



Database and Analytical Tool Development for the Management of Data Derived from US DOE (NETL) Funded Fine Particulate (PM_{2.5}) Research

**Presentation To:
MANE-VU Conference**

**June 18, 2003
Hartford, CT**





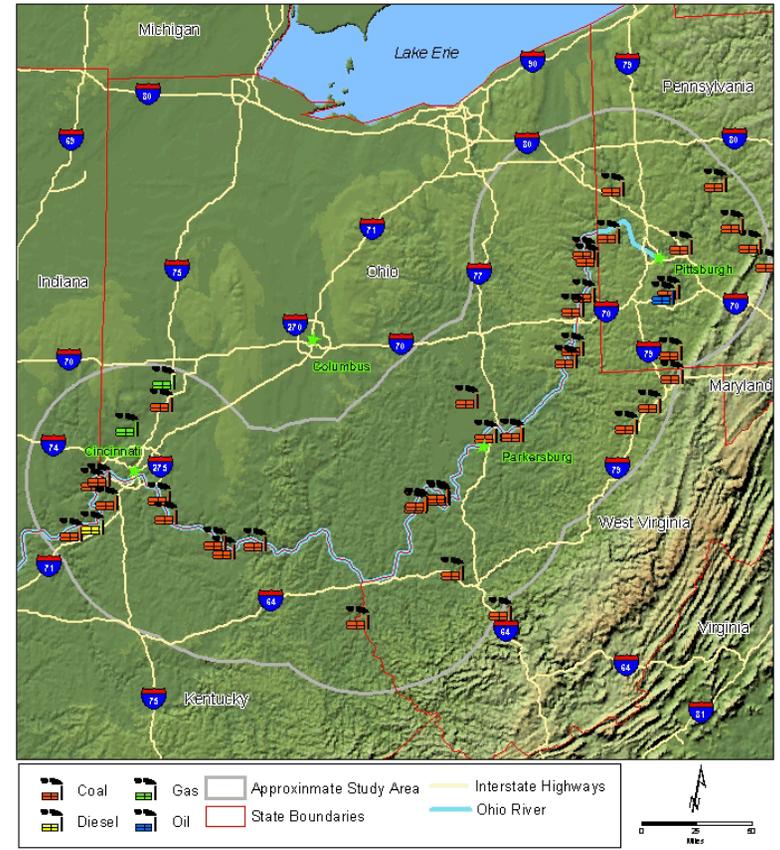
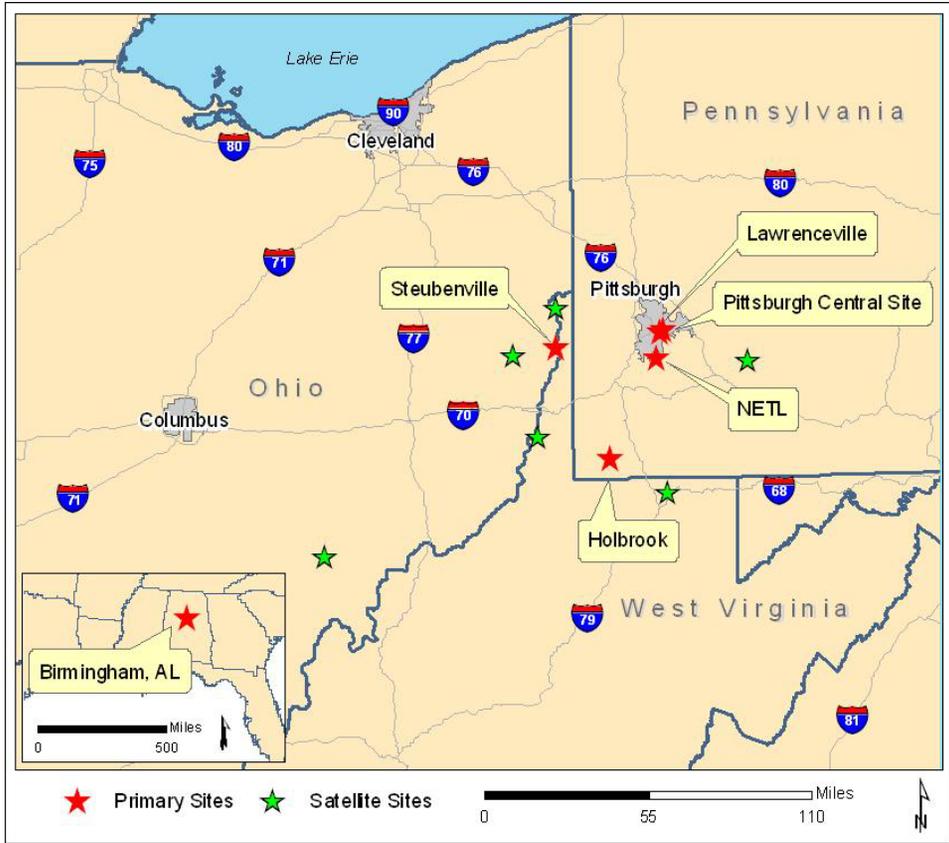
Project Objectives

Primary objective is to develop a comprehensive, web-based application for:

- Integrating the ambient air quality data being collected under multiple on-going DOE-sponsored monitoring programs in the Upper Ohio River Valley (UORV) region
- Creating a publicly-available tool for accessing, displaying, analyzing and interpreting these air quality data



Data Collection Sites





Upper Ohio River Valley Project (UORVP)



Lawrenceville (Urban)

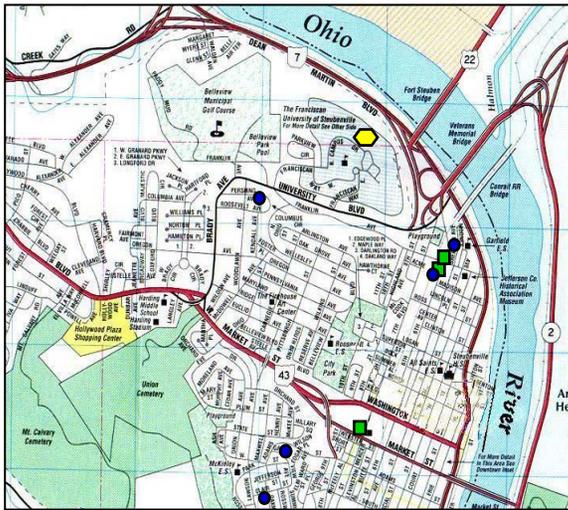


Holbrook (Rural)



Steubenville Comprehensive Air Monitoring Project (SCAMP)

- Outdoor (Ambient) Study
 - Primary performer: CONSOL, Inc.
 - Funding: DOE, EPA



- - Apartments
- - Houses
- - Central site

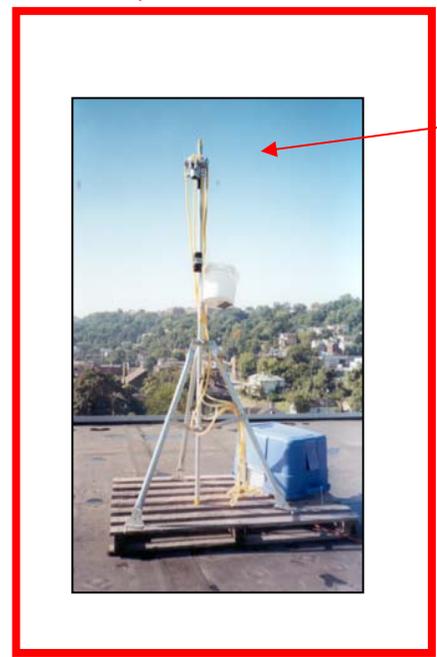


- Personal Exposure Study
 - Outdoor vs. indoor vs. personal PM_{2.5} in Steubenville
 - Primary Performer: Harvard School of Public Health
 - Funding: Ohio Coal Development Office (OCDO), EPRI, NMA, API, AISI, CONSOL



Harvard Multi-pollutant Sampler (SCAMP)

