



2004 Air Quality Report

New Jersey Department of Environmental Protection

SUMMARY

A summary of the New Jersey air quality monitoring data for 2004. Contains information on the Air Quality Index (AQI), concentrations of individual pollutants – carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur dioxide. Data on acid precipitation, sulfates, nitrates and other constituents of particulate matter, ozone precursors and toxic air contaminants are also provided.



Comprehensive Air Monitoring Station – Camden, New Jersey



2004 Air Quality Report

New Jersey Department of Environmental Protection

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2004 Introduction

New Jersey Department of Environmental Protection

INTRODUCTION

The State of New Jersey has been monitoring air quality for over 30 years. During that time, pollution levels have improved significantly. This is a result of state regulations, which are among the more stringent in the country, as well as regional and national air pollution reduction efforts.

But air quality problems do remain in the state. Ozone continues to be a significant problem in the summer months, and has been found to have serious health effects at lower levels than previously thought. The United States Environmental Protection Agency (USEPA) revised the NAAQS for ozone in 1997 to account for this new health information. Although the standard changes were challenged, the courts eventually upheld them. If the new standards for ozone are to be met, additional emission reduction strategies will have to be implemented.

At the same time the USEPA revised the standards for ozone, they promulgated a new standard for fine particles. Fine particles are defined as particles less than 2.5 micrometers in diameter and are referred to as PM2.5. These small particles have been found to have a greater impact on public health than larger particles, which were the focus of the previous standards. Monitoring data indicate PM2.5 levels in New Jersey are likely to be a problem in some areas of the state.

In addition to ozone and PM2.5, there is increasing concern about a class of air pollutants termed "air toxics". These pollutants include substances known to cause cancer or other serious health problems. The list of potential air toxics is very large and includes many different types of compounds from heavy metals to toxic volatile organic compounds such as benzene. New Jersey is using the results of an EPA air toxics study and other information to address this complex problem. More comprehensive monitoring of air toxics in New Jersey is being implemented and data from that program is presented in this report.

Questions or comments concerning this report can be made by e-mailing us at bamweb@dep.state.nj.us, by phone at (609) 292-0138 or by writing to us at:

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2004 Network Summary

New Jersey Department of Environmental Protection

NETWORK DESIGN

In 2004, 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 trailer located at the Rider University site

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
2004 – Continuous Monitoring Network

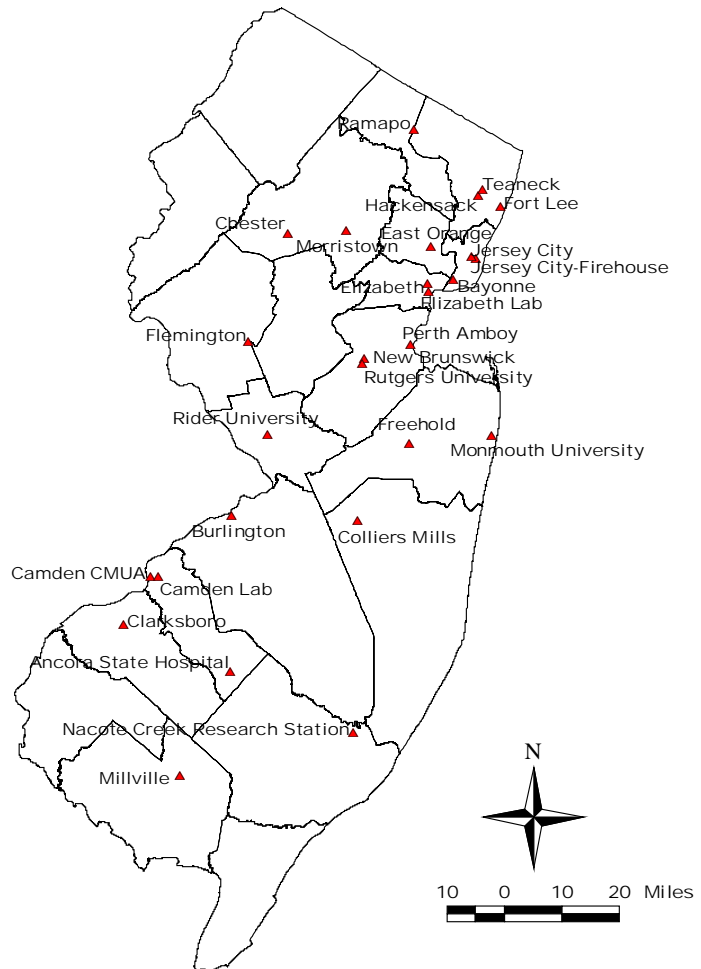


Table 1

2003-2004 Continuous Network Changes			
Monitoring Site	Parameter(s)	Action	Date
Camden CMUA	TEOM	Start-up	11/20/03
¹ Camden Lab	CO,NO ₂ ,O ₃ ,SO ₂ , SS,TEOM,MET	Temporary shutdown	09/22/03
Camden Lab	CO,NO ₂ ,O ₃ ,SO ₂ , SS,TEOM,MET	Start-up	01/01/04
Clarksboro	O ₃ ,SO ₂	Site relocated on same property	12/15/04
Fort Lee	CO,TEOM	Temporary Shutdown	10/04/04
² Newark Lab	CO,NO ₂ ,O ₃ ,SO ₂ , SS,TEOM	Temporary shutdown	06/04/03

¹The site was temporarily shutdown to replace the old monitoring shelter.

²The area where the site was located is under redevelopment. A replacement site is in the process of being established.

Table 2
2004 – Continuous Air Monitoring Network

Continuous Parameter Codes

- | | | | |
|-----------------------|-------------------------------------|-------------|---|
| CO | - Carbon Monoxide | SS | - Smoke Shade |
| NO_x | - Nitrogen Dioxide and Nitric Oxide | TEOM | - Continuous PM _{2.5} Analyzer |
| O₃ | - Ozone | MET | - Meteorological Parameters |
| SO₂ | - Sulfur Dioxide | | |

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			
Monmouth University			N				
Morristown	Mi				N		
Nacote Creek Research Station			U	U			
New Brunswick						N	
Perth Amboy	N			N	N		
Ramapo			U				
Rider University		N	N				U
Rutgers University		N	N				U
Teaneck		N	N				
TOTAL	12	9	14	13	10	6	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 PM₁₀), 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
2004 – Manual Monitoring Network

