



2005 Network Summary

New Jersey Department of Environmental Protection

NETWORK DESIGN

In 2005, the Bureau of Air Monitoring maintained 43 Ambient Air Monitoring Sites in New Jersey. These monitoring sites are designed to fulfill the following monitoring objectives for federal and state regulated pollutants: to measure maximum pollutant concentrations, to assess population exposure, to determine the impact of major pollution sources, to measure background levels, to determine the extent of regional pollutant transport, and to measure secondary impacts in rural areas. In addition, monitoring data are provided to various public and media outlets and are used to provide hourly updates on air quality to the Bureau's web page at www.state.nj.us/dep/airmon. The Air Monitoring Sites can be divided into two primary networks: the Continuous Monitoring Network and the Manual Sampling Network.

SPATIAL SCALES

There are many factors and constraints, which affect the design of a monitoring network. Among these factors, a network design should consider pollutant characteristics, topographical features, and resource limitations when evaluating whether data collected at a particular site can meet monitoring objectives. To assist in designing an effective air monitoring network, the United States Environmental Protection Agency (USEPA) developed the concept of spatial scales of representativeness. The spatial scales define prospective sites in terms of the area surrounding a monitor where the pollutant concentrations are relatively similar. For each monitoring objective, appropriate spatial scales can be used to identify the general physical location of a suitable monitoring site. The various spatial scales are defined below:

Micro-scale (10 – 100m): Monitors that show significant concentration differences from as little as 10 meters or up to 50 meters away from the monitor are classified being Micro-scale monitors. This often occurs when monitors are located right next to low-level emission sources, such as busy roadways, construction sites, and facilities with short stacks.



Figure 1: Ambient air monitoring sampler located on the roof of the Camden County Municipal Utilities Authority Building

These locations should be in areas where the general public is exposed to the concentrations measured.

Middle Scale (100 – 1000m): These monitors show pollutant measurement variations between locations that are approximately 1 kilometer apart. These differences may occur near large industrial areas with many different operations or near large construction sites. Middle scale monitoring sites are often source oriented. Monitoring measurements of this type might be appropriate for the evaluation of short-term exposure to an emission source.

Neighborhood scale (1 – 10km): Neighborhood scale monitors do not show significant differences in pollutant concentrations over areas of a few kilometers. A particular scale location can represent not only the immediate neighborhood but also neighborhoods of the same type in other parts of the city. Neighborhood scale monitors provide good data for trend analysis studies and compliance with National Ambient Air Quality Standards (NAAQS) because their zone of representation are often found in areas where people commonly reside.

Urban Scale (10 – 100km): Urban scale monitors show consistency among pollutant measurements with monitor separations of at least 10 kilometers. Urban scale sites are usually located at higher elevations and away from highly traveled roads, and industries. These locations are ideal for evaluating concentrations over an entire metropolitan and/or rural area.

Regional scale (100 – 1000km): Regional scale (background monitors) show consistency among measurements for monitor separations of a few hundred kilometers. These monitors are best located in rural areas away from local sources, and at higher elevations. National parks, national wilderness areas, and many state and county parks and reserves are appropriate areas for regional scale sites. Data gathered at this scale location is most useful in assessing pollutant concentrations over a large area and evaluating transported emissions.

THE CONTINUOUS MONITORING NETWORK

The Continuous Monitoring Network consists of sites which measure carbon monoxide (CO), oxides of nitrogen (NO_x), ozone (O₃), sulfur dioxide (SO₂), particulate matter, and meteorological data by automated instruments (not all pollutants are measured at all sites). The data is transmitted to a centralized computer system in Trenton, New Jersey, once every minute, thus providing near real-time data. A map showing the location of the continuous monitoring sites is shown in Figure 2 and the parameters recorded at each site are displayed in Table 2 (page 3). Changes to the Continuous Network are summarized in Table 1. Many of the continuous site locations are also part of the Manual Monitoring Network, which is described in the next section.

Figure 2
2005 – Continuous Monitoring Network

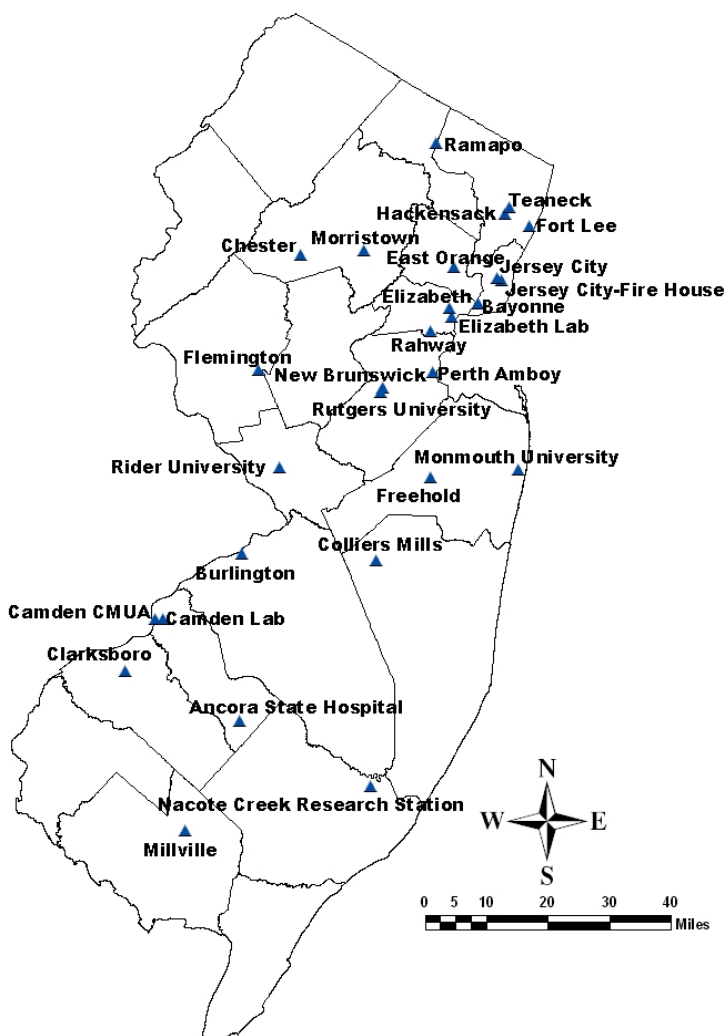


Table 1

2004-2005 Continuous Network Changes			
Monitoring Site	Parameter(s)	Action	Date
Clarksboro	O ₃ ,SO ₂	Site relocated on same property	12/15/04
Fort Lee	CO,TEOM	Re-Start	03/31/05
Millville	TEOM	Start-up	05/05/05

Table 2
2005 – Continuous Air Monitoring Network

Continuous Parameter Codes

CO - Carbon Monoxide
NO_x - Nitrogen Dioxide and Nitric Oxide
O₃ - Ozone
SO₂ - Sulfur Dioxide

SS - Smoke Shade
TEOM - Continuous PM_{2.5} Analyzer
MET - Meteorological Parameters

SITE	CO	NO _x	O ₃	SO ₂	SS	TEOM	MET
Ancora State Hospital	U		U	U			
Bayonne		U	N	N			
Burlington	Mi			N	N		
Camden CMUA						N	
Camden Lab	N	N	U	N	N	N	U
Chester		U	U	U			U
Clarksboro			U	U			
Colliers Mills			U				
East Orange	N	N					U
Elizabeth	Mi			M	N		
Elizabeth Lab	N	N		N	N	N	U
Flemington			U		N		U
Fort Lee	M					M	
Freehold	Mi				N		
Hackensack	N			N	N		
Jersey City-Firehouse						N	
Jersey City	Mi			N	N		
Millville		N	N	N		N	
Monmouth University			N				
Morristown	Mi				N		
Nacote Creek Research Station			U	U			
New Brunswick						N	
Perth Amboy	N			N	N		
Rahway						N	
Ramapo			U				
Rider University		N	N				U
Rutgers University		N	N				U
Teaneck		N	N				
TOTAL	12	9	14	13	10	8	7

Spatial Scale codes: Mi - **Micro**, M - **Middle**, N - **Neighborhood**, U - **Urban**, R – **Regional**

MANUAL MONITORING NETWORK

The Manual Monitoring Network does not transmit data in near real-time as does the Continuous Monitoring Network. The manual network consists primarily of various instruments that collect samples for subsequent analysis in a laboratory. The network provides data on fine particulates (particles smaller than 2.5 micrometers in diameter or $PM_{2.5}$), inhalable particulates (particles smaller than 10 micrometers in diameter or PM_{10}), lead (Pb), Total Suspended Particulates (TSP), several parameters associated with atmospheric deposition, pollutants important in the formation of ground level ozone (ozone precursors), and a group of organic and inorganic compounds that are considered toxic pollutants. Sites that measure ozone precursors are part of the national Photochemical Assessment Monitoring Station (PAMS) program. While these ozone precursors are automatically measured every hour, the data are retrieved once a day and require extensive review before they are validated. Changes to the Manual Network are summarized in Table 3. A map of the manual sampling sites is shown in Figure 3 and a list of the pollutants measured at each location is shown in Table 4 (page 5).

Figure 3
2005 – Manual Monitoring Network

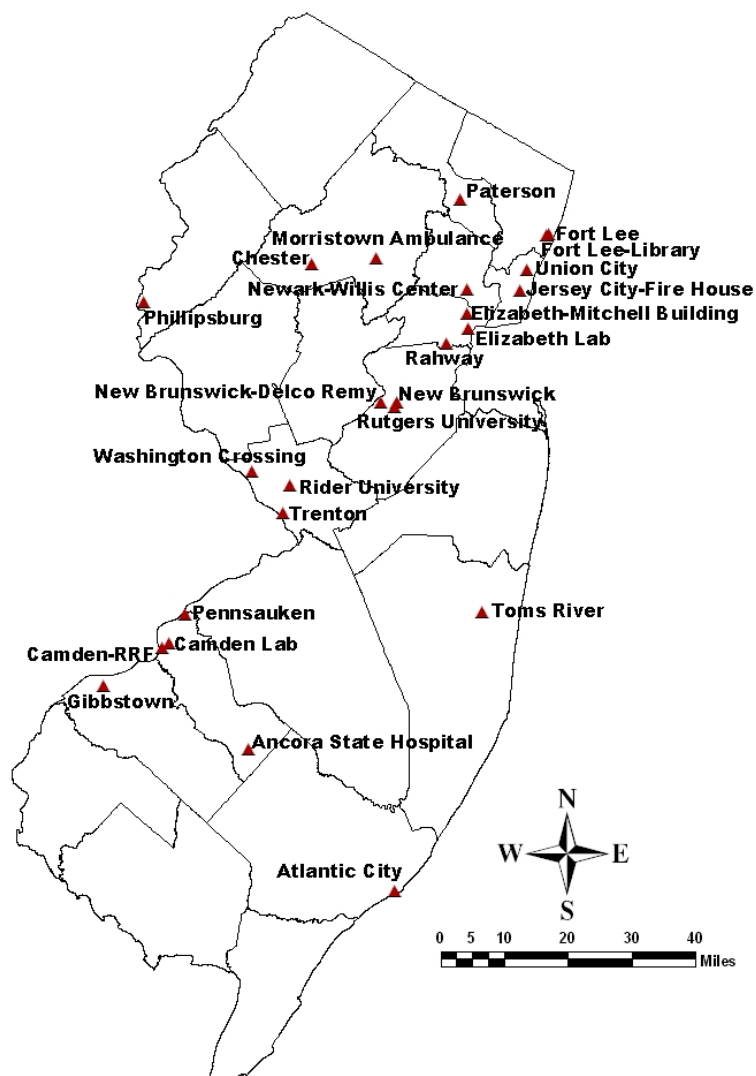


Table 3

2004-2005 Manual Network Changes			
Monitoring Site	Parameter(s)	Action	Date
Lebanon State Forest	Acid Deposition	Discontinued	10/27/04
Fort Lee	PM_{10}	Re-Start	03/31/05
¹ Jersey City-Firehouse	PM_{10}	Start-up	05/12/05
Union City	$PM_{2.5}$	Start-up	07/25/05

¹ Collocated a PM_{10} sampler for precision measurements.

Table 4
2005 - Manual Air Monitoring Network

Manual Parameter Codes

PM_{2.5}	- FRM (Federal Reference Method) Manual PM _{2.5} Sampler	PAMS	- Photochemical Assessment Monitoring Station (Ozone Precursors)
PM₁₀	- FRM Manual PM ₁₀ Sampler	CARB	- Carbonyls
Pb	- Particulates Analyzed for Lead	VOCs	- Volatile Organic Compounds
TSP	- Total Suspended Particulates	SVOCs	- Semi-Volatile Organic Compounds
PM_{2.5} Spec	- PM _{2.5} Speciation Trends Network Sampler	Acid Deposition	- Dry - Nitrates and Sulfates in PM ₁₀ Wet - Acidity (pH scale) in precipitation

SITE	PM _{2.5}	PM ₁₀	Pb	TSP	PM _{2.5} Spec	PAMS	CARB	VOCs	Acid Deposition	
									Dry	Wet
Ancora State Hospital										U
Atlantic City	N	N								
Camden Lab	N	N			N	N	N	N	N	
Camden-RRF		M								
Chester	U				U		U	U		
Elizabeth Lab	N				N		N	N		
Elizabeth-Mitchell Building	N									
Fort Lee		M							M	
Fort Lee-Library	N									
Gibbstown	N									
Jersey City-Firehouse	N	N								
Morristown-Ambulance Squad	N									
New Brunswick	N				N		N	N		
New Brunswick-Delco Remy			Mi	Mi						
Newark-Willis Center	N									
Paterson	N									
Pennsauken	N									
Phillipsburg	N									
Rahway	N									
Rider University						N				
Rutgers University						N				
Toms River	N									
Trenton	N	N								
Union City	N									
Washington Crossing	N									U
TOTAL	19	6	1	1	4	3	4	4	2	2

Spatial Scale codes: Mi - **Micro**, M - **Middle**, N - **Neighborhood**, U - **Urban**, R - **Regional**

REFERENCES

Ball, R. J. and G. E. Andersen, *Optimum Site Exposure Criteria for Sulfur Dioxide Monitoring*, EPA-450/3-77-013, The Center for the Environment and Man, Inc., Hartford, CT, Prepared for USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, April 1977

Ludwig, F. L. and J. H. S. Kealoha, *Selecting Sites for Carbon Monoxide Monitoring*, EPA-450/3-75-077, Stanford Research Institute, Menlo Park, CA. Prepared for USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1975.

Ludwig, F. L. and E. Shelar, *Site Selection for the Monitoring of Photochemical Air Pollutants*, EPA-450/3-78-013, Stanford Research Institute, Menlo Park, CA, Prepared for USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, April 1978.

Network Design for State and Local Air Monitoring Stations (SLAMS), National Air Monitoring Stations (NAMS), and Photochemical Assessment Monitoring Stations (PAMS), 40 CFR 58 Appendix D, US Government Printing Office, Washington DC, July 1997.

Pelton, D. J. and R. C. Koch, *Optimum Sampling Exposure Criteria for Lead*, EPA-450/4-84-012, GEOMET Technologies, Inc., Rockville, MD, Prepared for UESPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, February 1984.

Watson, J. G., et. al., *Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10}* , EPA-454/R-99-022, Desert Research Institute, University and Community College System of Nevada, Reno, NV. Prepared for USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, December 1997.



2005 Air Quality Index Summary

New Jersey Department of Environmental Protection

WHAT IS THE AIR QUALITY INDEX (AQI)?

The Air Quality Index (AQI) is a national air quality rating system based on the National Ambient Air Quality Standards (NAAQS). Generally, an index value of 100 is equal to the primary, or health based, NAAQS for each pollutant. This allows for a direct comparison of each of the pollutants used in the AQI (carbon monoxide, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide). The AQI rating for a reporting region is equal to the highest rating recorded for any pollutant within that region. In an effort to make the AQI easier to understand, a descriptive rating and a color code, based on the numerical rating are used (see Table 1).

For more information on the AQI, visit EPA's web site at <http://airnow.gov/>.

Table 1
Air Quality Index

Numerical AQI Rating	Descriptive Rating	AQI Color Code
0-50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy for Sensitive Groups	Orange
151-200	Unhealthy	Red
200-300	Very Unhealthy	Purple

Each weekday morning a forecast is prepared using the AQI format. The forecast is provided to participating radio and television stations. Each afternoon, an air quality update, which includes the current air quality information and a forecast for the following day, is issued to various newspapers.

For purposes of reporting the AQI, the state is divided into 9 regions (see Figure 1). Table 2 shows the monitoring sites and parameters used in each reporting region to calculate the AQI values.

Figure 1
Air Quality Index Regions

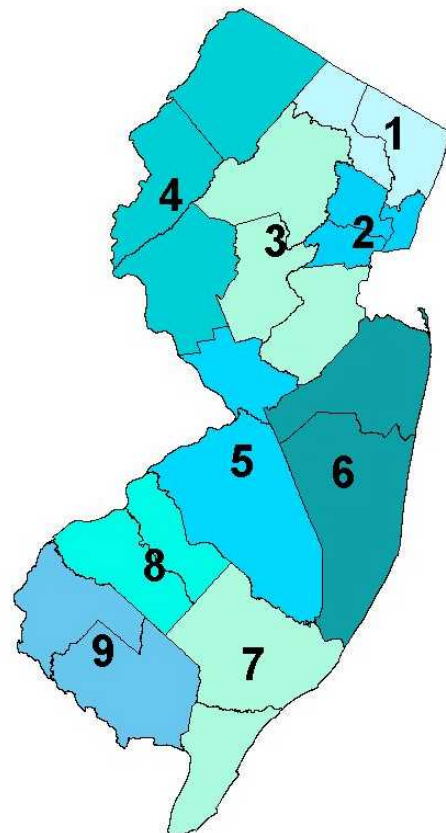


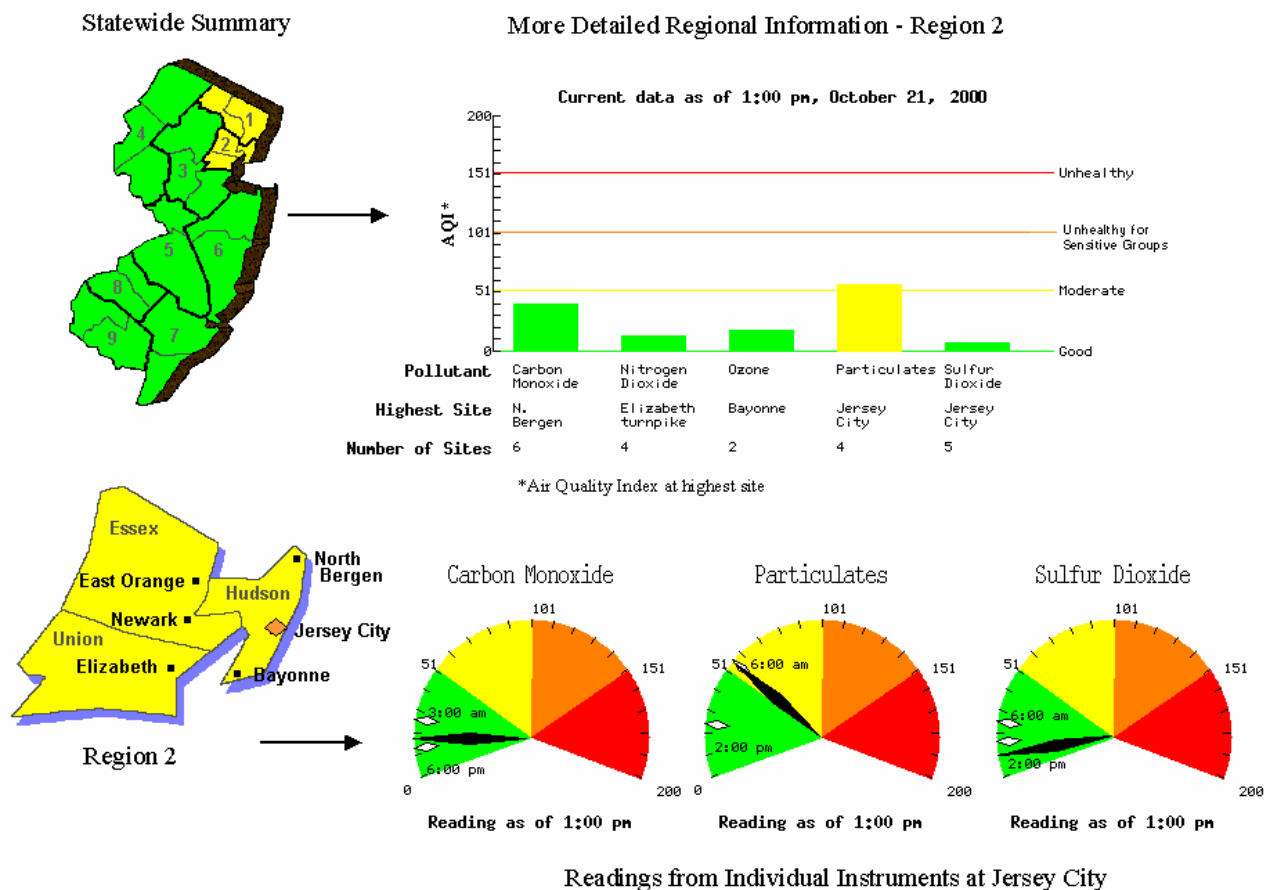
Table 2
Pollutants Monitored According to Air Quality Index Reporting Region - 2005

CO - Carbon Monoxide O₃ - Ozone
SO₂ - Sulfur Dioxide NO₂ - Nitrogen Dioxide
PM - Particulate Matter

Reporting Region	Monitoring Site	CO	SO ₂	PM	O ₃	NO ₂
1. Northern Metropolitan	Fort Lee	X	---	X	---	---
	Hackensack	X	X	X	---	---
	Ramapo	---	---	---	X	---
	Teaneck	---	---	---	X	X
2. Southern Metropolitan	Bayonne	---	X	---	X	X
	East Orange	X	---	---	---	X
	Elizabeth	X	X	X	---	---
	Elizabeth Lab	X	X	X	---	X
	Jersey City	X	X	X	---	---
	Jersey City Firehouse	---	---	X	---	---
3. Suburban	Chester	---	X	---	X	X
	Morristown	X	---	X	---	---
	New Brunswick	---	---	X	---	---
	Perth Amboy	X	X	X	---	---
	Rutgers University	---	---	---	X	X
4. Northern Delaware Valley	Flemington	---	---	X	X	---
5. Central Delaware Valley	Burlington	X	X	X	---	---
	Rider University	---	---	---	X	X
6. Northern Coastal	Colliers Mills	---	---	---	X	---
	Freehold	X	---	X	---	---
	Monmouth University	---	---	---	X	---
7. Southern Coastal	Nacote Creek R. S.	---	X	---	X	---
8. Southern Delaware Valley	Ancora State Hospital	X	X	---	X	---
	Camden Lab	X	X	X	X	X
	Clarksboro	---	X	---	X	---
	South Camden	---	---	X	---	---
9. Delaware Bay	Millville	---	X		X	X

Along with the forecast, cautionary statements are provided for days when the air quality is expected to be unhealthy. A weekday air quality forecast map, introduced during the 1996 ozone season, is televised on New Jersey Network's (NJN) TV News Broadcast. A web page was also created in 1996 to show current air quality levels. This page can be accessed at the following internet address: <http://www.state.nj.us/dep/airmon>. Some examples of the air quality information available on our web site are shown in Figure 2 below:

Figure 2
Examples of NJDEP's Air Monitoring Website



2005 AQI SUMMARY

A summary of the AQI ratings for New Jersey in 2005 is presented in the pie chart to the right. In 2005 there were 125 "Good" days, 211 were "Moderate", 27 were rated "Unhealthy for Sensitive Groups", 2 were considered "Unhealthy", and zero were rated "Very Unhealthy". This indicates that air quality in New Jersey is considered good or moderate most of the time, but that pollution is still bad enough to adversely affect some people on about one day in thirteen. Table 3 lists the dates when the AQI exceeded the "Unhealthy for Sensitive Groups" threshold at any monitoring location and shows which pollutant(s) were in that range or higher. Figure 4 shows the AQI ratings for the year broken down by AQI region.