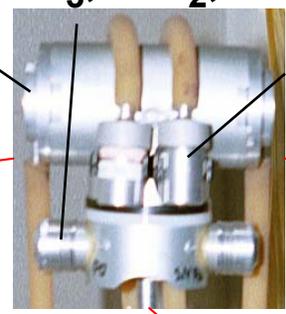
DOE Data



Outdoor

**PM_{2.5}
Mass**

O₃, NO₂, SO₂



EC, OC, SO₄



Indoor



Personal



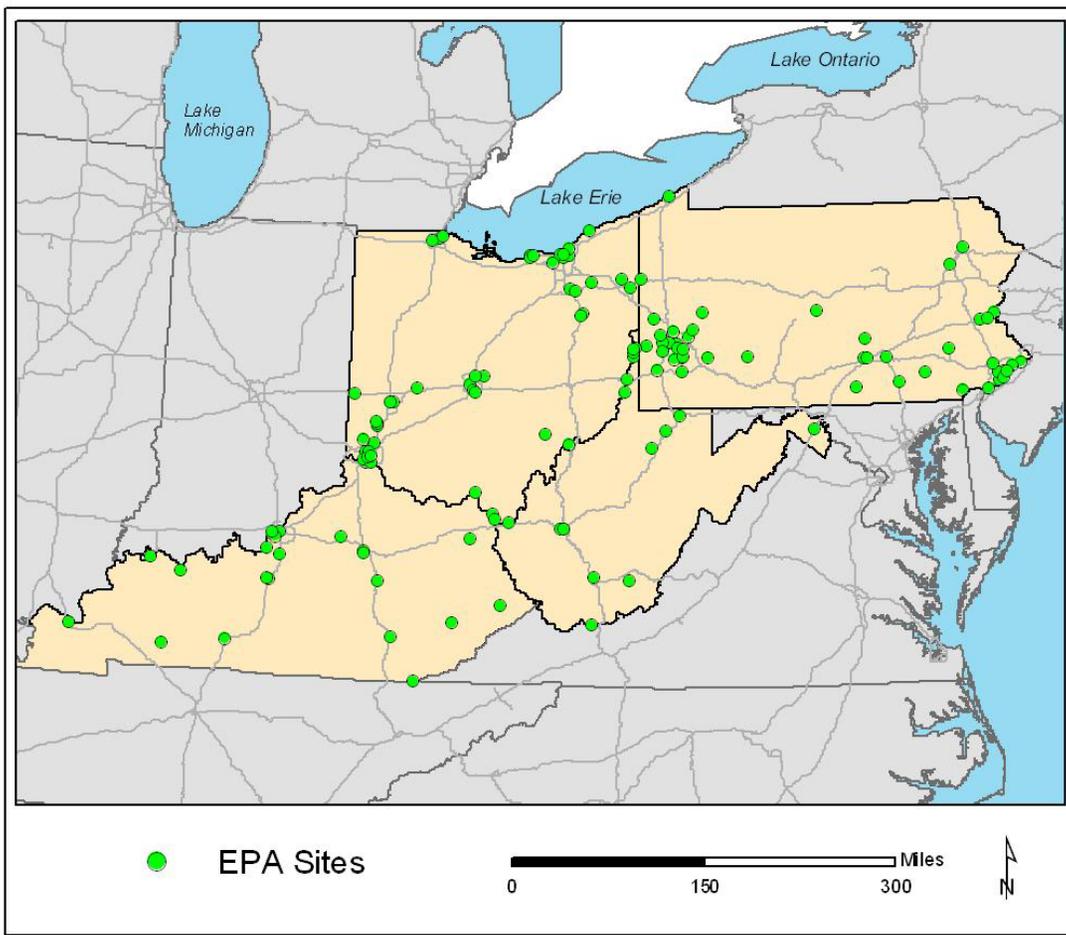
CMU/EPA Pittsburgh “Supersite”