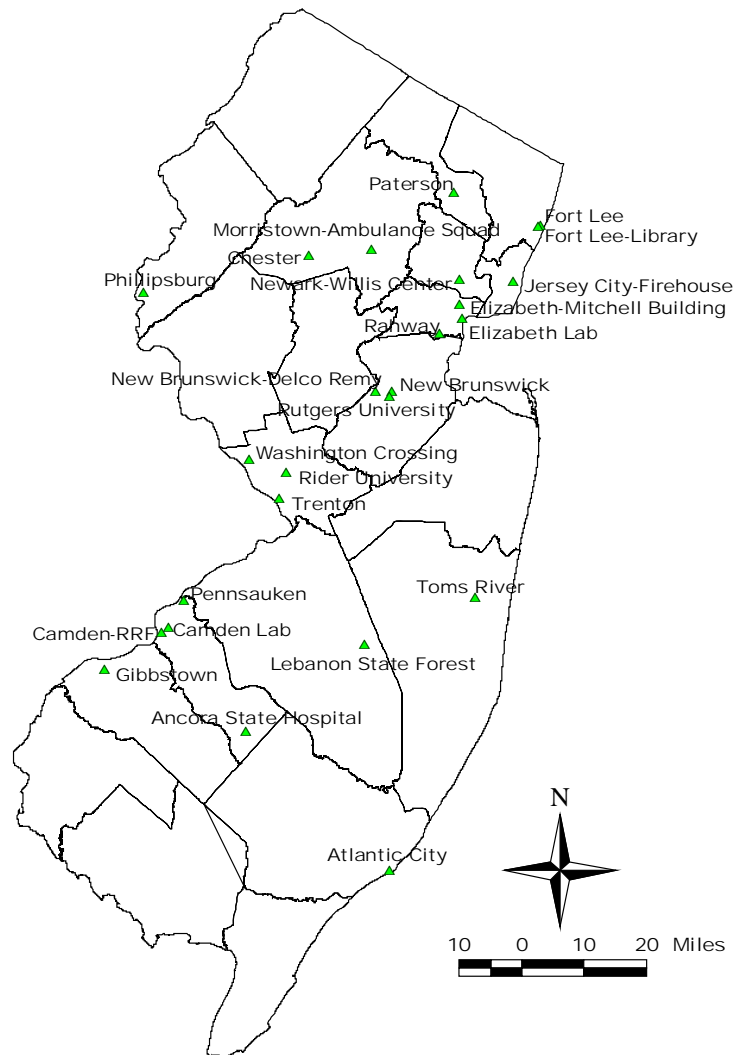


Table 3

2003-04' Manual Network Changes			
Monitoring Site	Parameter(s)	Action	Date
³ Camden Lab	PM _{2.5} , PM ₁₀	Temporary shutdown	09/12/03
Camden Lab	PM _{2.5}	Start-up	01/01/04
Camden Lab	PM ₁₀	Start-up	02/15/04
Fort Lee	PM ₁₀	Temporary shutdown	10/04/04
⁴ Newark Lab	PM _{2.5} , PM ₁₀	Temporary shutdown	06/04/03

³The site was temporarily shutdown to replace the old monitoring shelter.

⁴ The area where the site was located is under redevelopment. A replacement site is in the process of being established.

**Table 4
2004 - 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								
Lebanon State Forest										U
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								
Washington Crossing	N									U
TOTAL	18	6	1	1	4	3	4	4	2	3

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

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2004 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 www.epa.gov/airnow/aqibroch.

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 an air quality summary for the previous day, and a forecast are prepared using the AQI format. These are provided to the Associated Press wire service, the New York Times, and 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. An extended forecast consisting of the

expected descriptor ratings over the next 72-hour period is also provided for each reporting region on weekdays. A telephone recording of the AQI forecast is taped by 11 a.m., Monday-Friday, and can be heard by dialing **1-800-782-0160**.

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

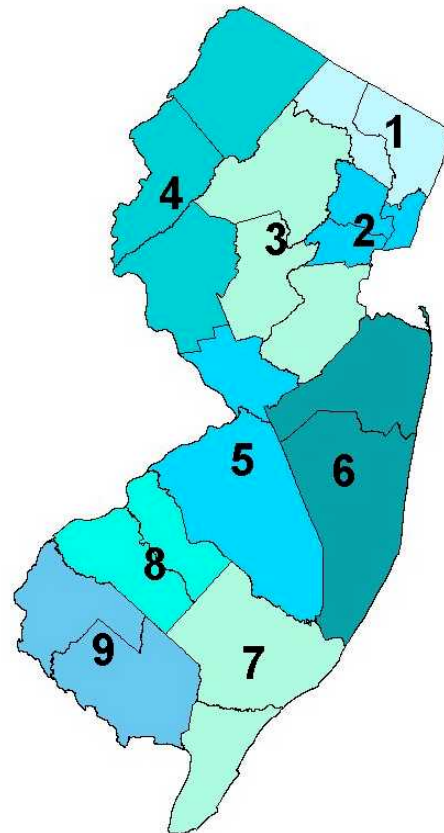


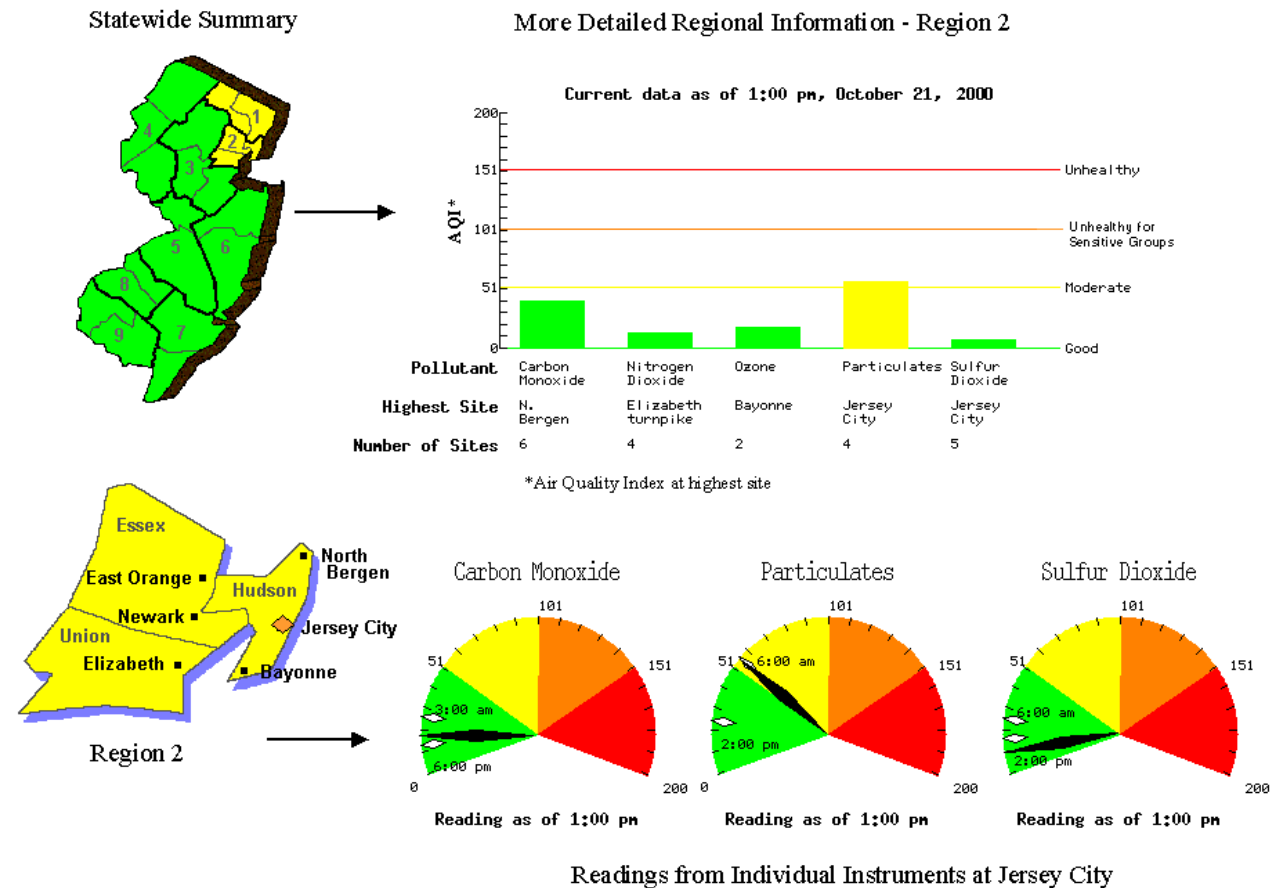
Table 2
Pollutants Monitored According to Air Quality Index Reporting Region - 2004

