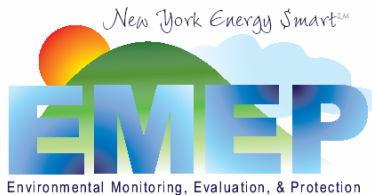


Session A:

Air Quality and Related Health Research: Particulates (PM) and Co-Pollutants

What is in Ambient Particulate Matter?

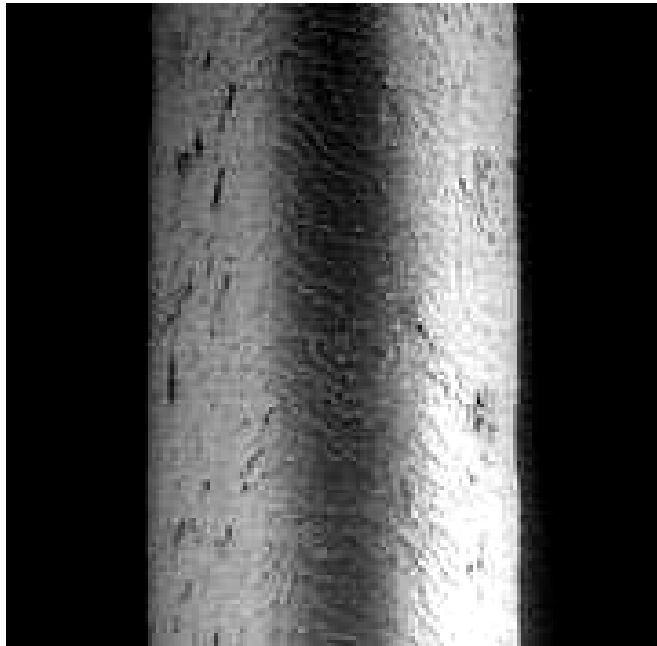


Dirk Felton
Bureau of Air Quality Surveillance
New York State Department of
Environmental Conservation

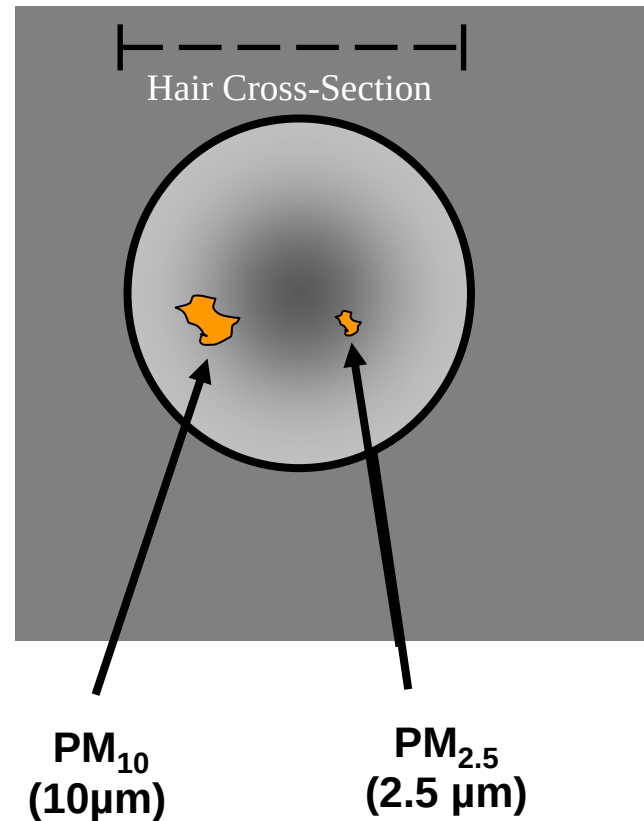
NYSERDA EMEP Conference Albany, NY October 25-26, 2005

Particulate Matter – What is it?

A complex mixture of extremely small solid particles and drops of liquid in the air



Human Hair (70 μm diameter)