Results of Ambient Monitoring Studies



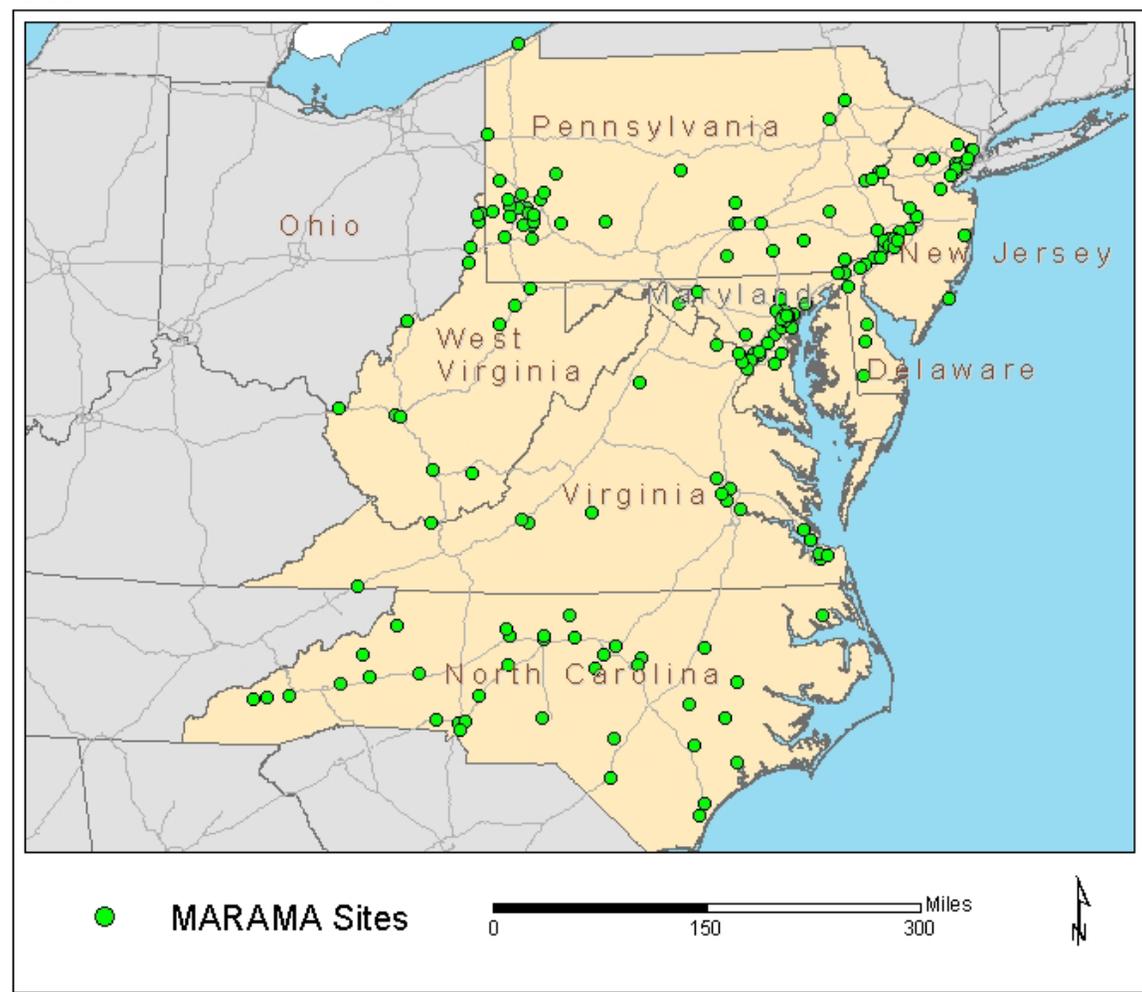


EXPANDED Sites - Ohio River Valley



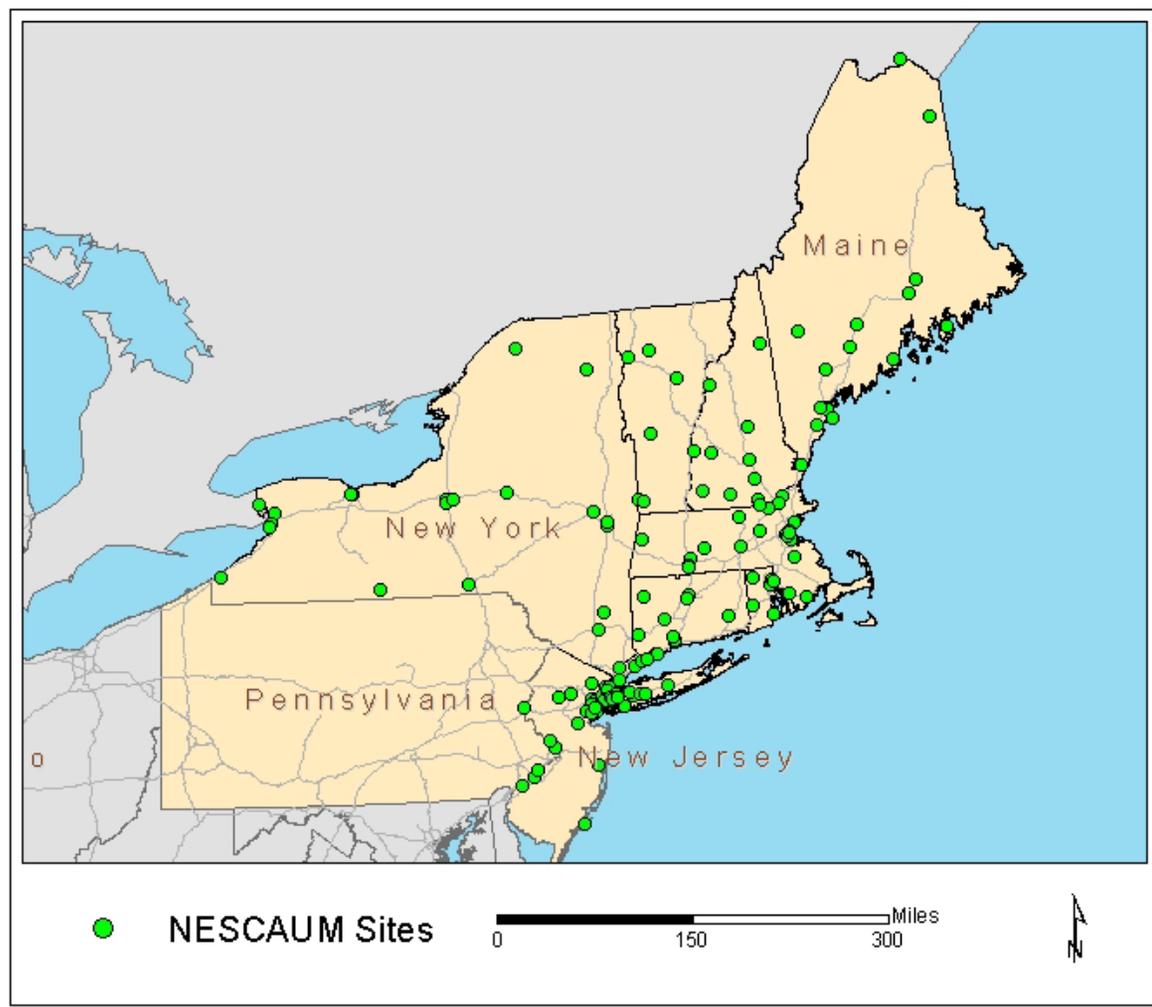


MARAMA Sites



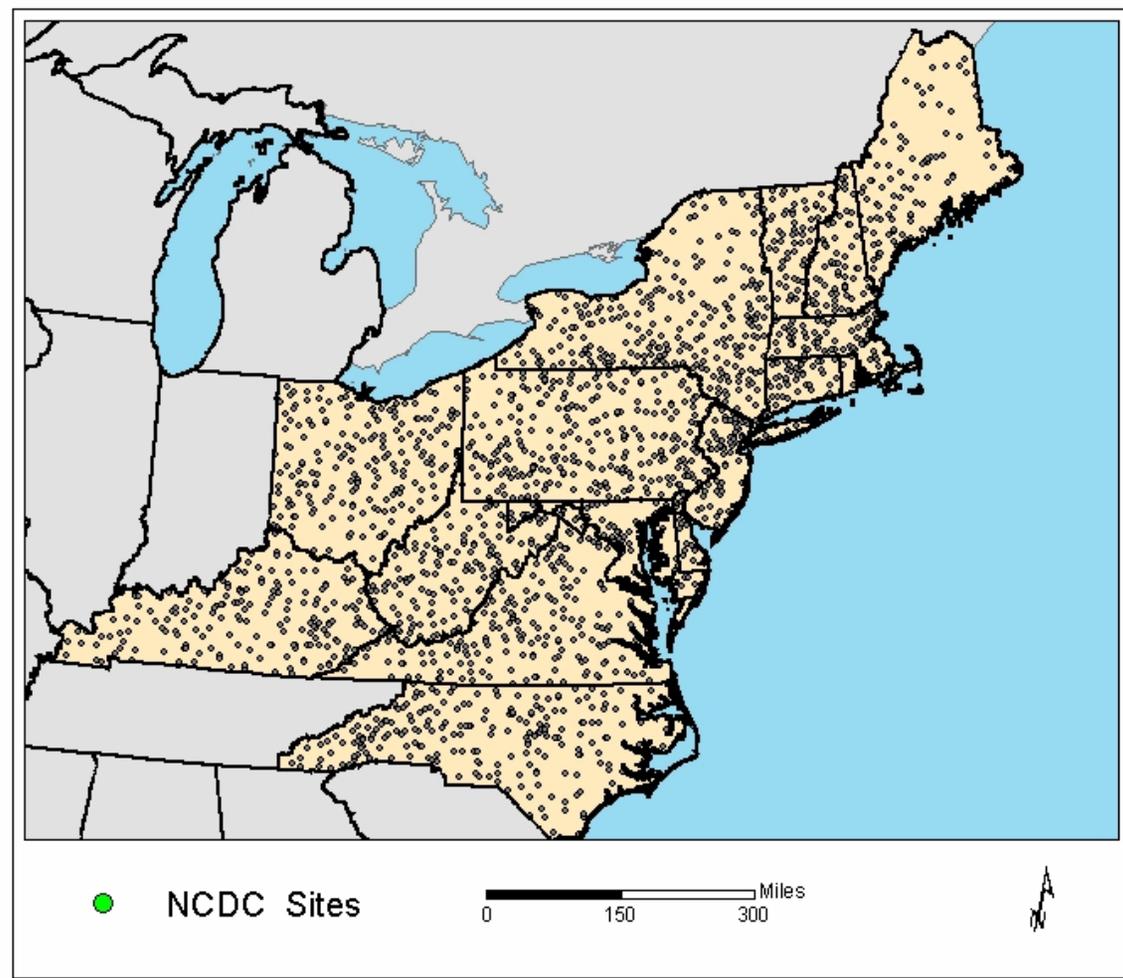


NESCAUM Sites





NCDC Weather Monitoring Sites





Task Breakdown – Phase One

Task #	Description
1.1	Data Inventory/Benchmarking for Database Applications
1.2	Develop Data Management System Architecture
1.3	Population of Database
1.4	Develop Web-Based Retrieval System
1.5	Develop Internal QA/QC System



Task Breakdown – Phase Two

Task #	Description
2.1	Develop Stakeholder Website
2.2	Develop Public Website
2.3	Develop Online Help Feature
2.4	Provide Graphical Representation of Data
2.5	Performance Test



Application Platform

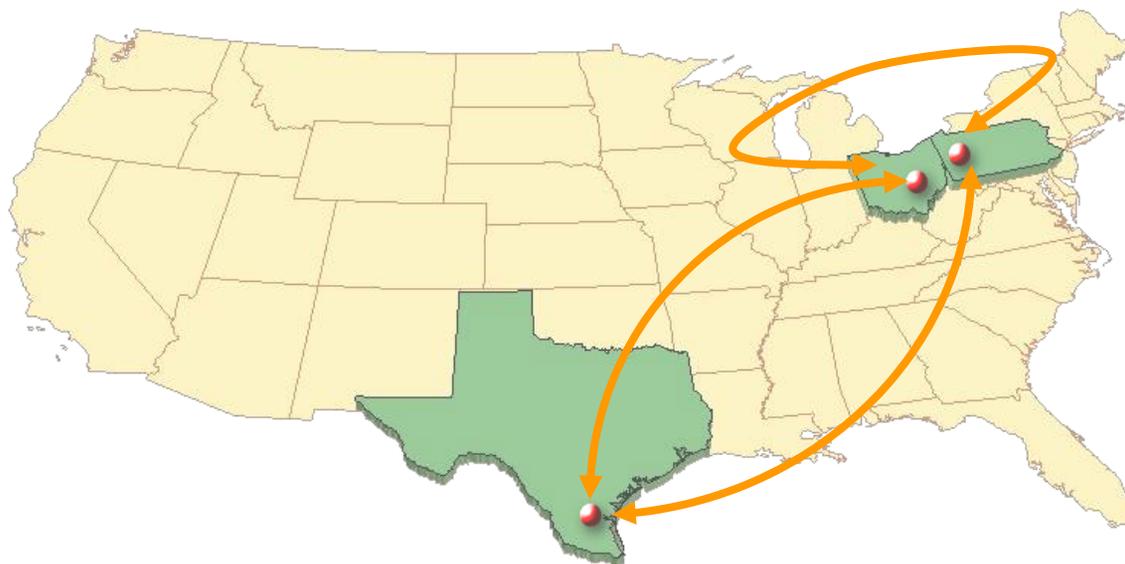
- **Development** - Microsoft Visual Studio .NET
- **Database** - Microsoft SQL Server 2000 Enterprise Edition
- **Web/Application Server** - Microsoft Internet Information Services





Database Features

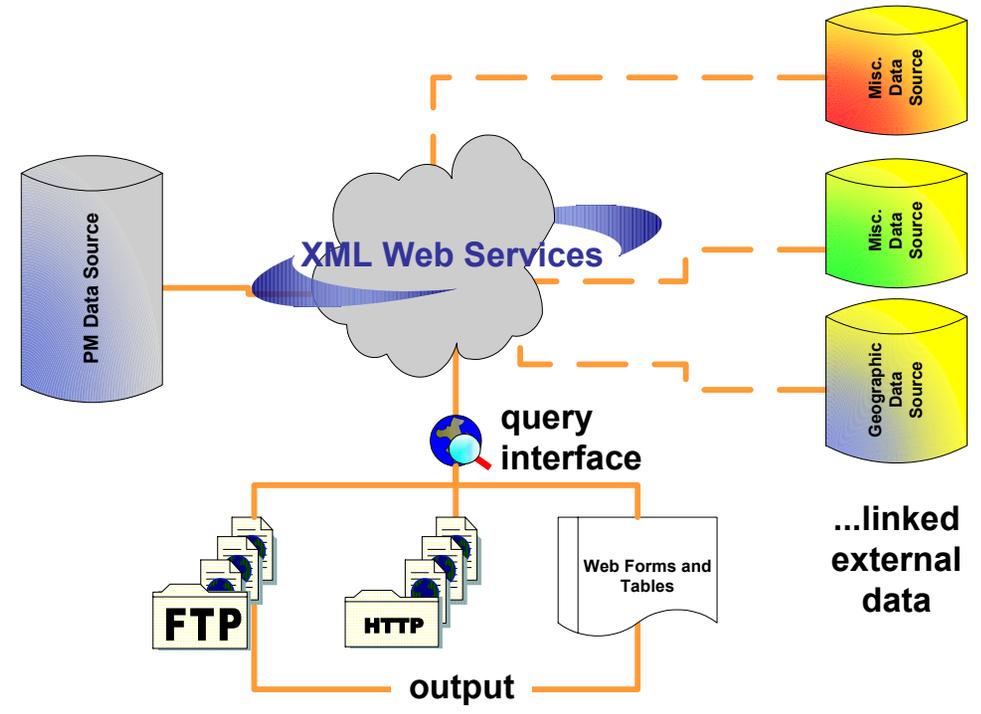
- Server Hardware and Software With Terabyte-Scale Data Capacity
- Servers Located in Pittsburgh, PA; Athens, OH and Kingsville, TX For Redundancy and Availability.