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 ozone forecast map, introduced during the 1996 ozone season, is televised on New Jersey Network's (NJN) TV News Broadcast. After the ozone season, an air quality forecast map is substituted. 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:

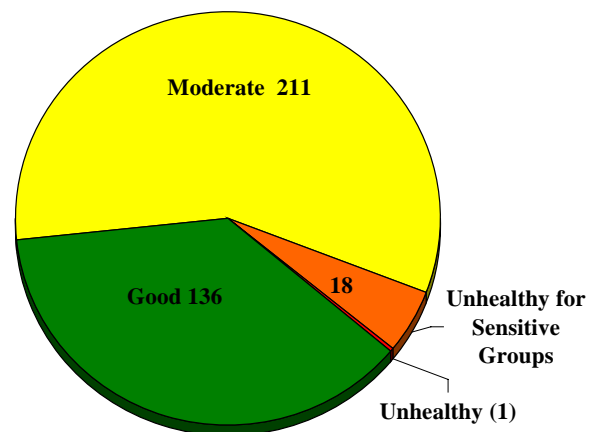
Figure 2
Examples of NJDEP's Air Monitoring Website



2004 AQI SUMMARY

A summary of the AQI ratings for New Jersey in 2004 is presented in the pie chart to the right. In 2004 there were 136 "Good" days, 211 were "Moderate", 18 were rated "Unhealthy for Sensitive Groups", 1 was 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 nineteen. 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



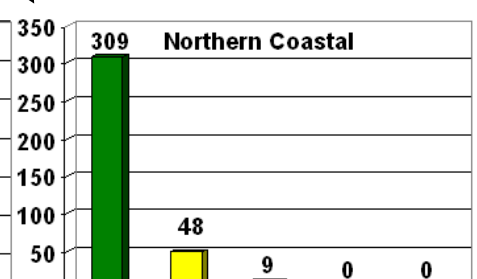
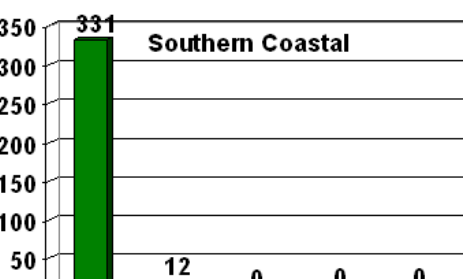
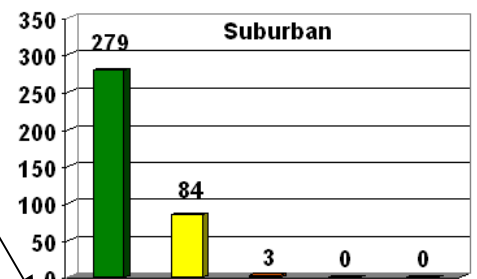
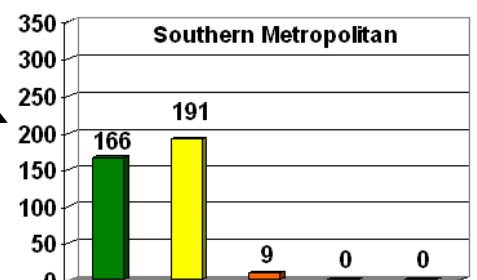
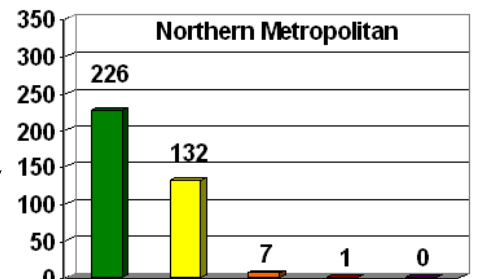
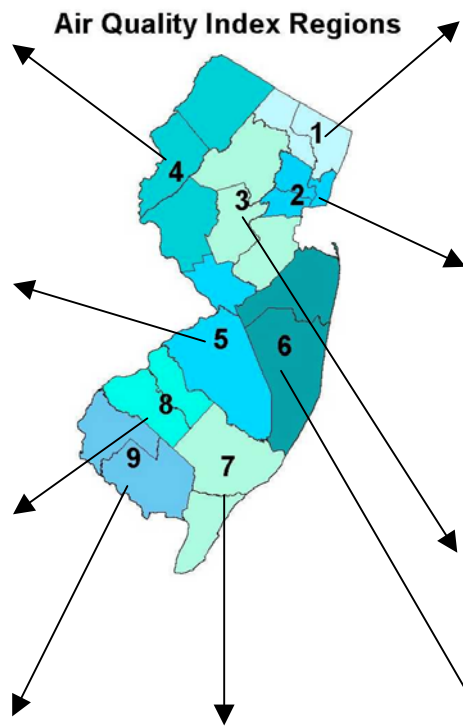
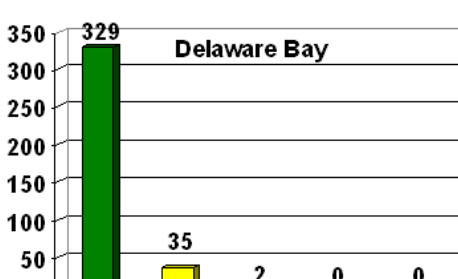
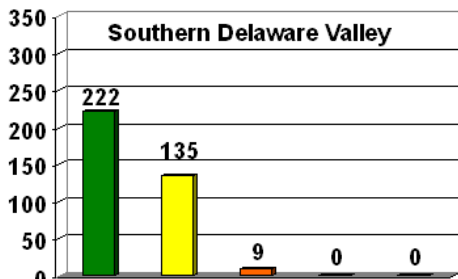
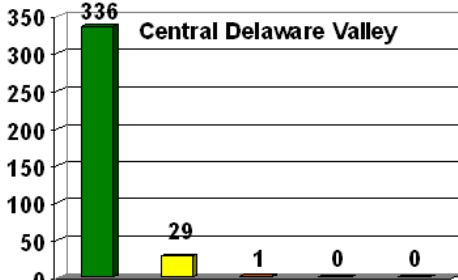
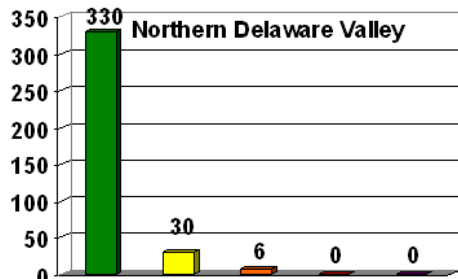
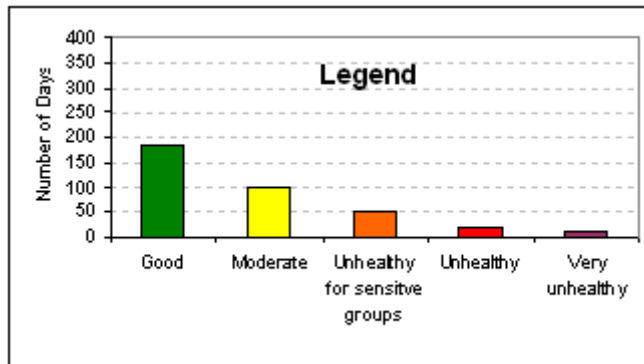
**Table 3
Air Quality Index (AQI) Exceedances of 100 During 2004**