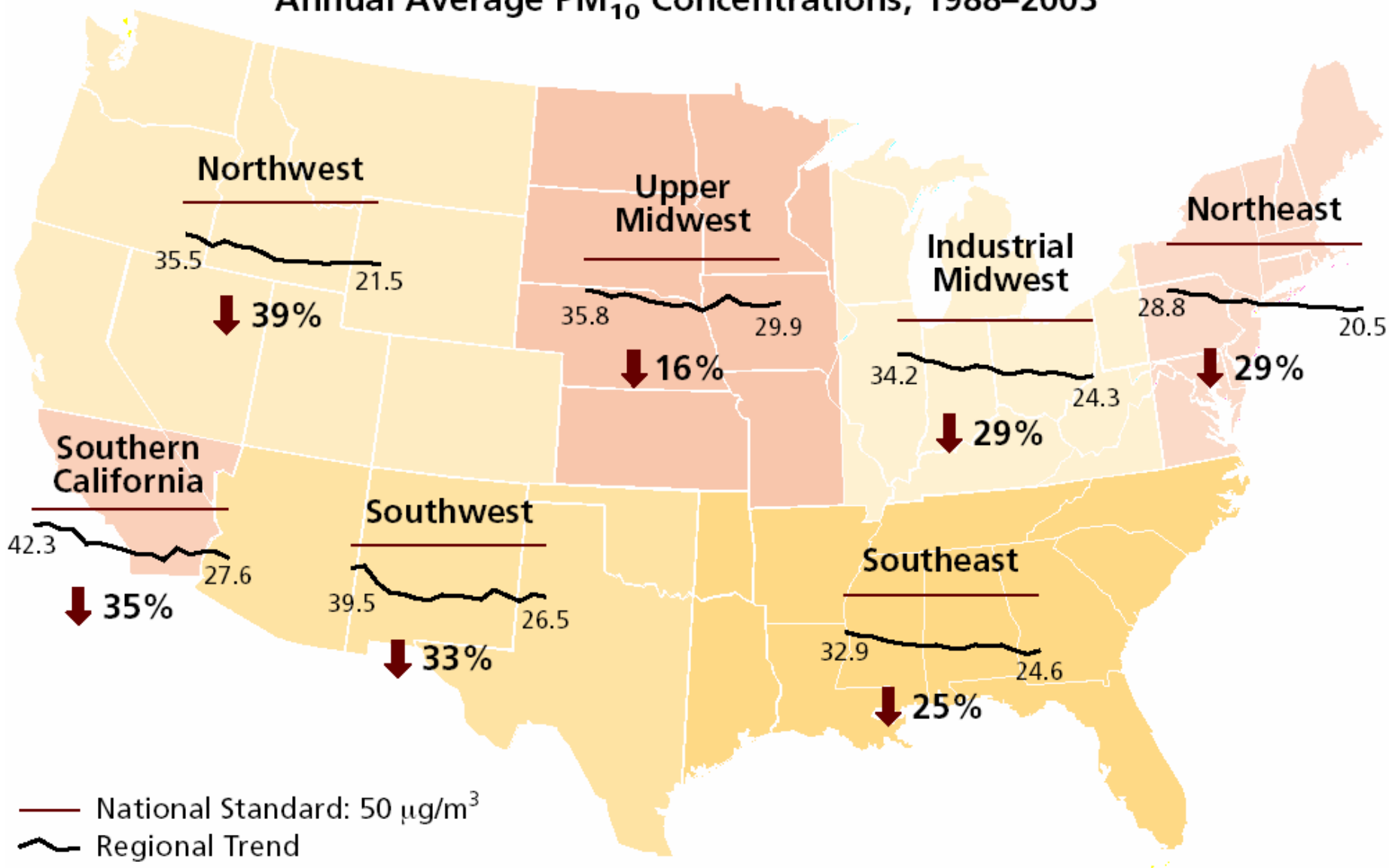


National Standards for Particulate Matter

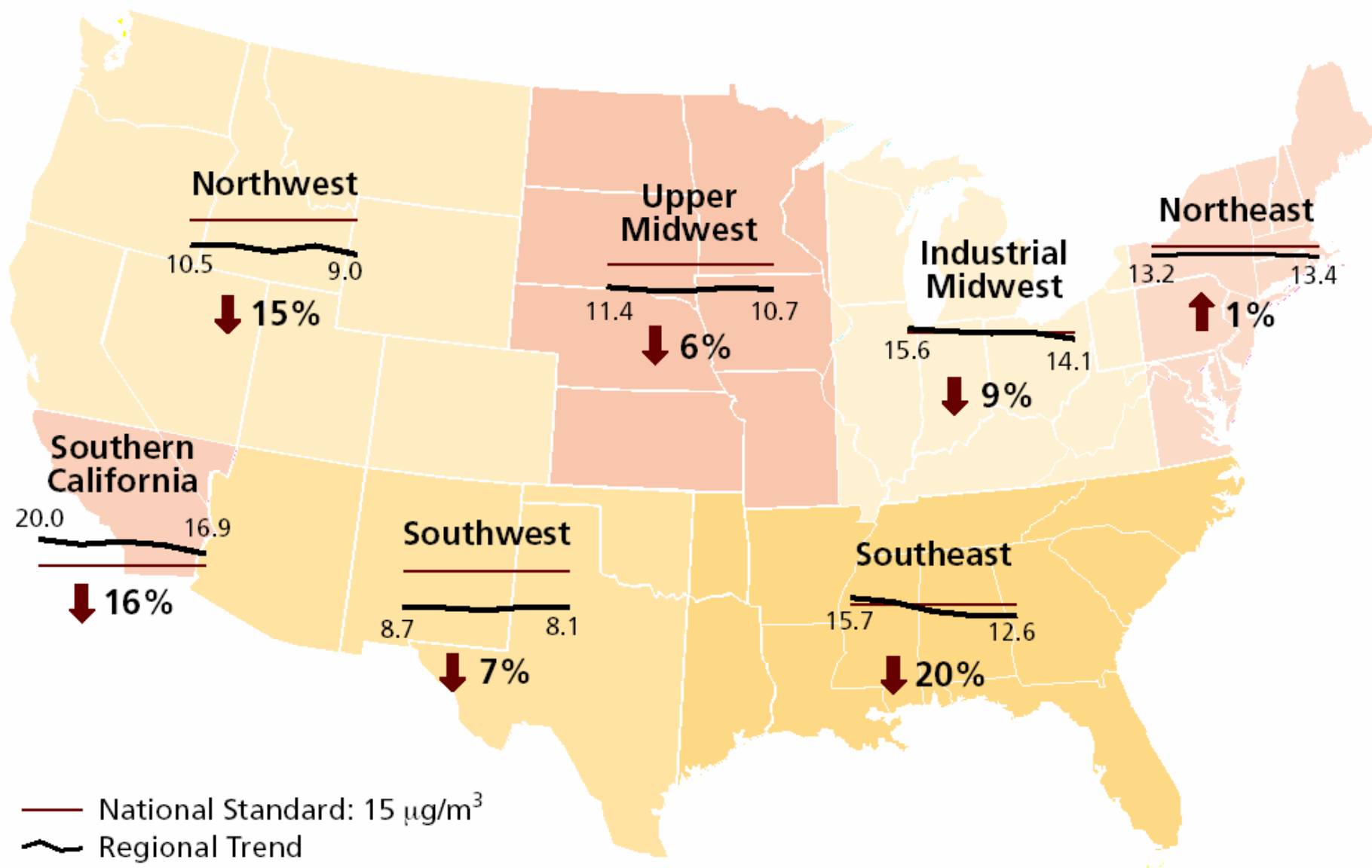
EPA first established National Ambient Air Quality Standards (NAAQS) for total suspended particulate (TSP) in 1971. When the standards were revised in 1987, TSP was replaced by PM₁₀. In 1997, EPA revised the primary (health) and secondary (welfare) PM NAAQS by adding standards for PM_{2.5}. EPA added PM_{2.5} standards because fine particles are more closely associated with serious health effects. The NAAQS for PM₁₀ and PM_{2.5} include both short-term (24-hour) and long-term (annual) standards:

NAAQS	PM _{2.5}	PM ₁₀
Short-term (24-hour average)	65 µg/m ³	150 µg/m ³
Long-term (annual average)	15 µg/m ³	50 µg/m ³

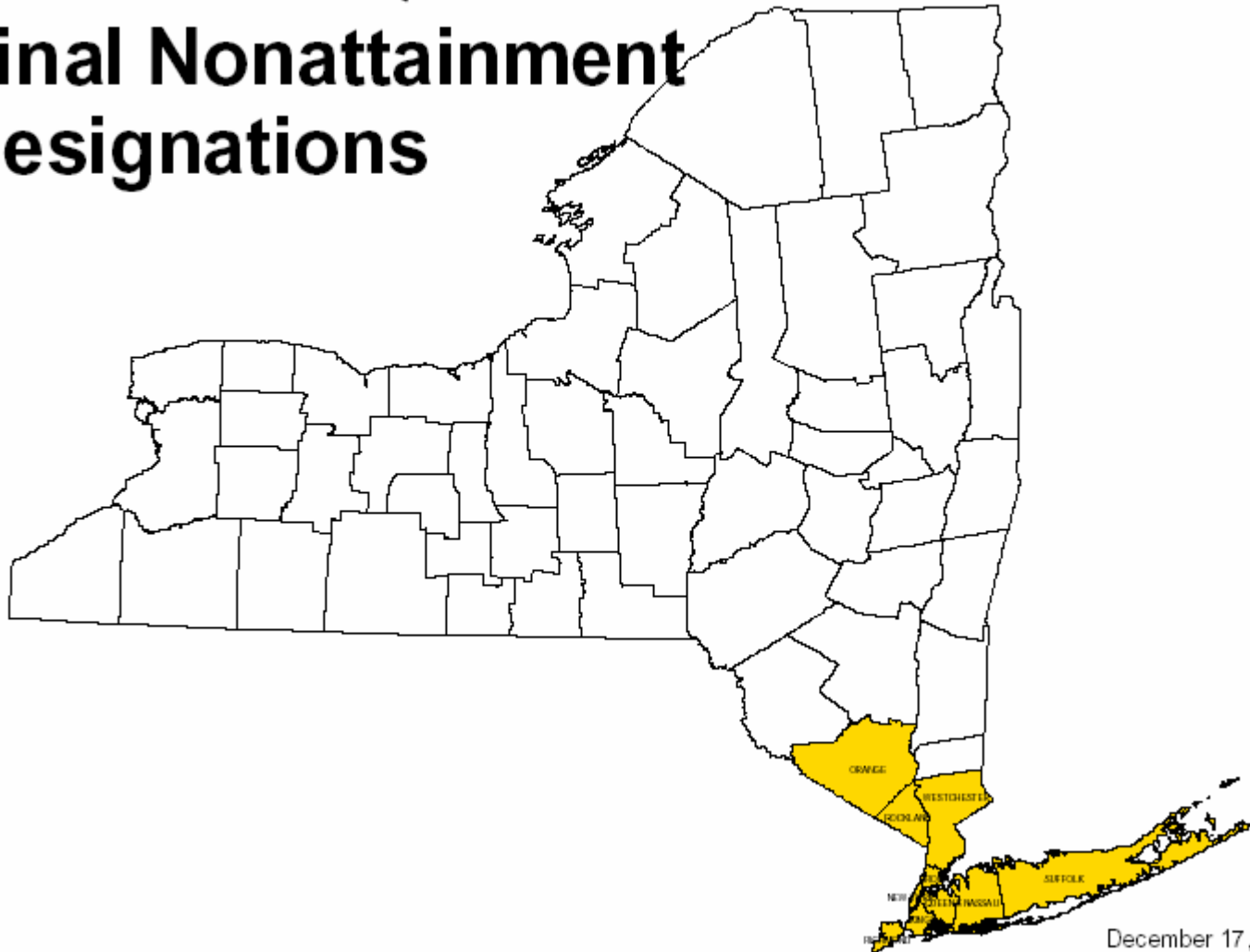
Annual Average PM₁₀ Concentrations, 1988–2003