Figure 3
Air Quality Summary by Days

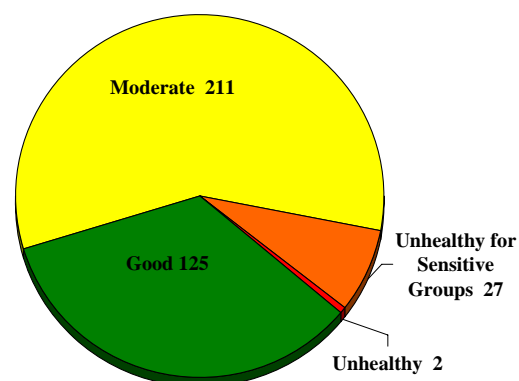


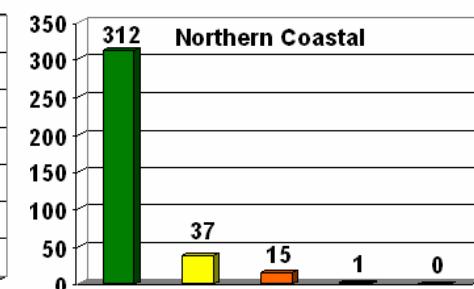
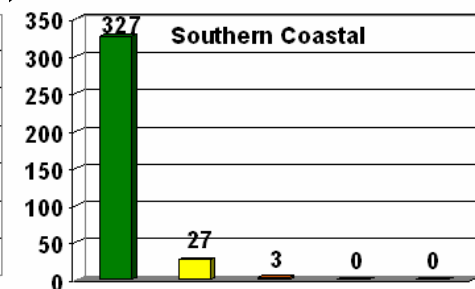
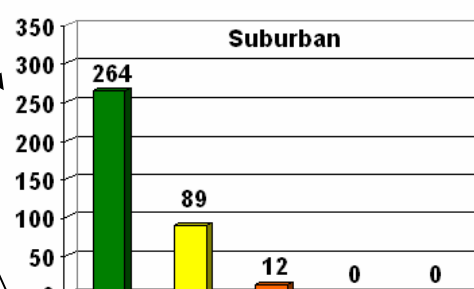
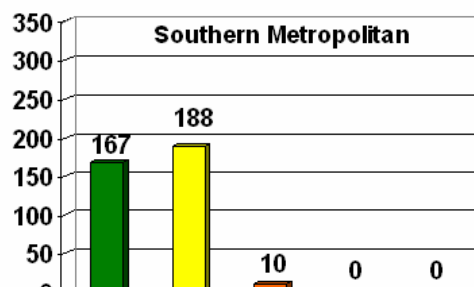
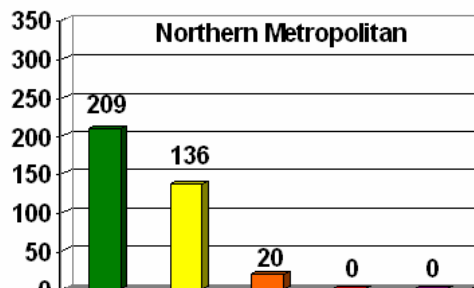
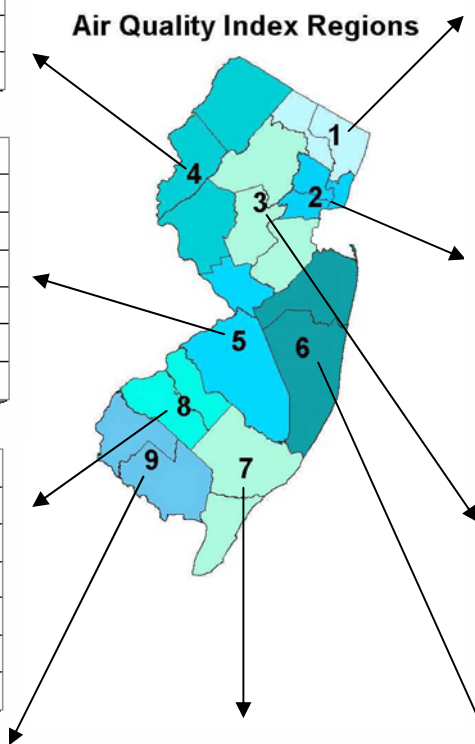
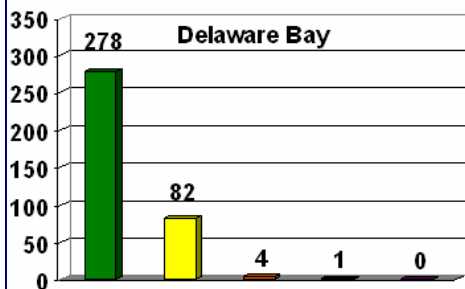
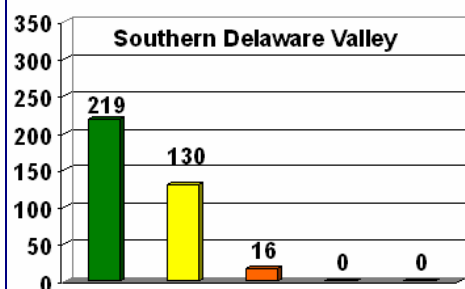
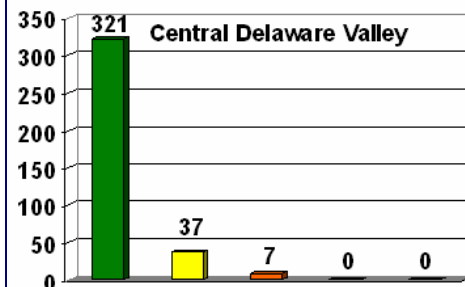
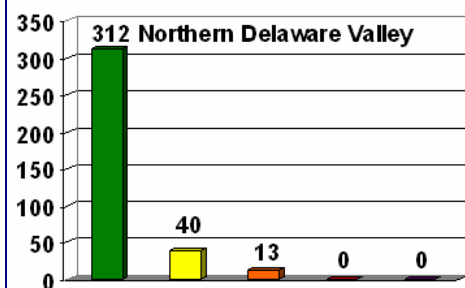
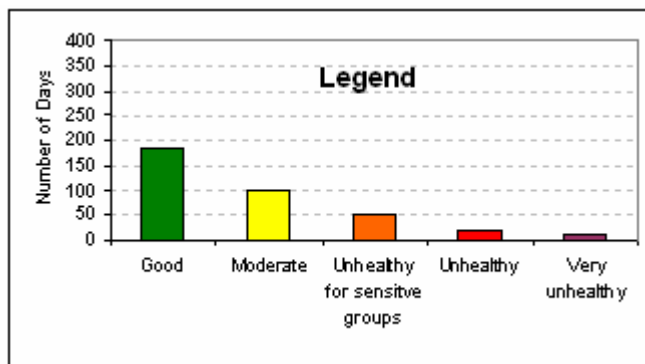
Table 3
Air Quality Index (AQI) Exceedances of 100 During 2005

<u>Ratings</u>		<u>Pollutants</u>	
USG	- Unhealthy for Sensitive Groups	PM	- Fine Particle Matter
UH	- Unhealthy	O ₃	- Ozone
VUH	- Very Unhealthy		

* Number in parentheses () indicates the number of monitoring sites exceeding 100 on a given day

Date	Highest Location	Highest AQI Value	Highest Pollutant	Highest Rating	Pollutant(s) with AQI above 100 *	
April 19	Colliers Mills/ Ft. Lee	116	O3 / PM	USG	O3 (4)	PM (1)
April 20	Ancora S.H.	109	O3	USG	O3 (4)	PM (1)
June 06	Fort Lee	114	PM	USG		PM (2)
June 08	Teaneck	111	O3	USG	O3 (6)	
June 09	J.C. Firehouse	108	PM	USG		PM (1)
June 21	Colliers Mills	129	O3	USG	O3 (4)	
June 24	Flemington	109	O3	USG	O3 (2)	
June 25	Rider University	137	O3	USG	O3 (6)	
June 26	Flemington/Teaneck	140	O3	USG	O3 (5)	
July 06	Fort Lee	104	PM	USG		PM (1)
July 18	Fort Lee	139	PM	USG		PM (1)
July 19	Fort Lee	118	PM	USG		PM (2)
July 21	Colliers Mills	150	O3	USG	O3 (10)	
July 22	Millville	164	O3	UH	O3 (8)	PM (1)
July 26	Colliers Mills	161	O3	UH	O3 (5)	PM (1)
July 27	Colliers Mills	119	O3	USG	O3 (3)	PM (3)
August 02	Ancora S.H.	119	O3	USG	O3 (2)	
August 03	Colliers Mills	127	O3	USG	O3 (6)	
August 04	Colliers Mills	140	O3	USG	O3 (5)	PM (1)
August 05	Colliers Mills	150	O3	USG	O3 (2)	PM (2)
August 11	Ancora S.H.	106	O3	USG	O3 (3)	
August 12	Rutgers University	127	O3	USG	O3 (5)	PM (4)
August 13	Ft. Lee/ J.C. Firehouse	128	PM	USG	O3 (5)	PM (7)
August 14	Flemington	114	O3	USG	O3 (1)	PM (1)
September 08	Ancora S.H.	132	O3	USG	O3 (8)	
September 12	Colliers Mills	104	O3	USG	O3 (2)	
September 13	Fort Lee	141	PM	USG	O3 (10)	PM (3)
November 06	Fort Lee	106	PM	USG		PM (1)
November 21	Fort Lee	114	PM	USG		PM (1)

Figure 4
2005 Air Quality Index Summary
Number of Days by Reporting Region



References

Air Quality Index, A Guide to Air Quality and Your Health, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, June 2000, EPA-454/R-00-005, URL: www.epa.gov/airnow/aqi_cl.pdf

Guideline for Reporting of Daily Air Quality - Air Quality Index (AQI), USEPA, Office of Air Quality Planning and Standards, July 1999, EPA-454/R-99-010, URL: www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf

Air Quality Index Reporting, Final Rule: Title 40, Part 58, Code of Federal Regulations, August 4, 1999. URL: http://www.epa.gov/ttn/oarpg/t1/fr_notices/airqual.pdf

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: www.epa.gov/oar/aqtrnd99/

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2001, URL: www.epa.gov/oar/aqtrnd00/

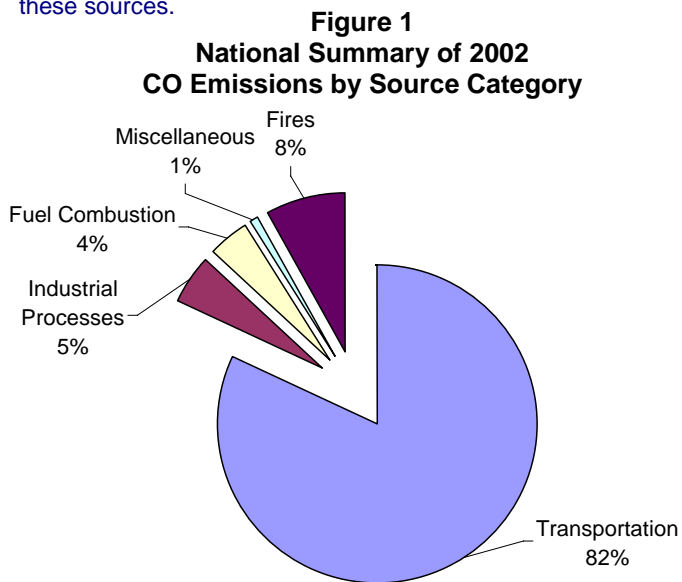


2005 Carbon Monoxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Carbon monoxide (CO) is a colorless, odorless, poisonous gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes over 50 percent of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions, and high CO levels often coincide with morning and afternoon rush hours (Figure 3 on page 2). Non-road engines and vehicles, such as construction equipment and boats, are also significant sources of CO and overall the transportation sector is responsible for about 82% of all CO emissions nationally. Other sources of CO include industrial processes, fuel combustion in sources such as boilers and incinerators, and natural sources such as forest fires. Figure 1 shows the national average contributions of these sources.

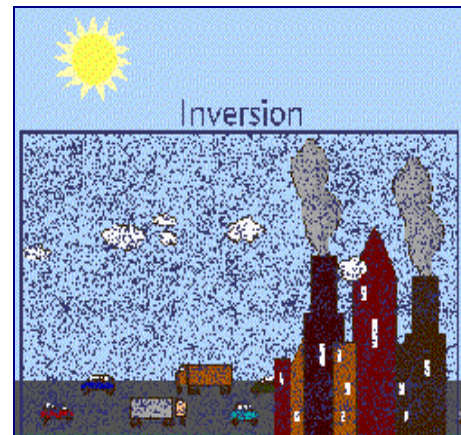
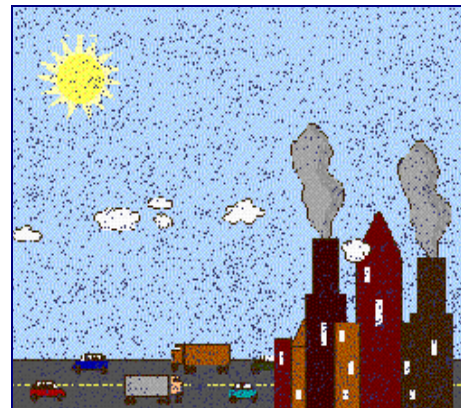


Source: USEPA National Air Quality Emissions Trends Report, 2003 Special Studies, September 2003

Figure 3 also shows that CO levels are typically higher in the winter. This is because motor vehicles do not burn fuel as efficiently when they are cold. Atmospheric inversions are also more frequent during the winter months. Inversions usually occur overnight when cooler air is trapped beneath a layer of warmer air aloft. When this occurs, the inversion acts

like a lid, preventing pollution from mixing in the atmosphere and effectively trapping it close to ground level (see Figure 2).

Figure 2: Effect of Atmospheric Inversion on Air Pollution



HEALTH AND ENVIRONMENTAL EFFECTS

Carbon monoxide enters the bloodstream and reduces the body's ability to distribute oxygen to organs and tissues. The most common symptoms associated with exposure to carbon monoxide are headaches and nausea. The health threat from exposure to CO is most serious for those who suffer from cardiovascular disease. For a person with

heart disease, a single exposure to CO at low levels may cause chest pain and reduce that individual's ability to exercise. Healthy people are also affected, but only at higher levels of exposure. Elevated CO levels are also associated with visual impairment, reduced work capacity, reduced manual dexterity, decreased learning ability, and difficulty in performing complex tasks.

opposed to parts per million), and our standards are not to be exceeded more than once in any 12-month period. The state has set secondary (welfare based) standards for CO at the same level as the primary standards. The standards are summarized in Table 1.

STANDARDS

There are currently two national primary, or health based, standards for carbon monoxide. They are set at a one-hour concentration of 35 parts per million (ppm), and an 8-hour average concentration of 9 ppm. These levels are not to be exceeded more than once in any calendar year. There are no national secondary (welfare based) standards for CO at this time.

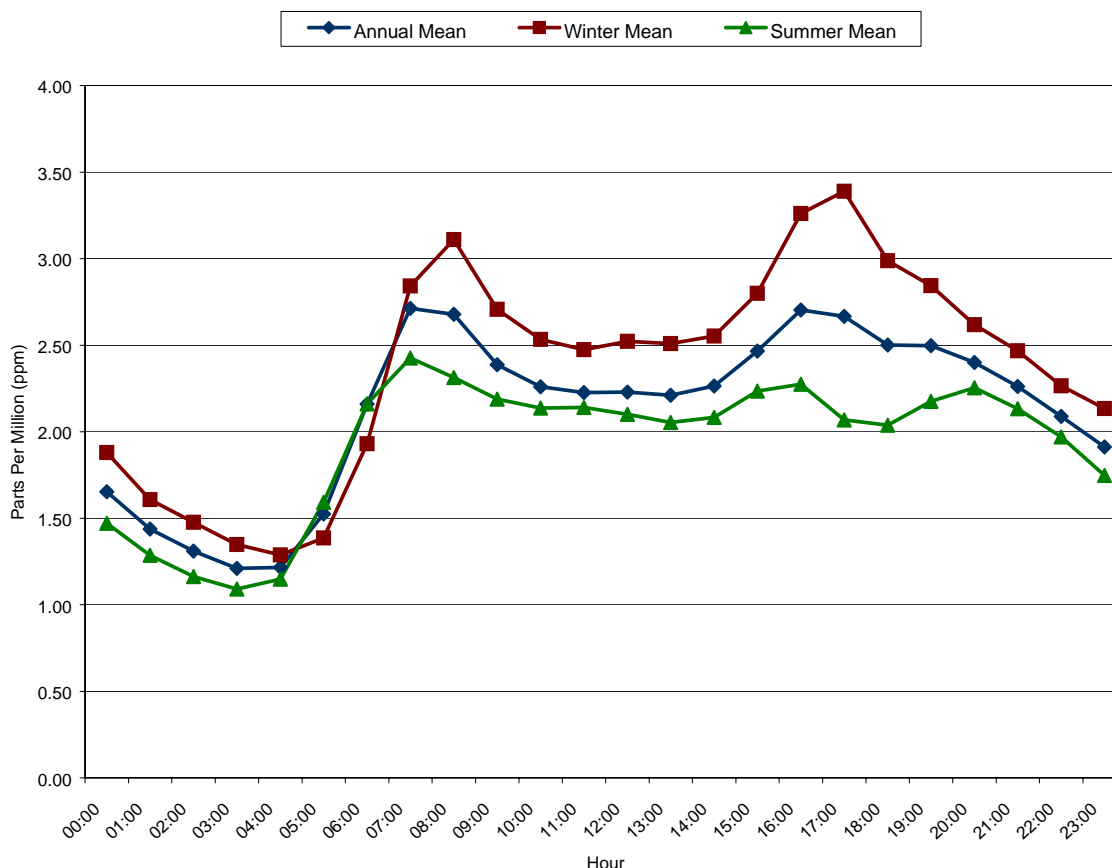
New Jersey state standards for CO are based on different units (milligrams per cubic meter as

Table 1
National and New Jersey Ambient Air Quality Standards for Carbon Monoxide

mg/m³ = Milligrams Per Cubic Meter
ppm = Parts per Million

Averaging Period	Type	New Jersey	National
1-Hour	Primary	40 mg/m ³ (35 ppm)	35 ppm
1-Hour	Secondary	40 mg/m ³ (35 ppm)	----
8-Hour	Primary	10 mg/m ³ (9 ppm)	9 ppm
8-Hour	Secondary	10 mg/m ³ (9 ppm)	----

Figure 3
Carbon Monoxide Concentrations – New Jersey
1967-1999
Seasonal and Hourly Variations



MONITORING LOCATIONS

The state monitored CO levels at 12 locations in 2005. These sites are shown in the map in Figure 4. The site in Fort Lee was shut down from October 2004 through March 2005 to allow for renovations to the overpass on which it was located.

CO LEVELS IN 2005

None of the monitoring sites recorded exceedances of any CO standard during 2005. The maximum one-hour average concentration recorded was 5.8 ppm at the site in Jersey City. The highest 8-hour average level recorded was 3.6 ppm, at the downtown Elizabeth site. Summaries of the 2005 data are provided in Figure 5 and Table 2 (page 4).

Figure 4
2005 Carbon Monoxide
Monitoring Network

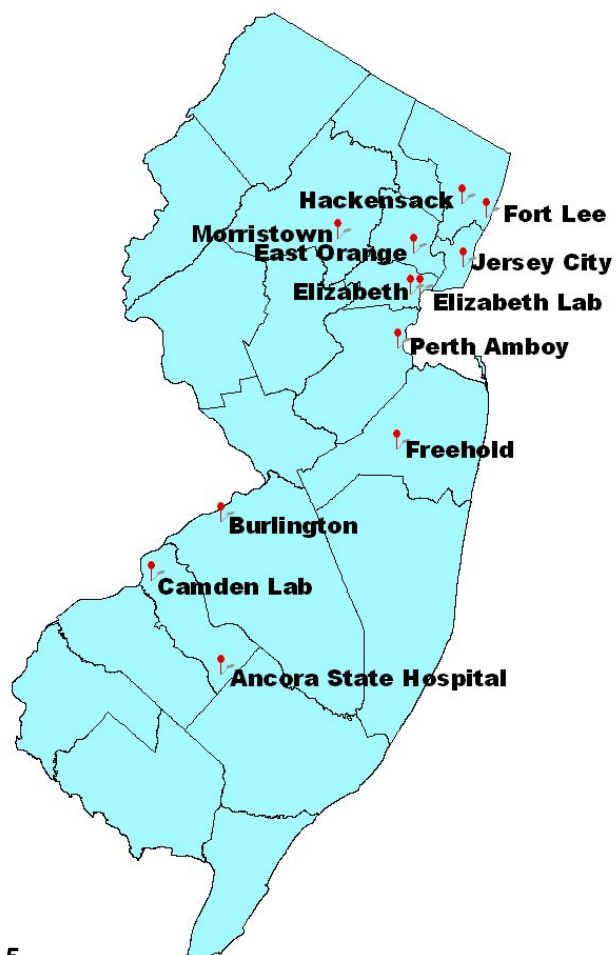


Figure 5
Highest and 2nd Highest 8-Hour Averages
of Carbon Monoxide in New Jersey - 2005

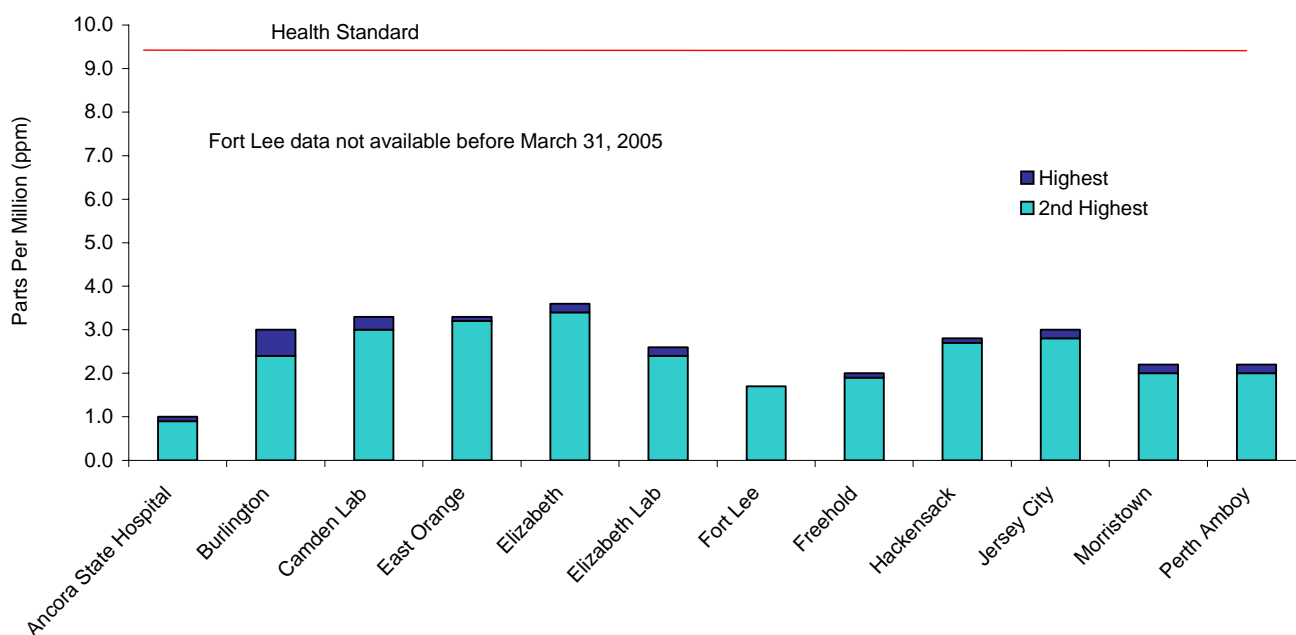


Table 2
Carbon Monoxide Data – 2005
1-Hour and 8-Hour Averages

Parts Per Million (ppm)
1-hour standard = 35 ppm
8-hour standard = 9 ppm

Monitoring Sites	Maximum 1-Hour Average	2nd Highest 1-Hour Average	Maximum 8-Hour Average	2nd Highest 8-Hour Average
Ancora State Hospital	1.3	1.2	1.0	0.9
Burlington	4.4	4.3	3.0	2.4
Camden Lab	4.0	3.9	3.3	3.0
East Orange	4.2	4.0	3.3	3.2
Elizabeth	4.8	4.6	3.6	3.4
Elizabeth Lab	3.4	3.0	2.6	2.4
Fort Lee ¹	2.1	2.1	1.7	1.7
Freehold	5.4	3.9	2.0	1.9
Hackensack	3.4	3.4	2.8	2.7
Jersey City	5.8	4.8	3.0	2.8
Morristown	2.8	2.7	2.2	2.0
Perth Amboy	3.7	3.0	2.2	2.0

¹ Data not available before March 31, 2005

Trends

Carbon monoxide levels have improved dramatically over the past 20 years. The last time the CO standard was exceeded in New Jersey was in January of 1995 (see Figure 6, page 5), and the entire state was officially declared as having attained the CO standard on August 23, 2002. At one time unhealthy levels of CO were recorded on a regular basis – as much as a hundred days a year at some sites. The reduction in CO levels is due primarily to cleaner running cars which are by far the largest source of this pollutant. A trend graph of CO levels showing the maximum, minimum and average concentrations recorded since 1975 is provided in Figure 7 (page 5). The graph depicts the second highest 8-hour value recorded, as this is the value that determines if the health standard is being met (one exceedance per site is allowed each year).

Figure 6
Carbon Monoxide
Unhealthy Days 1985-2005

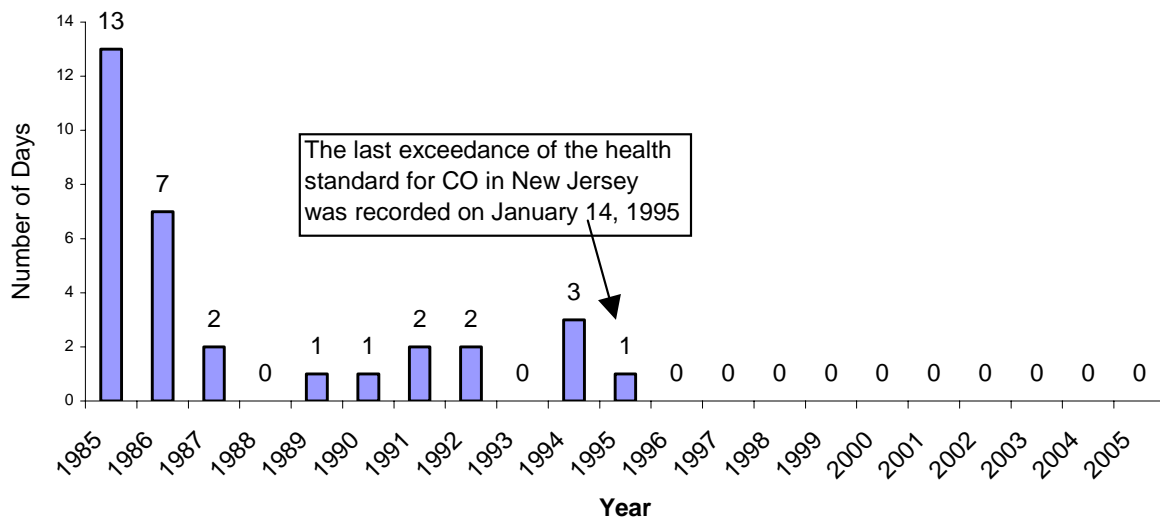
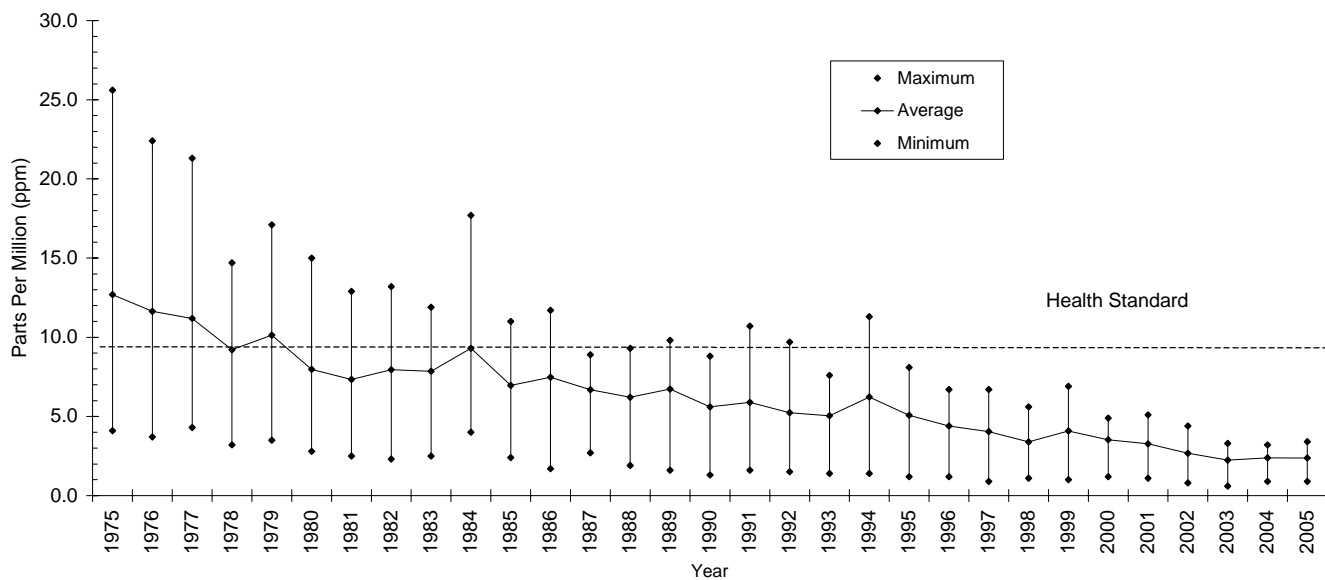


Figure 7
Carbon Monoxide Air Quality, 1975-2005
2nd Highest 8-Hour Average



REFERENCES

CO – How Carbon Monoxide Affects the Way We Live and Breathe, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC November 2000, URL: <http://www.epa.gov/air/urbanair/co/index.html>

Automobiles and Carbon Monoxide, OMS Fact Sheet, USEPA, January 1993, EPA-400/F-92-005, URL: <http://www.epa.gov/oms/03-co.htm>

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: www.epa.gov/oar/aqtrnd99/

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA , Office of Air Quality Planning and Standards, RTP, September 2001, URL: www.epa.gov/oar/aqtrnd00/

Latest Findings on National Air Quality: 2002 Status and Trends, EPA-454/K-03-001, USEPA , Office of Air Quality Planning and Standards, RTP, September 2001, URL: www.epa.gov/airtrends/carbon.html

National Air Quality and Emissions Trend Report, 2003 Special Studies Edition, EPA-454/R-03-005, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2003, URL: <http://www.epa.gov/oar/aqtrnd03/>.