	<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 18	Camden/Clarksboro	101	O3	USG	O3 (2)	
April 19	Colliers Mills	101	O3	USG	O3 (1)	
May 11	Colliers Mills	124	O3	USG	O3 (2)	
May 12	South Camden	114	PM	USG	O3 (2)	PM (5)
May 13	Elizabeth Lab	132	PM	USG		PM (3)
June 08	Rutgers University	137	O3	USG	O3 (5)	PM (2)
June 09	Colliers Mills	147	O3	USG	O3 (4)	PM (4)
June 16	Ramapo	114	O3	USG	O3 (1)	
June 24	Flemington	114	O3	USG	O3 (1)	
June 30	Colliers Mills	101	O3	USG	O3 (1)	
July 01	Flemington	101	O3	USG	O3 (1)	
July 02	Clarksboro	119	O3	USG	O3 (5)	
July 21	Ancora S.H.	147	O3	USG	O3 (5)	PM (1)
July 22	Fort Lee	151	PM	UH	O3 (7)	PM (6)
July 23	Elizabeth Lab	124	PM	USG		PM (2)
August 04	Monmouth University	137	O3	USG	O3 (2)	
August 20	South Camden	110	PM	USG		PM (4)
November 18	Jersey City Firehouse	102	PM	USG		PM (1)
December 22	Elizabeth Lab	104	PM	USG		PM (1)

Figure 4
2004 Air Quality Index Summary
Number of Days by Reporting Region



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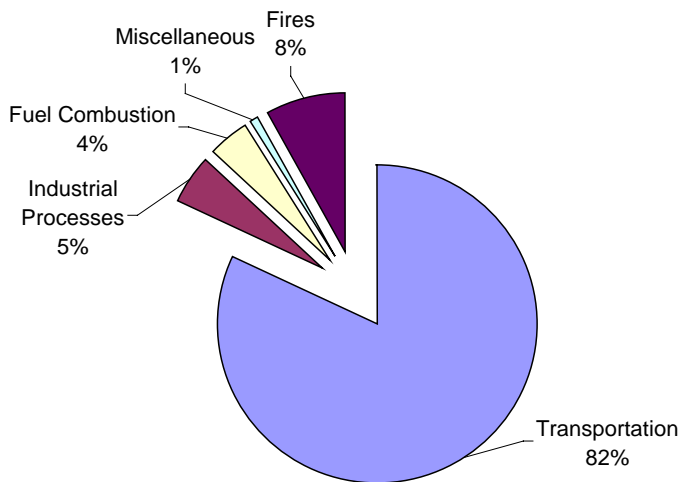
2004 Carbon Monoxide Summary

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.

**Figure 1
National Summary of 2002
CO Emissions by Source Category**

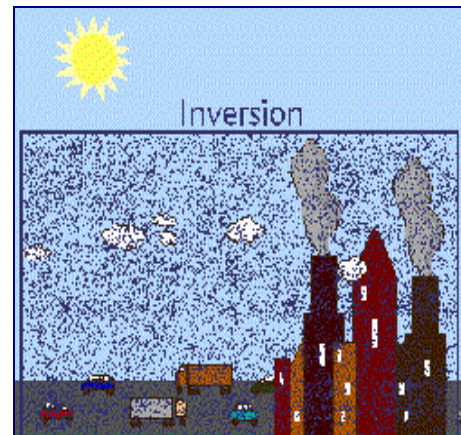
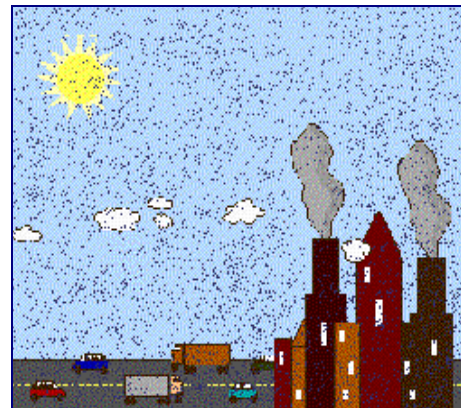


Source: USEPA National Air Quality Emissions Trends Report, 2003 Special Studies, September 2003

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.