Annual Average PM_{2.5} Concentrations, 1999–2003

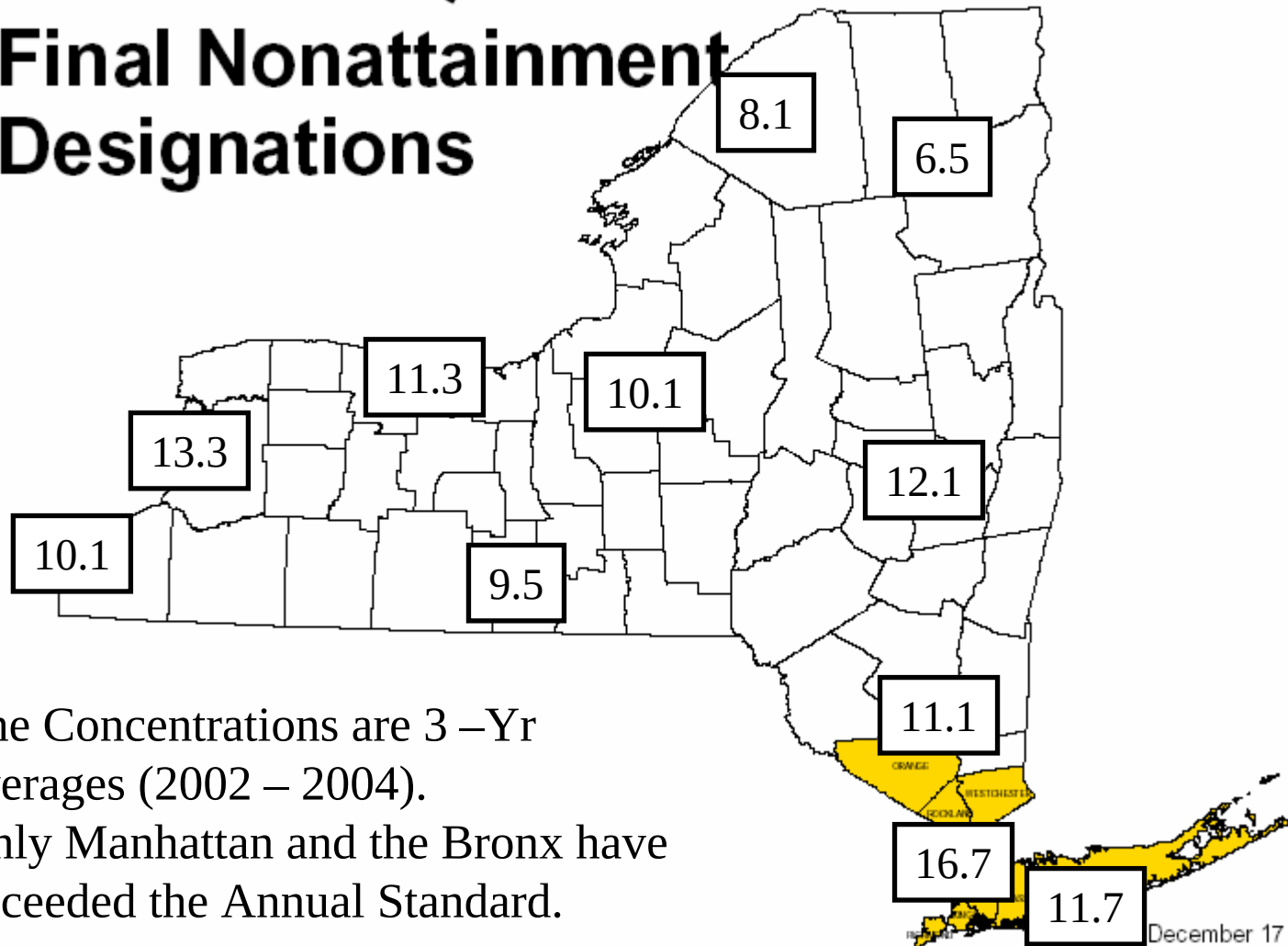


PM2.5 NAAQS Final Nonattainment Designations



December 17, 2004

PM2.5 NAAQS Final Nonattainment Designations



The Concentrations are 3 –Yr
averages (2002 – 2004).

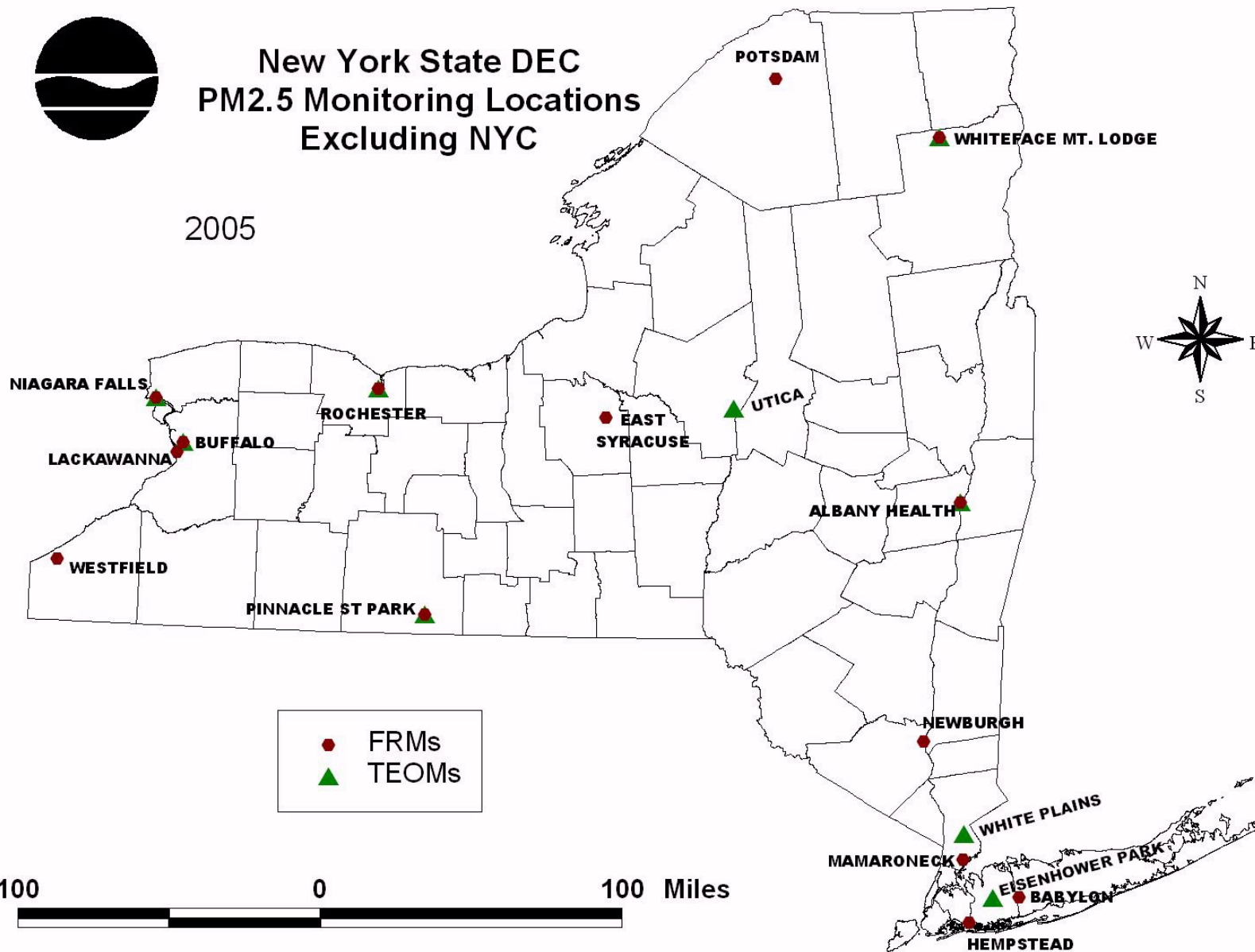
Only Manhattan and the Bronx have
exceeded the Annual Standard.

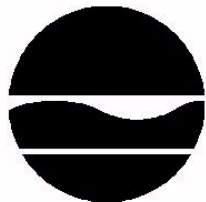
December 17, 2004



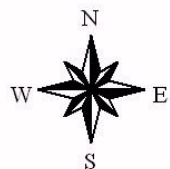
New York State DEC PM2.5 Monitoring Locations Excluding NYC

2005

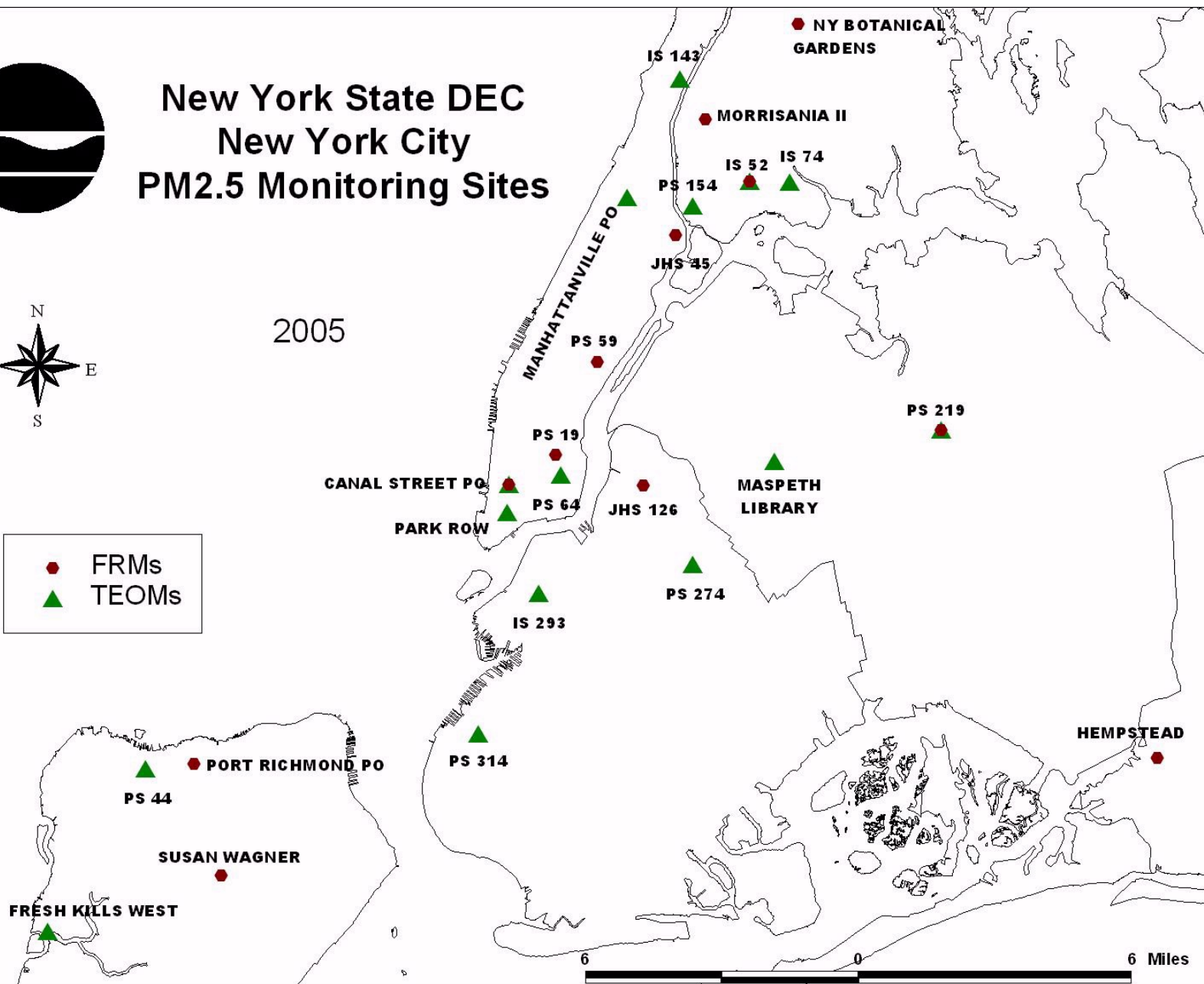
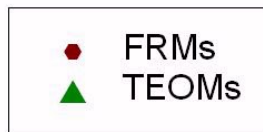