National Primary Ambient Air Quality Standards for Carbon Monoxide, 40 CFR 50.8, US Government Printing Office, Washington DC, July 2001.



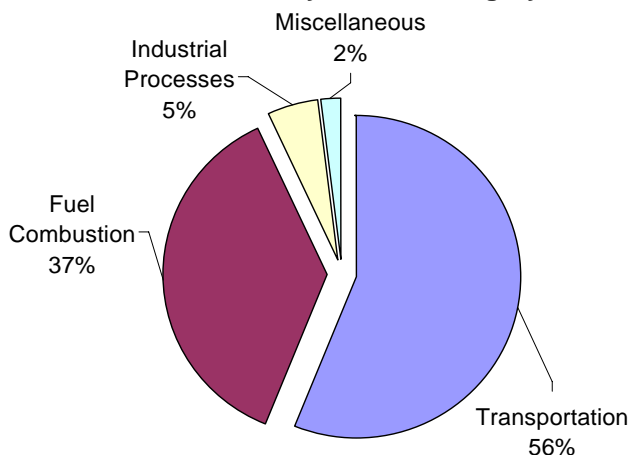
2005 Nitrogen Dioxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Nitrogen Dioxide (NO_2) is a reddish-brown, highly reactive gas that is formed in the air through the oxidation of Nitric Oxide (NO). When NO_2 reacts with other chemicals, it can form ozone, particulate matter, and other compounds which can contribute to regional haze and acid rain. Nitrogen Oxides (NO_x) is a mixture of gases which is mostly comprised of NO and NO_2 . These gases are emitted from the exhaust of motor vehicles, the burning of coal, oil or natural gas, and during industrial processes such as welding, electroplating, and dynamite blasting. Although most NO_x is emitted as NO , it is readily converted to NO_2 in the atmosphere. In the home, gas stoves and heaters produce substantial amounts of nitrogen dioxide. A pie chart summarizing the major sources of NO_x is shown below (Figure 1). As much of the NO_x in the air is emitted by motor vehicles, concentrations tend to peak during the morning and afternoon rush hours. This is shown in the graph in Figure 2 (page 2), which also indicates that concentrations tend to be higher in the winter than the summer. This is due in part to poorer local dispersion conditions caused by light winds and other weather conditions that are more prevalent in the colder months of the year.

Figure 1
National Summary of 2002
 NO_x Emissions by Source Category



Source: USEPA National Air Quality Emissions Trends Report, 2003 Special Studies, September 2003

HEALTH AND ENVIRONMENTAL EFFECTS

Short-term exposures (less than 3 hours) to low levels of nitrogen dioxide may aggravate pre-existing respiratory illnesses, and can cause respiratory illnesses, particularly in children ages 5-12. Symptoms of low level exposure to NO and NO_2 include irritation to eyes, nose, throat and lungs, coughing, shortness of breath, tiredness and nausea. Long-term exposures to NO_2 may increase susceptibility to respiratory infection and may cause permanent damage to the lung. NO and NO_2 are found in tobacco smoke, so people who smoke or breathe in second-hand smoke may be exposed to NO_x . The U.S. Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the U.S. Environmental Protection Agency (EPA) have determined that, with the available information, no conclusion can be made as to the carcinogenicity of NO or NO_2 to human beings.

Nitrogen Oxides contribute to a wide range of environmental problems. These include potential changes in the composition of some plants in wetland and terrestrial ecosystems, acidification of freshwater bodies, eutrophication of estuarine and coastal waters, increases in levels of toxins harmful to fish and other aquatic life, and visibility impairment.

STANDARDS

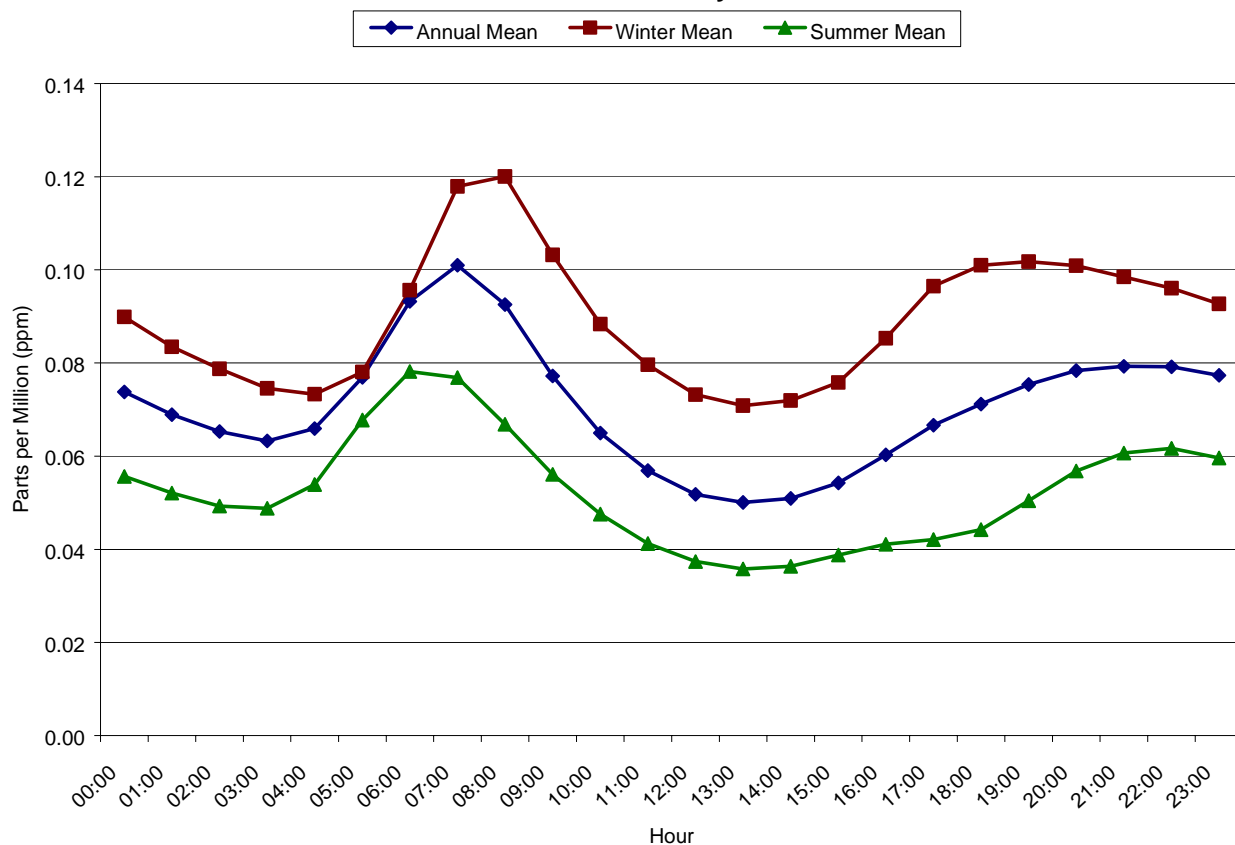
The primary (health based) and secondary (welfare based) National Ambient Air Quality Standards (NAAQS) for NO_2 are the same. They are set at a calendar year average concentration of 0.053 parts per million (ppm). The New Jersey Ambient Air Quality Standards (NJAAQS) are identical to the NAAQS except micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) are the standard units and the state standard applies to any 12-month period, not just the calendar year. The state of California has a one-hour average standard of $470 \mu\text{g}/\text{m}^3$ that New Jersey uses as a guideline in assessing short-term impacts from specific sources. Table 1 provides a summary of the NO_2 standards.

Table 1
National and New Jersey Ambient Air Quality Standards for
Nitrogen Dioxide

Parts Per Million (ppm)
Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Averaging Period	Type	New Jersey	National	California
12-month average	Primary	100 $\mu\text{g}/\text{m}^3$ (0.05 ppm)		
Annual average	Primary		0.053 ppm (100 $\mu\text{g}/\text{m}^3$)	
12-month average	Secondary	100 $\mu\text{g}/\text{m}^3$ (0.05 ppm)		
Annual average	Secondary		0.053 ppm (100 $\mu\text{g}/\text{m}^3$)	
1-hour average	Primary			470 $\mu\text{g}/\text{m}^3$ (0.25 ppm)

Figure 2
Nitrogen Dioxide & Nitric Oxide Concentrations – New Jersey
1967-1999
Seasonal and Hourly Variation



MONITORING LOCATIONS

The state monitored NO₂ levels at 9 locations in 2005. These sites are shown in the map to the right.

NO₂ LEVELS IN 2005

None of the monitoring sites recorded exceedances of either the National or New Jersey Air Quality Standards for NO₂ during 2005. The maximum annual average concentration recorded was 0.032 ppm at the Elizabeth Lab site located at Exit 13 of the New Jersey Turnpike. While national health and welfare standards have not been established for Nitric Oxide (NO), it is considered to be an important pollutant that contributes to the formation of ozone, fine particles and acid rain. The maximum annual average concentration of NO recorded in 2005 was 0.042 ppm, also at the Elizabeth Lab site (see Table 2 and Figure 4, page 4).

TRENDS

Routine monitoring for NO₂ began in 1966, and 1974 was the last year that concentrations exceeded the NAAQS in New Jersey. A graph of NO₂ levels provided in Figure 5 shows the statewide average annual mean concentrations recorded from 1975 to 2005 in the form of a trendline. The graph also includes the levels of the

Figure 3
2005 Oxides of Nitrogen
Monitoring Network

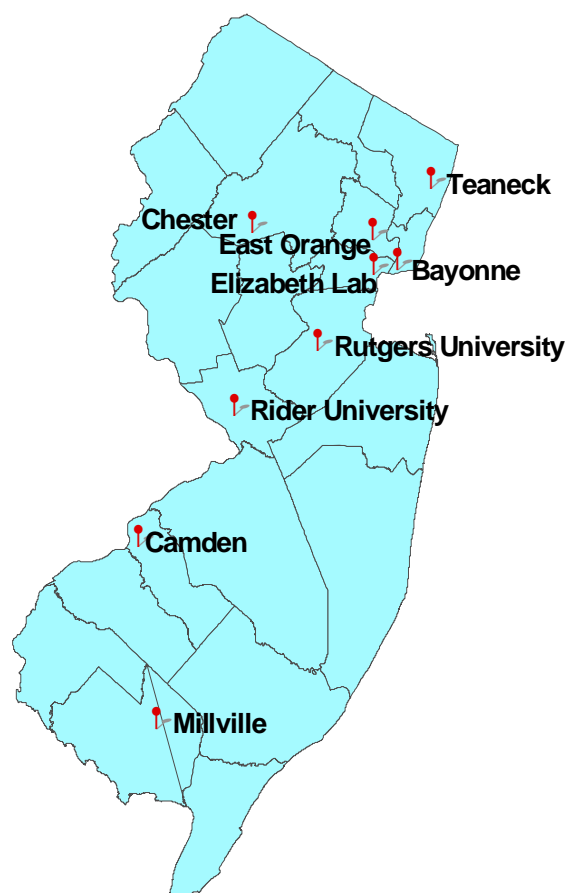


Table 2
Nitrogen Dioxide and Nitric Oxide Data-2005
1-Hour and 12-Month Averages

Parts Per Million (ppm)
California 1-Hour Standard = 0.25 ppm
National 12-Month Standard = 0.053 ppm

Monitoring Sites	Nitrogen Dioxide 1-Hour Average (ppm)		Nitrogen Dioxide 12-Month Average (ppm)		Nitric Oxides Annual Average(ppm)
	Maximum	2nd Highest	Maximum	Calendar year	
Bayonne	0.107	0.094	0.023	0.023	0.018
Camden Lab	0.089	0.083	0.022	0.021	0.012
Chester	0.056	0.056	0.011	0.011	0.004
East Orange	0.115	0.115	0.026	0.026	0.023
Elizabeth Lab	0.102	0.100	0.032	0.032	0.042
Millville	0.058	0.057	0.013	0.013	0.011
Rider University	0.064	0.063	0.016	0.016	0.011
Rutgers University	0.079	0.078	0.019	0.018	0.011
Teaneck	0.114	0.112	0.022	0.022	0.020

Figure 4
Annual Average NO and NO₂ Concentrations
in New Jersey - 2005

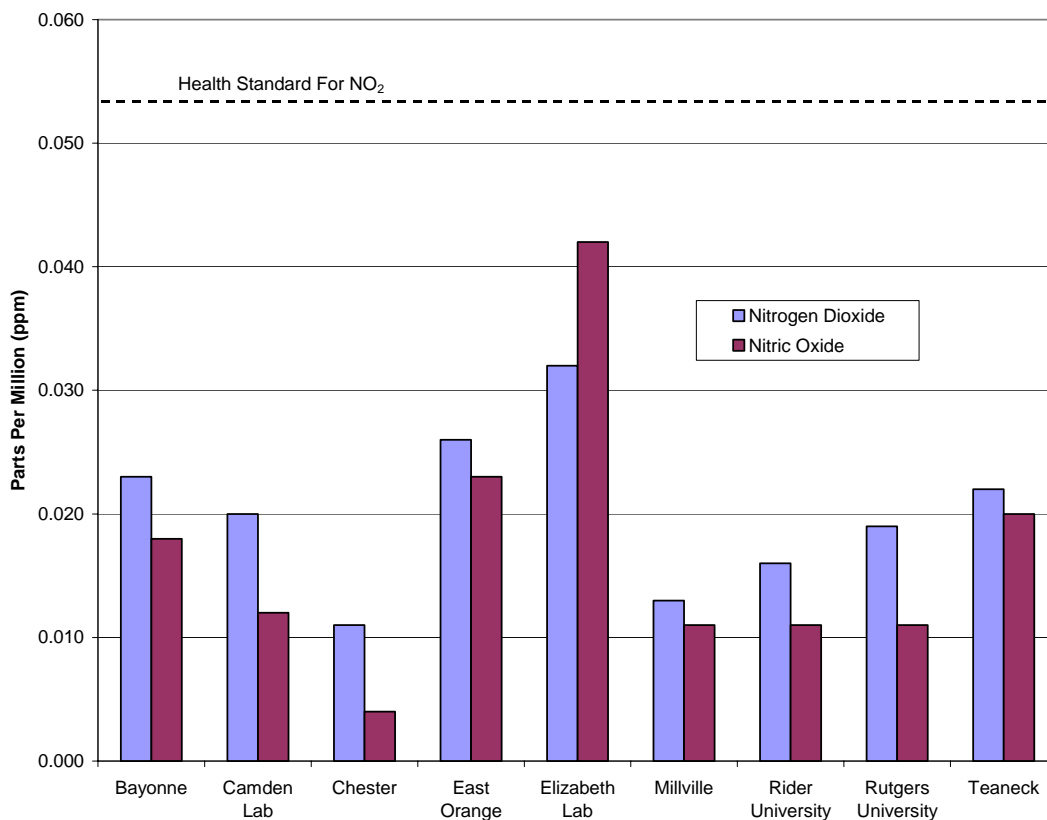
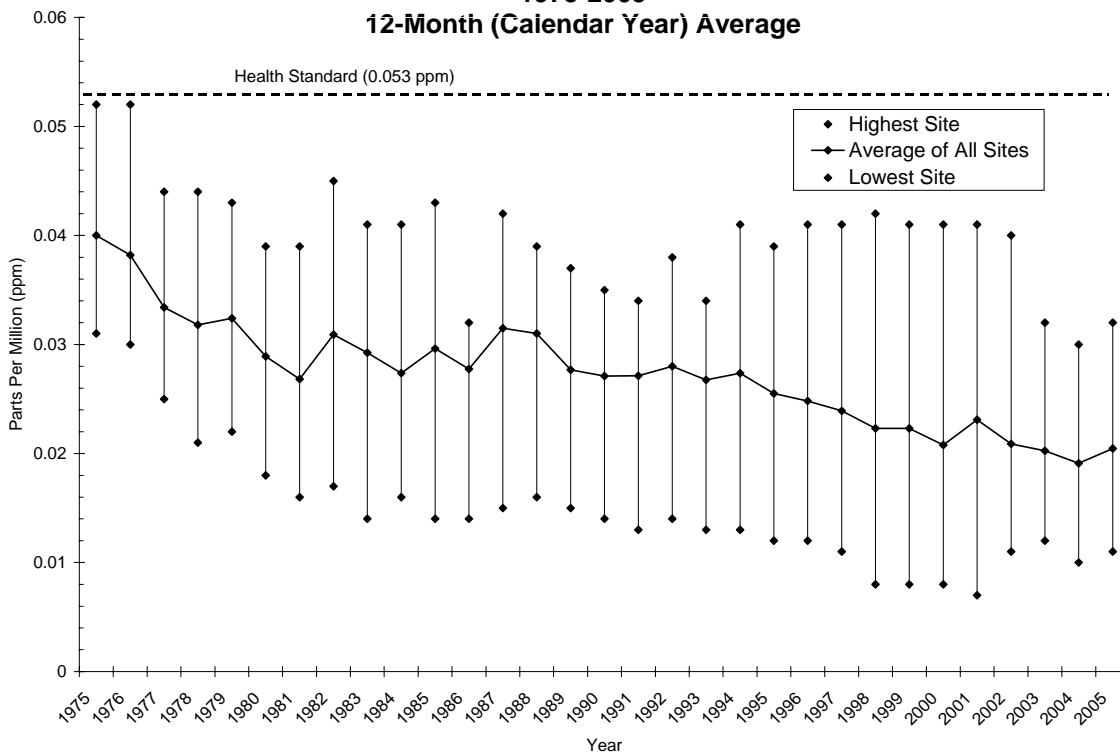


Figure 5
Nitrogen Dioxide Concentrations in New Jersey
1975-2005
12-Month (Calendar Year) Average



sites that measured the highest annual mean and lowest annual mean in each year as points above and below this trendline. Although NO₂ concentrations are well within the NAAQS, there is still a great deal of interest in oxides of nitrogen because of their role in the formation of other pollutants – most notably ozone and fine particles. Both these pollutants are of concern over much of the northeastern United States and efforts to reduce levels of ozone and fine particles are likely to require reductions in NO emissions.

TOTAL REACTIVE OXIDES OF NITROGEN (NO_y)

Although not specifically defined, there is a broad group of nitroxyl compounds in the ambient air that react in the troposphere and contribute to the formation of ozone. These compounds, called Total Reactive Oxides of Nitrogen (NO_y), include nitrogen oxides (NO_x), peroxyacyl nitrates (RC(O)OONO₂ or PAN), peroxyxynitric acid (HO₂NO₂), nitrous acid (HONO), nitric acid (HNO₃), dinitrogen pentoxide (N₂O₅) and nitrate radicals (•NO₃). NO_y can also be described as the sum of the nitrogen oxides (NO_x) and the atmospheric NO_x oxidation products. Although measuring NO_y is not required by the federal regulations, it is strongly recommended by the EPA to supplement the data collected by Photochemical Assessment Monitoring Stations (PAMS) Network. NO_y measurements may provide valuable information for evaluating chemical mechanisms in ozone (O₃) prediction models, indicate NO and NO₂ emission trends, and assist in developing regional control strategies for O₃.

The identification and measurement of individual NO_y compounds is technically difficult and expensive, however, a few manufacturers have introduced analyzers that measure total NO_y concentrations. The NJDEP evaluated one of these commercially available NO_y analyzers at the Rider University station starting in March 2002. The Rider University station was selected as the testing location for the NO_y analyzer because it is also a PAMS station.

After a lengthy period of testing, it was determined that there are significant uncertainties in the NO_y concentrations due to technical problems with the analytical method. The NJDEP has decided to postpone further NO_y monitoring until more accurate measurement technologies are established and become available.

REFERENCES

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2001, URL: <http://www.epa.gov/oar/aqtrnd00/>.

National Air Quality and Emissions Trend Report, 2003 Special Studies Edition, EPA-454/R-03-005, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2003, URL: <http://www.epa.gov/oar/aqtrnd03/>.

Meyer, Edwin L., Sennet, Donald H., Cole, Henry S., Richter, Harold G., *Technical Basis for Developing Control Strategies for High Ambient Concentrations of Nitrogen Dioxide*, EPA-450/4-80-017, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 1980.

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: <http://www.epa.gov/oar/aqtrnd99/>.

National Primary and Secondary Ambient Air Quality Standards for Nitrogen Dioxide, 40 CFR 50.11, US Government Printing Office, Washington DC, July 2001.

Nitrogen Dioxide and Respiratory Illness in Children, Health Effects Institute, 1994.

NO_x – How Nitrogen Oxides Affect the Way We Live and Breathe, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 1998, URL: <http://www.epa.gov/air/urbanair/nox/index.html>.

The Regional Transport of Ozone, New EPA Rulemaking on Nitrogen Oxide Emissions, EPA-456/F-98-006, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, URL: <http://www.epa.gov/air/noxfacts.pdf>.

Review Of The National Ambient Air Quality Standards For Nitrogen Dioxide Assessment Of Scientific And Technical Information, EPA-452/R-95-005, OAQPS staff paper, USEPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, 1995.

Sittig, M., *Handbook of Toxic and Hazardous Chemicals and Carcinogens Third Edition, Volume 2*, Noyes Publications, Park Ridge, NJ, 1991.

ToxFaQs for Nitrogen Oxides, U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, April 2002, URL: <http://www.atsdr.cdc.gov/tfacts175.pdf>.

Utell, Mark J., *Mechanisms of Nitrogen Dioxide Toxicity in Humans*, Health Effects Institute, 1991.



2005 Ozone Summary

New Jersey Department of Environmental Protection

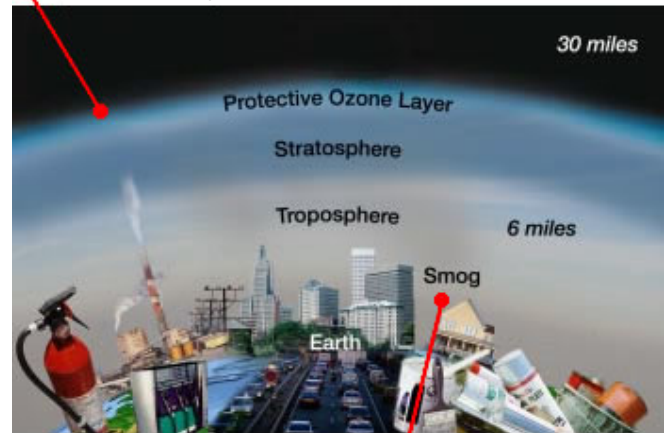
NATURE AND SOURCES

Ozone (O_3) is a gas consisting of three oxygen atoms. It occurs naturally in the upper atmosphere (stratospheric ozone) where it protects us from harmful ultraviolet rays (see Figure 1). However, at ground-level (tropospheric ozone) it is considered an air pollutant and can have serious adverse health effects. Ground-level ozone is created when nitrogen oxides (NO_x) and volatile organic compounds (VOC's) react in the presence of sunlight and heat. NO_x is primarily emitted by motor vehicles, power plants, and other sources of combustion. VOC's are emitted from sources such as motor vehicles, chemical plants, factories, consumer and commercial products, and even natural sources such as trees. Ozone and the pollutants that form ozone (precursor pollutants) can also be transported into an area from sources hundreds of miles upwind.

Since ground-level ozone needs sunlight to form, it is mainly a daytime problem during the summer months. Weather patterns have a significant effect on ozone formation and hot, dry summers will result in more ozone than cool, wet ones. In New Jersey, the ozone monitoring season runs from April 1st to October 31st, although unhealthy conditions are rare before mid-May or after the first few weeks of September. For a more complete explanation of the difference between ozone in the upper and lower atmosphere, see the U.S. Environmental Protection Agency (EPA) publication "Ozone: Good Up High, Bad Nearby".

Figure 1: Good and Bad Ozone

Ozone is good up here... Many popular consumer products like air conditioners and refrigerators involve CFCs or halons during either manufacturing or use. Over time, these chemicals damage the earth's protective ozone layer.



Ozone is bad down here... Cars, trucks, power plants and factories all emit air pollution that forms ground-level ozone, a primary component of smog.

Source: EPA

ENVIRONMENTAL EFFECTS

Ground-level ozone damages plant life and is responsible for 500 million dollars in reduced crop production in the United States each year. It interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. "Bad" ozone damages the foliage of trees and other plants, sometimes marring the landscape of cities, national parks and forests, and recreation areas. The black areas on the leaves of the blackberry bush and sassafras tree shown in Figure 2 and Figure 3 are damage caused by exposure to ground-level ozone. (Figure 2 and 3 Photos by: Teague Prichard, Wisconsin Department of Natural Resources)

Figure 2: Ozone Damage to Blackberry Bush



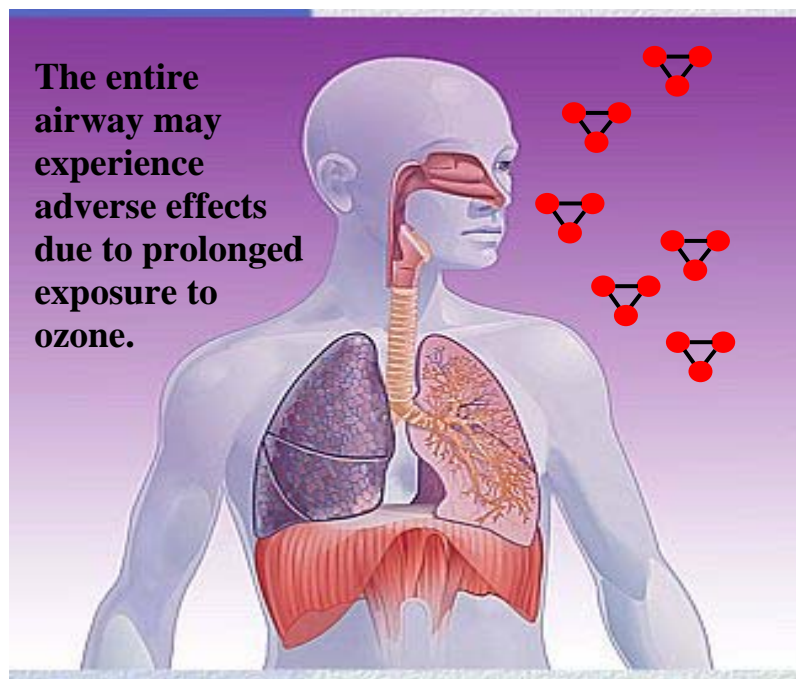
Figure 3: Ozone Damage to Sassafras Tree



HEALTH EFFECTS

Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it can trigger a variety of health problems including chest pains, coughing, nausea, throat irritation, and congestion. Ozone also can aggravate other health problems such as bronchitis, heart disease, emphysema, and asthma, and can reduce lung capacity. People with pre-existing respiratory ailments are especially prone to the effects of ozone. For example, asthmatics affected by ozone may have more frequent or severe attacks during periods when ozone levels are high. As shown in Figure 4 ozone can irritate the entire respiratory tract. Children are also at risk for ozone related problems. Their respiratory systems are still developing and they breathe more air per pound of body weight than adults. They are also generally active outdoors during the summer when ozone levels are at their highest. Anyone who spends time outdoors in the summer can be affected and studies have shown that even healthy adults can experience difficulty in breathing when exposed to ozone. Anyone engaged in strenuous outdoor activities, such as jogging, should limit activity to the early morning or late evening hours on days when ozone levels are expected to be high.