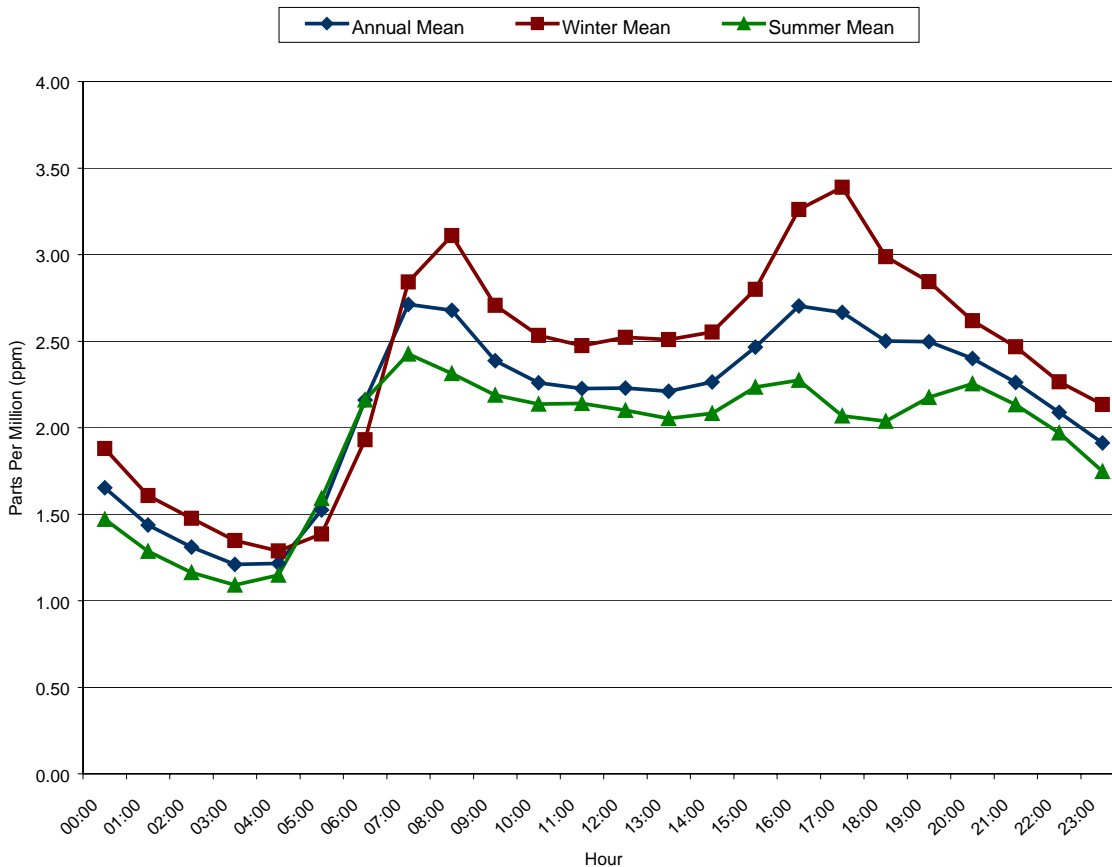
New Jersey state standards for CO are based on different units (milligrams per cubic meter as

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 2004. These sites are shown in the map in Figure 4. The site in Fort Lee was shut down in October 2004 to allow for renovations to the overpass on which it was located.

CO LEVELS IN 2004

None of the monitoring sites recorded exceedances of any CO standard during 2004. The maximum one-hour average concentration recorded was 8.6 ppm at the site in Freehold. The highest 8-hour average level recorded was 3.9 ppm, at the downtown Elizabeth site. Summaries of the 2004 data are provided in Figure 5 and Table 2 (page 4).

Figure 4
2004 Carbon Monoxide
Monitoring Network

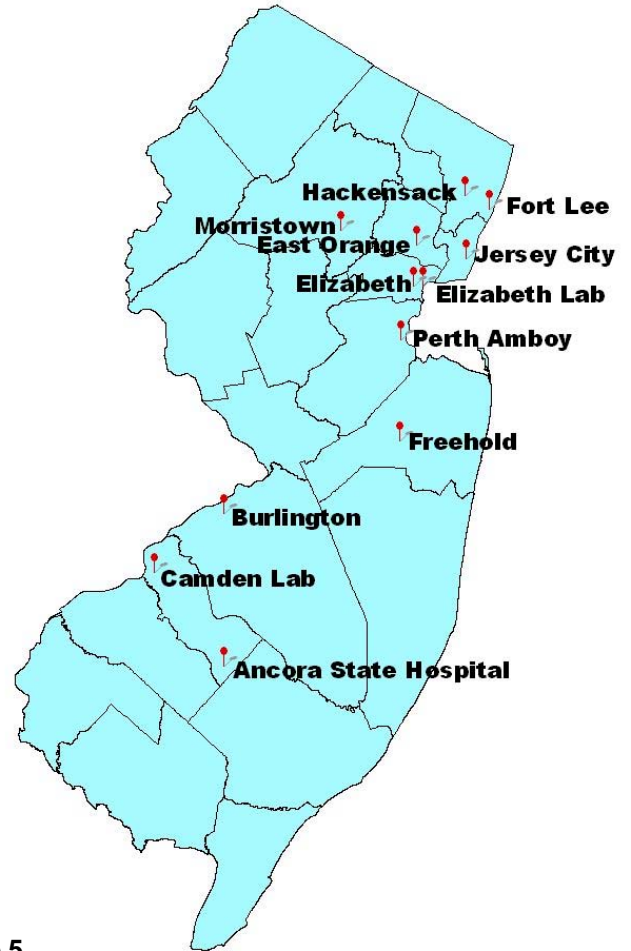
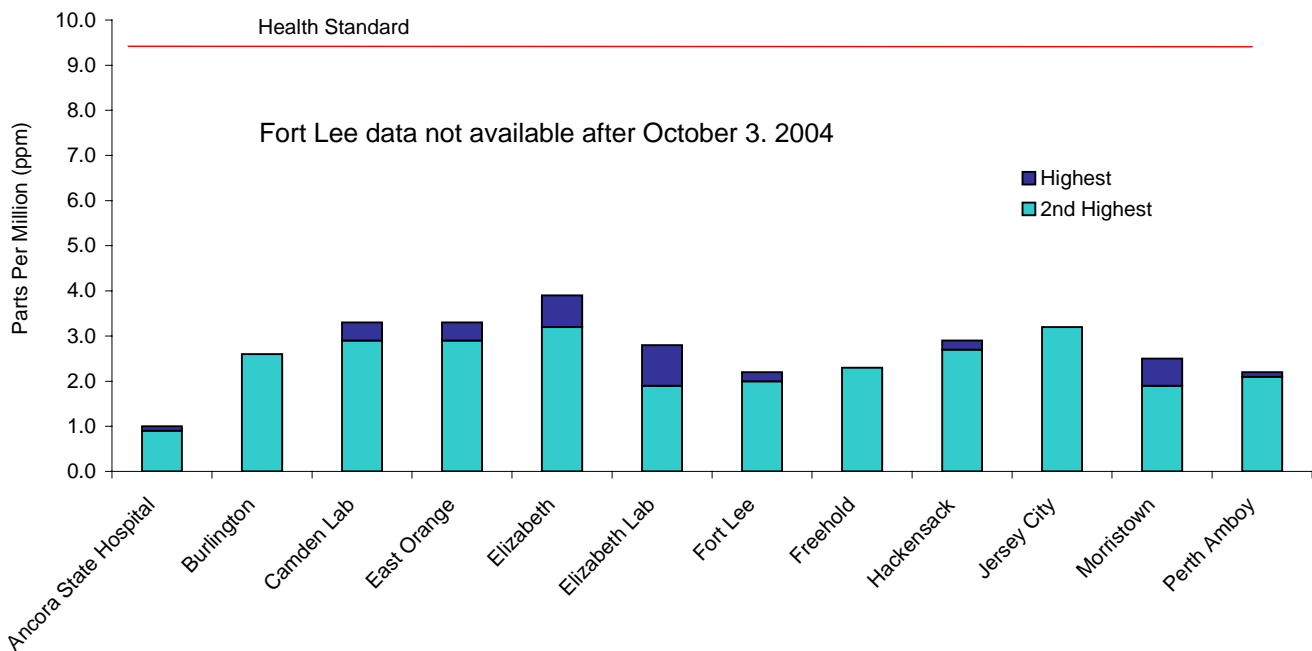