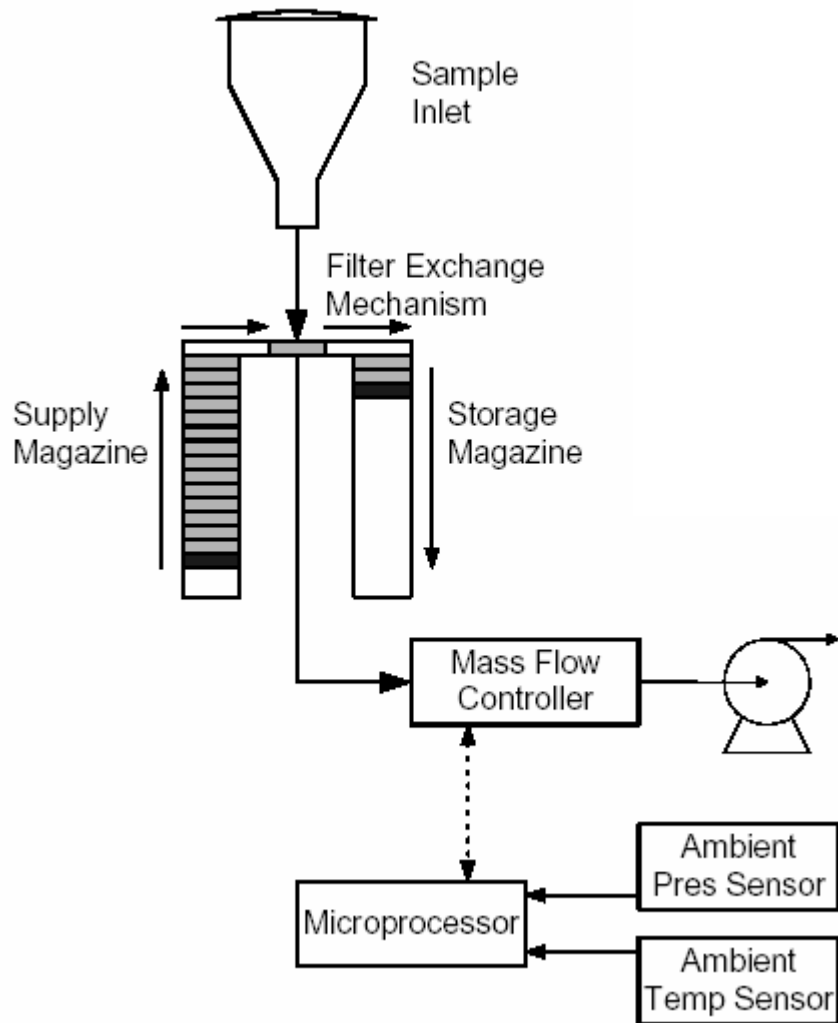
New York State DEC New York City PM2.5 Monitoring Sites



2005



Partisol®-Plus Model 2025 Sequential Air Sampler





PM-2.5 FRM Sampling:

24-Hr sample periods 1 day/3 Midnight to Midnight.

Federally purchased and tested 47 mm Teflon filters.

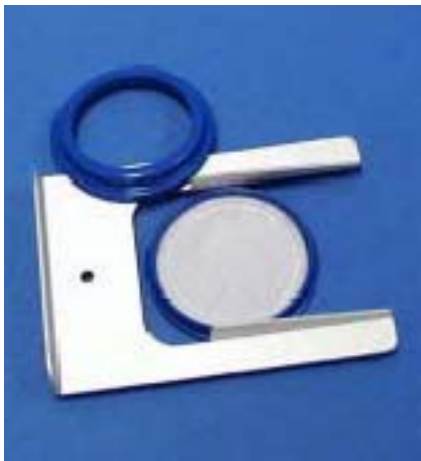
The filters are conditioned for at least 24 hours prior to weighing.

The pre-weighted filters must be used within 30 days and conditioned and “post”weighed within 30 days of when the sample was collected. (if refrigerated)

Filter must be removed from the sampler within 7 days.

Volumetric Flow controlled and reported 16.7 l/m.
(Approximately equal to Human Respiration)

Expensive Program: Labor, QA, Sample Shipping,
Equipment Maintenance.



TEOM® Series 1400a Ambient Particulate Monitor

T - Tapered
E - Element
O - Oscillating
M - Microbalance





The NYSDEC uses R&P TEOM 1400 instruments for real-time monitoring of PM-2.5 and PM-10 at 26 locations across New York State.

Hourly data reporting is required for Health based public notification.

The TEOM installed as shown with a data logger and modem provides hourly concentrations updated within 20 minutes of the top of the hour.

Continuous instruments have higher initial costs but generally cost less to operate due to reduced labor needs.

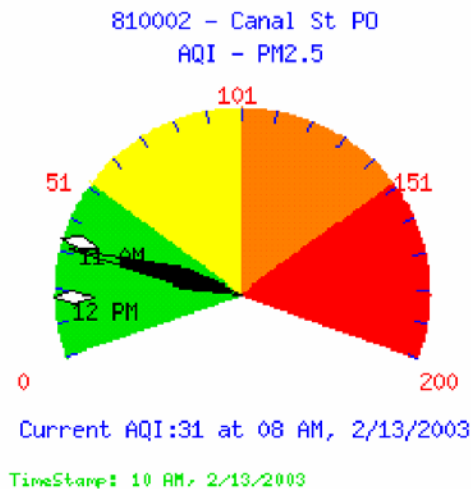
810002 Canal St P0
Pollutant: 24Hr PM2.5 AQI: 32



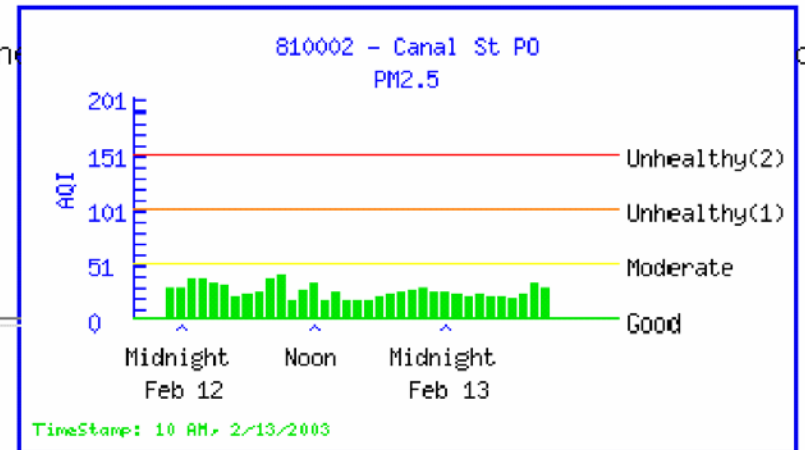
Current as of 09 AM, Thursday, Feb 13 2003
TimeStamp: 10 AM, 2/13/2003

Metropolitan areas with populations over 350,000 are required to report AQI concentrations for the criteria pollutants.

Many Agencies also forecast the AQI concentrations 1 – 3 days in advance.



Note: PM-2.5 is measured in micrograms per cubic meter (µg/m³).



NYSDEC's Forecast:

<http://www.dec.state.ny.us/apps/aqi/>

Each Criteria Pollutant has its own range of concentrations for each AQI category.

Good

Moderate

Unhealthy for Sensitive Groups

Unhealthy

Very Unhealthy

AQI	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)
0–50	0.0–15.4	0–54
51–100	15.5–40.4	55–154
101–150	40.5–65.4	155–254
151–200	65.5–150.4	255–354
201–300	150.5–250.4	355–424

Health Advisory

None.