Web-Based Retrieval System

- XML Web Services
- Tabular Datasets



DataGrid was used from cache. The cache was populated at 3/23/2003 2:52:00 PM
 Query: select method_ID from tblMethod where parameter_ID = 43
 Select Table

32081 records found Page 1 of 1605 [Next] [Last]

Observation ID	Site ID	Observation Date	Method	Flag Code	Parameter	Observation Value
495485	9	4/19/2001 11:45:00 PM	7	1	Ammonia	62.4068946838379
495613	9	4/14/2001 11:00:00 PM	7	1	Ammonia	16.7850532531738
495512	9	4/28/2001 10:00:00 AM	7	1	Ammonia	7.37704801559448
495487	9	4/29/2001 6:30:00 PM	7	1	Ammonia	7.8050856590271
495493	9	4/29/2001 3:15:00 AM	7	2	Ammonia	22.2610359191895
495486	9	4/28/2001 11:00:00 PM	7	1	Ammonia	13.8966970443726
495471	9	4/29/2001 6:15:00 AM	7	1	Ammonia	25.3657283782959
495492	9	4/25/2001 7:30:00 AM	7	1	Ammonia	16.1818408966064
495488	9	4/30/2001 10:30:00 AM	7	2	Ammonia	36.709300994873
495756	9	4/19/2001 8:45:00 PM	7	1	Ammonia	38.5223083496094
495816	9	4/20/2001 4:15:00 PM	7	1	Ammonia	12.7679748535156
496640	9	4/28/2001 12:00:00 AM	7	1	Ammonia	7.93058061599731
496671	9	4/29/2001 8:45:00 PM	7	1	Ammonia	16.1467819213867
496722	9	4/24/2001 4:15:00 AM	7	1	Ammonia	11.1774597167969
496639	9	4/7/2001 12:45:00 PM	7	1	Ammonia	12.3545074462891
496666	9	4/25/2001 6:15:00 PM	7	1	Ammonia	26.1274929046631
496641	9	4/17/2001 5:45:00 PM	7	1	Ammonia	6.90112161636353
496046	9	4/30/2001 9:15:00 AM	7	1	Ammonia	48.4222640991211
496664	9	4/29/2001 7:15:00 AM	7	1	Ammonia	21.8282489776611
496764	9	4/16/2001 12:45:00 AM	7	1	Ammonia	3.94028949737549

Records Per Page 20 Change Page 1 of 1605 [Next] [Last]

Change Query



Offline Datasets

- Datasets Can Be Downloaded For Further Use Locally
- Datasets Are Cached At The Server To Reduce Database Resource Demands
- Offline Datasets Are Available In NARSTO, CSV And XML Formats





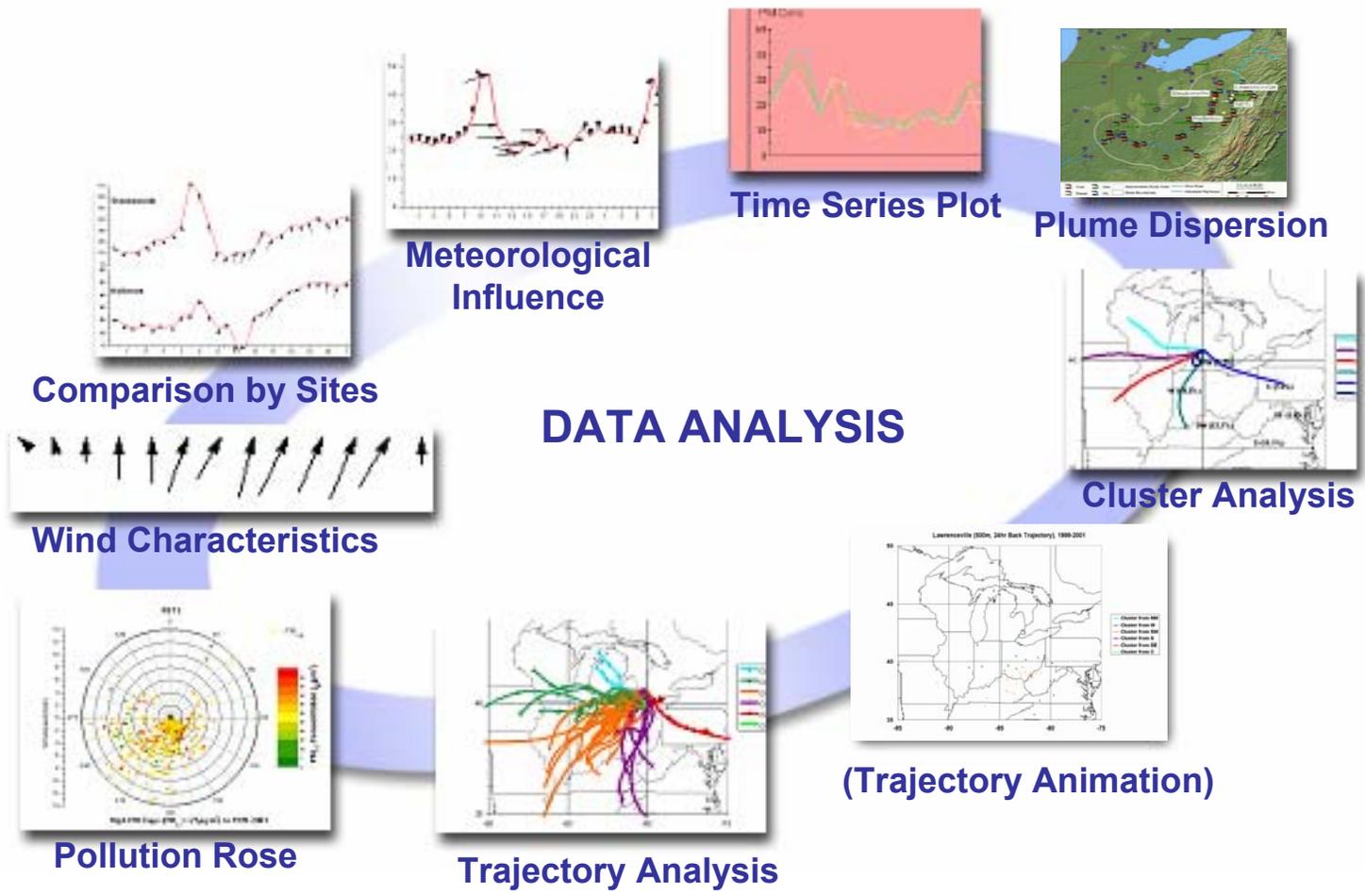
Measured Parameters

- **Gases:** CO, SO₂, Nitrogen Oxides, Ammonia, Ozone, VOC's and Hydrogen Peroxide.
- **PM Sampling:** PM₁₀, PM_{2.5}, PM_{2.5-10} and TSP
- **PM Chemistry :** Mass, Ions, Metals, Elements, Nitrate, Sulfate, Organic Carbon/Elemental Carbon (OC/EC), Semi-volatile organics and Organic speciation
- **Meteorological Parameters:** Relative Humidity, Wind Speed, Wind Direction, Temperature, Precipitation and Pressure





Stakeholder Website





Site Specific Data Retrieval

- Lawrenceville

Monitor Name	Lawrenceville	County	Allegheny, PA
Latitude	40°46'53"	Longitude	79°96'03"
Note	This site is maintained by Allegheny County Health Dept. This site is affected by emissions from heavy traffic in the area. Coke processing facilities and coal-fired power plants are located to the northwest along the Ohio River.		

Site description



Site image and map

- [Data Retrieval Sample](#)
- [Data Analysis Sample](#)

• Select Other Site



GIS Query Process

Select Monitoring Program

Select Monitoring Program
Stubenville Air Quality Study (SCAMP)

Select Site
Steubenville

Select Location

Select State
OHIO

Select County
Jefferson County

Select Parameter

Select Parameter
Ambient Temperature
Ammonia
Barometric Station Pressure
CAMM
Carbon Monoxide

[View GIS Map](#) [View Tabular Results](#) [Download Result](#)

- 1 • Choose search parameters
- 2 • View GIS Map
- 3 • View Tabular Results
- 4 • Download Results

2

3

4



GIS Query Tools

Legend

- Selected Features
- ★ Major Cities
- ▲ EPA Sites
- ▭ States
- Lakes

Selected	SITEID	LATITUDE	LONGITUDE	PM25	O3
<input checked="" type="checkbox"/>	390170016	39.338333	-84.566389	Yes	No
<input checked="" type="checkbox"/>	390170017	39.525	-84.369444	Yes	No
<input type="checkbox"/>	390171004	39.53	-84.3925	Yes	Yes
<input checked="" type="checkbox"/>	390230005	39.928889	-83.809722	Yes	No
<input checked="" type="checkbox"/>	390350013	41.484167	-81.673333	Yes	No

[View Tabular Results](#)