Figure 5
Highest and 2nd Highest 8-Hour Averages
of Carbon Monoxide in New Jersey - 2004



**Table 2
Carbon Monoxide Data – 2004
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	1.6	1.4	1.0	0.9
Burlington	4.3	4.0	2.6	2.6
Camden Lab	3.7	3.7	3.3	2.9
East Orange	5.5	5.3	3.3	2.9
Elizabeth	5.5	5.4	3.9	3.2
Elizabeth Lab	5.1	4.3	2.8	1.9
Fort Lee ¹	3.3	2.8	2.2	2.0
Freehold	8.6	3.6	2.3	2.3
Hackensack	4.3	4.1	2.9	2.7
Jersey City	4.6	4.1	3.2	3.2
Morristown	3.2	3.1	2.5	1.9
Perth Amboy	3.7	3.5	2.2	2.1

¹ Data not available after October 3, 2004

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 second highest 8-hour 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 1985-2004

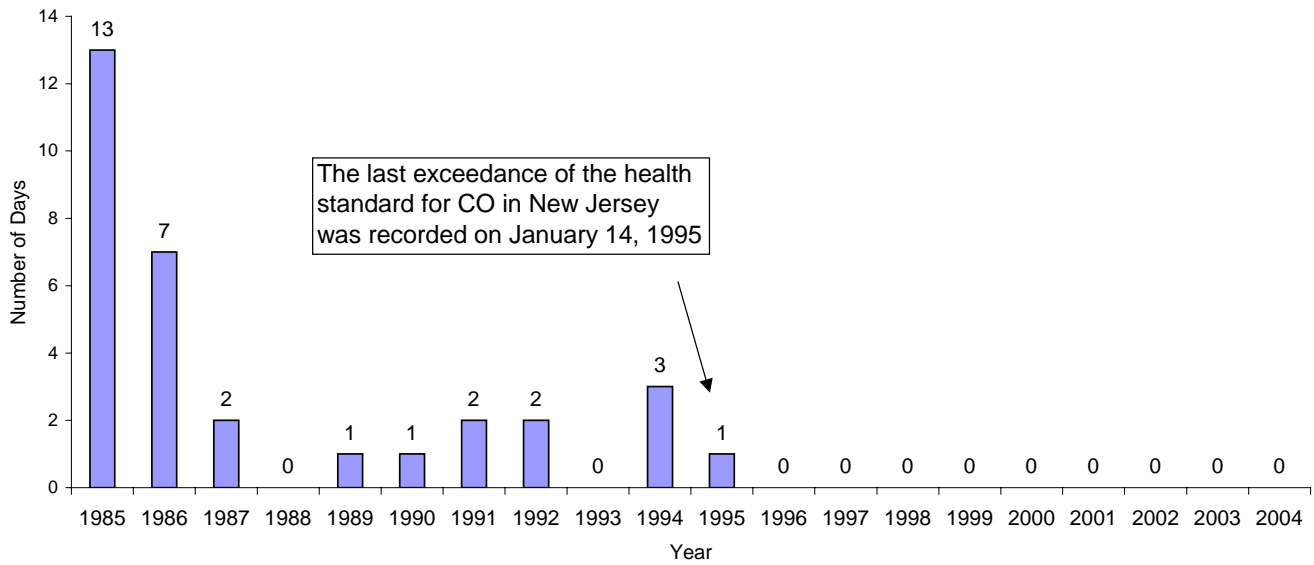
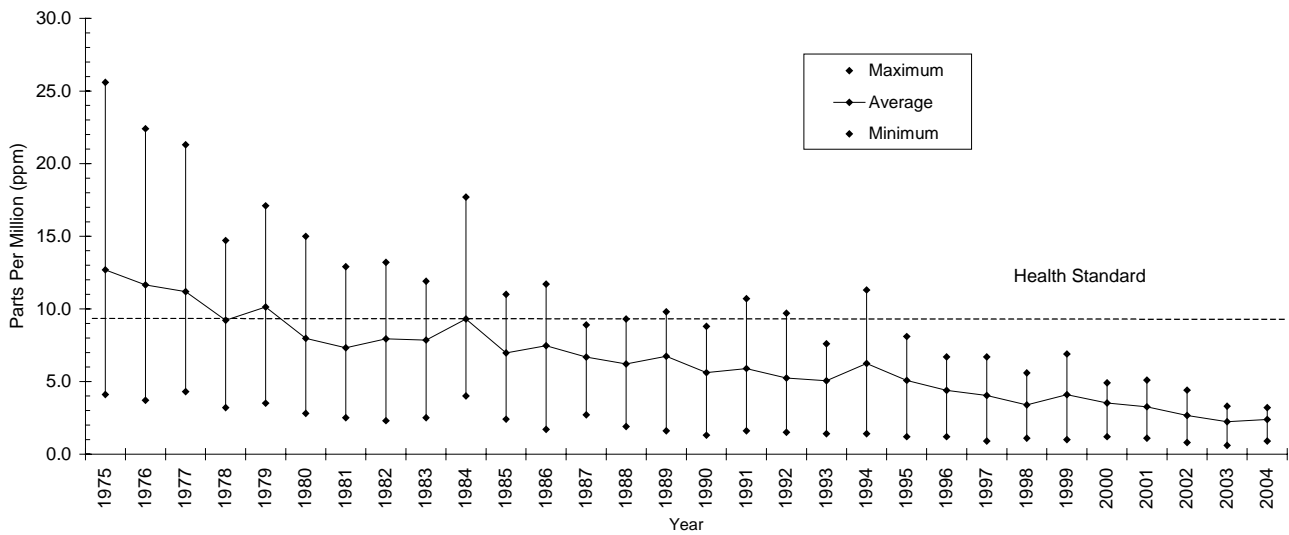