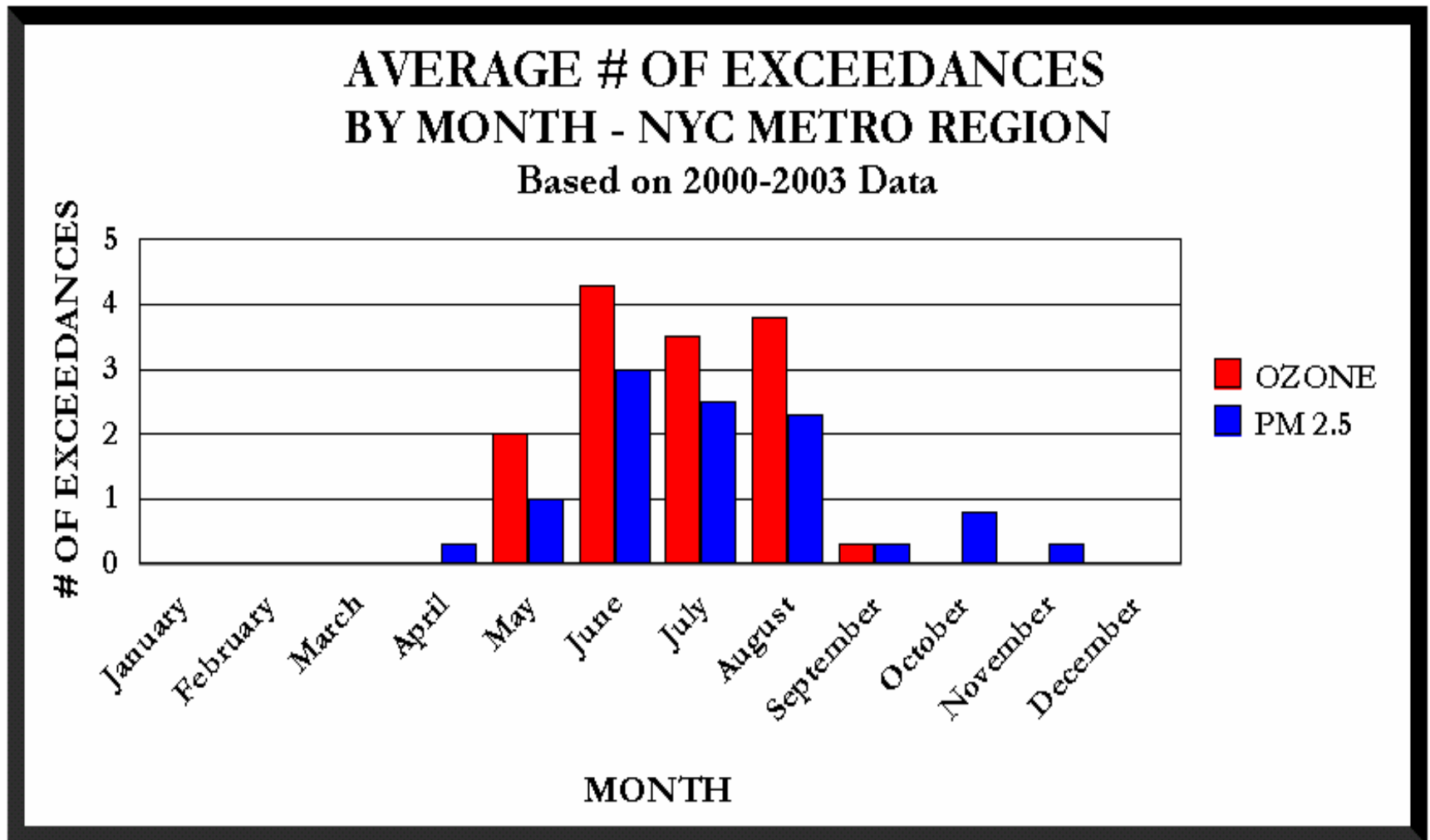
Unusually sensitive people should consider reducing prolonged or heavy exertion.

People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.

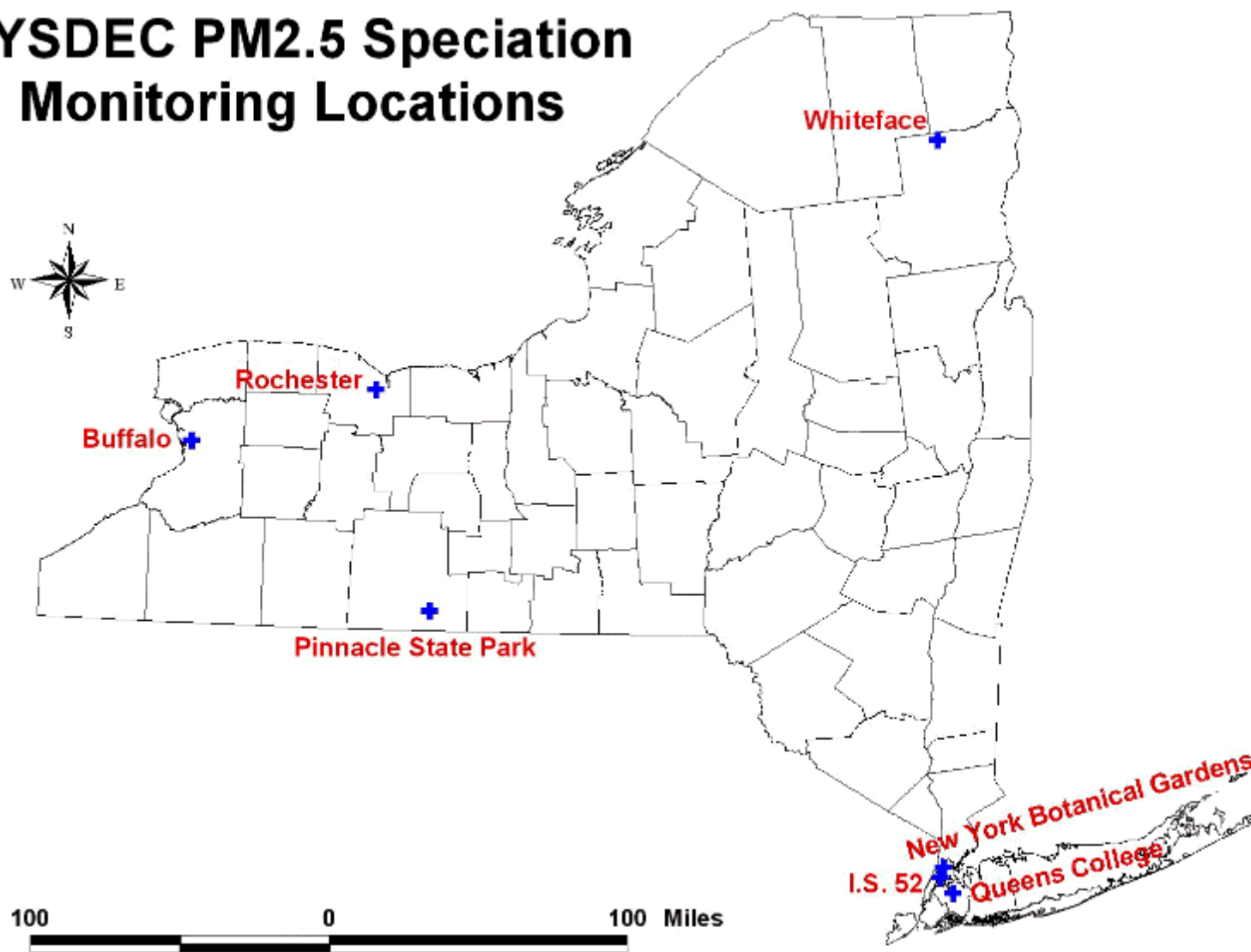
People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.

People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.

Ozone monitoring is seasonal because exceedances only occur in NY during the photochemically active months from May through September. PM-2.5 exceedances can occur in all but the coldest months.



NYSDEC PM2.5 Speciation Monitoring Locations

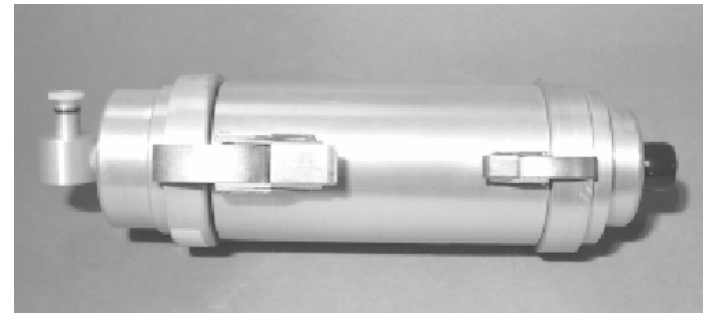




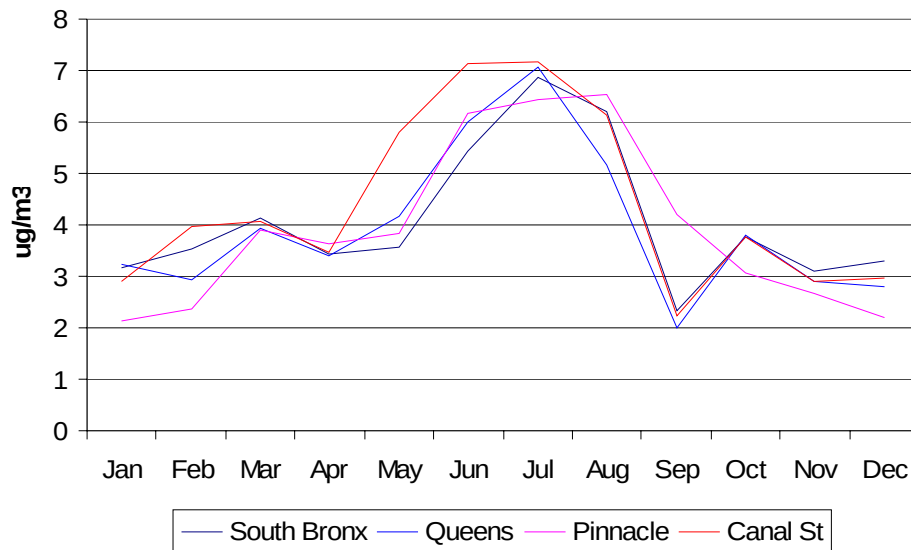
The Speciation Trends
Network (STN) Sampler uses 3
filters to collect 24-Hr samples
1 Day in Three.