Figure 4



**Area of the Respiratory Tract that
may be Affected by Ozone**

AMBIENT AIR QUALITY STANDARDS FOR OZONE

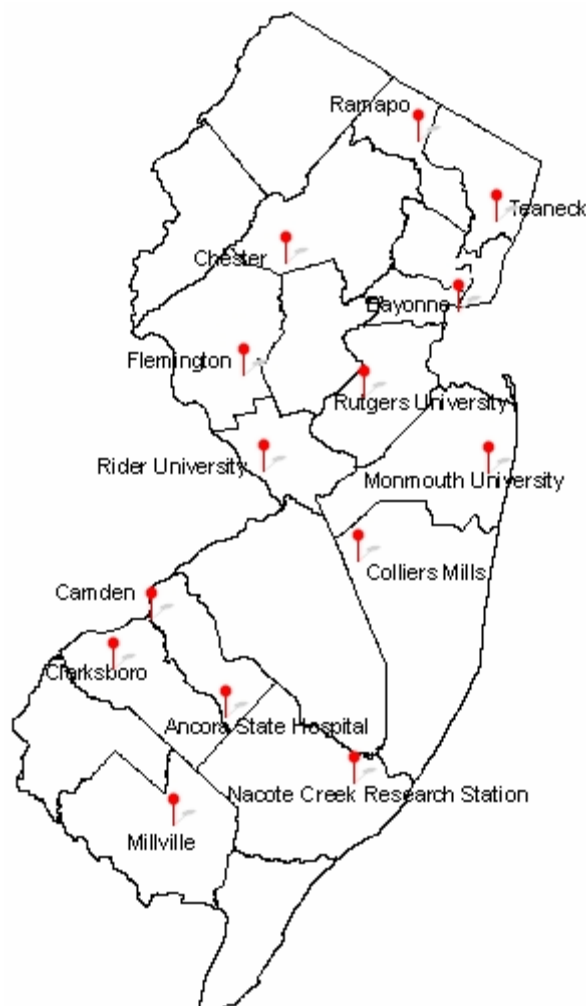
National and state air quality standards have been established for ground-level ozone. There are both primary standards, which are based on health effects, and secondary standards, which are based on welfare effects (e.g. damage to trees, crops and materials). For ground-level ozone, the primary and secondary National Ambient Air Quality Standards (NAAQS) are the same (see Table 1). The ozone NAAQS were revised in 1997 because EPA had determined that the old standard of 0.12 parts per million (ppm) maximum daily one-hour average was not sufficiently protective of public health. They set a revised standard of 0.08 ppm maximum daily 8-hour average. The standard changes were challenged in court but eventually upheld. As many people are accustomed to the old standards, summary information relative to that standard will be provided in this report along with summaries based on the new standard.

Table 1
National and New Jersey Ambient Air Quality Standards for Ozone

ppm = Parts per Million

Averaging Period	Type	New Jersey	National
1-Hour	Primary	0.12 ppm	0.12 ppm
1-Hour	Secondary	0.08 ppm	0.12 ppm
8-Hour	Primary	-----	0.08 ppm
8-Hour	Secondary	-----	0.08 ppm

Figure 5
2005 Ozone Monitoring Network



OZONE NETWORK

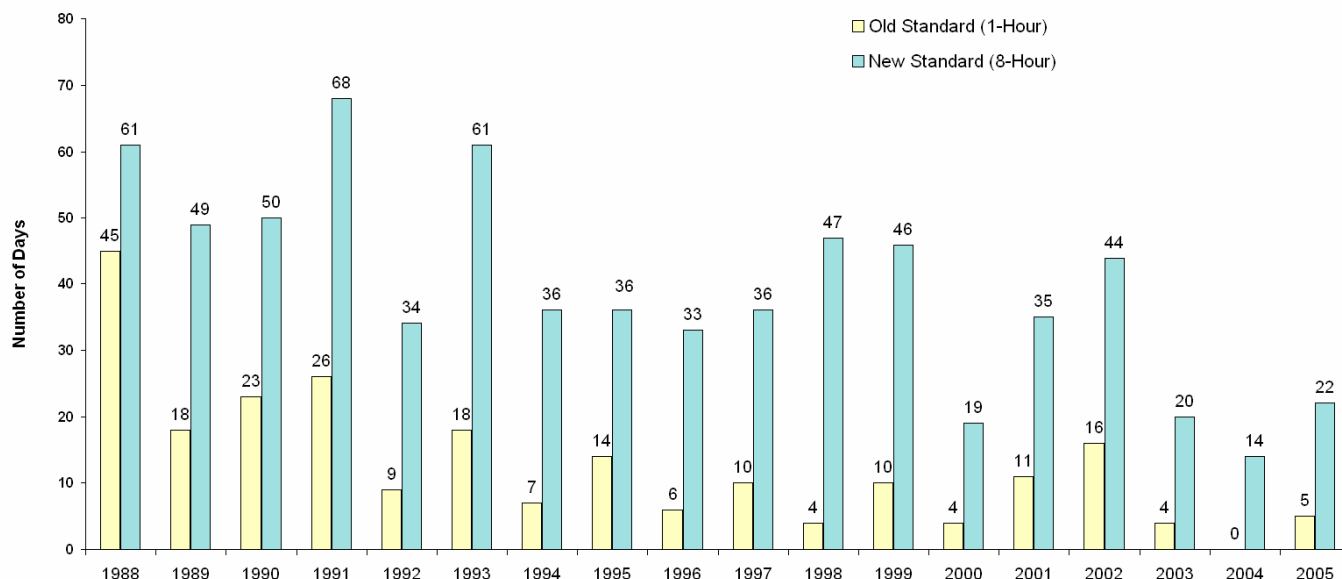
Ozone was monitored at 14 locations in New Jersey during 2005. Of those 14 sites, 11 operated year round and 3 operated only during the ozone season (April 1st through October 31st). Site locations are shown in Figure 5.

HOW THE CHANGES TO THE OZONE STANDARDS AFFECT AIR QUALITY RATINGS

In 2005 there were five days on which the old standard was exceeded in New Jersey and 22 days on which the new standard was exceeded. Significant progress is being made towards meeting the old standard (see Figure 6 below). There are fewer days on which that standard is exceeded, and when it is, fewer sites tend to be involved. Also, the maximum levels reached are not as high as they were in the past. The maximum 1-hour average concentration recorded in 1988 was 0.218 ppm, compared to a maximum of 0.141 ppm in 2005.

It is apparent, however, that the current standard is significantly more stringent than the old one (see Figure 6 below). As a result, additional control measures to reduce ozone levels will be needed. These measures will have to be implemented over a wide area and will require the cooperative effort of many states and the federal government if they are to be successful.

Figure 6
Days on Which the Old and New
Ozone Standards Have Been Exceeded in New Jersey
1988 - 2005



DESIGN VALUES

The NAAQS for ozone are set in such a way that determining whether they are being attained is not based on a single year. For example, an area was considered to be attaining the old 1-hour average standard if the average number of times the standard was exceeded over a three-year period was 1 or less (after correcting for missing data). Thus it was the fourth highest daily maximum 1-hour concentration that occurred over a three-year period that determined if an area would be in attainment. If the fourth highest value was above 0.12 ppm then the average number of exceedances would be greater than 1. The fourth highest value is also known as the design value.

Under the new standard, attainment is determined by taking the average of the fourth highest daily maximum 8-hour average concentration that is recorded each year for three years. This becomes the design value for an area under the new standard. When plans are developed for reducing ozone concentrations, an area must demonstrate that the ozone reduction achieved will be sufficient to ensure the design value will be below the NAAQS, as opposed to ensuring that the standards are never exceeded. This avoids having to develop plans based on extremely rare events.

Figures 7 and 8 show the design value for the 1 and 8-hour standards starting with the 1986-1988 period. Design values are calculated for all ozone sites in the network and the median, maximum and minimum for each year were used in the graphics.

Figure 7
1 Hour Ozone Air Quality, 1986 - 2005
(Based on 4th Highest 1-hour average - Design Values)

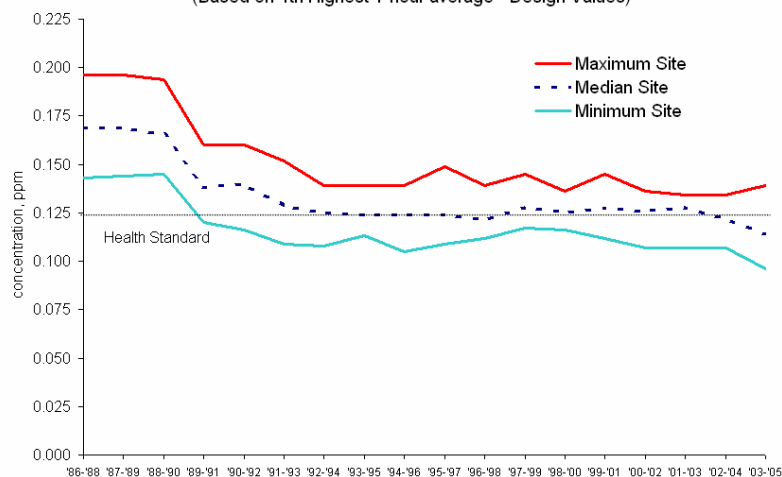
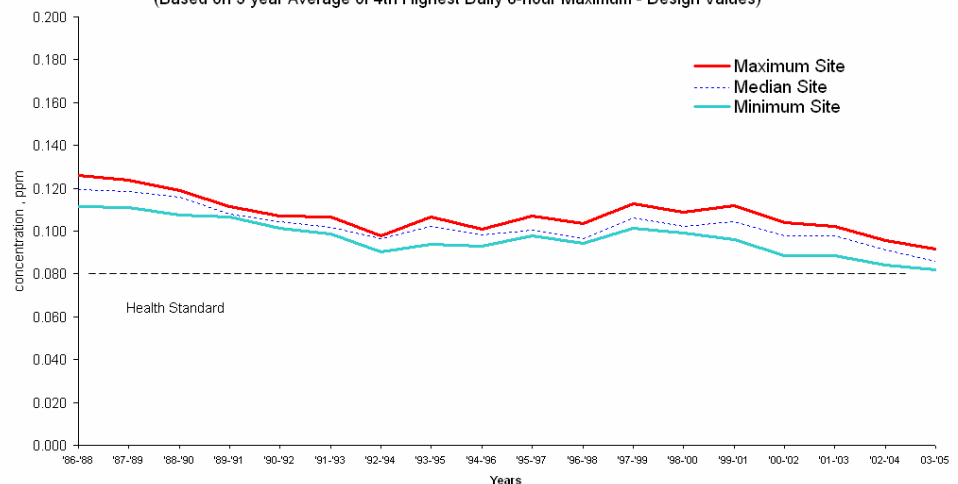


Figure 8
8-Hour Ozone Air Quality, 1986 - 2005
(Based on 3 year Average of 4th Highest Daily 8-hour Maximum - Design Values)

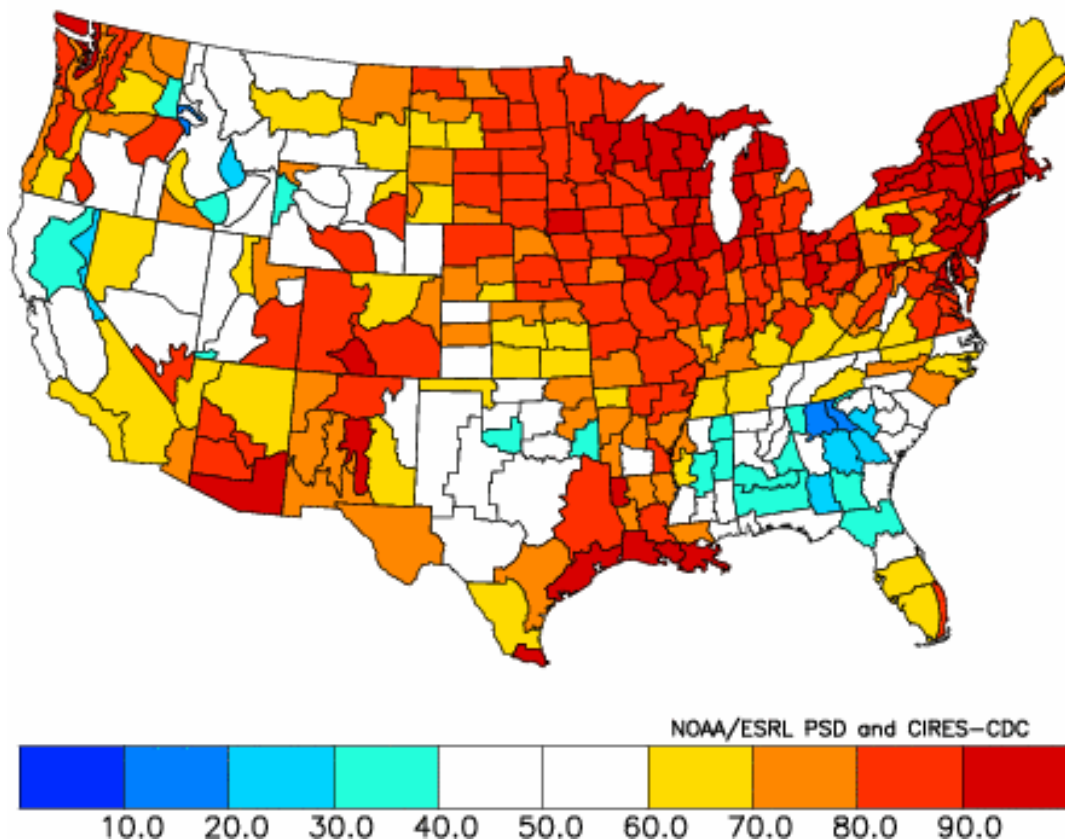


MAJOR OZONE EPISODES

Historically, several ozone episodes occur throughout the New Jersey summer. The 2005 ozone season, unlike a typical New Jersey ozone season, produced no major ozone episodes. An ozone episode is loosely defined as two or more consecutive days of widespread ozone concentrations above the health standard. There were 5 exceedance days above the 0.12 ppm level and 22 exceedance days of the 0.08 ppm standard. Both July 21st and September 13th produced the most single day exceedances as 10 sites went above the 0.08 ppm standard with Colliers Mills and Camden being the highest, respectively with 0.104 ppm and 0.098 ppm 8-hour averages. As recently as 1998, there were 47 days when ozone concentrations were above the 8-hour standard. Unlike 2005, the 1998 exceedance days were more widespread with typically more than half of the monitors exceeding the standard on each exceedance day. There were instances in 2005 when several consecutive days recorded exceedances of the 8-hour standard, but they were not widespread occurrences. August 11th -14th were all exceedance days but at no more than 5 monitors per day and at only 1 monitor exceeded the standard on August 14th.

The summer of 2005 showed typical weather characteristics of an ordinary New Jersey ozone season. Figure 9 below illustrates the average temperature throughout the summer and how it deviated from typical averages. Besides the Southeast, most of the nation experienced near standard summer temperatures. Ozone exceedances remained relatively low, despite normal hot and humid conditions.

Figure 9
Temperature Percentile Value Relative to 1895–1999
Apr to Sep 2005



SUMMARY OF 2005 Ozone Data Relative to the 1-HOUR STANDARD

Of the 14 monitoring sites that operated during the 2005 ozone season, 5 recorded levels above the old 1-hour standard of 0.12 ppm during the year. The highest 1-hour concentration was 0.141 ppm at the Bayonne monitor on July 22nd. In the 2004 ozone season no sites recorded levels above the 1-hour standard.

Figure 10
Highest and Second Highest Daily 1-Hour Averages

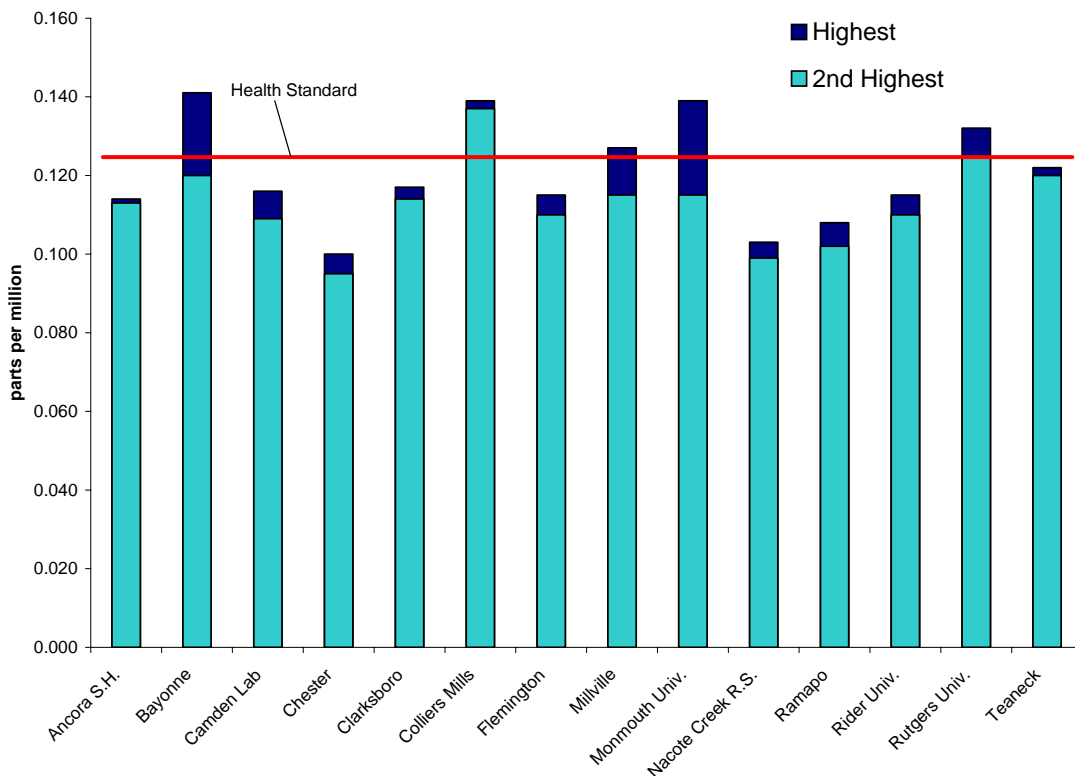


Table 3
Ozone Data – 2005
1-Hour Averages

Parts Per Million (ppm)

1-hour standard is 0.12 ppm

Monitoring Site	1-hr Max	2nd Highest 1-hr Max	4th Highest ¹ 1-hour Average 2003-2005	# of days with 1-hour Averages above 0.12ppm
Ancora S.H.	0.114	0.113	0.114	0
Bayonne	0.141	0.120	0.115	1
Camden Lab	0.116	0.109	0.114	0
Chester	0.100	0.095	0.096	0
Clarksboro	0.117	0.114	0.117	0
Colliers Mills	0.139	0.137	0.122	2
Flemington	0.115	0.110	0.114	0
Millville	0.127	0.115	0.113	1
Monmouth Univ.	0.139	0.115	0.139	1
Nacote Creek R.S.	0.103	0.099	0.101	0
Ramapo	0.108	0.102	0.102	0
Rider University	0.115	0.110	0.110	0
Rutgers University	0.132	0.125	0.120	2
Teaneck	0.122	0.120	0.110	0
Statewide	0.141	0.139	0.139	5

SUMMARY OF 2005 OZONE DATA RELATIVE TO THE 8-HOUR STANDARD

All 14 monitoring sites that operated during the 2005 ozone season recorded levels above the 8-hour standard of 0.08 ppm. Colliers Mills recorded the most exceedances with 14. The highest 8-hour concentration recorded was 0.110 ppm at the Millville site on July 22nd. 12 of 14 sites recorded levels above the 8-hour standard in 2004, with a maximum concentration of 0.103 ppm, recorded at the Ancora S.H. site on July 21st. Design values for the 8-hour standard were also above the standard at 10 of 14, indicating that the ozone standard is being violated throughout most of New Jersey.

Figure 11
Ozone Design Values for 2003-2005
3 Year Average of the 4th Highest 8-Hour Value

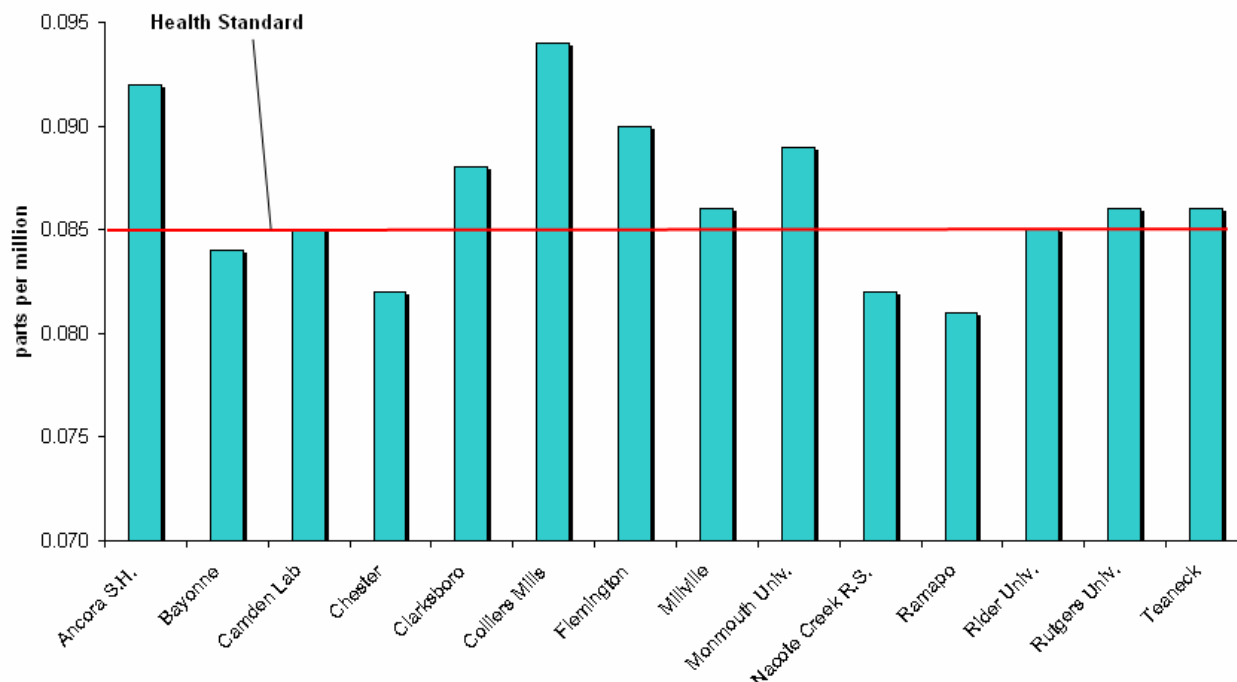


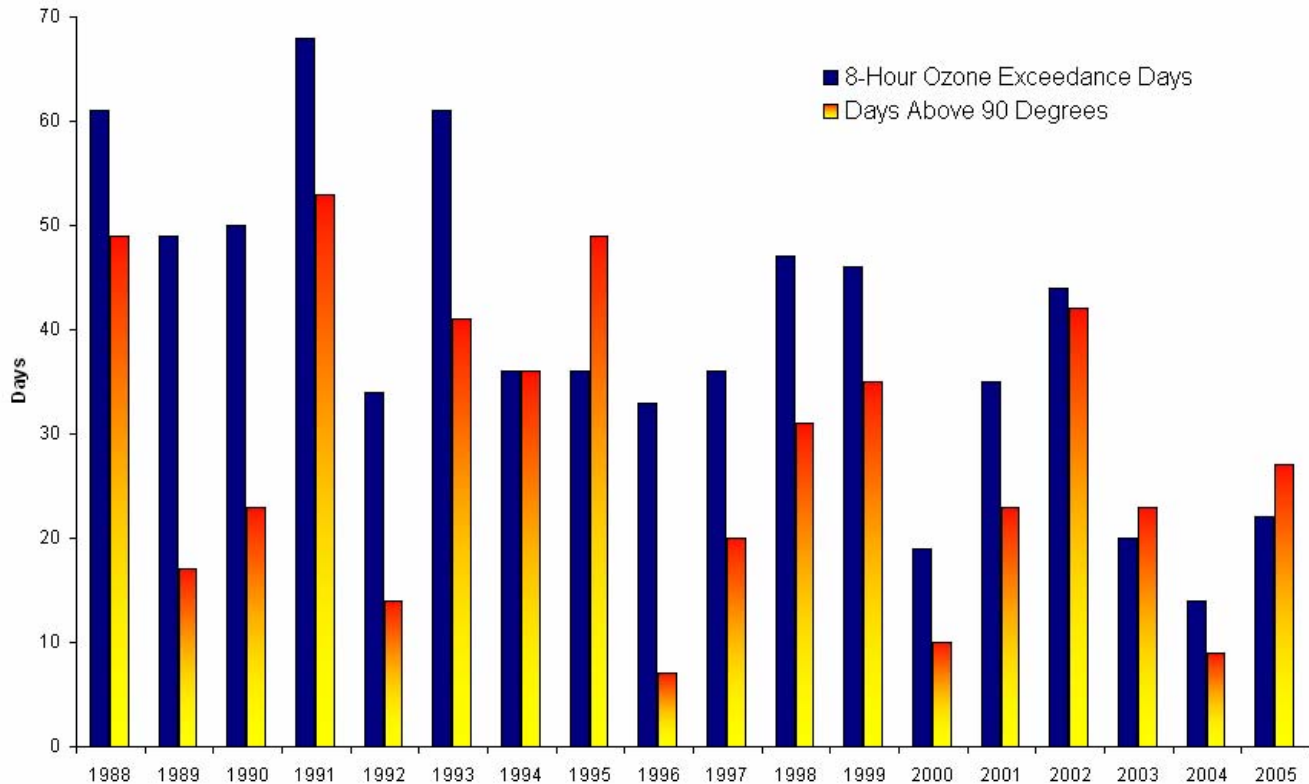
Table 4
Ozone Data – 2005
8-Hour Averages
Parts Per Million (ppm)