Figure 7
Carbon Monoxide Air Quality, 1975-2004
2nd Highest 8-Hour Average



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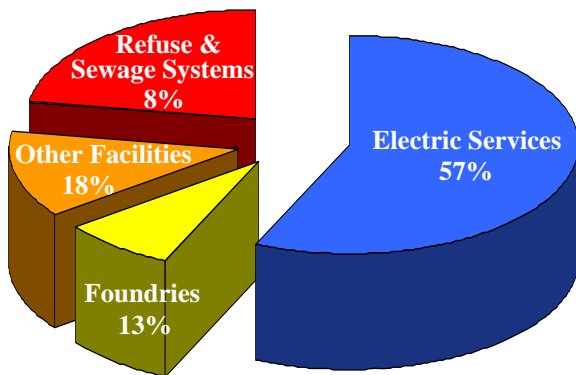
2004 Lead Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Lead (Pb) is a metal that occurs naturally in the environment as well as being produced by a variety of human activities. Historically, the major sources of lead in the air have been motor vehicles and industrial facilities. With the phase out of lead in gasoline, however, the industrial sources now predominate. Because of the reductions in lead emissions from cars and trucks, levels in the air have decreased dramatically. When high levels do occur, they are usually near industrial sources. The pie chart below shows the major industrial sources of lead in New Jersey. The industrial sources include Electric Services (Energy generating facilities), Foundries (Metal casting facilities), and Refuse and Sewage systems.

Figure 1
New Jersey's Summary of 2004
Lead Emissions by Industrial Category



Source: NJDEP, Air Quality Planning Data 2004

HEALTH AND ENVIRONMENTAL EFFECTS

Lead accumulates in the blood, bones, muscles, and fat. People are mainly exposed to lead by breathing it from the air

or by ingesting food, water, soil, or dust that has been contaminated with lead. Infants and small children are especially sensitive to lead, even at low levels. Lead can damage the kidneys, liver, brain, and nerves and very high exposures can result in mental retardation, behavioral disorders, memory problems, and seizures. Lower levels of lead can damage the brain and nerves in fetuses and young children, resulting in learning disabilities. Lead can also cause high blood pressure and increase the risk of heart disease.

Animals can ingest lead while grazing and may experience health effects similar to those seen in humans. Lead can enter water systems through runoff and from sewage and industrial waste streams. Elevated levels of lead in water can cause reproductive damage in aquatic life and may cause changes in the blood and nerves of fish.

STANDARDS

The primary (health based) and secondary (welfare based) standards for lead are the same. The national standards are set at a maximum quarterly average concentration of 1.5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The table below shows the National and New Jersey Ambient Air Quality Standards (NAAQS and NJAAQS) for lead. The difference between the national and state standards is that the national standards are based on calendar quarters (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec) while the state standards are based on concentrations recorded over any three consecutive months.

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

$\mu\text{g}/\text{m}^3$ = Micrograms Per Cubic Meter

Averaging Period	Type	New Jersey	National
3-Month Arithmetic Mean	Primary and Secondary	1.5 $\mu\text{g}/\text{m}^3$	
Calendar Quarter Arithmetic Mean	Primary and Secondary		1.5 $\mu\text{g}/\text{m}^3$

MONITORING LOCATIONS

Lead concentrations in recent years have been so low that many of the monitoring sites have been discontinued. As a result, New Jersey monitored lead at only one location in 2004. This location, near a battery manufacturing plant in New Brunswick, is shown on the map in Figure 2.

LEAD LEVELS IN 2004

A summary of the lead levels monitored in 2004 is shown in Table 2 and Figure 3. No exceedances of the primary or secondary standards were recorded. The maximum 3-month average was 0.117 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), less than a tenth of the health standard.

Figure 2
2004 Lead
Monitoring Network

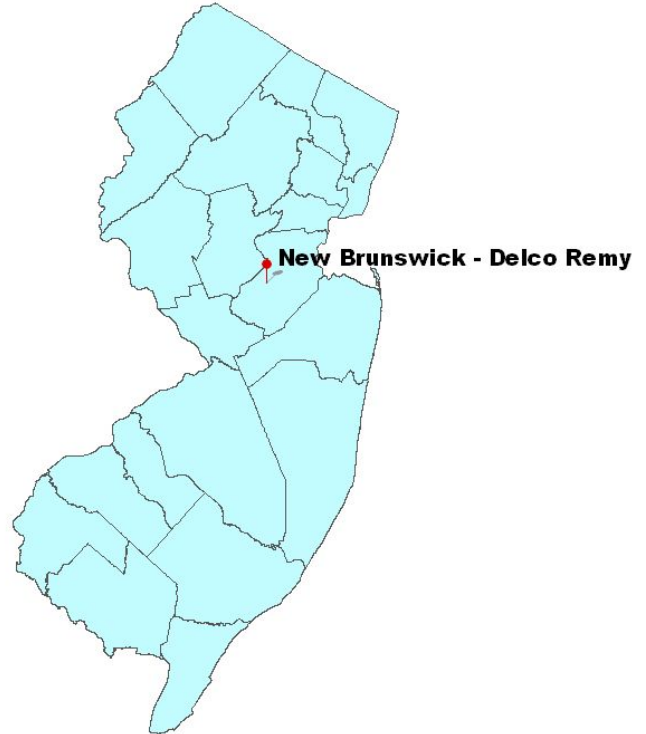
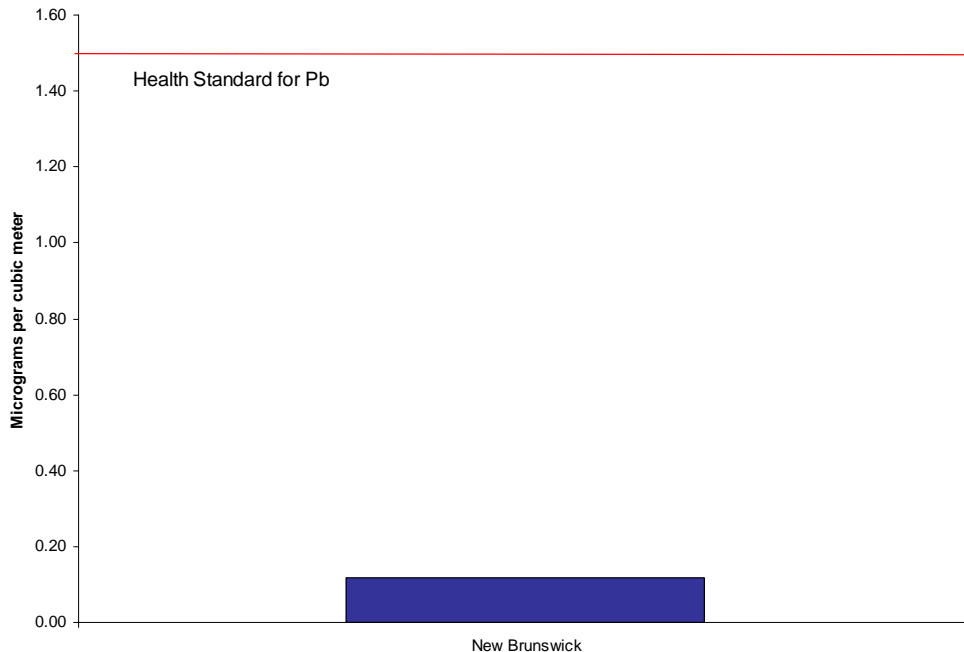