Teflon: Mass & Elements
Nylon with Denuder: Ions
Quartz: Carbon EC and OC

The filters are shipped to and
from the lab in Harvard
Impactors.

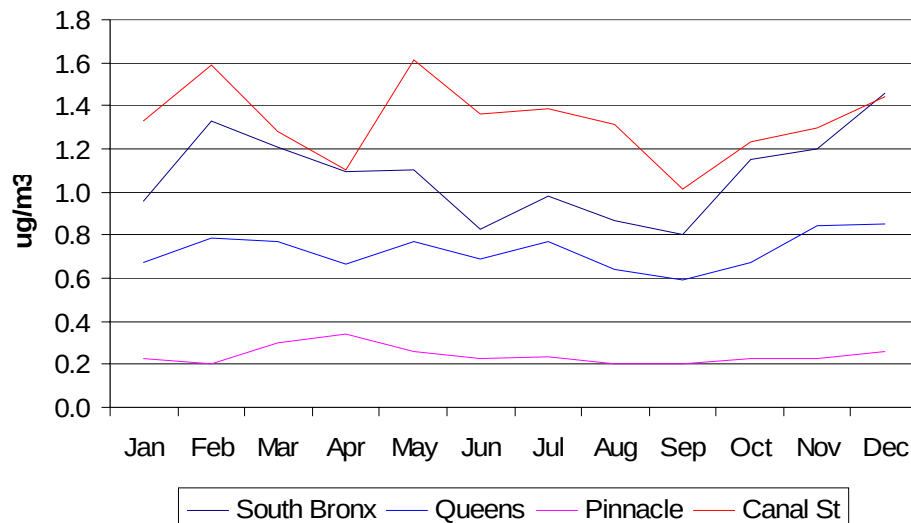


Sulfate: 2002 - 2004



Sulfate is primarily a Regional pollutant. The concentrations are similar in both urban and rural locations.

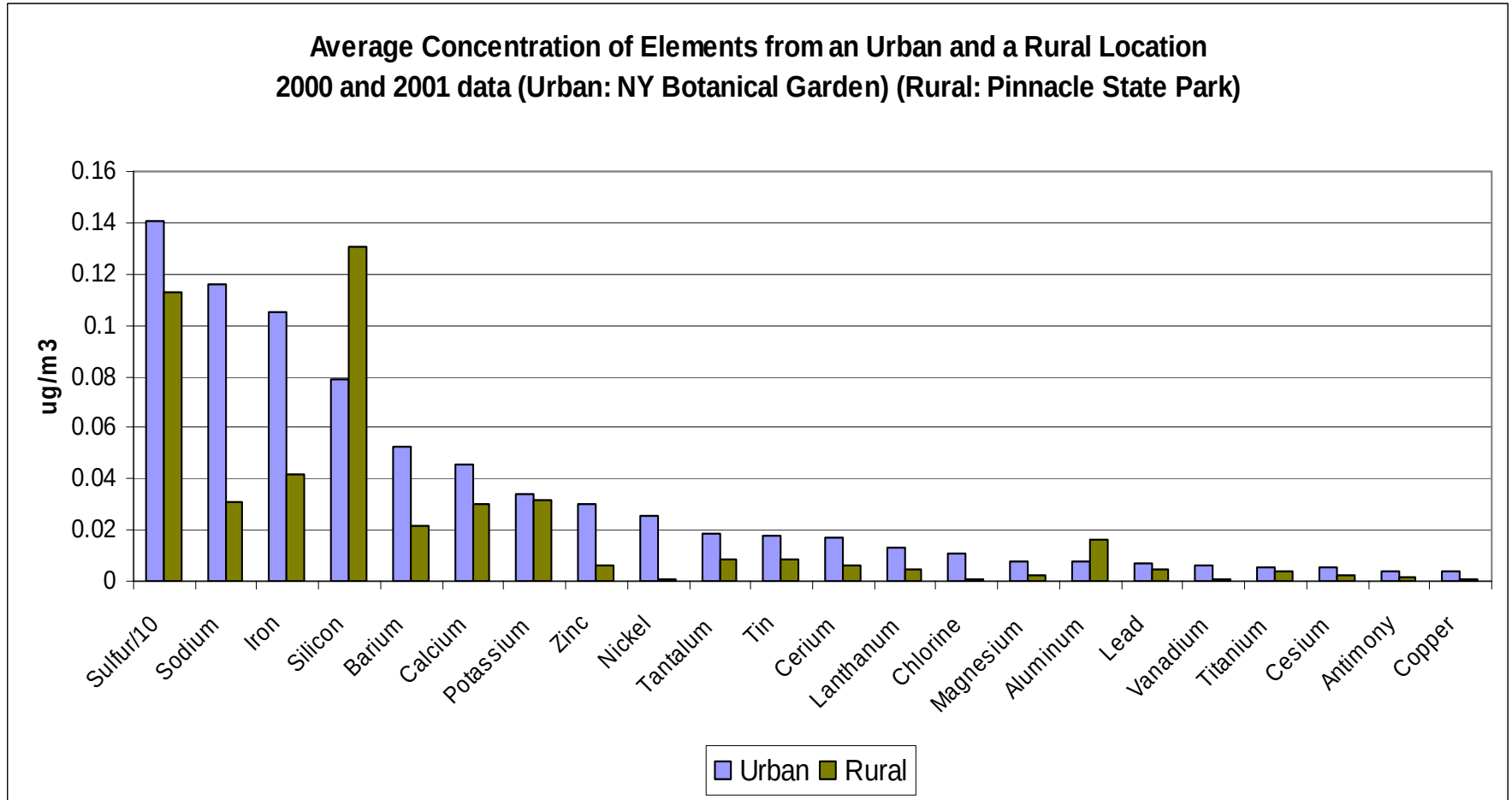
Elemental Carbon: 2002 - 2004

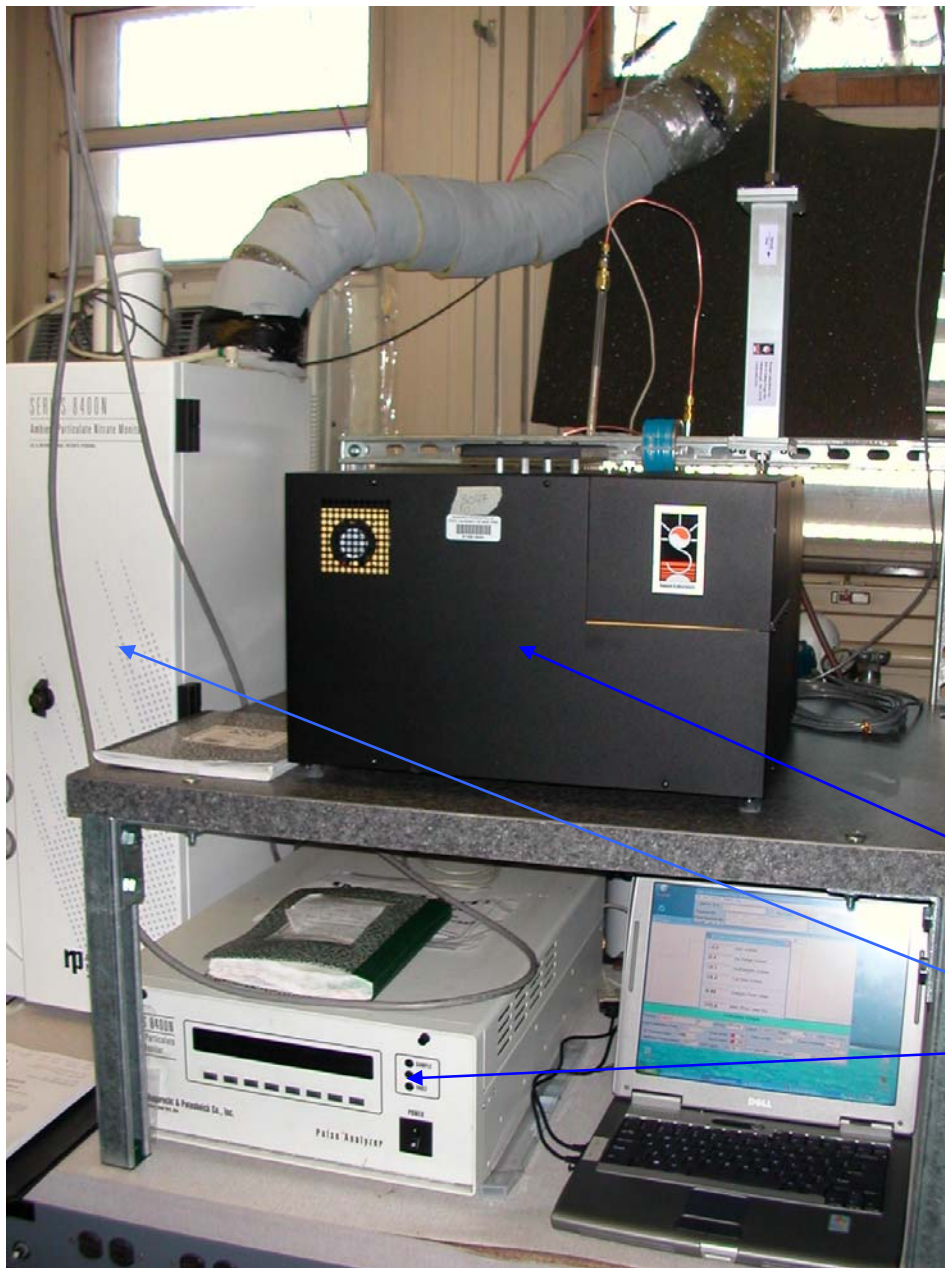


Elemental Carbon has significant spatial gradients even between sites located in the same urban area.