8-hour standard is 0.08 ppm

Monitoring Site	1 st Highest	2 nd Highest	3 rd Highest	4 th Highest	Avg. of 4 th Highest 8-hour Averages 2003-2005	# of days with 8-hour above 0.08ppm
Ancora S.H.	0.097	0.096	0.093	0.092	0.092	12
Bayonne	0.096	0.093	0.092	0.091	0.084	6
Camden Lab	0.100	0.098	0.092	0.087	0.085	5
Chester	0.091	0.088	0.085	0.081	0.082	3
Clarksboro	0.097	0.094	0.091	0.091	0.088	6
Colliers Mills	0.109	0.104	0.104	0.100	0.094	14
Flemington	0.100	0.093	0.093	0.093	0.090	13
Millville	0.110	0.092	0.088	0.085	0.086	4
Monmouth Univ.	0.100	0.096	0.089	0.088	0.089	8
Nacote Creek R.S.	0.091	0.087	0.086	0.084	0.082	3
Ramapo	0.095	0.091	0.091	0.088	0.081	8
Rider University	0.099	0.094	0.093	0.089	0.085	7
Rutgers University	0.097	0.095	0.095	0.093	0.086	10
Teaneck	0.100	0.094	0.093	0.091	0.086	8
Statewide	0.110	0.109	0.104	0.104	0.100	22

Figure 12

**Number of Days 8-Hour Ozone Standard was Exceeded and
Number of Days Above 90 Degrees in New Jersey 1988 - 2005**



ACCOUNTING FOR THE INFLUENCE OF WEATHER

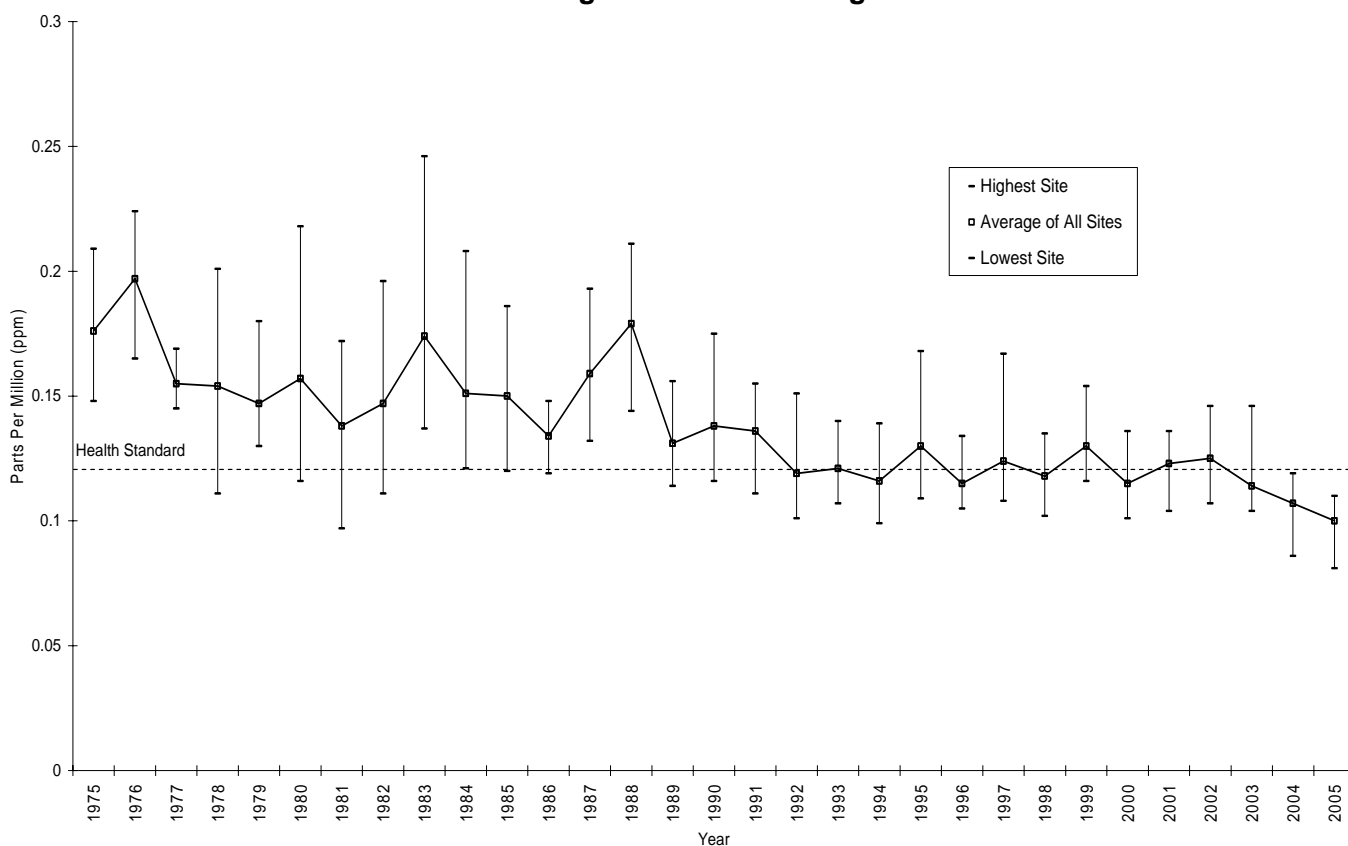
Trends in ground level ozone are influenced by many factors including weather conditions, transport, growth, and the state of the economy, in addition to changes brought about by regulatory control measures. Of these factors, weather probably has the most profound effect on year to year variations in ozone levels. Several methods have been developed to try to account for the effect of weather on ozone levels so that the change due to emissions could be isolated. While none of these methods are completely successful they do show that over the long term, real reductions in ozone levels have been achieved. A

simple way of showing the changing effect of weather on ozone is shown above in Figure 12. The number of days each year on which the ambient temperature was 90 degrees or greater is shown next to the number of days the ozone standard was exceeded. In the earliest years shown (1981-1985) there are significantly more days with high ozone than days above 90 degrees. But this pattern gradually changes and for the most recent years there are more "hot" days than "ozone" days. This is an indication that on the days when conditions are suitable for ozone formation, unhealthy levels are being reached less frequently.

OZONE TRENDS

The primary focus of efforts to reduce concentrations of ground-level ozone in New Jersey has been on reducing emissions of volatile organic compounds (VOCs). Studies have shown that such an approach should lower peak ozone concentrations, and it does appear to have been effective in achieving that goal. Maximum 1-hour concentrations have not exceeded 0.200 ppm since 1988 and the last time levels above 0.180 ppm were recorded was in 1990 (Figure 13). Improvements have leveled off in recent years, especially with respect to maximum 8-hour average concentrations. Significant further improvements will require reductions in both VOCs and NO_x. The NO_x reductions will have to be achieved over a very large region of the country because levels in New Jersey are dependent on emissions from upwind sources.

Figure 13
Ozone Concentrations in New Jersey
1975 – 2005
Second Highest 1-Hour Averages

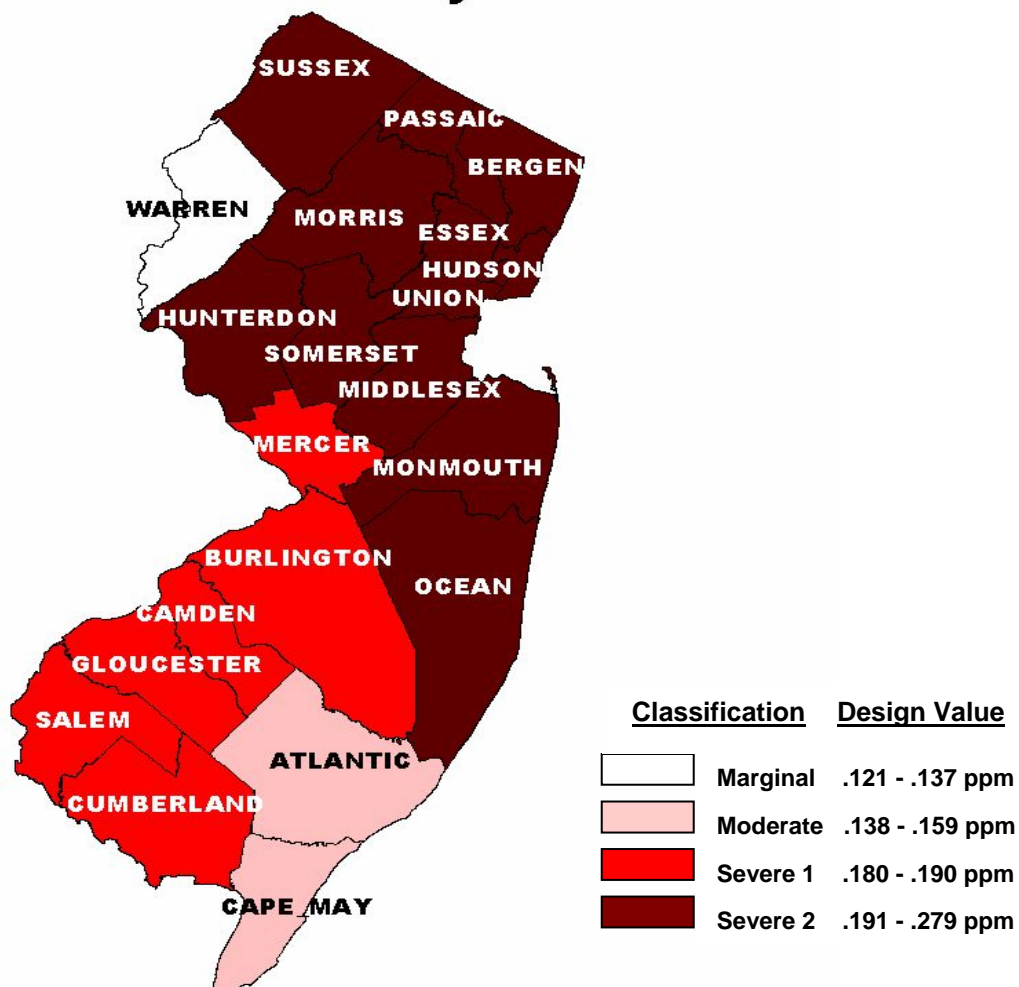


OZONE NON-ATTAINMENT AREAS IN NEW JERSEY

The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Areas can also be found to be “unclassifiable” under certain circumstances. The 1990 amendments to the act required that areas be further classified based on the severity of non-attainment. The classifications range from “marginal” to “extreme” and are based on “design values”. The design value is the value that actually determines whether an area meets the standard. For the 1-hour ozone standard for example, the design value is the fourth highest daily maximum 1-hour average concentration recorded over a three year period. Note that these classifications did not take into account the transport of ozone and its precursors and missed the concept of multi-state controls.

New Jersey is part of four planning areas, the New York, Philadelphia, Atlantic City and Allentown/Bethlehem areas. Their classification with respect to the old 1-hour standard is shown on the map below. Now that the new 8-hour average standard for ozone has been upheld by the courts, new designations will have to be made.

Figure 14
Ozone Non-Attainment Areas
in New Jersey



REFERENCES

Ozone: Good Up High, Bad Nearby, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC October 1997, URL: www.epa.gov/oar/oaqps/gooduphigh/

USEPA Fact Sheet: *Health and Environmental Effects of Ground Level Ozone*, USEPA, Office of Air and Radiation, July 1997, URL: www.epa.gov/ttn/oarpg/naaqsfin/o3health.html

USEPA Ozone Map Archives, URL: www.epa.gov/airnow/maparch.html

Enhanced Ozone Monitoring – PAMS General Information, USEPA, 1994, URL: www.epa.gov/air/oaqps/pams/general.html

Guidelines for Developing an Air Quality (Ozone and PM_{2.5}) Forecasting Program, EPA-456/R-03-002, June 2003

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: www.epa.gov/oar/aqtrnd99/

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA, Office of Air Quality Planning and Standards, RTP, September 2001, URL: www.epa.gov/oar/aqtrnd00/

Smog – Who Does it Hurt?, EPA-452/K-99-001, USEPA, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/health/

Ozone and Your Health, EPA-152/F-99-000, USEPA, Air and Radiation, Washington, DC, September 1999, URL: www.epa.gov/airnow/brochure.html

Air Quality Guide for Ozone, EPA-456/F-002, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/consumer.html



2005 PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

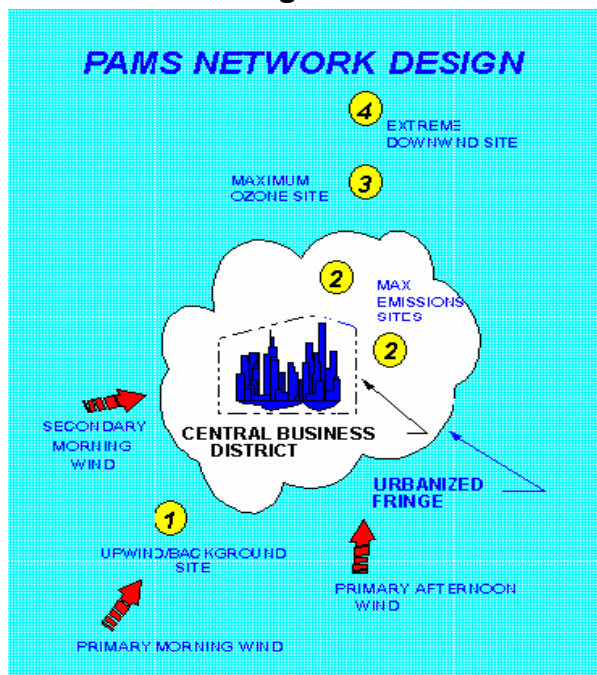
New Jersey Department of Environmental Protection

PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

Most ground-level ozone is the result of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) reacting in the presence of sunlight. As a result, it is necessary to measure these ozone forming pollutants, also known as precursor pollutants, to effectively evaluate strategies for reducing ozone levels. The Photochemical Assessment Monitoring Stations (PAMS) network was established for this purpose. Data from the PAMS network is used to better characterize the nature and extent of the O₃ problem, track VOC and NO_x emission inventory reductions, assess air quality trends, and make attainment/nonattainment decisions. PAMS monitor both criteria and non-criteria pollutants including ozone (O₃), oxides of nitrogen (NO_x), nitric oxide (NO), nitrogen dioxide (NO₂), and specific VOCs, including several carbonyls, that are important in ozone formation. In addition, the measurement of specific weather parameters (e.g. Wind speed/direction, temperature) is required at all PAMS, and upper air weather measurements are required in certain areas. The VOC and carbonyl measurements are only taken during the peak part of the ozone season, from June 1st to August 31st each year.

The PAMS network is designed around metropolitan areas where ozone is a significant problem, and each site in the network has a specific purpose as shown in the Figure 1 below. New Jersey is part of the Philadelphia and New York Metropolitan areas and has a total of three PAMS sites. A Type 3 maximum ozone site for the Philadelphia area is located at Rider University in Mercer County, a Type 2 maximum emissions site is located downwind of the Philadelphia Metropolitan urban area in Camden, and a site at Rutgers University in New Brunswick has been designated both a PAMS Type 1 upwind site for the New York urban area, as well as a Type 4 downwind site for the Philadelphia Metropolitan urban area. An upper air weather monitoring station is also located at the Rutgers University site. All of the PAMS sites for the Philadelphia and New York City areas are shown in Figure 2.

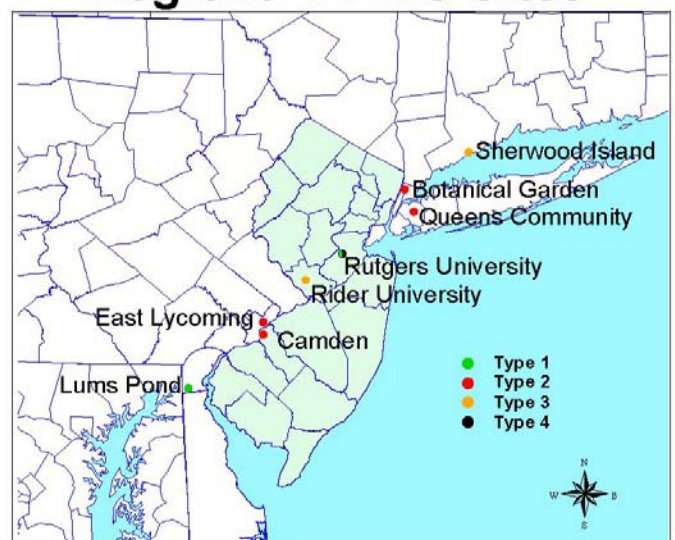
Figure 1



⁵ USEPA , PAMS General Information

Figure 2

Regional PAMS Sites

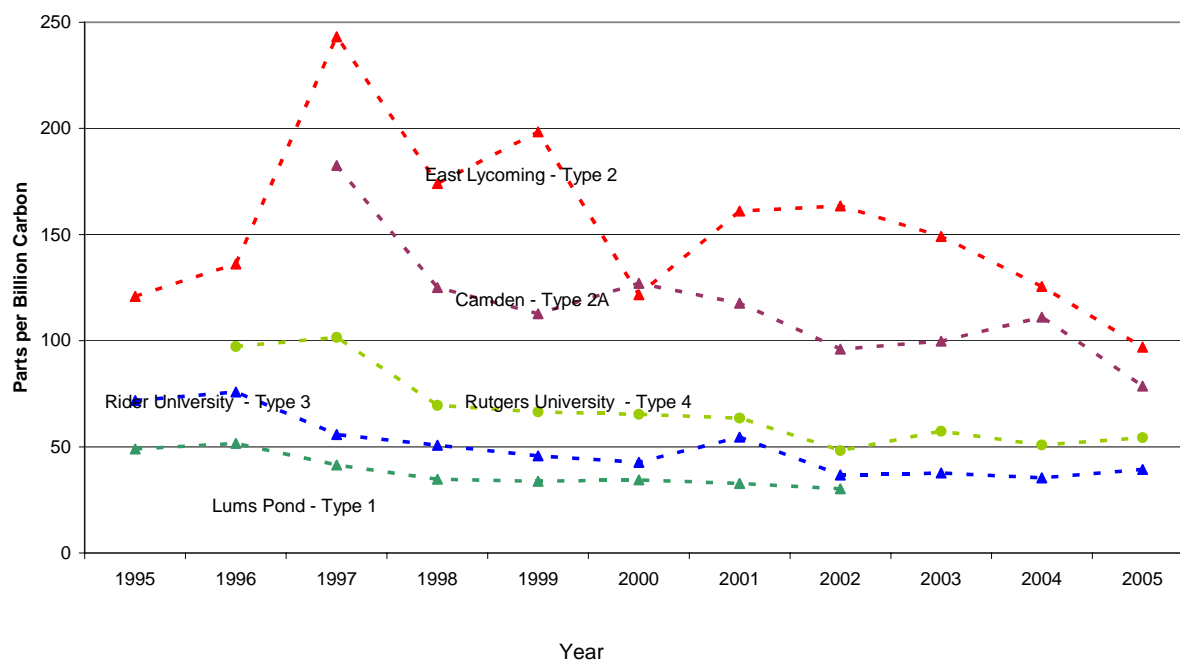


Note: Rutgers University PAMS site is both Type 4 for Philadelphia and Type 1 for New York City.

PAMS (CONT.)

Figure 3 shows VOC trends for the PAMS sites in the Philadelphia area. In general, for Lums Pond (upwind - Type 1), Rider University (maximum ozone concentration - Type 3) and Rutgers University (downwind - Type 4), VOCs have declined over the measurement period. The improvements were initially more dramatic, with more level, though still discernibly declining concentrations, over the last several years. The maximum emissions -Type 2 sites (Camden and East Lycoming) for this area show more variation from year to year, though the trend at both sites is downward since 1997. This greater variability may be due to the fact that Type 2 sites are typically impacted by varied sources, whereas other sites are mostly impacted by transportation sources. Delaware's Department of Natural Resources and Environmental Control (DNREC) discontinued operation of the Lums Pond site after the 2002 season.

Figure 3
Philadelphia Region
Total Non-methane Organic Carbon (TNMOC)
Seasonal Average 1995-2005



PAMS (cont.)

Figure 4 shows VOC trends for the PAMS sites in the New York City metropolitan area. In general, observations here are similar to those for the Philadelphia area. The Type 2 site in the NY area at the Bronx Botanical Gardens shows even more year to year variability than does the Philadelphia Type 2 site at East Lycoming. Operation of the Queens Community College site was discontinued after the 2001 season.

In conclusion, trends for VOC values measured at all PAMS sites in the Philadelphia and New York City areas show a decline over the time period these measurements were made. Changes in gasoline formulation over the period as well as the effect of newer, cleaner vehicles replacing older vehicles in the automotive fleet could account for the reductions. Type 2 sites, though impacted by vehicle emissions, are also affected by urban stationary sources whose emission trends over the measurement period are less clear, hence these sites seem to show more year to year variability. All sites are also impacted by naturally occurring isoprene, which is emitted by trees. All VOCs are not equal in their contribution to ozone formation and while isoprene levels are generally lower than many other VOCs, isoprene can account for a significant amount of the ozone forming potential, especially at the non-urban sites. Isoprene levels are also highest during the middle of the day, when photochemical conditions are most conducive to ozone formation. Isoprene levels are thought to be influenced by factors that affect tree health and growth, such as rainfall and severe temperatures.

Summaries of results for all of the VOCs measured at the New Jersey PAMS sites are provided in Table 1.

Figure 4
New York City Region
Total Non-methane Organic Carbon (TNMOC)
Seasonal Average 1995-2005

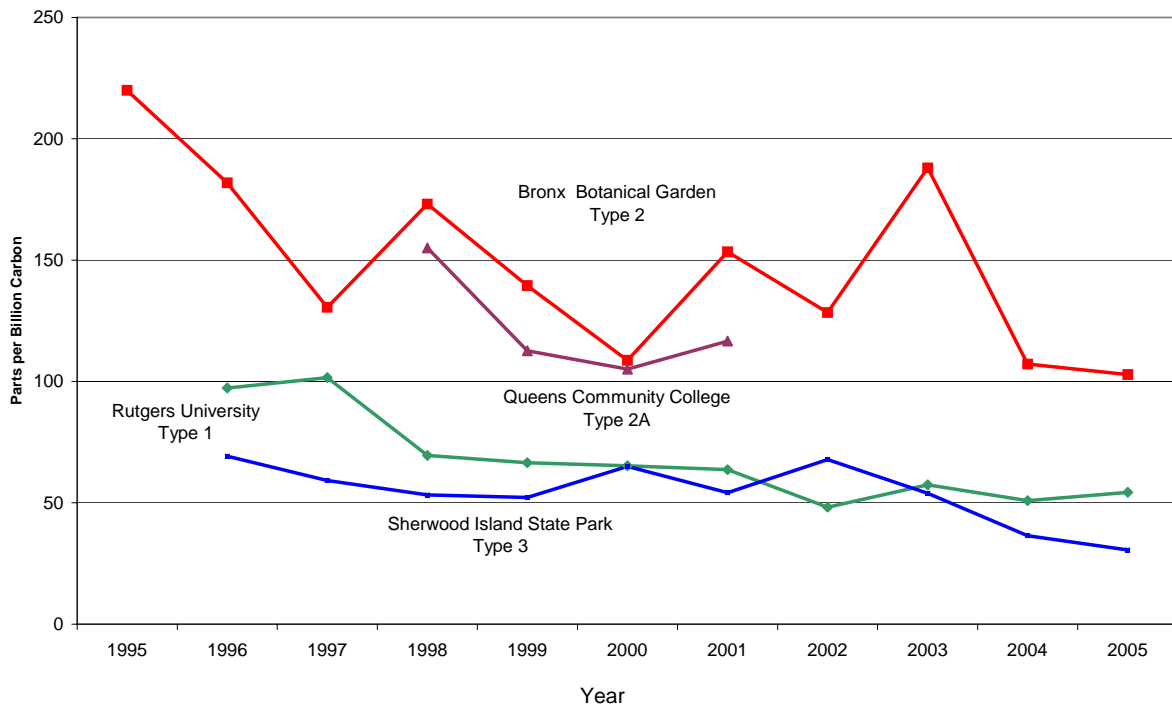


Table 1
Summary of Photochemical Assessment Monitoring (PAMS) Data
June, July, and August, 2005

Parts Per Billion (Volume) – ppbv
Parts Per Billion (Carbon) – ppbC
Max – Maximum Avg - Average