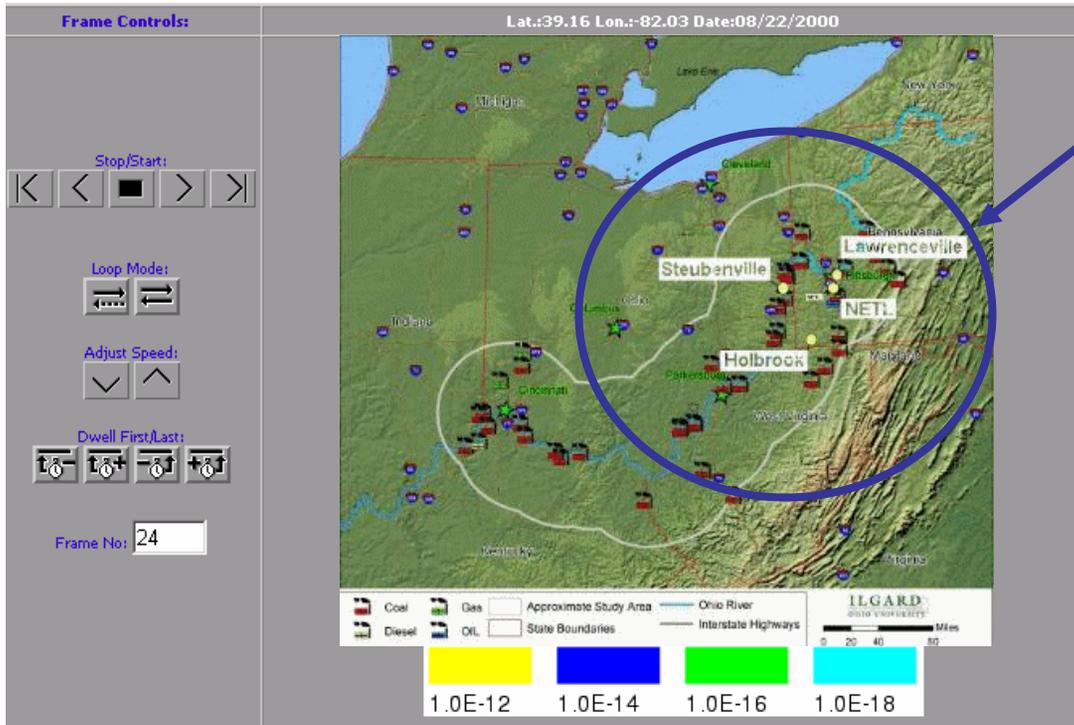
[Download Result](#)

Manually select additional monitors, or unselect from previous query



Plume Dispersion

- Plume Dispersion from Major Point Source



Regional and local impacts of point sources (power plants) using online dispersion modeling tools

Notice:
It is only demo. You will select point sources on the final version.

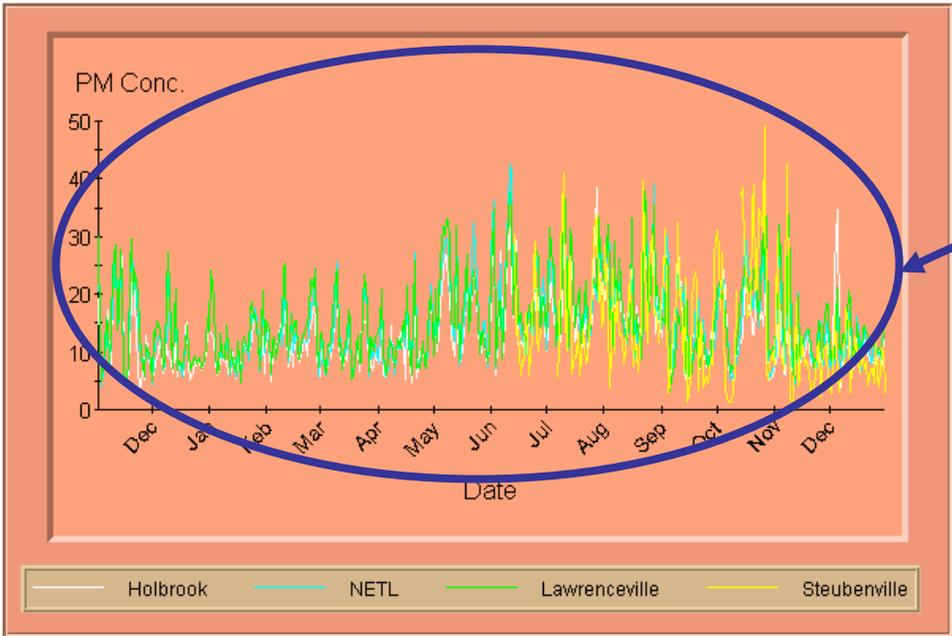


Time Series Plot

Time Series for PM

Select Site(s): Holbrook NETL Lawrenceville Steubenville

From: 11/1/1999 To: 12/31/2000

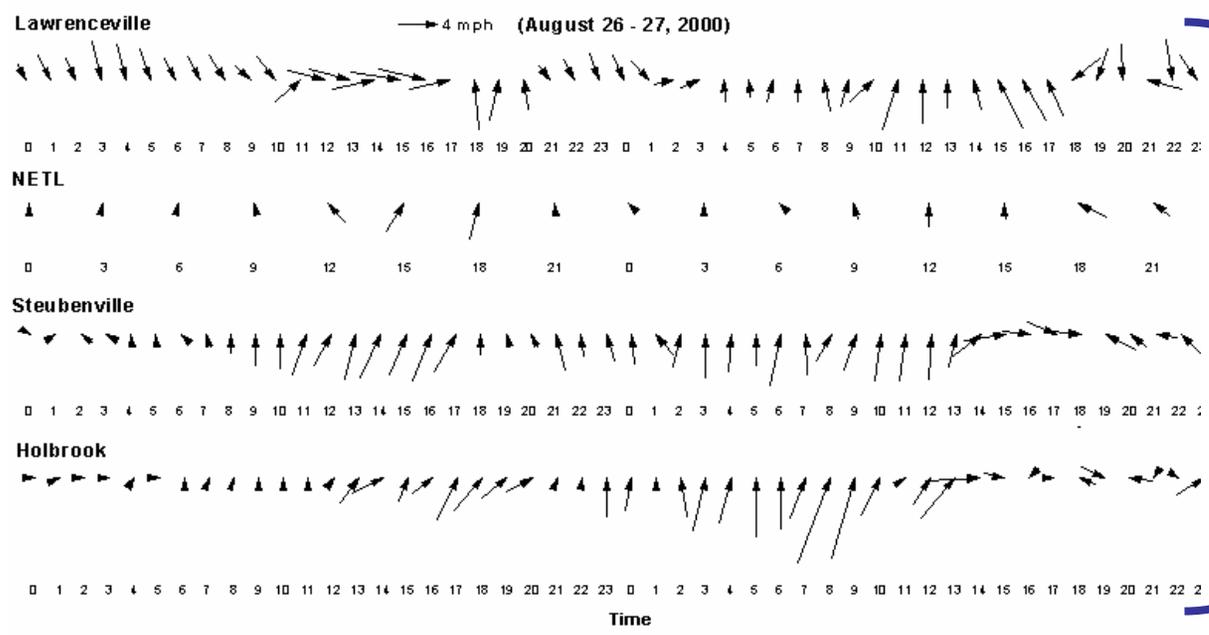


Time series of the PM data for the selected sites



Wind Characteristics

- Site by Site Comparison Analysis (Wind) on High PM Days



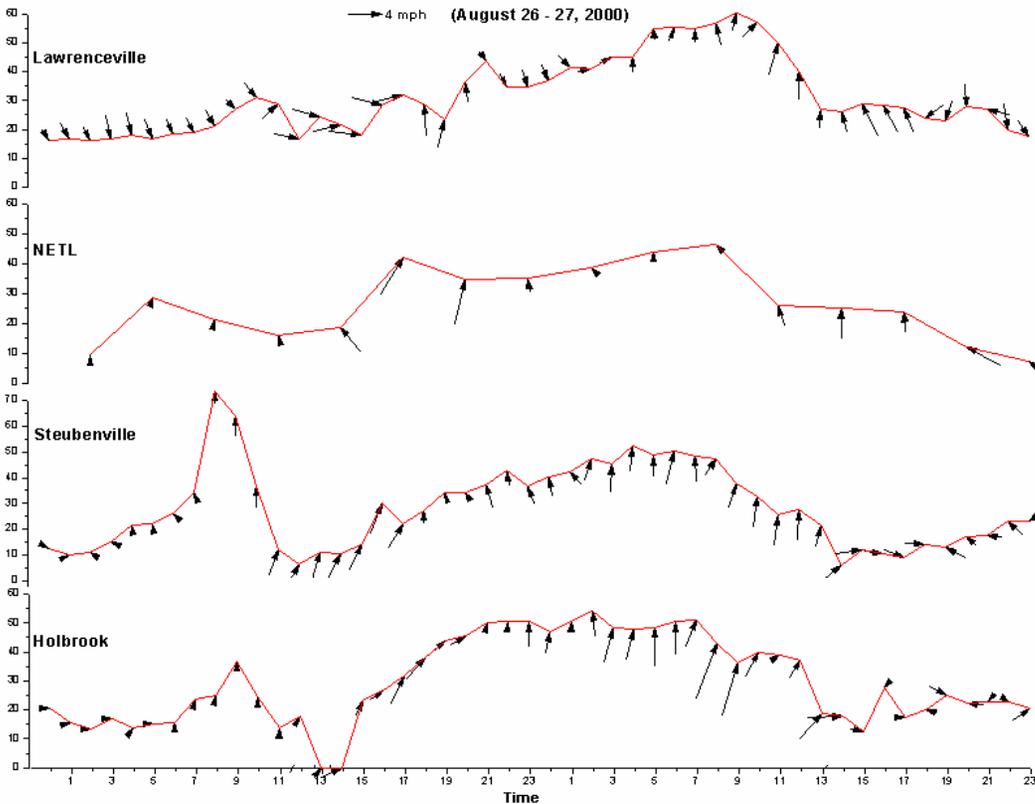
Diurnal comparison of wind shifts by sites

