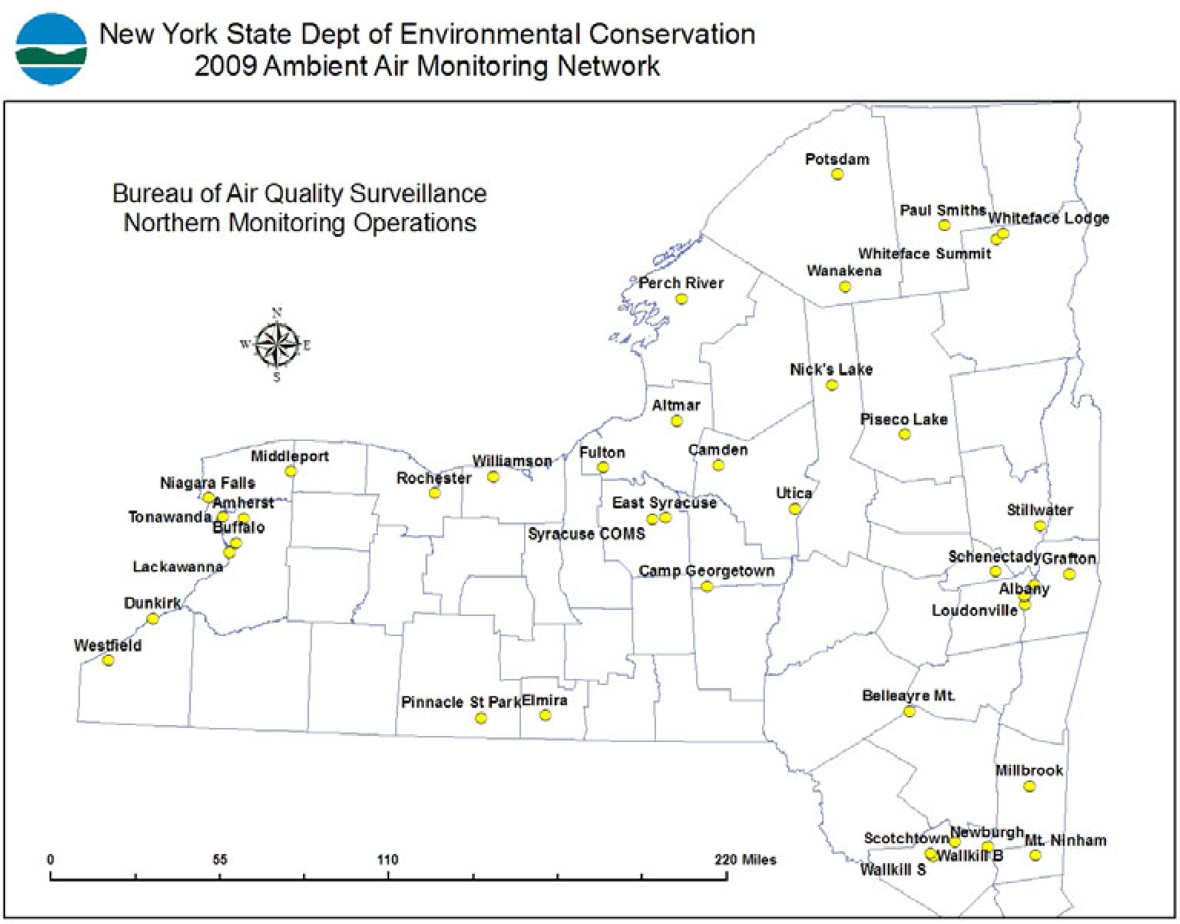

Figure 3.1 Site Locations for Northern Monitoring Operation

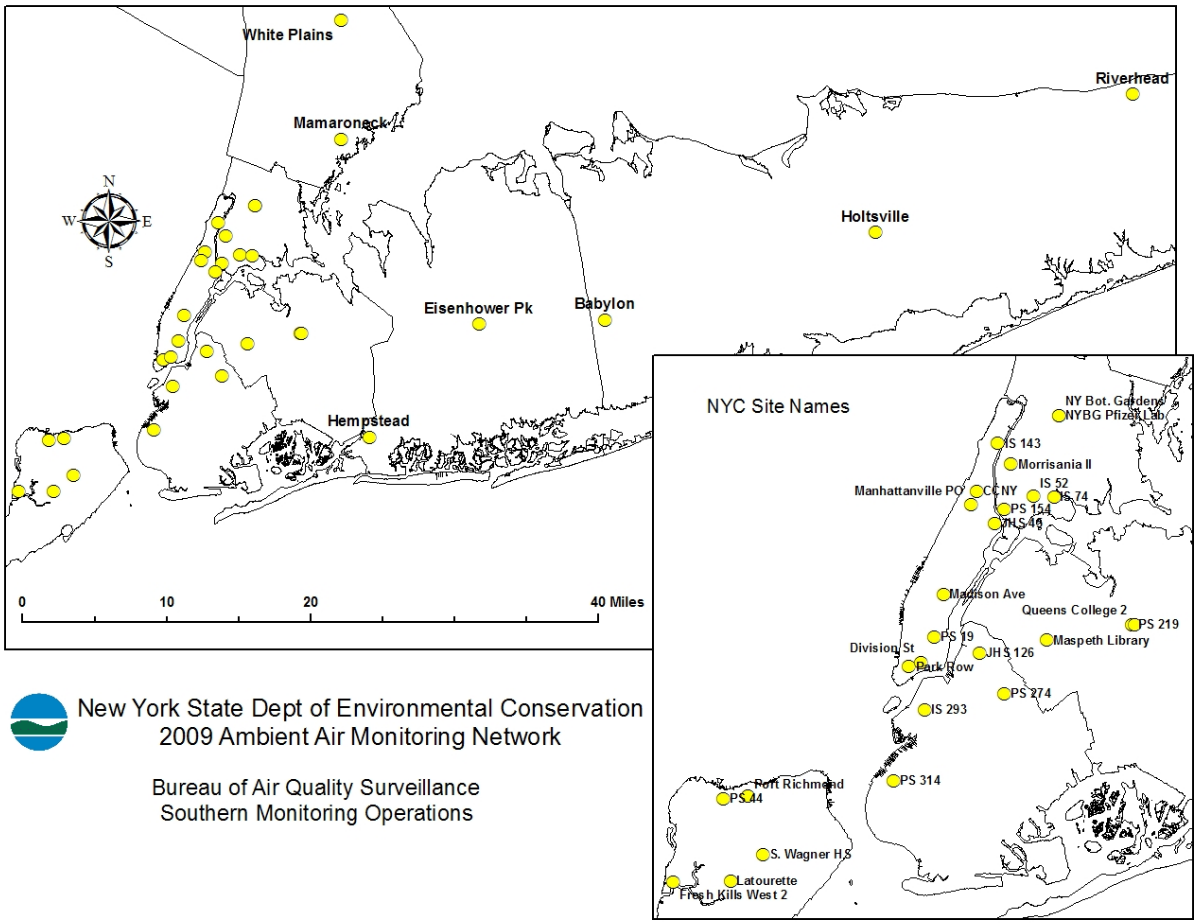

Figure 3.2 Site Locations for Southern Monitoring Operation

Information pertaining to each monitoring site including site photo, location, parameters monitored, sampling frequency, and analysis methodologies is provided below for the two monitoring operations.

Most of the monitoring sites meet the siting criteria requirements for the parameters monitored as specified in Appendix E of 40 CFR Part 50. For the few sites that do not meet all of the siting requirements, we have demonstrated to EPA that in all instances the site is as representative of the monitoring area as it would be if the siting criteria were being met, and that the monitor or probe cannot reasonably be located so as to meet the siting criteria because of physical constraints. Waivers have been granted by the Regional Administrator for these sites.

No scheduled site changes are anticipated in the next 18 months except where noted otherwise.