	Camden Lab				Rider University				Rutgers University			
	ppbv		ppbC		ppbv		ppbC		ppbv		ppbC	
	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
Acetylene	4.14	0.30	8.28	0.60	0.69	0.15	1.37	0.30	4.45	0.26	8.89	0.52
Benzene	6.79	0.24	40.75	1.46	0.64	0.11	3.84	0.68	2.06	0.11	12.33	0.64
n-Butane	22.73	1.33	90.91	5.33	5.26	0.37	21.02	1.49	28.21	0.65	112.85	2.59
1-Butene	0.99	0.09	3.94	0.35	0.36	0.03	1.42	0.13	2.97	0.05	11.88	0.19
cis-2-Butene	0.82	0.06	3.26	0.22	0.11	0.02	0.45	0.08	6.97	0.06	27.86	0.23
trans-2-Butene	1.06	0.06	4.24	0.26	0.12	0.02	0.49	0.09	7.60	0.13	30.4	0.53
Cyclohexane	3.72	0.08	22.33	0.48	0.25	0.03	1.47	0.18	1.41	0.03	8.47	0.20
Cyclopentane	0.78	0.07	3.91	0.36	0.22	0.04	1.09	0.21	3.06	0.05	15.28	0.25
n-Decane	0.78	0.03	7.75	0.35	0.21	0.02	2.06	0.23	1.13	0.03	11.29	0.29
m-Diethylbenzene	0.15	0.01	1.54	0.12	0.33	0.02	3.26	0.16	0.30	0.02	3.02	0.18
p-Diethylbenzene	0.20	0.01	1.99	0.13	0.18	0.01	1.77	0.13	0.12	0.01	1.17	0.12
2,2-Dimethylbutane	3.69	0.13	18.46	0.66	0.28	0.04	1.41	0.19	1.61	0.06	8.06	0.31
2,3-Dimethylbutane	1.10	0.12	5.52	0.58	0.31	0.07	1.55	0.36	4.53	0.06	22.64	0.30
2,3-Dimethylpentane	0.61	0.07	4.28	0.46	0.22	0.04	1.52	0.29	2.07	0.04	14.46	0.25
2,4-Dimethylpentane	0.35	0.04	2.47	0.30	0.12	0.03	0.85	0.19	1.80	0.03	12.58	0.18
Ethane	22.04	2.78	44.08	5.57	9.53	1.95	19.05	3.90	68.54	2.46	137.08	4.93
Ethylbenzene	1.06	0.07	8.44	0.58	0.27	0.04	2.12	0.30	0.59	0.04	4.7	0.36
Ethylene (Ethene)	6.22	0.78	12.43	1.55	3.32	0.47	6.63	0.94	11.99	1.20	23.97	2.40
m/p-Ethyltoluene	0.82	0.07	7.34	0.61	0.54	0.06	4.84	0.50	0.67	0.06	6.07	0.55
o-Ethyltoluene	0.19	0.02	1.72	0.16	0.08	0.01	0.7	0.13	0.17	0.01	1.49	0.12
n-Heptane	1.31	0.11	9.19	0.78	0.35	0.05	2.44	0.33	1.22	0.05	8.57	0.36
Hexane	3.31	0.24	19.86	1.43	0.69	0.10	4.13	0.60	8.11	0.15	48.68	0.91
1-Hexene	0.42	0.02	2.49	0.13	0.42	0.01	2.53	0.07	0.36	0.02	2.16	0.11
Isobutane	18.65	0.85	74.61	3.40	7.62	0.26	30.47	1.05	15.50	0.33	61.99	1.33
Isopentane	16.09	1.19	80.45	5.96	2.97	0.46	14.87	2.29	88.38	0.66	441.88	3.30
Isoprene	2.69	0.38	13.44	1.89	5.76	0.44	28.82	2.18	8.80	0.76	44.02	3.82
Isopropylbenzene	1.75	0.04	15.79	0.37	0.42	0.02	3.74	0.17	0.15	0.01	1.31	0.11
Methylcyclohexane	1.16	0.09	8.09	0.63	0.32	0.04	2.27	0.27	1.46	0.04	10.19	0.27
Methylcyclopentane	1.46	0.14	8.75	0.85	0.39	0.07	2.35	0.40	4.97	0.08	29.83	0.46
2-Methylheptane	0.34	0.03	2.69	0.26	0.10	0.02	0.8	0.12	1.56	0.02	12.44	0.14
3-Methylheptane	0.32	0.03	2.56	0.27	0.11	0.02	0.91	0.15	1.77	0.02	14.19	0.16
2-Methylhexane	1.43	0.09	10.02	0.65	0.39	0.06	2.76	0.39	1.41	0.05	9.84	0.34

Table 1 (Continued)
Summary of Photochemical Assessment Monitoring (PAMS) Data
June, July, and August, 2005

	Camden Lab				Rider University				Rutgers University			
	ppbv		ppbC		ppbv		ppbC		ppbv		ppbC	
	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg
3-Methylhexane	1.78	0.12	12.44	0.86	0.44	0.07	3.09	0.47	1.61	0.06	11.29	0.40
2-Methylpentane	3.32	0.31	19.94	1.86	0.82	0.12	4.93	0.75	12.89	0.16	77.33	0.93
3-Methylpentane	1.98	0.20	11.9	1.19	0.52	0.08	3.1	0.49	7.40	0.10	44.38	0.63
n-Nonane	0.54	0.04	4.83	0.37	0.30	0.02	2.72	0.21	1.43	0.03	12.85	0.25
n-Octane	0.57	0.05	4.54	0.44	0.29	0.03	2.32	0.21	0.33	0.03	2.66	0.21
n-Pentane	9.69	0.66	48.45	3.28	1.54	0.23	7.69	1.14	36.77	0.32	183.85	1.58
1-Pentene	0.35	0.05	1.75	0.23	0.10	0.02	0.49	0.10	1.95	0.04	9.76	0.21
cis-2-Pentene	0.32	0.03	1.62	0.17	0.08	0.02	0.42	0.09	2.21	0.06	11.07	0.28
trans-2-Pentene	1.06	0.06	4.24	0.26	0.12	0.02	0.49	0.09	7.60	0.13	30.4	0.53
Propane	93.81	2.81	281.42	8.44	8.37	1.25	25.1	3.75	15.62	1.44	46.87	4.31
n-Propylbenzene	0.15	0.02	1.39	0.16	0.07	0.01	0.62	0.12	0.16	0.01	1.45	0.12
Propylene (Propene)	13.86	0.59	41.59	1.78	3.51	0.22	10.53	0.65	3.26	0.35	9.79	1.05
Styrene	0.50	0.03	4.00	0.22	0.15	0.03	1.22	0.20	0.22	0.02	1.78	0.19
Toluene	5.04	0.58	35.25	4.08	1.77	0.28	12.37	1.97	90.49	0.50	633.4	3.53
1,2,3-Trimethylbenzene	0.41	0.04	3.65	0.36	1.00	0.08	9.00	0.71	0.32	0.05	2.87	0.49
1,2,4-Trimethylbenzene	0.72	0.06	6.5	0.57	1.91	0.08	17.22	0.71	0.65	0.07	5.85	0.59
1,3,5-Trimethylbenzene	0.41	0.02	3.69	0.20	0.16	0.02	1.4	0.20	0.41	0.02	3.7	0.19
2,2,4-Trimethylpentane	1.10	0.15	8.78	1.20	0.40	0.07	3.23	0.58	2.43	0.10	19.4	0.84
2,3,4-Trimethylpentane	0.35	0.05	2.83	0.36	0.13	0.03	1.03	0.20	0.49	0.03	3.91	0.23
n-Undecane	0.51	0.03	5.59	0.31	0.76	0.02	8.37	0.18	0.37	0.02	4.04	0.23
m/p-Xylene	3.19	0.21	25.54	1.65	0.89	0.10	7.15	0.83	1.94	0.12	15.52	0.94
o-Xylene	0.86	0.08	6.84	0.66	0.33	0.04	2.61	0.35	0.74	0.05	5.89	0.38

REFERENCES

1. *Ozone: Good Up High, Bad Nearby*, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC October 1997, URL: www.epa.gov/oar/oaqps/gooduphigh/
 2. USEPA Fact Sheet: *Health and Environmental Effects of Ground Level Ozone*, USEPA, Office of Air and Radiation, July 1997, URL: www.epa.gov/ttn/oarpg/naaqsfin/o3health.html
 3. Ryan, William, *Air Quality Forecast Report Philadelphia Forecast Area 2001*, Pennsylvania State University, Department of Meteorology, University Park, PA, March 2002, URL: http://www.meteo.psu.edu/~wfryan/phl_2001_final_report.htm
 4. USEPA Ozone Map Archives, URL: www.epa.gov/airnow/maparch.html
 5. Enhanced Ozone Monitoring – PAMS General Information, USEPA, 1994, URL: www.epa.gov/air/oaqps/pams/general.html
- National Air Quality and Emissions Trend Report, 1999*, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: www.epa.gov/oar/aqtrnd99/
- Latest Findings on National Air Quality: 2000 Status and Trends*, EPA-454/K-01-002, USEPA, Office of Air Quality Planning and Standards, RTP, September 2001, URL: www.epa.gov/oar/aqtrnd00/
- Smog – Who Does it Hurt?*, EPA-452/K-99-001, USEPA, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/health/
- Ozone and Your Health*, EPA-152/F-99-000, USEPA, Air and Radiation, Washington, DC, September 1999, URL: www.epa.gov/airnow/brochure.html
- Air Quality Guide for Ozone*, EPA-456/F-002, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/consumer.html



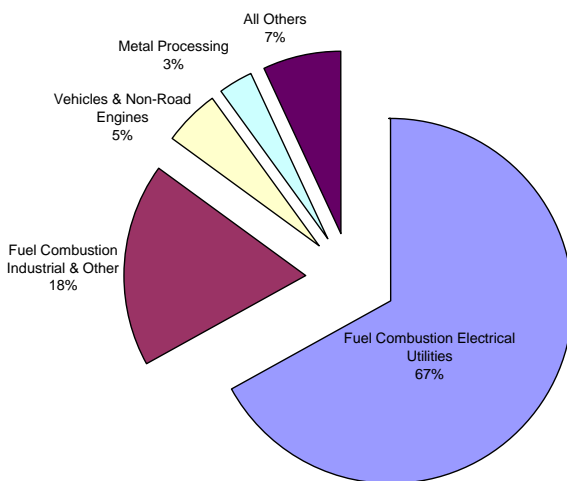
2005 Sulfur Dioxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Sulfur dioxide (SO_2) is a heavy, colorless gas with a suffocating odor that easily dissolves in water to form sulfuric acid. SO_2 gases can be formed when fuels containing sulfur are burned, or when gasoline is extracted from oil. Most of the sulfur dioxide released into the air comes from electric utilities, especially those that burn coal with a high sulfur content. Sulfur is found in raw materials such as crude oil, coal, and ores that contain metals such as aluminum, copper, zinc, lead and iron. Industrial facilities that derive their products from these materials may also release SO_2 . A pie chart summarizing the major sources of SO_2 is shown in Figure 1.

Figure 1
National Summary
 SO_2 Emissions by Source Category



Source: USEPA website
<http://www.epa.gov/air/urbanair/so2/what1.html>
Last updated, Monday, July 23, 2007

SO_2 concentrations in New Jersey are generally higher in the winter than in the summer due to higher emissions from space heating and other sources. This is shown in the chart depicted in Figure 2 (page 2). The chart also shows that SO_2 levels tend to peak in the morning as emissions accumulate prior to being more effectively dispersed when wind speeds increase and atmospheric mixing increases later in the day.

HEALTH AND ENVIRONMENTAL EFFECTS

Sulfur dioxide causes irritation of the mucous membranes. This is probably the result of the action of sulfurous acid that is formed when the highly soluble SO_2 dissolves at the surface of the membranes. Groups that are especially susceptible to the harmful health effects of SO_2 include children, the elderly, and people with heart or lung disorders such as asthma. When SO_2 concentrations in the air become elevated, people belonging to these sensitive groups and those who are active outdoors may have trouble breathing. The International Agency for Research on Cancer (IARC) evaluated SO_2 and based on available information, determined that no conclusion can be made as to the carcinogenicity of SO_2 to human beings.

Sulfur dioxide reacts with other gases and particles in the air to form sulfates that can be harmful to people and the environment. Sulfate particles are the major cause of reduced visibility in the eastern United States. SO_2 can also react with other substances in the air to form acids, which fall to the earth in rain and snow. Acid rain damages forests and crops, can make lakes and streams too acidic for fish, and speeds up the decay of building materials and paints.

STANDARDS

There are three National Ambient Air Quality Standards (NAAQS) for SO_2 . There is an annual average health standard of 0.030 parts per million (ppm). This is based on a calendar year average of continuously monitored levels. There is also a 24-hour average health based standard of 0.14 ppm which is not to be exceeded more than once a year, and a secondary (welfare based) standard of 0.5 ppm, 3-hour average concentration that is also not to be exceeded more than once per year.

New Jersey has also set state air quality standards for SO_2 . They are similar to the federal standards but are expressed in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) instead

of ppm. They are also based on rolling averages rather than block averages. So, for example, the state's primary 12-month standard is based on any twelve-month average recorded during the year, while the federal standard is based solely on the calendar

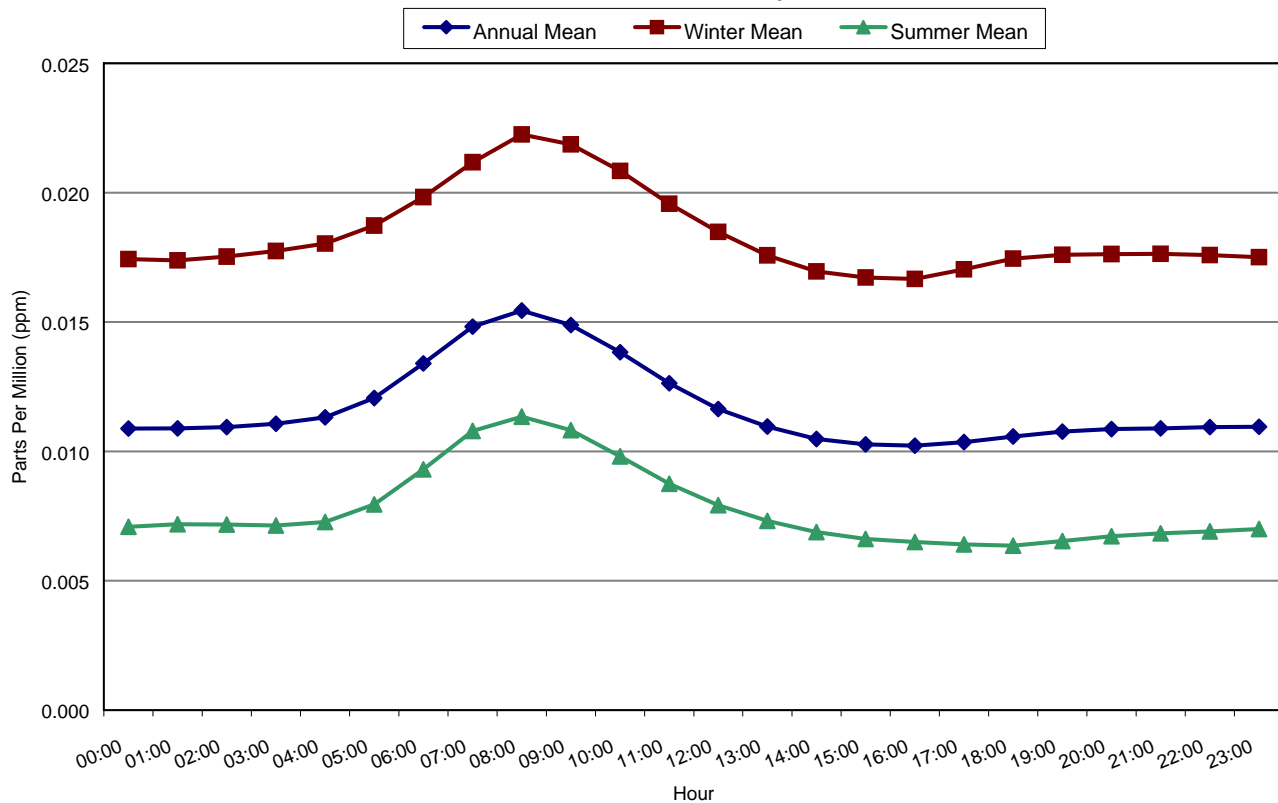
year average. The state also has secondary 12-month, 24-hour, and 3-hour average standards. Table 1 summarizes the NAAQS and the New Jersey Ambient Air Quality Standards (NJAAQS) for SO₂.

Table 1
National and New Jersey Ambient Air Quality Standards for Sulfur Dioxide

Averaging Period	Type	Parts Per Million (ppm) Micrograms Per Cubic Meter (µg/m ³)	
		New Jersey	National ^a
12-month average	Primary	80 µg/m ³ (0.03 ppm)	0.030 ppm
12-month average	Secondary	60 µg/m ³ (0.02 ppm)	---
24-hour average	Primary	365 µg/m ³ (0.14 ppm)	0.14 ppm
24-hour average	Secondary	260 µg/m ³ (0.10 ppm)	---
3-hour average	Secondary	1300 µg/m ³ (0.5 ppm)	0.5 ppm

^a – National standards are block averages rather than moving averages

Figure 2
Sulfur Dioxide Concentration - New Jersey
1967-1999
Seasonal and Hourly Variation



MONITORING LOCATIONS

The state monitored SO₂ levels at 13 locations in 2005. These sites are shown in the map in Figure 3.

SO₂ LEVELS IN 2005

None of the monitoring sites recorded exceedances of the primary or secondary SO₂ standards during 2005. The maximum 12-month average concentration recorded was 0.008 ppm in Bayonne, Elizabeth Lab, and Jersey City. The maximum 24-hour average level recorded was 0.044 ppm which was recorded in Clarksboro. The highest 3-hour average recorded was 0.164 ppm at Clarksboro. Summaries of the 2005 data are provided in Table 2 below, Table 3 (page 4) and Figure 4 (page 4).

Figure 3
2005 Sulfur Dioxide
Monitoring Network

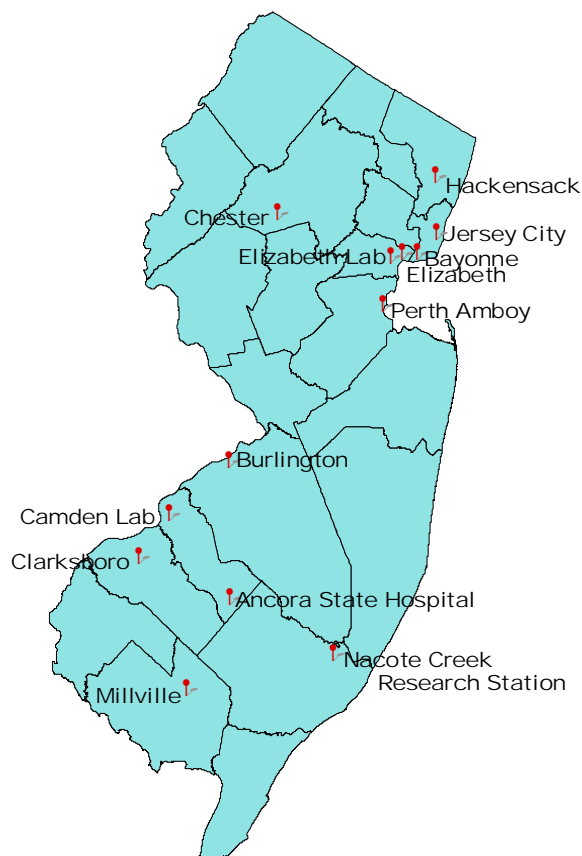


Table 2
Sulfur Dioxide Data – 2005
3-Hour and Annual Averages

Parts Per Million (ppm)

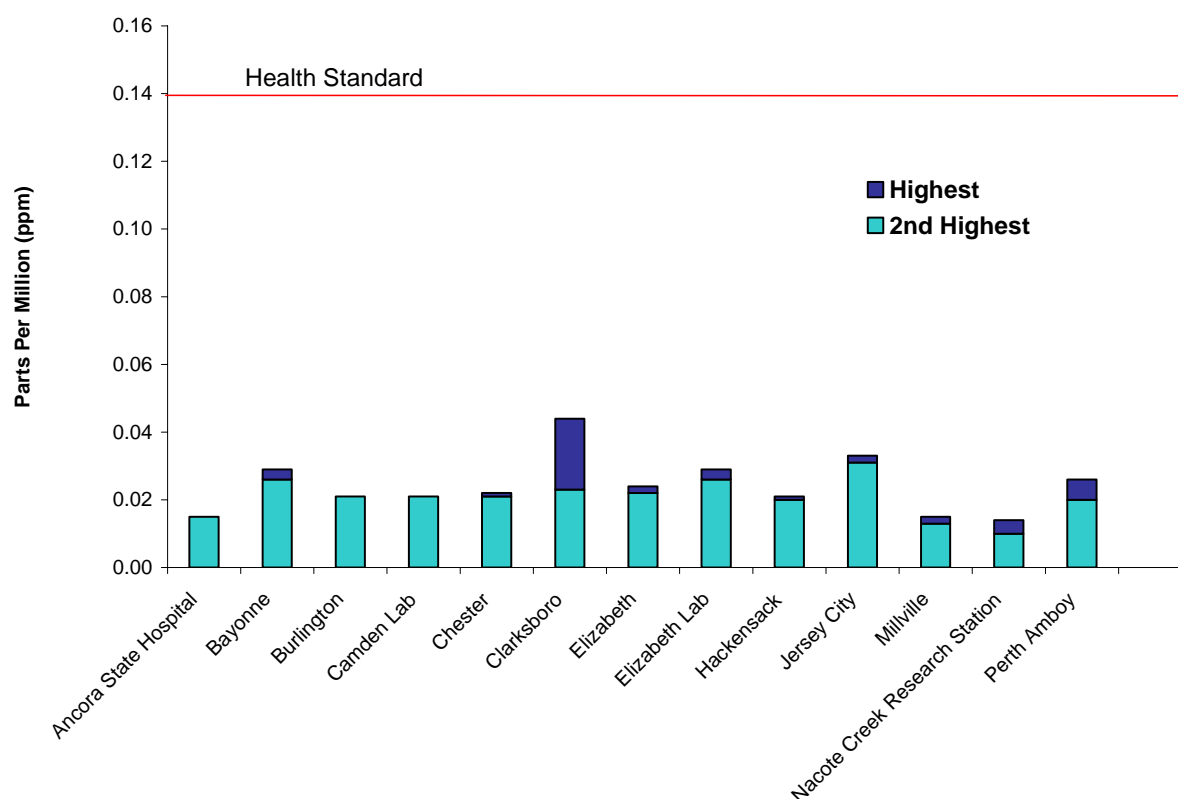
Monitoring Sites	3-Hour Average Maximum	3-Hour Average 2 nd Highest	12-Month Average Maximum	Average Calendar Year
Ancora State Hospital	0.031	0.025	0.003	0.003
Bayonne	0.055	0.051	0.008	0.008
Burlington	0.035	0.031	0.004	0.004
Camden Lab	0.038	0.036	0.006	0.005
Chester	0.051	0.047	0.004	0.004
Clarksboro	0.164	0.128	0.005	0.005
Elizabeth	0.045	0.045	0.006	0.006
Elizabeth Lab	0.048	0.045	0.008	0.007
Hackensack	0.034	0.032	0.004	0.004
Jersey City	0.055	0.050	0.008	0.008
Millville	0.025	0.024	0.004	0.004
Nacote Creek Research Center	0.032	0.019	0.002	0.002
Perth Amboy	0.054	0.042	0.004	0.004

Table 3
Sulfur Dioxide Data – 2005
24-Hour and Daily Averages

Parts Per Million (ppm)

Monitoring Sites	24-Hour Average Maximum	24-Hour Average 2nd Highest	Daily Average Maximum	Daily Average 2nd Highest
Ancora State Hospital	0.015	0.015	0.015	0.014
Bayonne	0.029	0.026	0.029	0.026
Burlington	0.021	0.021	0.017	0.016
Camden Lab	0.021	0.021	0.020	0.018
Chester	0.022	0.021	0.021	0.018
Clarksboro	0.044	0.023	0.044	0.017
Elizabeth	0.024	0.022	0.024	0.021
Elizabeth Lab	0.029	0.026	0.028	0.027
Hackensack	0.021	0.020	0.019	0.016
Jersey City	0.033	0.031	0.032	0.029
Millville	0.015	0.013	0.013	0.013
Nacote Creek Research Station	0.014	0.010	0.012	0.009
Perth Amboy	0.026	0.020	0.025	0.021

Figure 4
Highest and 2nd Highest 24-Hour Averages
of SO₂ in New Jersey - 2005



TRENDS

Since the implementation of regulations requiring the use of low sulfur fuels in New Jersey, SO₂ concentrations have improved significantly. The last time an exceedance of any of the National SO₂ standards was recorded in the state was in 1980. A trend graph of SO₂ levels showing the daily average concentrations recorded since 1975 from the highest, average, and lowest of all sites is shown in Figure 5 below. The graph uses the second highest daily value, as this is the value that determines if the national

health standard is being met (one exceedance per site is allowed each year).

Although there has not been a measured exceedance of the NAAQS in over two decades, there is still a small area of New Jersey that is classified as a non-attainment area for SO₂. This is the result of air quality modeling studies that predicted non-attainment of the standard within a small area of Warren County. The area is shown in the map in Figure 6 (page 6).