- Comparison Parameter Option: [PM_{2.5} & Wind](#)
- [Other Analyses](#)



Comparison by Site

- Site by Site Comparison Analysis (Time Series & Wind) on High PM Days



- Diurnal distribution and spatial comparison of PM
- Influence of wind speed and direction on PM level

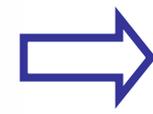
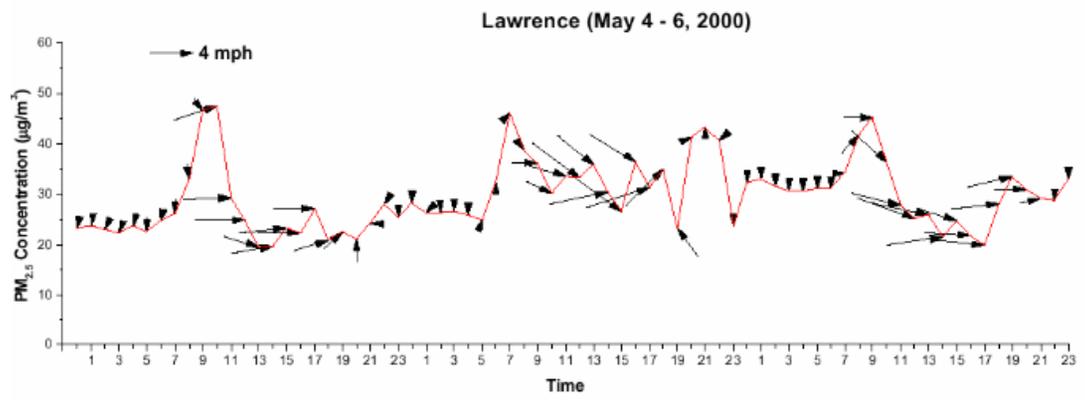
- Comparison Parameter Option: [Wind](#)

- [Other Analyses](#)



Meteorological Influence

- Meteorological Influences for the Lawrenceville Site on High PM Days



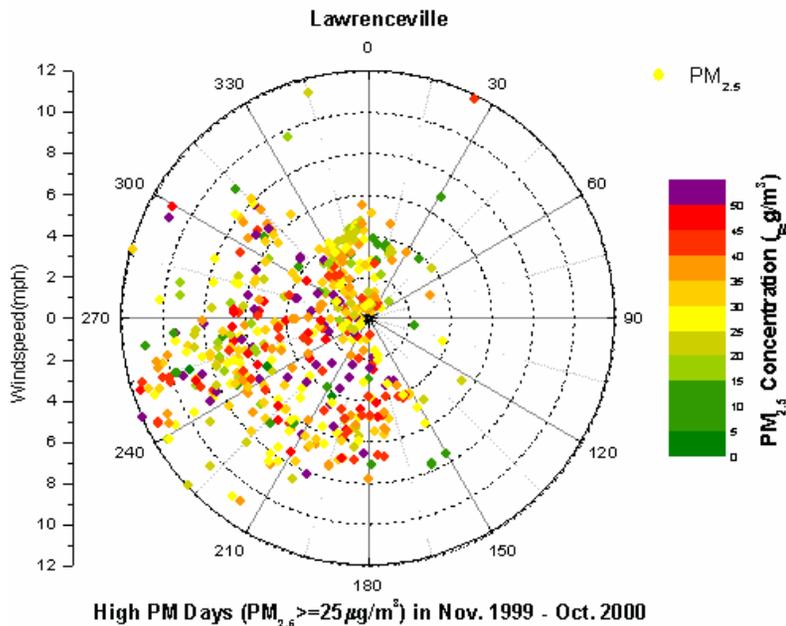
PM vs. wind direction and speed by time

- [Other Analyses](#)



Pollution Rose

- Pollution Rose Analysis for the Lawrenceville Site on High PM Days



- [Other Analyses](#)

- Regional characteristics of meteorological influences (wind) on PM level
- Directional distribution of PM concentration with wind speed

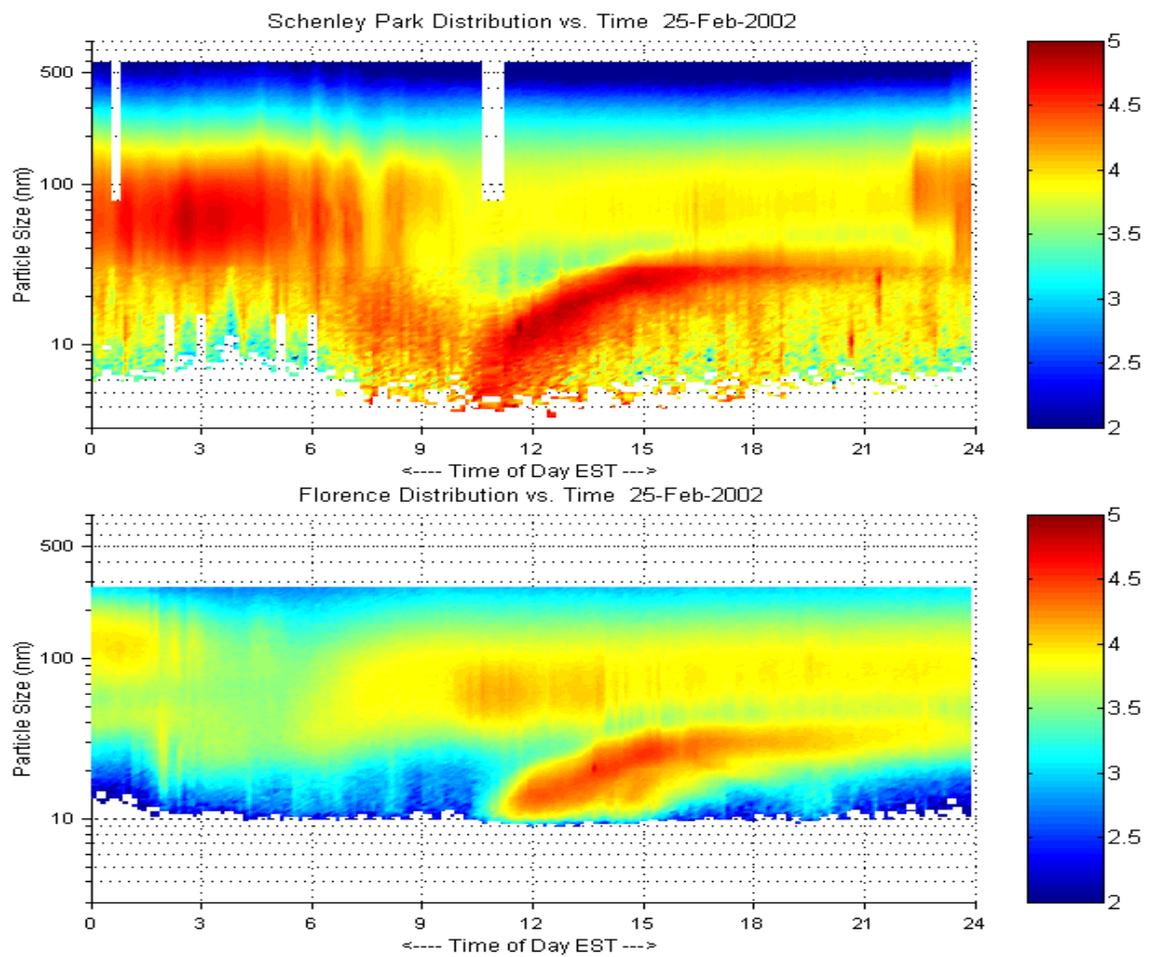


Particle Nucleation on "Clean Day"