The South Bronx and Queens sites are separated by 6.8 miles.

The STN filters are analyzed by X-Ray Fluorescence for Elements.
The concentrations of individual Elements are not significant for their mass but they are useful as tracers for larger sources.





New instruments can provide hourly PM-2.5 species data.

The NYSDEC operates:
Carbon Elemental, Organic,
Black

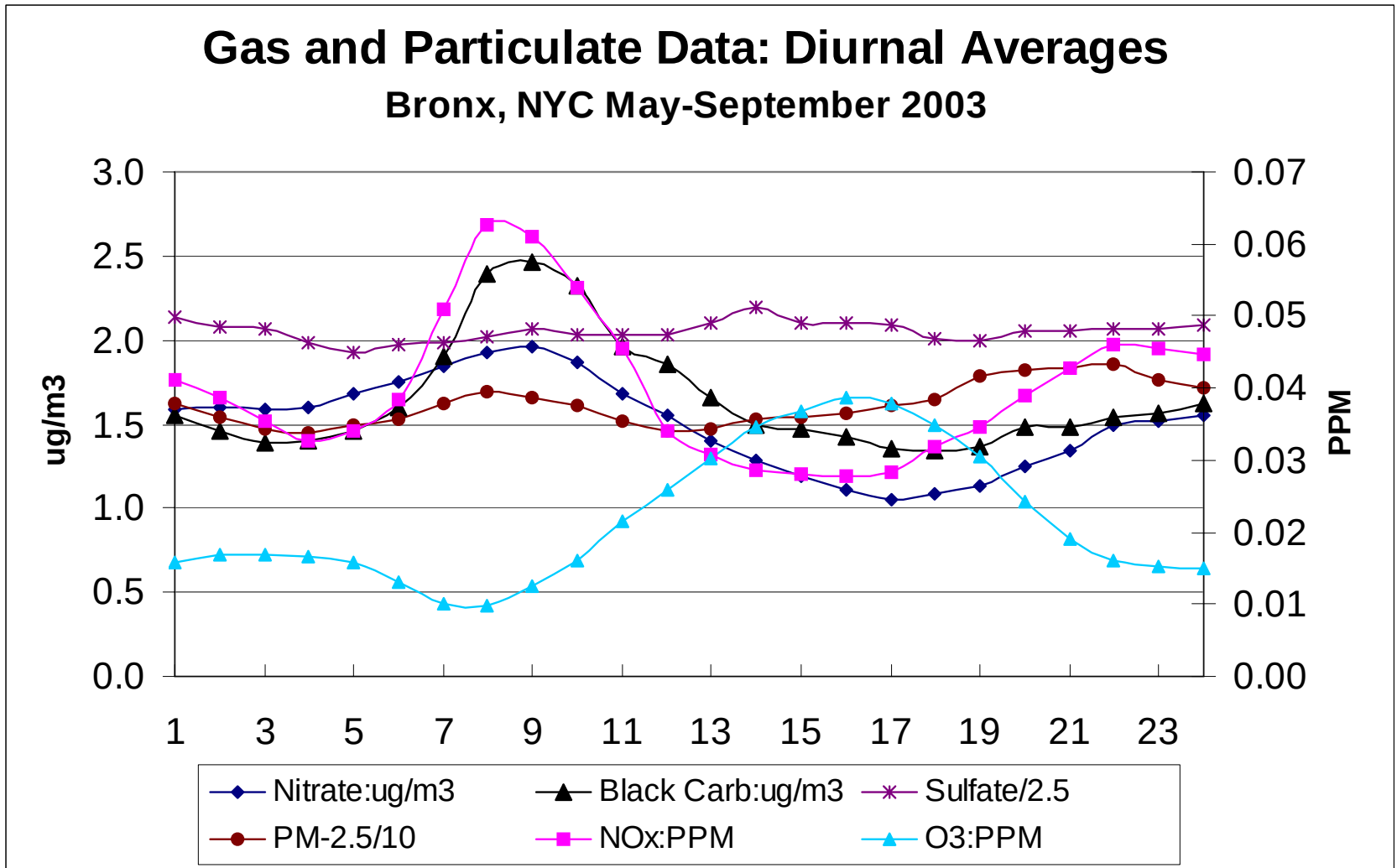
Sulfate

Nitrate

Sunset EC/OC Instrument

R&P 8400N Instrument

Examining Hourly Gas and Particulate data at the same location provides insight into the origin of specific pollutants.





R&P **F D M S** 8500

System
Measurement
Dynamic
Filter

The FDMS is designed to characterize the volatile and non-volatile portions of ambient PM-2.5.

The NYSDEC operates 3 FDMS TEOMs in:

New York City

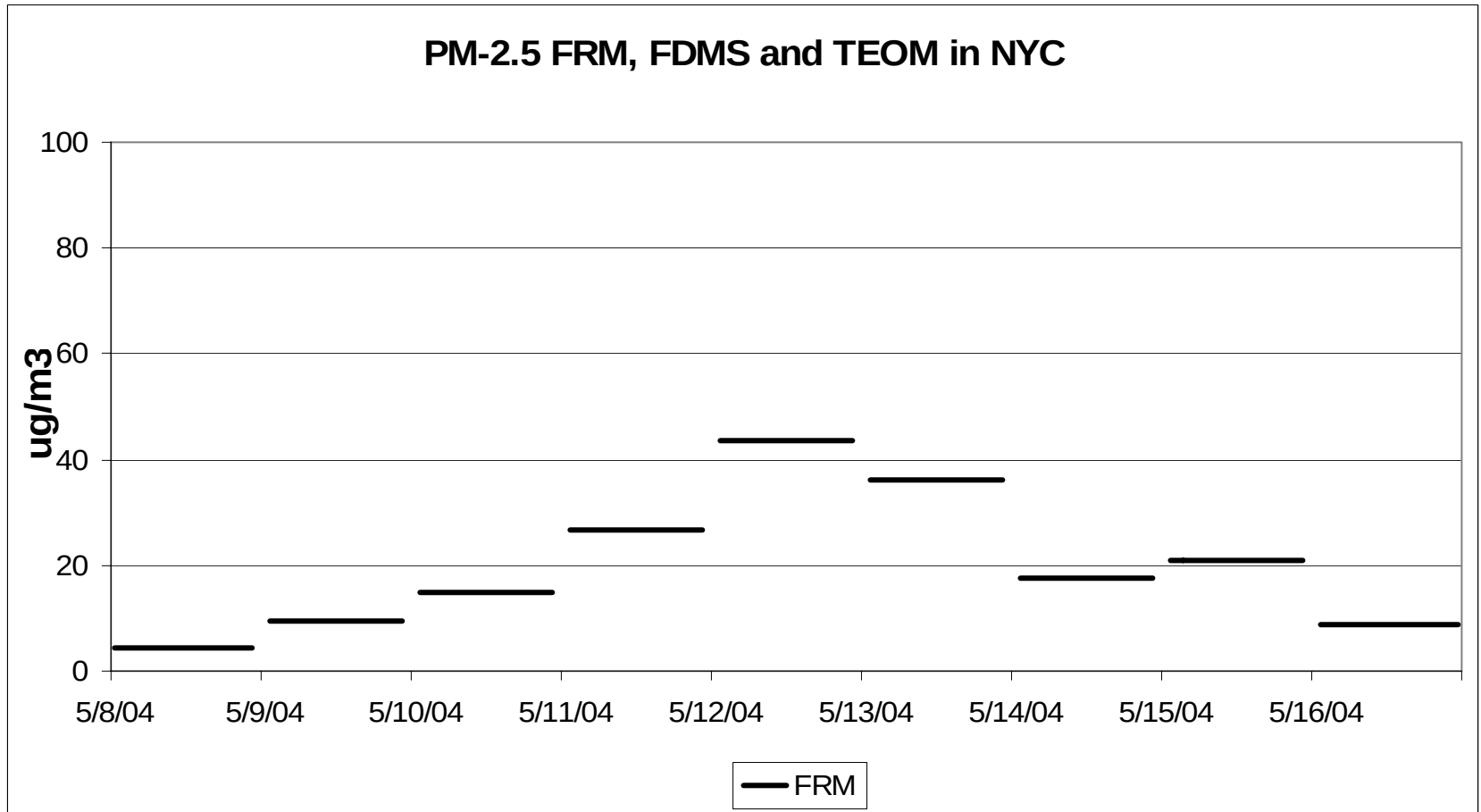
Niagara Falls

Addison - Southern Tier

This pollution episode occurred in May 2004.