Figure 5
Sulfur Dioxide Concentrations in New Jersey
1975-2005
Second Highest Daily Average

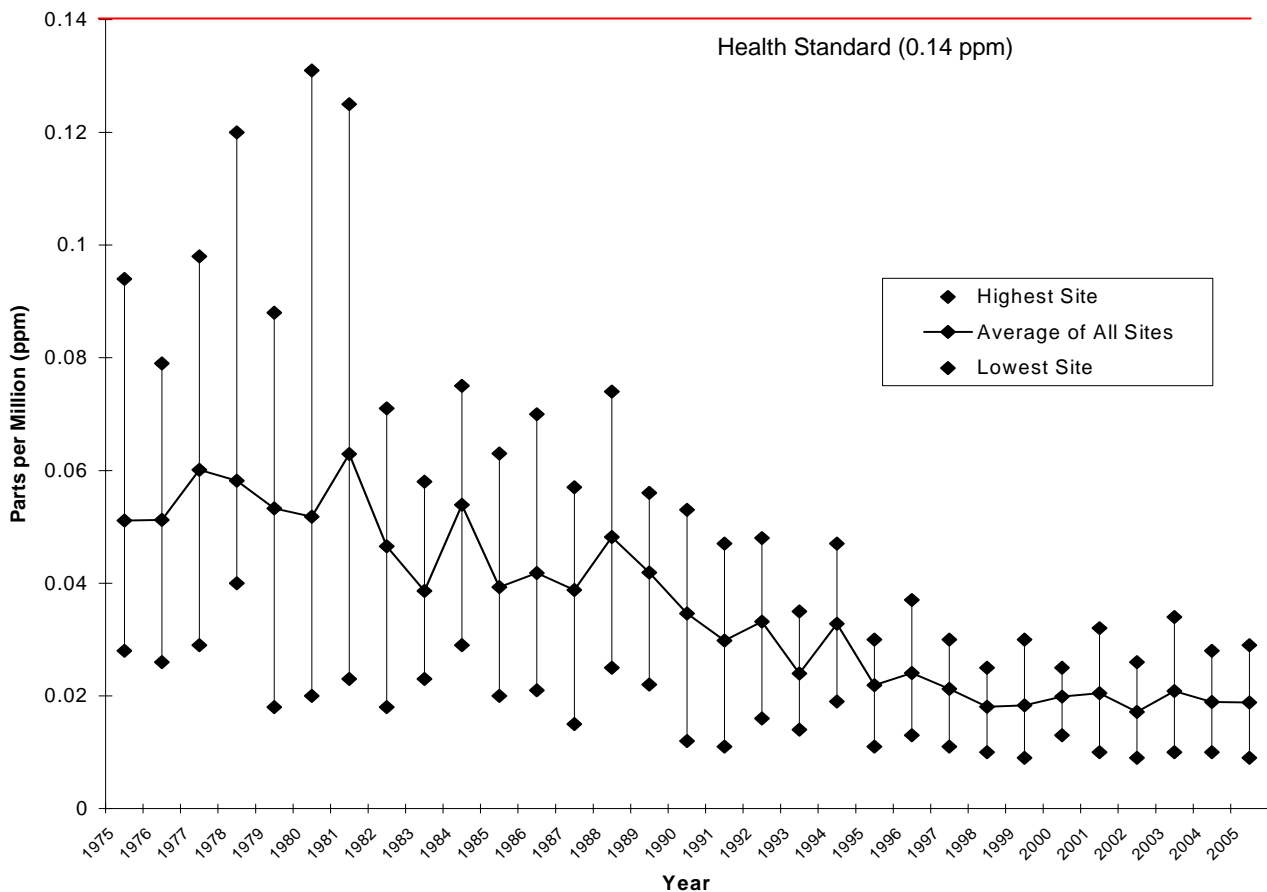
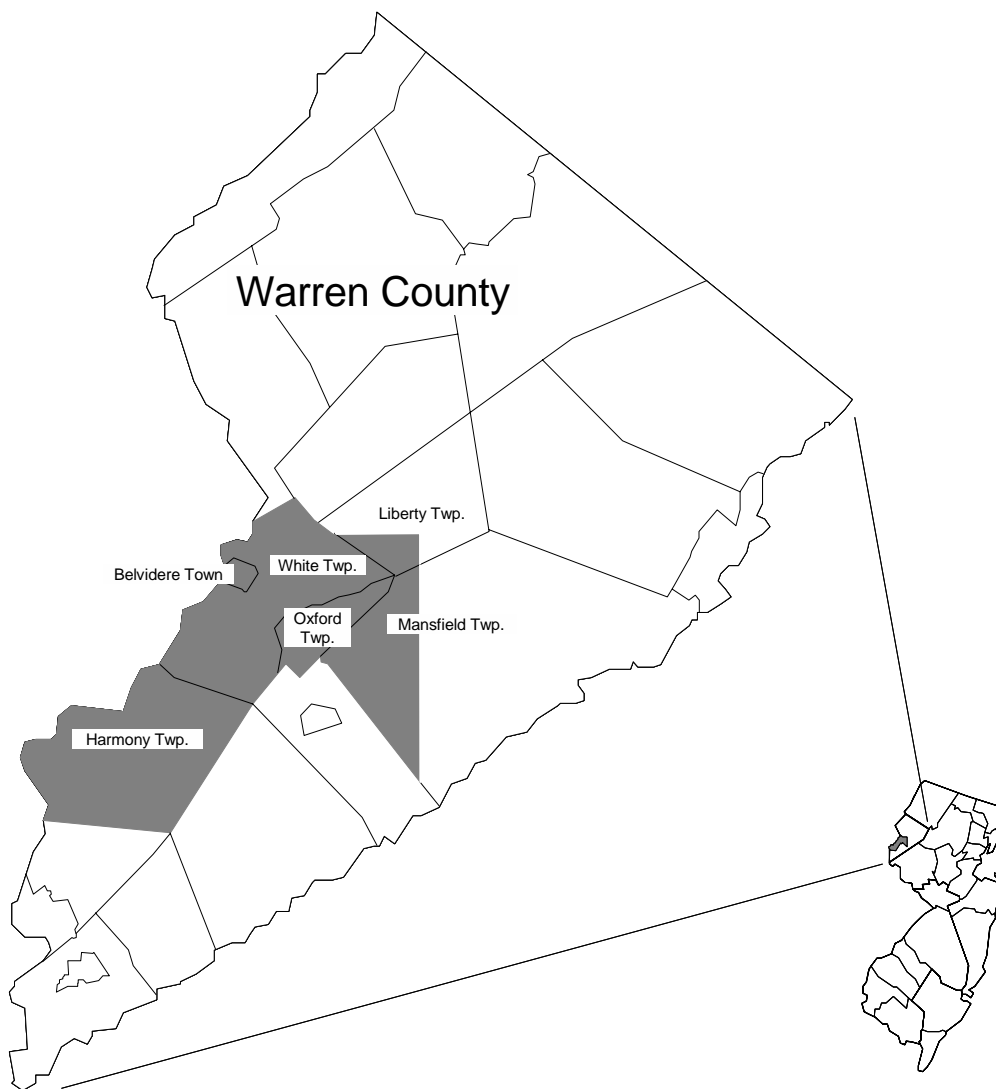


Figure 6
Sulfur Dioxide Non-Attainment Areas* in New Jersey



Legend

- Sulfur Dioxide Nonattainment Area
(includes Belvidere Town; Harmony Township; Oxford Township;
White Township; the portion of Liberty Township south of
UTM northing 4,255,000 and west of UTM easting 505,000;
and the portion of Mansfield Township west of UTM easting 505,000).

*Nonattainment of the National Primary (Health) and Secondary (Welfare) Standards

FIVE MINUTE AVERAGE SO₂ MONITORING

A 1992 court decision compelled the USEPA to review, and if appropriate, revise the NAAQS for SO₂. After soliciting comments from the public and evaluating several options, the USEPA determined that high short-term SO₂ concentrations are a local problem rather than a widespread national concern. The USEPA Administrator decided in May 1996 not to revise the NAAQS for SO₂, but concluded that in some local areas, 5-minute SO₂ concentrations greater than 0.6 ppm pose a health threat to sensitive persons. In January 1997, the USEPA published proposed revisions to the regulations that would establish “concern and intervention levels (IL).” This IL would have a lower range of 0.6 ppm and an upper range of 2.0 ppm of SO₂. These levels are based on a 5-minute SO₂ concentration that is the highest of the 5-minute averages from the 12 possible non-overlapping periods during a clock hour. Under the proposed regulations, the USEPA would leave the responsibility of assessing the health risk and implementing corrective measures to the States. Also, the USEPA recommended that States evaluate the need to monitor 5-minute SO₂ averages around sources based on citizen complaints, the actual emissions of a source, the population in the vicinity of the source, and environmental justice issues.

The USEPA published a draft “Guideline Document for Ambient Monitoring of 5-Minute SO₂ Concentrations” on July 20, 2000. This guidance is intended to assist State and local agencies in determining whether 5-minute SO₂ monitoring should be established in their jurisdictions, and how to redesign an existing SO₂ network to fulfill these additional needs.

In October 2002, an air monitoring project was established in Warren County, New Jersey to evaluate the feasibility of monitoring 5-minute SO₂ concentrations in the vicinity of local point source. This is the first time since the publication of USEPA’s draft “Guideline Document for Ambient Monitoring of 5-Minute SO₂ Concentrations” that SO₂ concentrations anywhere in New Jersey are being directly compared to the 5-minute SO₂ guideline IL. Warren County was selected for this study as the Belvidere area of the county is the only SO₂ non-attainment area in the state (see Figure 6 – page 6). The study had broad community involvement in its design and implementation. It is primarily being supported by a local industrial facility as part of a Supplemental Environmental

Project (SEP). SEPs are sometimes part of settlement agreements between the DEP and a regulated facility. They are projects deemed to have an environmental benefit for the community, and are supported by a facility in lieu of, or in addition to, direct monetary penalties. The results of the monitoring study are available on the World Wide Web at www.airgap.com

REFERENCES

Air Quality Criteria for Particulate Matter and Sulfur Oxides (1982): Assessment of New Findings on Sulfur Dioxide Acute Exposure Health Effects in Asthmatic Individuals, Supplement to the Second Addendum (1986), U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Research Triangle Park, NC, 1994.

Draft Guideline Document for Ambient Monitoring of 5-minute SO₂ Concentrations, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 20, 2000.

Horstman, D., Roger, L. J., Kehrl, H. and Hazucha, M., *Airway Sensitivity of Asthmatics to Sulfur Dioxide*, EPA-600/J-86-282, Health Effects Research Lab, Research Triangle Park, NC, Clinical Research Branch, Environmental Monitoring and Services, Inc., Chapel Hill, NC, North Carolina University at Chapel Hill, NC, Prepared for USEPA, Research Triangle Park, NC, 1986.

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2001, URL: <http://www.epa.gov/oar/aqtrnd00/>.

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: <http://www.epa.gov/oar/aqtrnd99/>.

SO₂ – How Sulfur Dioxide Affects the Way We Live and Breathe, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, November 2000, URL: <http://www.epa.gov/air/urbanair/so2>

National Primary Ambient Air Quality Standards for Sulfur Dioxide, 40 CFR 50.4, US Government Printing Office, Washington DC, July 2001.

National Secondary Ambient Air Quality Standards for Sulfur Dioxide, 40 CFR 50.5, US Government Printing Office, Washington DC, July 2001.

Sittig, M., *Handbook of Toxic and Hazardous Chemicals and Carcinogens Third Edition, Volume 2*, Noyes Publications, Park Ridge, NJ, 1991.

ToxFaqS for Sulfur Dioxide, U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, April 2002, URL: <http://www.atsdr.cdc.gov/tfacts116.pdf>.



2005 Atmospheric Deposition Summary

New Jersey Department of Environmental Protection

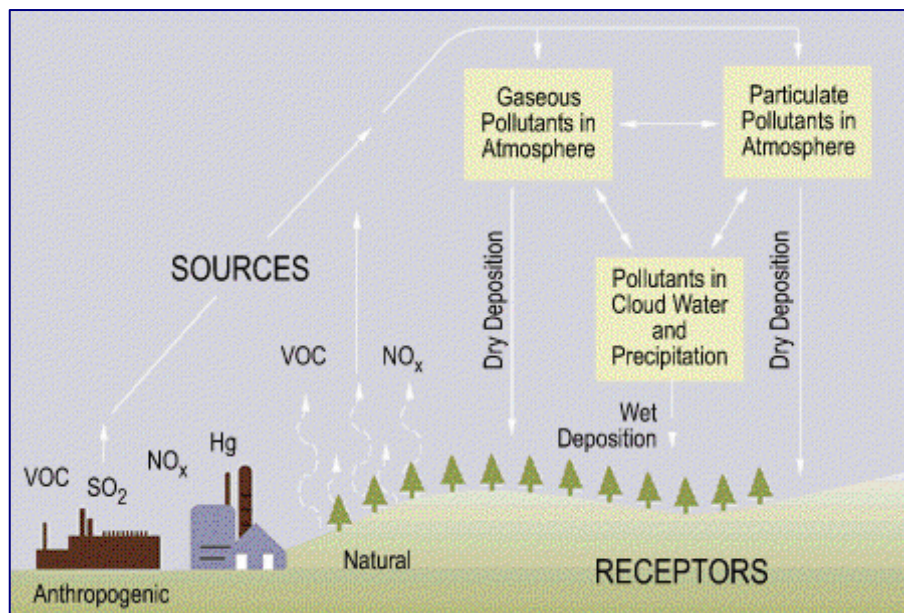
NATURE AND SOURCES

Atmospheric deposition refers to pollutants that are deposited on land or water from the air. Deposition is usually the result of pollutants being removed from the atmosphere and deposited by precipitation (wet deposition) or by the settling out of particulates (dry deposition). Dry deposition also includes gaseous pollutants that are absorbed by land or water bodies. Figure 1 shows the basic mechanisms of deposition and the major pollutants of concern. These include sulfur dioxide (SO_2), nitrogen oxides (NO_x), mercury (Hg), and volatile organic compounds (VOCs). SO_2 is a major contributor to acid deposition, which can reduce the ability of water bodies to support certain types of fish and other aquatic organisms. NO_x also contributes to the acid deposition problem and can contribute to eutrophication of water bodies as well. Hg will accumulate in fish by a process

known as bio-magnification. Small concentrations of Hg in water are concentrated in smaller organisms. These smaller organisms are in turn consumed by larger ones. As the Hg moves up the food chain, it becomes more concentrated. Fish in Hg contaminated water can become contaminated to the point where they are no longer safe for people to eat. For more information on Hg in fish see "A Guide to Health Advisories for Eating Fish and Crabs Caught in New Jersey Waters" which is available at www.state.nj.us/dep/dsr/njmainfish.htm. VOCs are a very diverse group of compounds, some of which are toxic, including known carcinogens.

Atmospheric deposition is the result of pollution from a wide variety of sources and in some cases the pollution can travel great distances before being deposited on the land or water. Some known sources of atmospheric deposition are power plants, motor vehicles, incinerators, and certain industries.

Figure 1



Source: USEPA Clean Air Markets

Web Site: <http://www.epa.gov/airmarkets/acidrain/index.html#what>

MONITORING LOCATIONS

The state monitored wet deposition levels at 2 locations in 2005. These sites are shown in Figure 2. A sample is collected each week from both sites and after each significant rain event at the Washington Crossing State Park site. The Washington Crossing site is also part of the National Atmospheric Deposition Program (NADP) network which is used by the U.S. Environmental Protection Agency to assess national deposition patterns and trends.

Both sites shown in Figure 2 have a sampler for collecting wet deposition (rain and snow) and a rain gauge for determining precipitation amounts. Due to the Lebanon monitor's remote location, it was phased out of operation during 2004.

Figure 2
Acid Precipitation Monitoring
Network - 2005



SUMMARY OF 2005 DATA

A summary of the 2005 wet deposition data is provided in Table 1. The table shows total deposition, pH, conductivity and concentrations of several important ions. When acidity is reported on the pH scale, neutral is considered a 7 with decreasing pH values corresponding to increasing acidity. Normal rainfall has a pH of approximately 5.6 due to the natural presence of carbonic acid in the air. The mean pH value recorded at the Washington Crossing State Park weekly sampler was 4.47 and the Ancora State Hospital sampler recorded a mean pH of 4.57.

Conductivity is a measure of the total density of ions in the water collected. It is used as an indicator of the total amount of pollution in the sample. Conductivity is the ability of the water to conduct electricity and generally increases as the concentration of ions in water increases.

Concentrations of specific ions considered important because they can affect the chemistry of lakes, streams and other water bodies, are also reported for each site. Summaries are provided for each season of the year along with annual averages in Table 1.

Table 1
Acid Precipitation Monitoring Network - 2005
Annual and Seasonal Averages
 Weighted by Precipitation Amount

Ca ²⁺	- Calcium	PO ₄ ³⁻	- Phosphate
Mg ⁺	- Magnesium	Cond.	- Specific conductance
K ⁺	- Potassium	us/cm	- MicroSiemens per centimeter
Na ⁺	- Sodium	mg/l	- Milligrams per liter
NH ₄	- Ammonium	<MDL	- Below minimum detection limit
NO ₃ ⁻	- Nitrate	Winter	- January – March
Cl ⁻	- Chloride	Spring	- April – June
SO ₄ ²⁻	- Sulfate	Summer	- July – September
–	- No Data	Fall	- October – December

Ancora State Hospital – Weekly

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁻ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	8.28	4.37	25.6	0.081	0.046	0.045	0.346	0.424	1.734	0.599	1.974	< MDL
Spring	9.51	4.56	17.5	0.099	0.049	0.048	0.317	0.290	1.293	0.552	1.500	< MDL
Summer	8.09	4.39	23.3	0.113	0.039	0.027	0.176	0.353	1.280	0.413	2.301	< MDL
Fall	17.75	4.86	9.2	0.036	0.045	0.033	0.364	0.070	0.489	0.624	0.660	< MDL
Annual	43.63	4.57	16.7	0.072	0.045	0.037	0.315	0.238	1.047	0.564	1.397	< MDL

Washington Crossing State Park – Weekly

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁻ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	8.98	4.41	20.8	0.069	0.018	0.011	0.135	0.191	1.328	0.275	1.343	< MDL
Spring	9.28	4.52	16.7	0.071	0.025	0.016	0.161	0.232	1.017	0.319	1.424	< MDL
Summer	12.78	4.26	28.1	0.092	0.022	0.013	0.084	0.328	1.325	0.205	2.541	< MDL
Fall	15.59	4.81	11.5	0.134	0.051	0.123	0.280	0.115	0.687	0.522	1.010	0.054
Annual	46.63	4.47	18.9	0.097	0.031	0.050	0.175	0.211	1.051	0.347	1.576	0.022

Table 1 (Continued)
Acid Precipitation Monitoring Network – 2005
Annual and Seasonal Averages
 Weighted by Precipitation Amount

Ca ²⁺	- Calcium	PO ₄ ³⁻	- Phosphate
Mg ⁺	- Magnesium	Cond.	- Specific conductance
K ⁺	- Potassium	us/cm	- MicroSiemens per centimeter
Na ⁺	- Sodium	mg/l	- Milligrams per liter
NH ₄	- Ammonium	<MDL	- Below minimum detection limit
NO ₃ ⁻	- Nitrate	Winter	- January – March
Cl ⁻	- Chloride	Spring	- April – June
SO ₄ ²⁻	- Sulfate	Summer	- July – September
–	- No Data	Fall	- October – December

Washington Crossing State Park – Event

	Precip. Inches	pH	Cond. us/cm	Ca ²⁺ mg/l	Mg ⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	NH ₄ ⁺ mg/l	NO ₃ ⁻ mg/l	Cl ⁻ mg/l	SO ₄ ²⁻ mg/l	PO ₄ ³⁻ mg/l
Winter	9.19	4.42	21.1	0.089	0.024	0.034	0.171	0.220	1.485	0.331	1.440	< MDL
Spring	9.10	4.52	17.7	0.073	0.030	0.034	0.177	0.254	1.133	0.358	1.523	< MDL
Summer	12.89	4.29	26.6	0.104	0.026	0.031	0.109	0.345	1.445	0.246	2.600	< MDL
Fall	15.74	4.76	12.2	0.157	0.064	0.134	0.303	0.106	0.866	0.486	1.149	< MDL
Annual	46.92	4.48	19.0	0.113	0.039	0.067	0.200	0.223	1.198	0.365	1.677	< MDL

TRENDS

Figure 3 shows the change in the amount of sulfate ion deposited over the last 15 years at the site in Washington Crossing State Park. The figure shows “wet deposition” only. It does not include dry particulate sulfate that was deposited when no precipitation was occurring.

Therefore, the total deposition is higher than what is shown here.

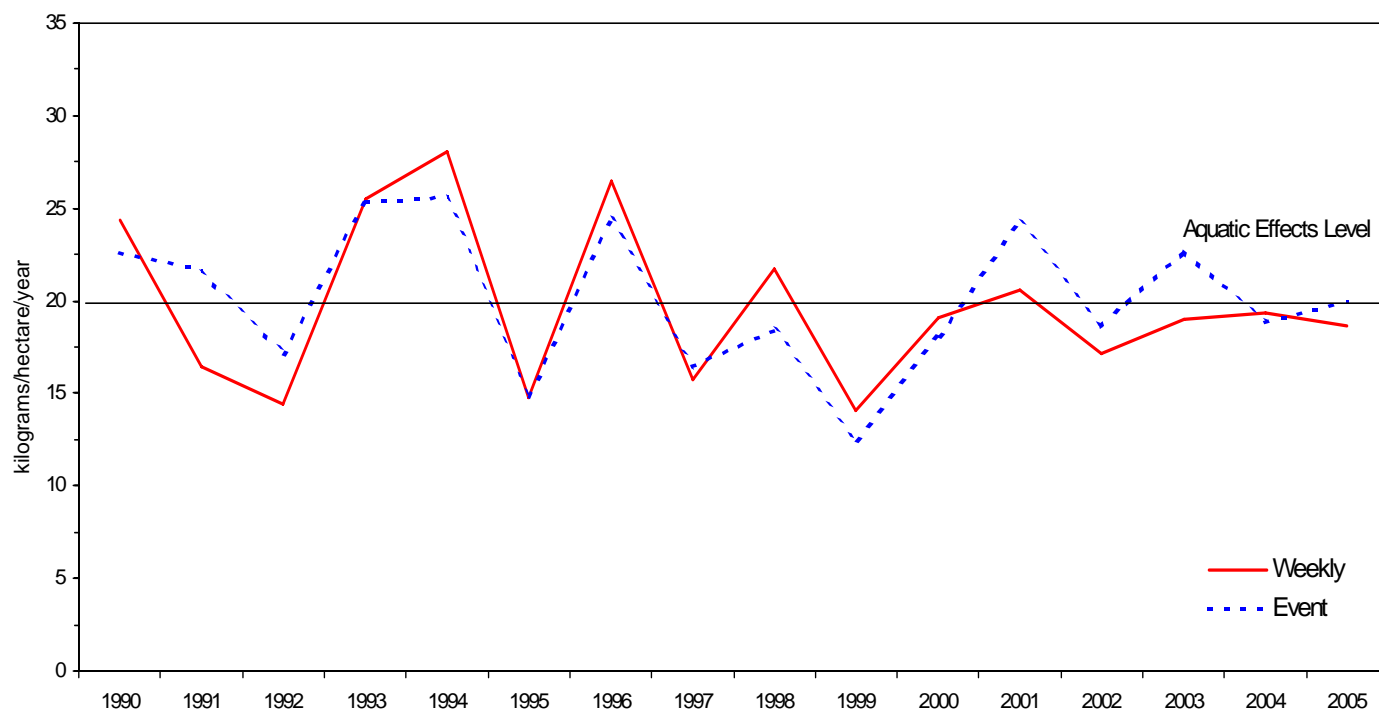
The factors controlling the trend are the sulfate concentrations in air and cloud droplets and the total amount of precipitation in a given year. For example, in 1991 and 1992, both the sulfate concentrations and the total precipitation were below normal, while they were high in 1993 and 1994. Since the values shown here are annual totals, they are also sensitive to loss of samples due to contamination or other factors.

Sulfate can alter soil and water chemistry, and a deposition level of 20 kilograms per hectare per year has been generally accepted as the limit above which damage to sensitive natural resources is likely to occur (i.e. Aquatic Effect Level). However, there are no national or New Jersey standards for sulfate deposition.

According to the New Jersey Comparative Risk Project Ecological Technical Work Group, streams and lakes with significant buffering capacity are somewhat protected from the effects of acid deposition. It is for this reason, that the risk assessment is based primarily on observation of reduced pH in streams and lakes, and on observed effects on aquatic species.

Sulfate deposition in rain and snow is expressed as mass per unit land area over time. To convert the values shown in Figure 3 to pounds per acre per year, multiply by 0.89 (since one kilogram equals 2.21 pounds and one hectare equals 2.47 acres).

Figure 3
Trend in Sulfate Deposition in Precipitation at
Washington Crossing State Park, New Jersey, 1990-2005:
Annual Loading



REFERENCES

FISH SMART, EAT SMART: A Guide to Health Advisories for Eating Fish & Crabs Caught in New Jersey Waters -2006, New Jersey Department of Environmental Protection (NJDEP), Division of Science, Research and Technology, 2006, URL: www.state.nj.us/dep/dsr/njmainfish.htm.

New Jersey Comparative Risk Project, Ecological Technical Work Group, NJDEP, Division of Science, Research and Technology, July 2003, URL: <http://www.state.nj.us/dep/dsr/njcrp/>.

United States Environmental Protection Agency (USEPA) Clean Air Markets, 2007, URL: <http://www.epa.gov/airmarkets/acidrain/index.html#what>.