**Pittsburgh
Supersite**

↑
~ 50 miles

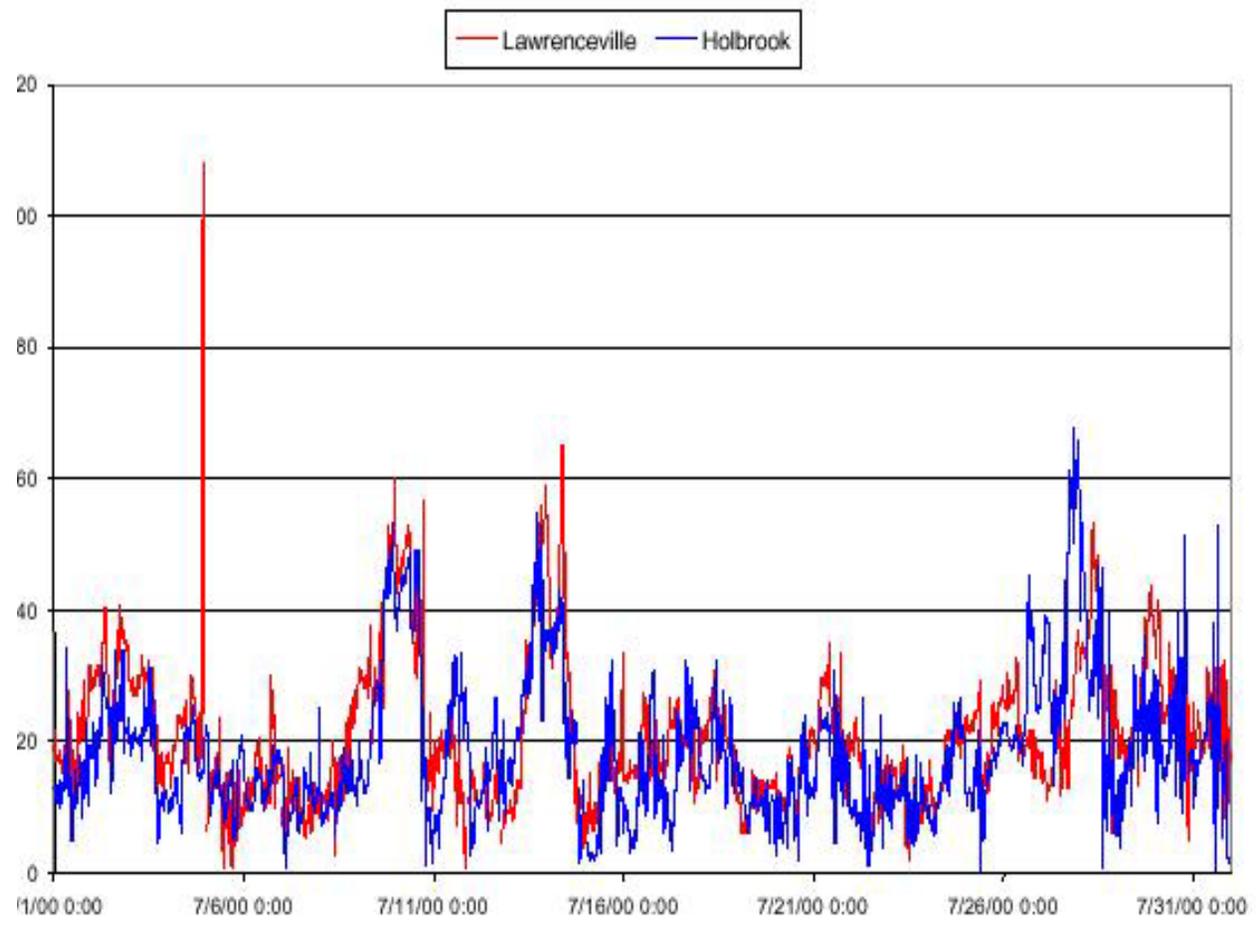
↓
Florence, PA





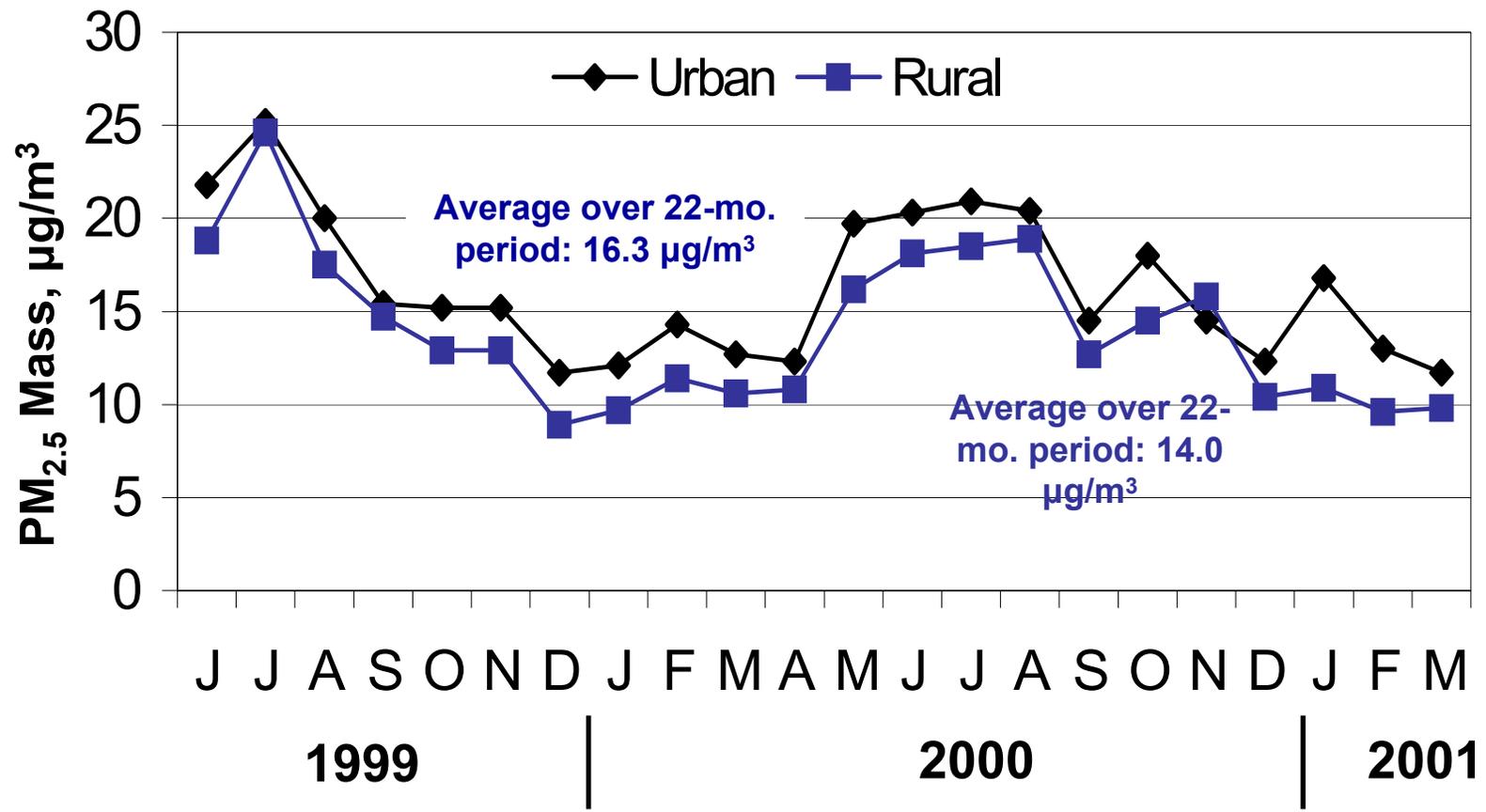
PM_{2.5} TEOM Data, July 2000

Urban-Rural Site Comparison



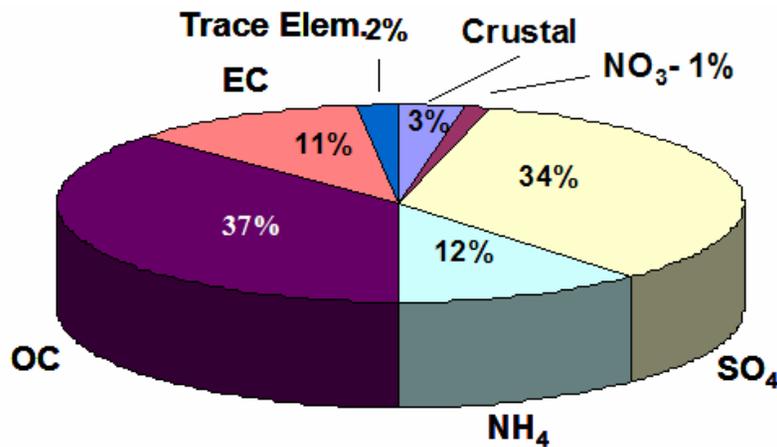


Monthly Average TEOM PM_{2.5} (UORVP)

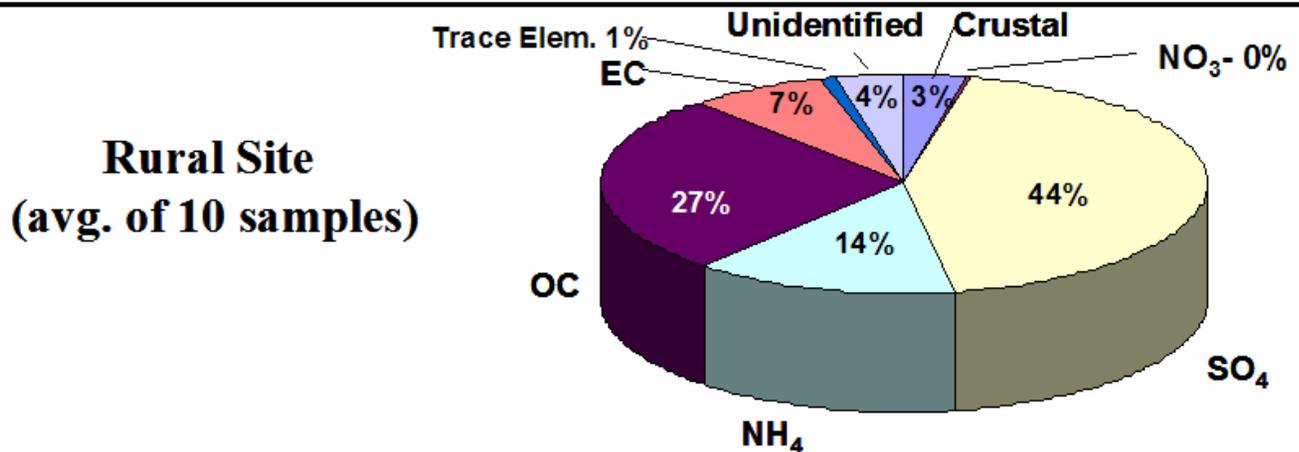




Typical PM_{2.5} Composition in Western Pennsylvania (Summer 1999)