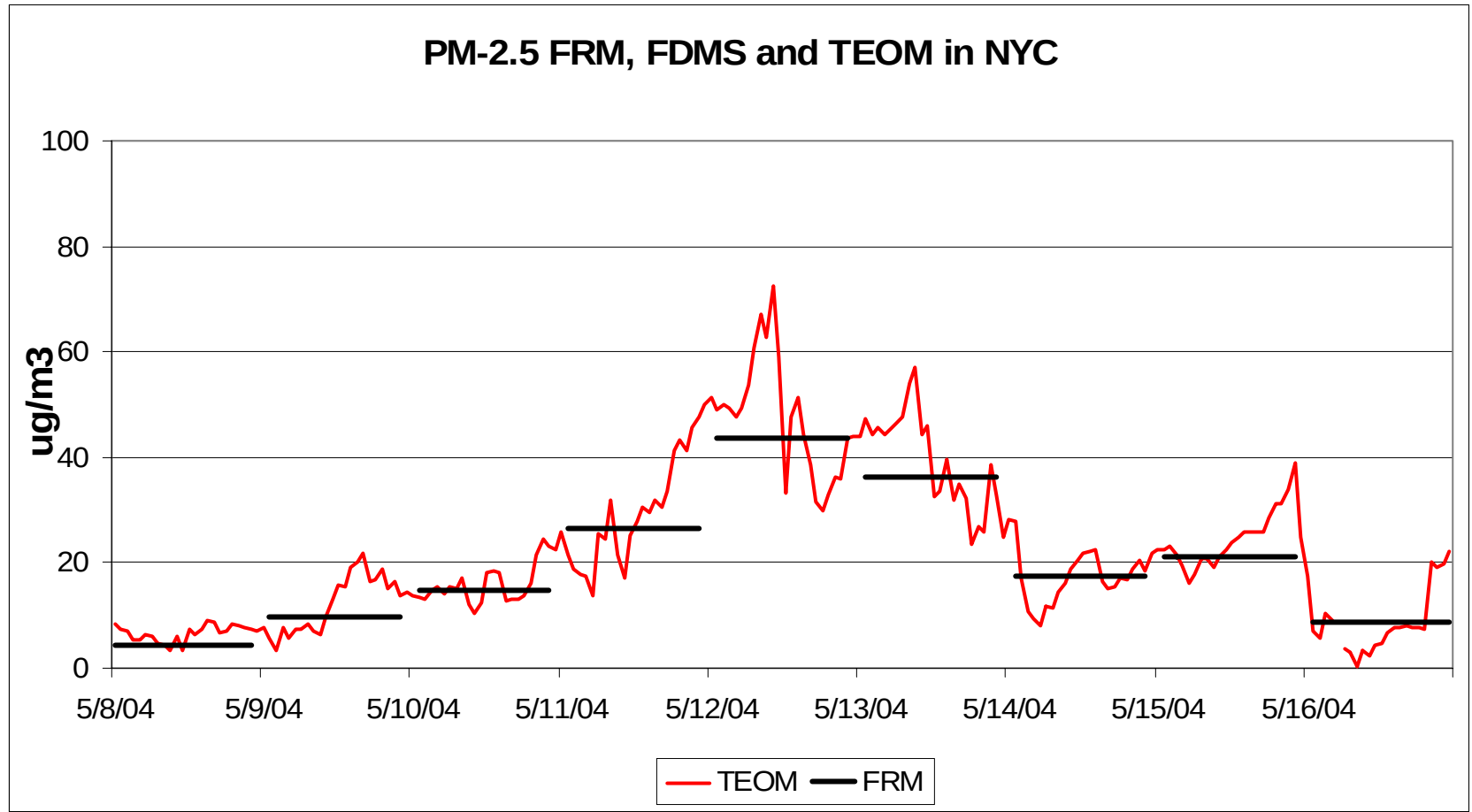
The majority of FRMs collect one sample on every third day.

At four locations in NY the FRM operates daily.

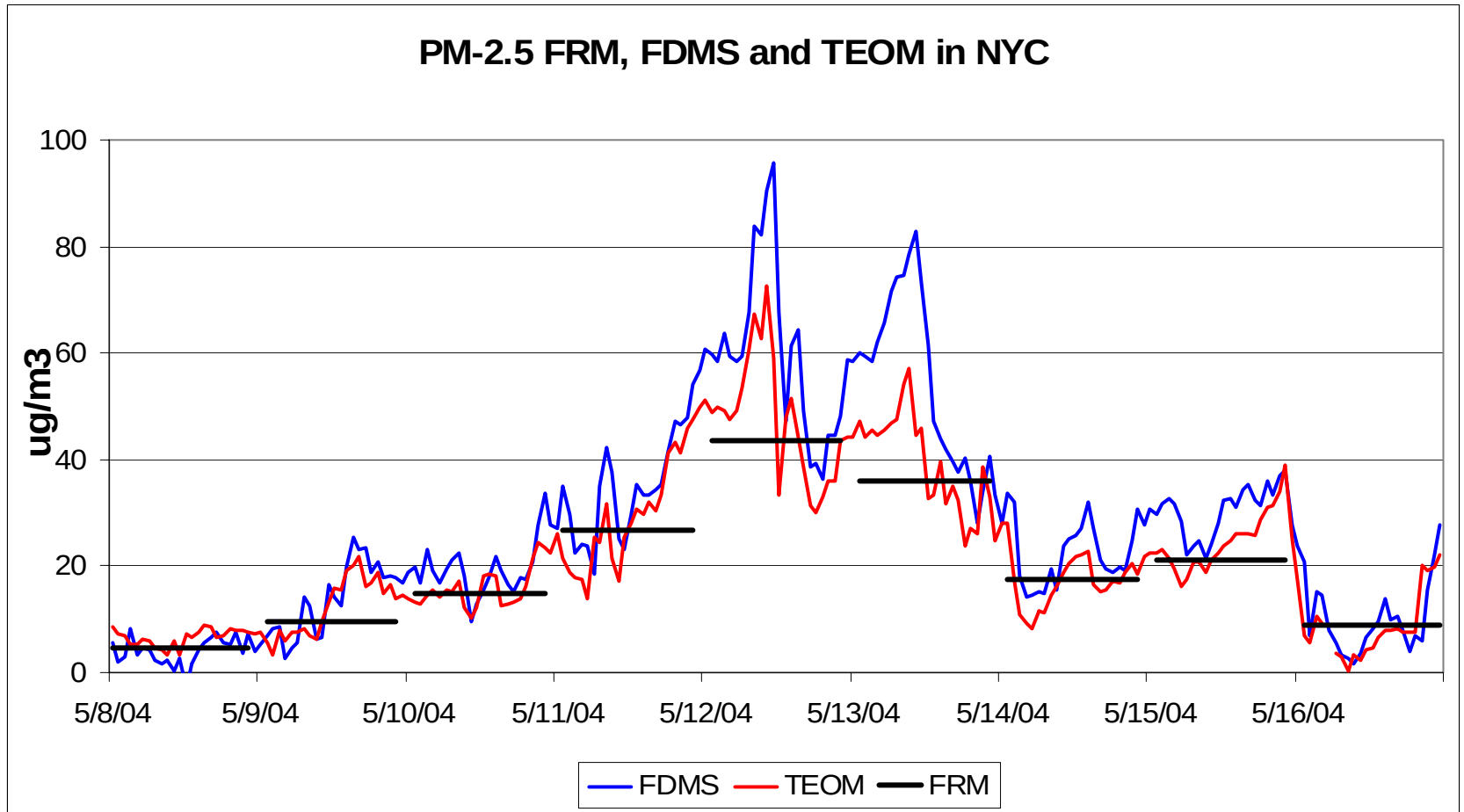


The TEOM's hourly data shows how much information is lost due to the averaging period of the FRM.

The 50 Deg C. TEOM data matches the FRM more closely in warm Months.



The FDMS data indicates that the FRM and the 50 Deg C TEOM did not capture a substantial fraction of PM-2.5 during this pollution episode.



The NYSDEC Monitors PM-2.5 for many reasons:

Regulatory: The NYSDEC is the Agency charged with determining if the air in New York State meets the health based NAAQS.

The EPA requires Air Monitoring Agencies to produce near real-time public notification and forecasts of the air quality in larger cities. (NYSDEC Website and EPA's AirNow website)

State Needs: The NYSDEC must have specific information about the components of PM-2.5 for source apportionment, examination of atmospheric reactions and for toxics.

Method Development: The NYSDEC understands that the FRM does not comprehensively measure the quantity of all PM-2.5 species in each season. The result of this work will improve our ability to predict the response of the environment to pollution control strategies as measured by the FRM.

It is also anticipated that the additional information provided by speciation and volatile PM mass monitoring programs will be valuable to the Health community.