Appendix A

2005 Air Monitoring Sites

New Jersey Department of Environmental Protection

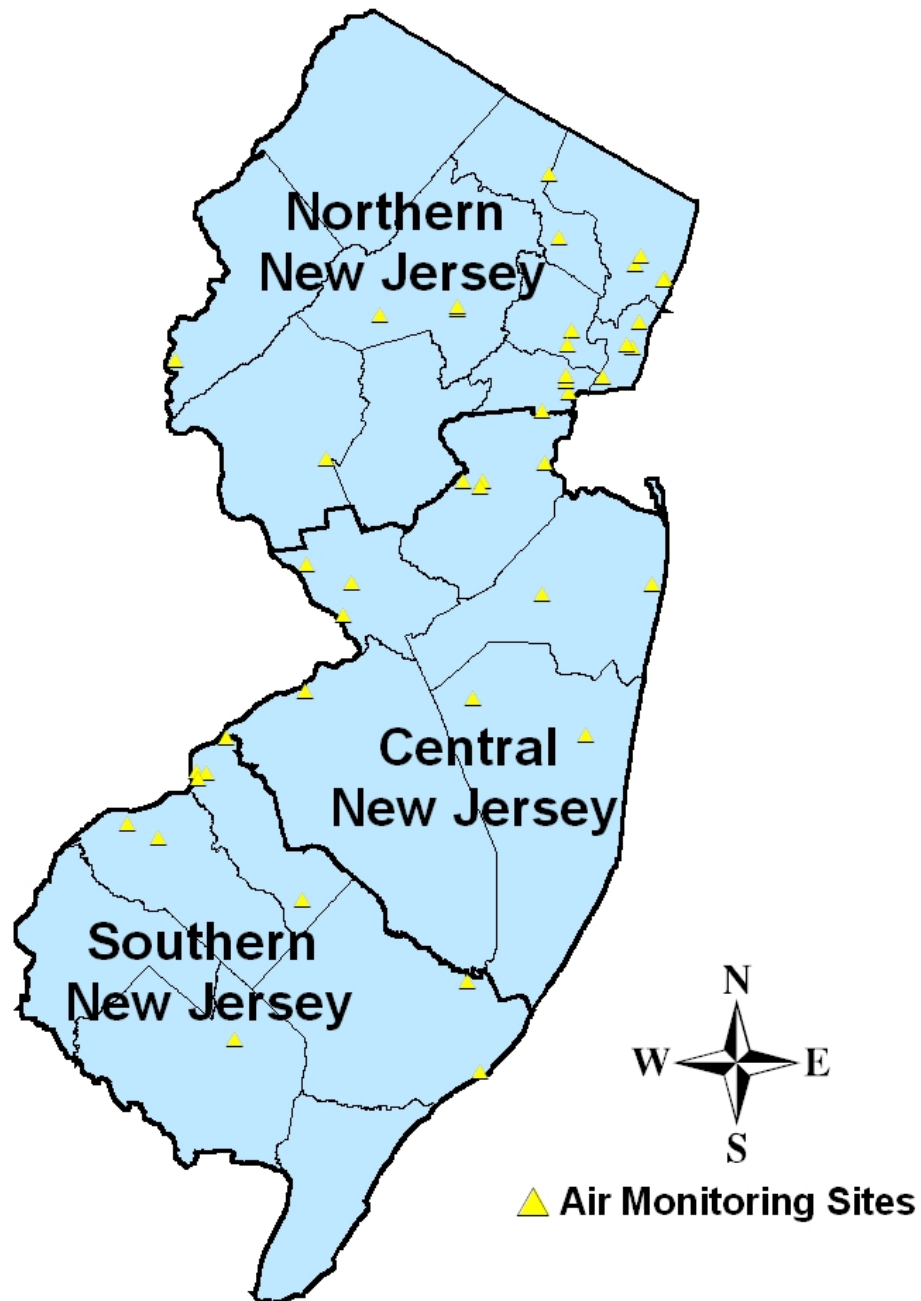


Figure 1
Northern New Jersey
Air Monitoring Sites

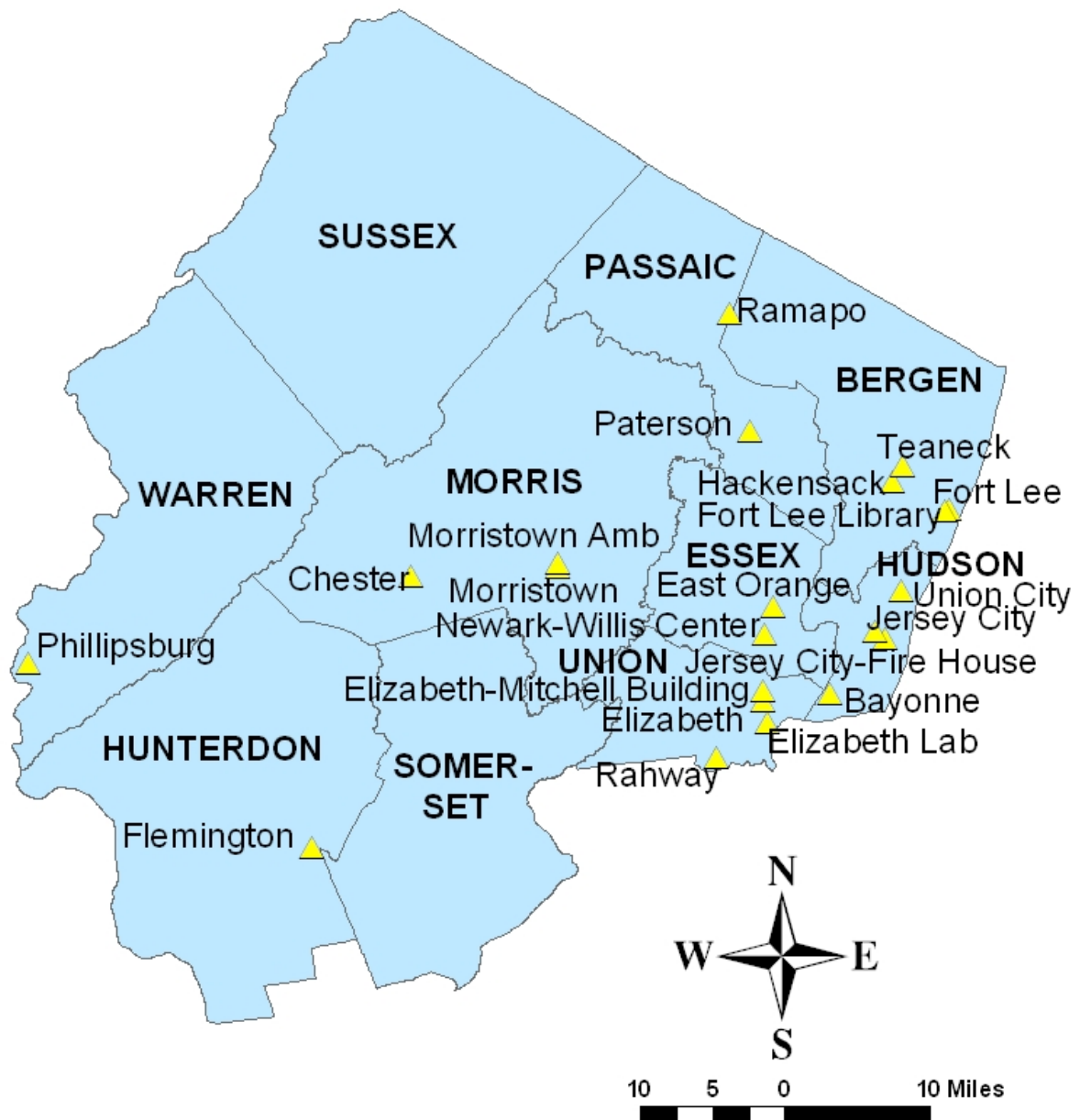


Table 1
Northern New Jersey Air Monitoring Sites

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Degrees-minutes-decimal seconds)		Address
				Latitude	Longitude	
BERGEN	Fort Lee	34 003 0004	CO, TEOM, PM ₁₀	40 51 15.7	- 73 58 05.7	Lemoine Avenue Overpass over I-95
	Fort Lee-Library	34 003 0003	PM _{2.5}	40 51 08.1	- 73 58 23.9	Fort Lee Public Library, 320 Main Street
	Hackensack	34 003 5001	CO, SO ₂ , SS	40 52 56.5	- 74 02 31.8	133 River St. near Moore & Mercer Streets
	Teaneck	34 003 0005	NO _x , O ₃	40 53 54.9	- 74 01 47.6	1000 River Road, Fairleigh Dickinson University
ESSEX	East Orange	34 013 1003	CO, NO _x , MET	40 45 27.0	- 74 12 02.0	Engine No. 2, Main Street & Greenwood
	Newark-Willis Center	34 013 0015	PM _{2.5}	40 43 49.0	- 74 12 45.9	Mary Willis Cultural Center 447 18 th Ave.
HUDSON	Bayonne	34 017 0006	NO _x , O ₃ , SO ₂	40 40 12.9	- 74 07 33.9	Veterans Park, 25 th St. near Park Road
	Jersey City	34 017 1002	CO, SO ₂ , SS	40 43 54.1	- 74 03 59.6	2828 Kennedy Blvd.
	Jersey City-Firehouse	34 017 1003	PM _{2.5} , PM ₁₀ , TEOM	40 43 31.6	- 74 03 08.2	Firehouse, 355 Newark Ave.
	Union City	34 017 2002	PM _{2.5}	40 46 21.9	-74 01 54.1	Health Department, 714 31 st Street
HUNTERDON	Flemington	34 019 0001	O ₃ , SS, MET	40 30 55.0	- 74 48 24.0	Raritan Twp. MUA, 365 Old York Road
MORRIS	Chester	34 027 3001	NO _x , O ₃ , SO ₂ , MET, PM _{2.5} , TOXICS	40 47 15.5	- 74 40 34.7	Bldg. #1, Lucent Tech., Route 513
	Morristown	34 027 0003	CO, SS	40 47 51.6	- 74 28 57.8	11 Washington St.
	Morristown-Ambulance Squad	34 027 0004	PM _{2.5}	40 48 05.7	- 74 29 01.7	Ambulance Squad, 16 Early St.
PASSAIC	Paterson	34 031 0005	PM _{2.5}	40 55 07.2	- 74 10 03.9	Health Department, 176 Broadway Ave.
	Ramapo	34 031 5001	O ₃	41 03 07.9	- 74 15 22.8	Access Road, off Skyline Drive, Wanaque Borough
UNION	Elizabeth	34 039 0003	CO, SO ₂ , SS	40 39 44.8	- 74 12 53.1	7 Broad St.
	Elizabeth Lab	34 039 0004	CO, NO _x , SO ₂ , SS, TEOM, MET, PM _{2.5} , TOXICS	40 38 29.2	- 74 12 30.1	Interchange 13, NJTP
	Elizabeth-Mitchell Building	34 039 0006	PM _{2.5}	40 40 24.3	- 74 12 50.7	Mitchell Bldg., 500 North Broad Street
	Rahway	34 039 2003	PM _{2.5} , TEOM	40 36 21.9	- 74 16 29.9	Fire Dept. Bldg., 1300 Main Street
WARREN	Phillipsburg	34 041 0006	PM _{2.5}	40 41 57.2	- 75 10 49.9	Municipal Bldg., 675 Corliss Avenue

¹ See Parameter Codes, Table 4 (page Appendix A-8)

Figure 2
Central New Jersey Air
Monitoring Sites

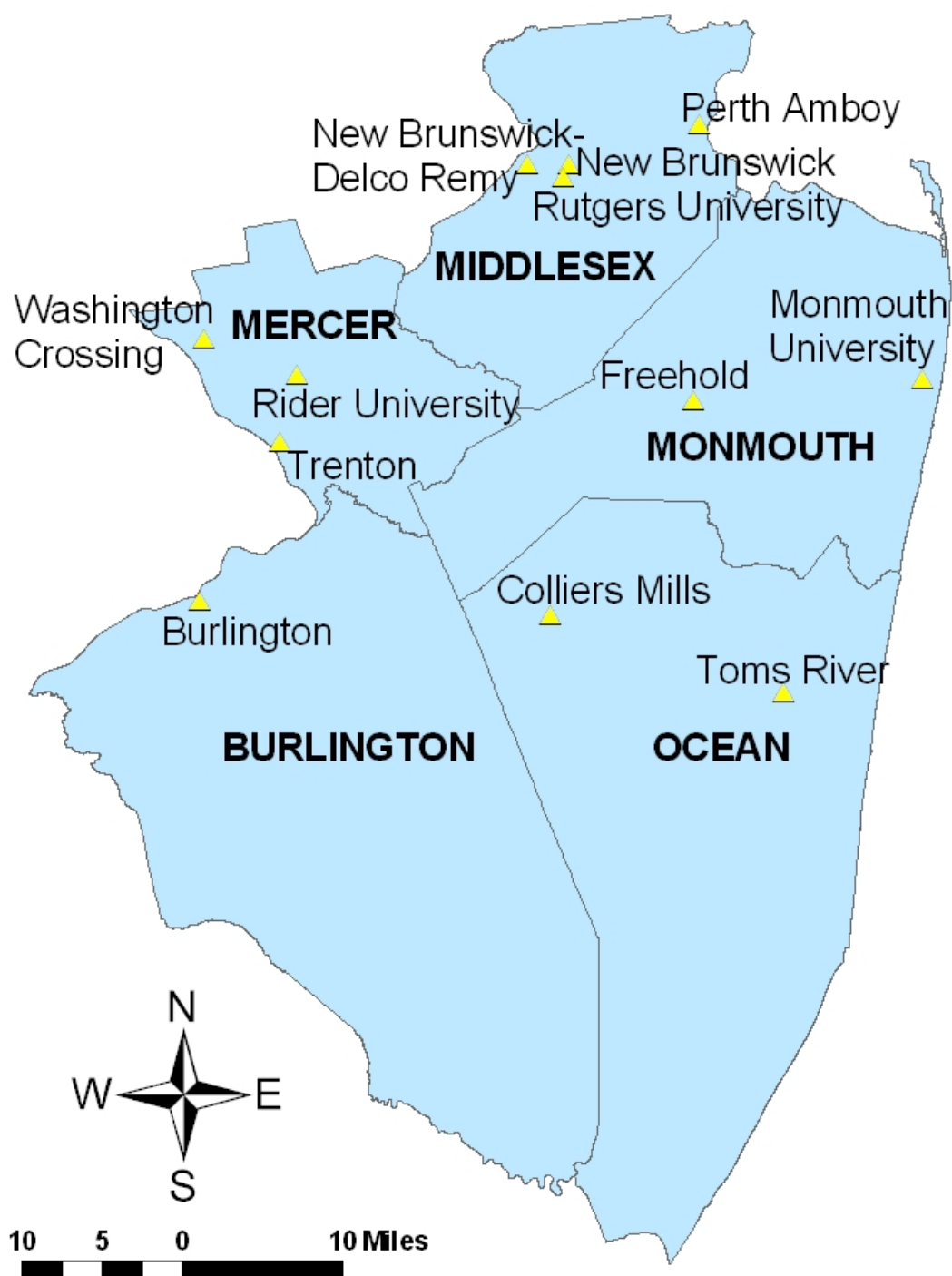


Table 2
Central New Jersey Air Monitoring Sites

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Degrees-minutes-decimal seconds)		Address
				Latitude	Longitude	
BURLINGTON	Burlington	34 005 1001	CO, SO ₂ , SS	40 04 41.0	- 74 51 27.8	1 East Broad Street
MERCER	Rider University	34 021 0005	NO _x , O ₃ , PAMS, MET	40 16 59.1	- 74 44 33.5	Athletic Fields, Route 206 South, Lawrenceville
	Trenton	34 021 0008	PM _{2.5} , PM ₁₀	40 13 20.2	- 74 45 47.3	Trenton Library, 120 Academy Street
	Washington Crossing	34 021 8001	PM _{2.5} , ACID	40 18 55.6	- 74 51 13.8	Washington Crossing State Park, off Church Road, Titusville
MIDDLESEX	New Brunswick	34 023 0006	TEOM, PM _{2.5} , TOXICS	40 28 22.0	- 74 25 21.1	Cook College, Log Cabin Road
	New Brunswick-Delco Remy	34 023 1003	Pb, TSP	40 28 22.6	- 74 28 15.0	End of 12 th Street, West of Joyce Kilmer Avenue
	Perth Amboy	34 023 2003	CO, SO ₂ , SS	40 30 32.0	- 74 16 05.5	130 Smith Street, Perth Amboy
	Rutgers University	34 023 0011	NO _x , O ₃ , MET, PAMS	40 27 43.9	- 74 25 46.0	Horticultural Farm #3, off Ryder's Lane, New Brunswick
MONMOUTH	Freehold	34 025 2001	CO, SS	40 15 35.6	- 74 16 28.9	5 West Main Street
	Monmouth University	34 025 0005	O ₃	40 16 42.5	- 74 00 19.2	Edison Science Bldg., 400 Cedar Ave., West Long Branch
OCEAN	Colliers Mills	34 029 0006	O ₃	40 03 53.4	- 74 26 38.5	Colliers Mills Wildlife Management Area
	Toms River	34 029 2002	PM _{2.5}	39 59 40.8	- 74 10 12.5	Elementary School, 1517 Hooper Avenue

¹ See Parameter Codes, Table 4 (page Appendix A-8)

Figure 3
Southern New Jersey
Air Monitoring Sites



Table 3
Southern New Jersey Air Monitoring Sites

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Degrees-minutes-decimal seconds)		Address
				Latitude	Longitude	
ATLANTIC	Atlantic City	34 001 1006	PM _{2.5} , PM ₁₀	39 21 45.5	- 74 25 45.6	Atlantic-Cape May Community College, 1535 Bacharach Blvd., Atlantic City
	Nacote Creek Research Station	34 001 0005	O ₃ , SO ₂	39 31 48.9	- 74 27 38.5	Brigantine National Wildlife Refuge near Smithville
CAMDEN	Ancora State Hospital	34 007 1001	CO, O ₃ , SO ₂ , ACID	39 41 03.3	- 74 51 41.4	Ancora State Hospital, 202 Spring Garden Road, Hammonton
	Camden CMUA	34 007 0010	TEOM	39 55 26.4	- 75 07 20.6	Camden County Sewage Treatment Plant, 1645 Ferry Avenue
	Camden Lab	34 007 0003	CO, NO _x , O ₃ , SO ₂ , SS, TEOM, MET, PAMS, PM _{2.5} , TOXICS	39 55 23.0	- 75 05 51.4	1667 Davis Street, corner of Copewood St.
	Camden-RRF	34 007 0009	PM ₁₀	39 54 44.9	- 75 07 04.0	Camden RRF, Morgan Blvd. & I-676
	Pennsauken	34 007 1007	PM _{2.5}	39 59 19.9	- 75 02 57.0	Morris-Delair WTP, near Griffith Morgan Lane
CUMBERLAND	Millville	34 011 0007	NO _x , O ₃ , SO ₂	39 25 20.2	- 75 01 30.7	Lincoln Avenue & Route 55
GLOUCESTER	Clarksboro	34 015 0002	O ₃ , SO ₂	39 48 01.2	- 75 12 43.6	Clarksboro Shady Lane Rest Home, County House Road
	Gibbstown	34 015 5001	PM _{2.5}	39 49 32.6	- 75 17 21.8	Municipal Building, 420 Washington Street

¹ See Parameter Codes, Table 4 (page Appendix A-8)

Table 4
Parameter Codes

ACID	Acid Deposition	PM _{2.5}	Fine Particles (2.5 Microns or less) collected by a Federal Reference Method PM _{2.5} Sampler
CO	Carbon Monoxide	TEOM	Continuous PM _{2.5} Analyzer
MET	Meteorological Parameters	SO ₂	Sulfur Dioxide
NO _x	Nitrogen Dioxide and Nitric Oxide	SS	Smoke Shade
O ₃	Ozone	Pb	Lead
PAMS	Photochemical Assessment Monitoring Station	TOXICS	Air Toxics
PM ₁₀	Coarse Particles (10 Microns or less) collected by a Federal Reference Method PM ₁₀ Sampler	TSP	Total Suspended Particulates



Appendix B

Fine Particulate Speciation Summary- 2005

New Jersey Department of Environmental Protection

Table 1
Fine Particulate Speciation Data – 2005
Camden Lab, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Aluminum	0.0188	0.1341	0.1120
Ammonium	1.9596	6.4489	4.8040
Antimony	0.0072	0.0548	0.0537
Arsenic	0.0011	0.0060	0.0051
Barium	0.0166	0.2113	0.1202
Bromine	0.0040	0.0451	0.0117
Cadmium	0.0020	0.0160	0.0153
Calcium	0.0620	0.2679	0.2493
Cerium	0.0102	0.0768	0.0670
Cesium	0.0007	0.0217	0.0178
Chlorine	0.0222	0.5371	0.3115
Chromium	0.0032	0.0339	0.0146
Cobalt	0.0001	0.0011	0.0011
Copper	0.0056	0.0218	0.0215
Elemental carbon	0.7027	2.4036	2.3505
Europium	0.0017	0.0267	0.0191
Gallium	0.0007	0.0055	0.0048
Gold	0.0009	0.0061	0.0050
Hafnium	0.0017	0.0111	0.0101
Indium	0.0026	0.0153	0.0152
Iridium	0.0009	0.0086	0.0068
Iron	0.1169	0.4064	0.3724
Lanthanum	0.0074	0.0599	0.0562
Lead	0.0043	0.0175	0.0134
Magnesium	0.0050	0.0927	0.0544
Manganese	0.0028	0.0188	0.0156
Mercury	0.0024	0.0332	0.0117
Molybdenum	0.0002	0.0042	0.0038
Nickel	0.0039	0.0191	0.0126
Niobium	0.0003	0.0051	0.0041
Nitrate	2.1018	8.3617	8.1652

Table 1 (Continued)
Fine Particulate Speciation Data – 2005
Camden Lab, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Organic carbon	4.0894	8.5234	8.4416
Phosphorus	0.0000	0.0032	0.0000
Potassium	0.0651	0.3358	0.2013
Rubidium	0.0003	0.0021	0.0019
Samarium	0.0021	0.0292	0.0153
Scandium	0.0001	0.0016	0.0016
Selenium	0.0015	0.0077	0.0049
Silicon	0.0770	0.5653	0.3563
Silver	0.0019	0.0165	0.0151
Sodium	0.1197	1.2464	0.5471
Strontium	0.0014	0.0059	0.0056
Sulfate	4.2237	17.5730	14.9241
Sulfur	1.4450	5.9500	5.2460
Tantalum	0.0012	0.0125	0.0120
Terbium	0.0055	0.0440	0.0305
Tin	0.0057	0.0420	0.0337
Titanium	0.0076	0.0393	0.0327
Total mass	16.1116	51.5836	49.3190
Vanadium	0.0061	0.0328	0.0221
Wolfram	0.0010	0.0071	0.0070
Yttrium	0.0006	0.0064	0.0035
Zinc	0.0136	0.0749	0.0422
Zirconium	0.0023	0.0476	0.0123

Table 2
Fine Particulate Speciation Data – 2005
Chester, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Aluminum	0.0101	0.0502	0.0489
Ammonium	1.4786	5.5199	5.5104
Antimony	0.0059	0.0724	0.0685
Arsenic	0.0007	0.0040	0.0034
Barium	0.0112	0.2077	0.1050
Bromine	0.0028	0.0068	0.0067
Cadmium	0.0020	0.0186	0.0176
Calcium	0.0206	0.0725	0.0699
Cerium	0.0062	0.0572	0.0477
Cesium	0.0025	0.0263	0.0262
Chlorine	0.0031	0.0302	0.0249
Chromium	0.0035	0.1140	0.0300
Cobalt	0.0002	0.0015	0.0013
Copper	0.0018	0.0112	0.0057
Elemental carbon	0.3899	2.6056	1.0928
Europium	0.0012	0.0109	0.0085
Gallium	0.0007	0.0056	0.0055
Gold	0.0010	0.0126	0.0093
Hafnium	0.0012	0.0110	0.0099
Indium	0.0027	0.0238	0.0179
Iridium	0.0008	0.0070	0.0057
Iron	0.0451	0.3979	0.1235
Lanthanum	0.0039	0.0561	0.0351
Lead	0.0032	0.0134	0.0129
Magnesium	0.0044	0.1151	0.0652
Manganese	0.0011	0.0140	0.0060
Mercury	0.0017	0.0086	0.0077
Molybdenum	0.0003	0.0049	0.0044
Nickel	0.0025	0.0347	0.0182
Niobium	0.0006	0.0063	0.0052
Nitrate	1.1909	7.3583	5.1231
Organic carbon	3.0902	10.6298	7.4595
Phosphorus	0.0001	0.0054	0.0037
Potassium	0.0370	0.1695	0.0963
Rubidium	0.0003	0.0036	0.0016
Samarium	0.0015	0.0231	0.0121
Scandium	0.0002	0.0029	0.0019
Selenium	0.0011	0.0046	0.0044

Table 2 (Continued)
Fine Particulate Speciation Data – 2005
Chester, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Silicon	0.0307	0.2078	0.1775
Silver	0.0026	0.0244	0.0181
Sodium	0.0591	0.2836	0.2002
Strontium	0.0008	0.0038	0.0031
Sulfate	3.9331	19.0725	18.2442
Sulfur	1.2423	6.4550	6.0356
Tantalum	0.0012	0.0182	0.0109
Terbium	0.0022	0.0380	0.0124
Tin	0.0050	0.0405	0.0299
Titanium	0.0024	0.0097	0.0088
Total mass	11.9954	44.1374	41.7140
Vanadium	0.0022	0.0100	0.0086
Wolfram	0.0014	0.0193	0.0118
Yttrium	0.0007	0.0034	0.0032
Zinc	0.0072	0.0196	0.0194
Zirconium	0.0025	0.0706	0.0462

Table 3
Fine Particulate Speciation Data – 2005
Elizabeth Lab, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Aluminum	0.0307	0.8281	0.1561
Ammonium	2.0579	6.7192	6.4150
Antimony	0.0077	0.0734	0.0698
Arsenic	0.0010	0.0059	0.0042
Barium	0.0157	0.1360	0.1140
Bromine	0.0042	0.0292	0.0110
Cadmium	0.0022	0.0217	0.0191
Calcium	0.0600	0.2689	0.1936
Cerium	0.0096	0.0739	0.0512
Cesium	0.0008	0.0180	0.0162
Chlorine	0.0460	0.8680	0.5327
Chromium	0.0095	0.2794	0.1004
Cobalt	0.0002	0.0023	0.0020
Copper	0.0084	0.0651	0.0643
Elemental carbon	1.7846	5.7169	5.1478
Europium	0.0018	0.0227	0.0177
Gallium	0.0005	0.0058	0.0031
Gold	0.0010	0.0159	0.0097
Hafnium	0.0016	0.0122	0.0120
Indium	0.0021	0.0213	0.0143
Iridium	0.0007	0.0085	0.0057
Iron	0.1773	1.0332	0.5029
Lanthanum	0.0069	0.0671	0.0549
Lead	0.0051	0.0146	0.0142
Magnesium	0.0079	0.0834	0.0748
Manganese	0.0035	0.0144	0.0127
Mercury	0.0017	0.0204	0.0093
Molybdenum	0.0004	0.0123	0.0056
Nickel	0.0082	0.0912	0.0525
Niobium	0.0004	0.0048	0.0041
Nitrate	2.1636	9.3276	8.9357
Organic carbon	5.2929	12.6196	12.0494
Phosphorus	0.0001	0.0120	0.0000
Potassium	0.0598	0.7841	0.2384
Rubidium	0.0003	0.0026	0.0020
Samarium	0.0019	0.0236	0.0140
Scandium	0.0001	0.0020	0.0019
Selenium	0.0014	0.0054	0.0051

Table 3 (Continued)
Fine Particulate Speciation Data – 2005
Elizabeth Lab, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Silicon	0.0642	0.5105	0.2238
Silver	0.0029	0.0177	0.0152
Sodium	0.1077	0.8023	0.5424
Strontium	0.0016	0.0131	0.0119
Sulfate	4.1368	16.8884	16.5916
Sulfur	1.3578	5.9537	5.3301
Tantalum	0.0012	0.0119	0.0116
Terbium	0.0071	0.0541	0.0343
Tin	0.0045	0.0385	0.0268
Titanium	0.0067	0.0248	0.0215
Total mass	0.0091	0.0378	0.0355
Vanadium	0.0016	0.0249	0.0164
Wolfram	0.0004	0.0044	0.0040
Yttrium	0.0207	0.1143	0.0913
Zinc	0.0013	0.0055	0.0055
Zirconium	0.0016	0.0131	0.0119

Table 4
Fine Particulate Speciation Data – 2005
New Brunswick, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Aluminum	0.0167	0.2994	0.0934
Ammonium	1.6947	4.9548	4.6052
Antimony	0.0062	0.0629	0.0571
Arsenic	0.0012	0.0047	0.0046
Barium	0.0109	0.1635	0.1110
Bromine	0.0033	0.0151	0.0085
Cadmium	0.0025	0.0197	0.0186
Calcium	0.0285	0.1361	0.1163
Cerium	0.0084	0.0634	0.0505
Cesium	0.0014	0.0330	0.0313
Chlorine	0.0199	0.4803	0.4450
Chromium	0.0053	0.2358	0.0345
Cobalt	0.0002	0.0021	0.0018
Copper	0.0071	0.2485	0.0507
Elemental carbon	0.6836	2.7916	2.3039
Europium	0.0014	0.0134	0.0103
Gallium	0.0005	0.0034	0.0027
Gold	0.0007	0.0062	0.0062
Hafnium	0.0019	0.0130	0.0118
Indium	0.0025	0.0210	0.0201
Iridium	0.0003	0.0061	0.0038
Iron	0.0891	0.8622	0.2629
Lanthanum	0.0031	0.0565	0.0443
Lead	0.0052	0.0217	0.0216
Magnesium	0.0052	0.0734	0.0582
Manganese	0.0031	0.0257	0.0249
Mercury	0.0017	0.0103	0.0099
Molybdenum	0.0002	0.0051	0.0043
Nickel	0.0042	0.0776	0.0336
Niobium	0.0004	0.0049	0.0048
Nitrate	1.6697	7.8079	6.7919
Organic carbon	3.8247	8.2941	8.2222
Phosphorus	0.0001	0.0048	0.0046
Potassium	0.0548	0.6283	0.3315
Rubidium	0.0004	0.0026	0.0019
Samarium	0.0012	0.0169	0.0105
Scandium	0.0001	0.0022	0.0021
Selenium	0.0012	0.0052	0.0050

Table 4 (Continued)
Fine Particulate Speciation Data – 2005
New Brunswick, New Jersey

Concentrations in Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2nd Highest Concentration
Silicon	0.0330	0.2820	0.1638
Silver	0.0023	0.0182	0.0122
Sodium	0.1028	0.7692	0.7667
Strontium	0.0010	0.0112	0.0067
Sulfate	3.9550	15.5291	14.8919
Sulfur	1.3471	6.1222	5.2079
Tantalum	0.0008	0.0097	0.0089
Terbium	0.0047	0.0785	0.0183
Tin	0.0045	0.0331	0.0315
Titanium	0.0044	0.0176	0.0155
Total mass	13.8028	39.6203	36.0239
Vanadium	0.0035	0.0204	0.0144
Wolfram	0.0009	0.0090	0.0084
Yttrium	0.0006	0.0043	0.0036
Zinc	0.0149	0.1820	0.0663
Zirconium	0.0013	0.0068	0.0062