Urban Site
(avg. of 39 samples)

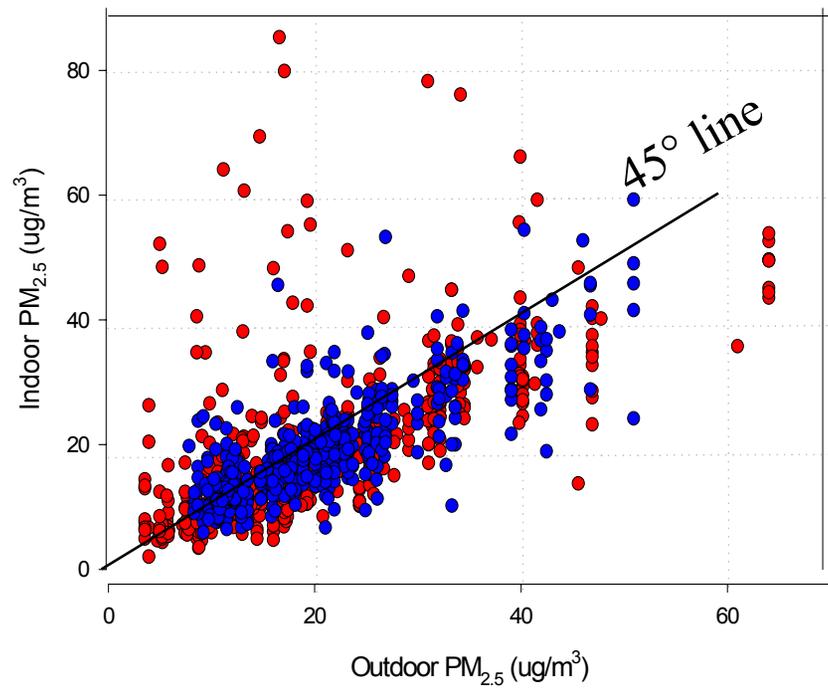


Rural Site
(avg. of 10 samples)

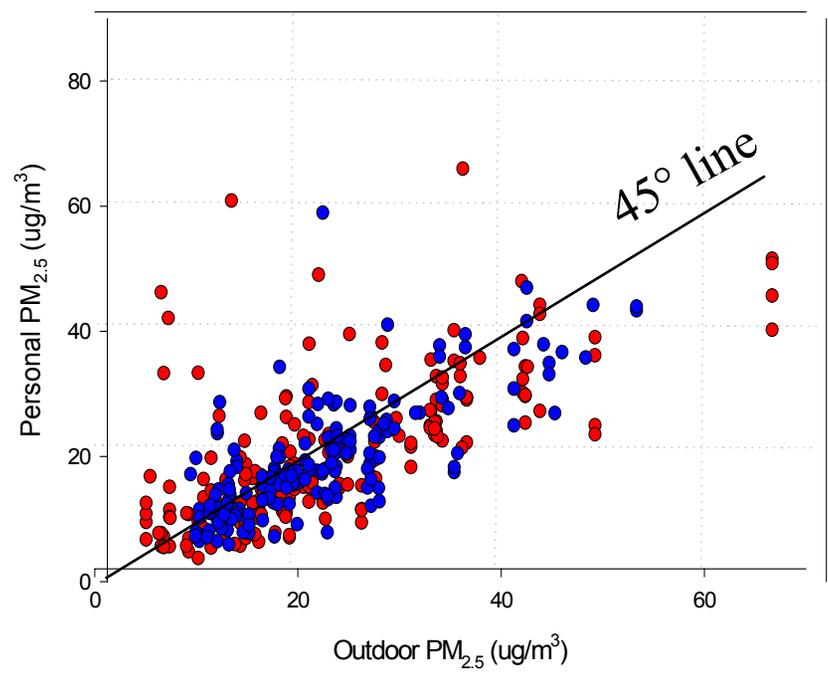


Example of Exposure Study Data (SCAMP)

Outdoor vs. Indoor



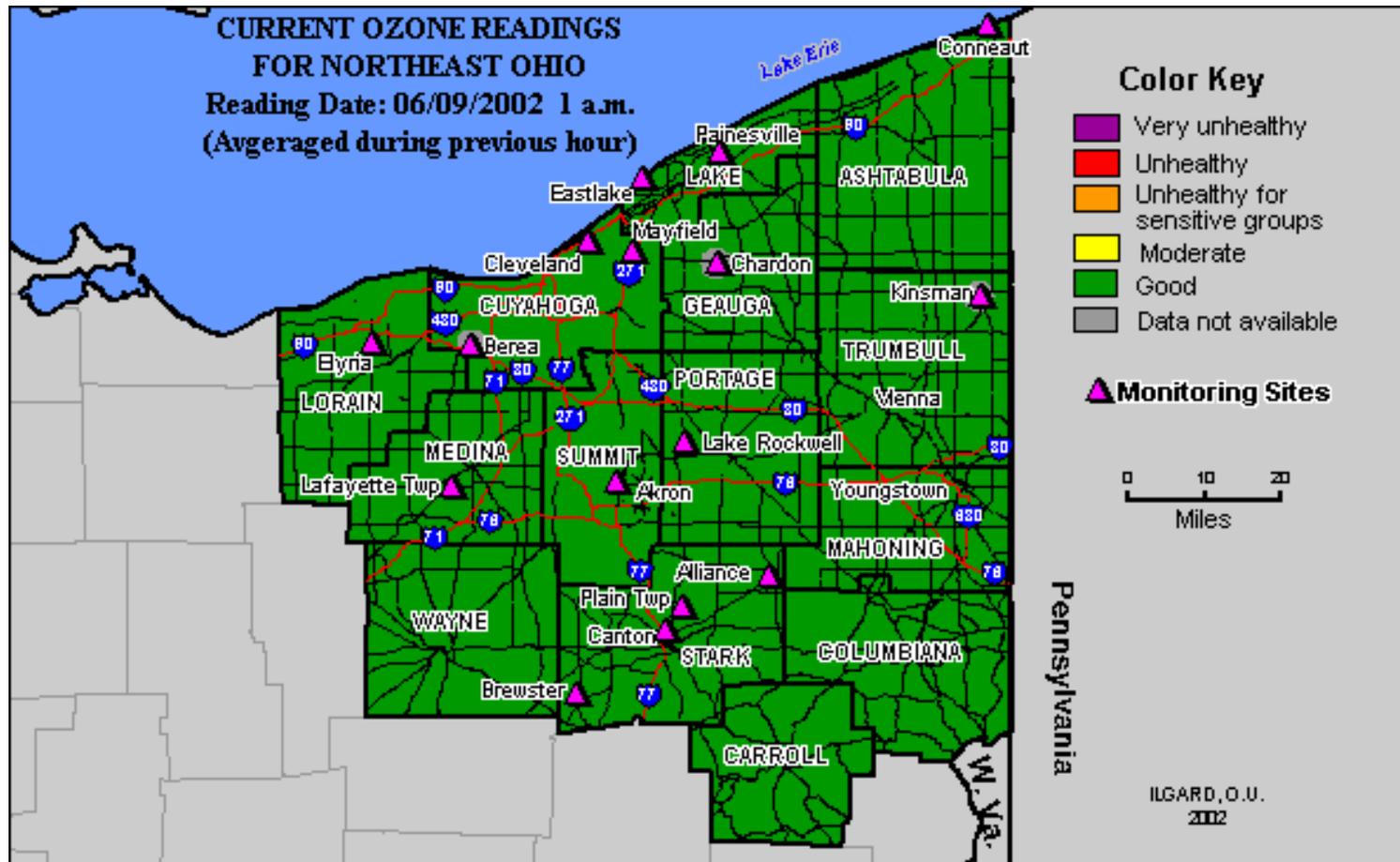
Outdoor vs. Personal



- Summer 2000
- Fall 2000



GIS Ozone Animation



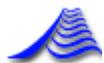


Online Resources



NETL – Environmental & Water Resources: Air Quality Research

http://www.netl.doe.gov/coalpower/environment/air_q/index.html



CARB – California Air Resources Board

<http://www.arb.ca.gov/airways>



Pittsburgh Air Quality Study (PAQS)

<http://homer.cheme.cmu.edu/abstract.htm>



Online Resources – Continued



MARAMA – Mid-Atlantic Regional Air Management Association

<http://www.marama.org>



NESCAUM – Northeast States for Coordinated Air Use Management

<http://www.nescaum.org>

IEWS **IEWS – Visibility Information Exchange Web System**

<http://vista.cira.colostate.edu/iews/Default.htm>



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