Figure 3

Maximum Quarterly Average Pb Concentrations in New Jersey
2004



**Table 2
Lead Data – 2004
3-Month and Calendar Quarter Averages**

$\mu\text{g}/\text{m}^3$ = Micrograms Per Cubic Meter

Monitoring Site	3-Month Average $\mu\text{g}/\text{m}^3$		Calendar Quarter Averages $\mu\text{g}/\text{m}^3$			
	Maximum	Month ¹	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
New Brunswick	.117	Dec.	.012	.033	.062	.115

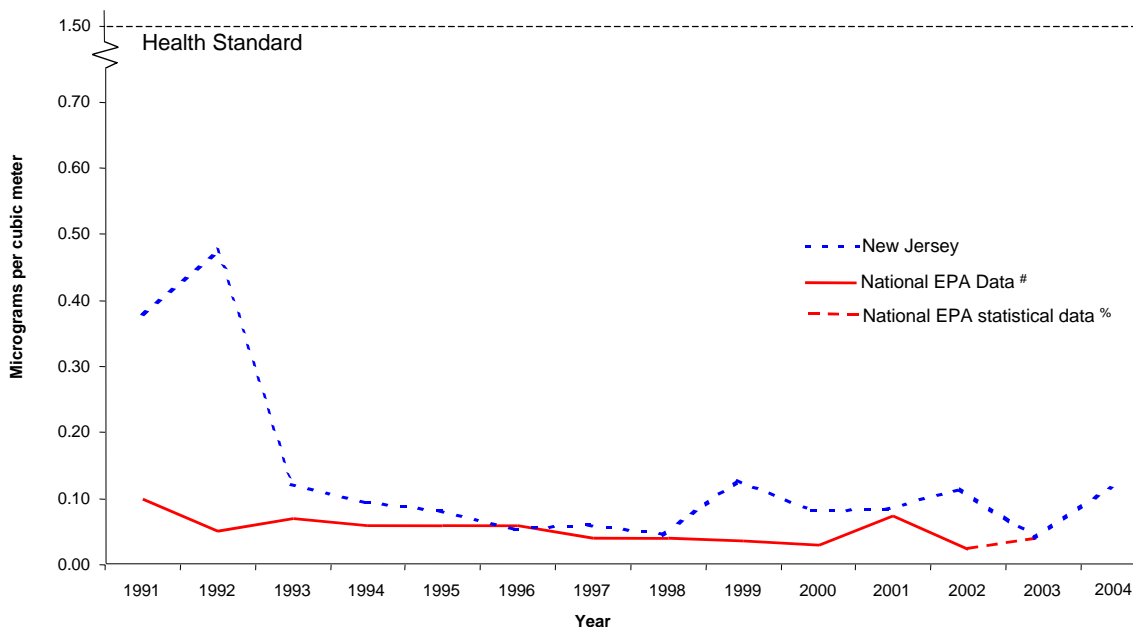
¹ The month indicates the last month in the 3-month period

TRENDS

The phase out of lead in gasoline has resulted in substantial improvements in air quality, and lead levels in New Jersey are now well within the air quality standards. Below is a trend graph showing New Jersey's maximum quarterly average concentrations from 1991 to 2004, compared to EPA's 1991 to 2002 national maximum quarterly average data and its 2003 national county fact book lead data. Also, EPA's 2004 national lead data is not displayed in Figure 4 because it is not yet available. New Jersey's lead levels have decreased approximately 70% from 1991 to 2004, and the national trend concentrations have been consistently low over the same time span. New Jersey values in more recent years are based on data from very few sites (only one site since 2002). While meeting the NAAQS for lead is no longer a major environmental issue in New Jersey, concern still exists over lead exposure via routes other than direct inhalation. Lead may have accumulated in the soil over time and children playing in such areas may ingest the lead directly.

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**Figure 4
Lead Concentrations in New Jersey
1991 - 2004
Maximum Quarterly Average**



Source: U.S. Environmental Protection Agency, 2002 Air Trends Report

% Source: U.S. Environmental Protection Agency, 2003 Air Trends County Fact book data

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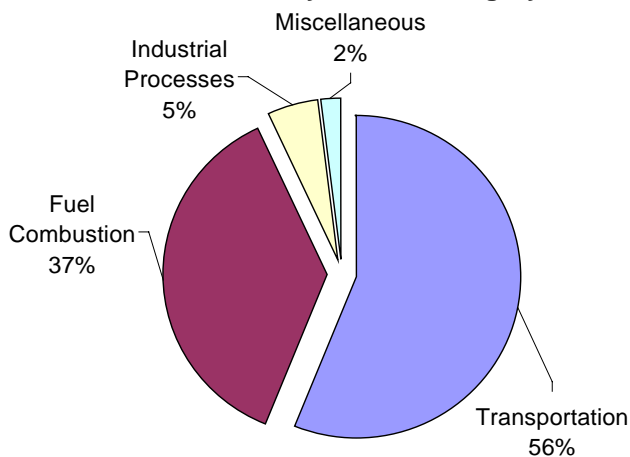
2004 Nitrogen Dioxide Summary

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.

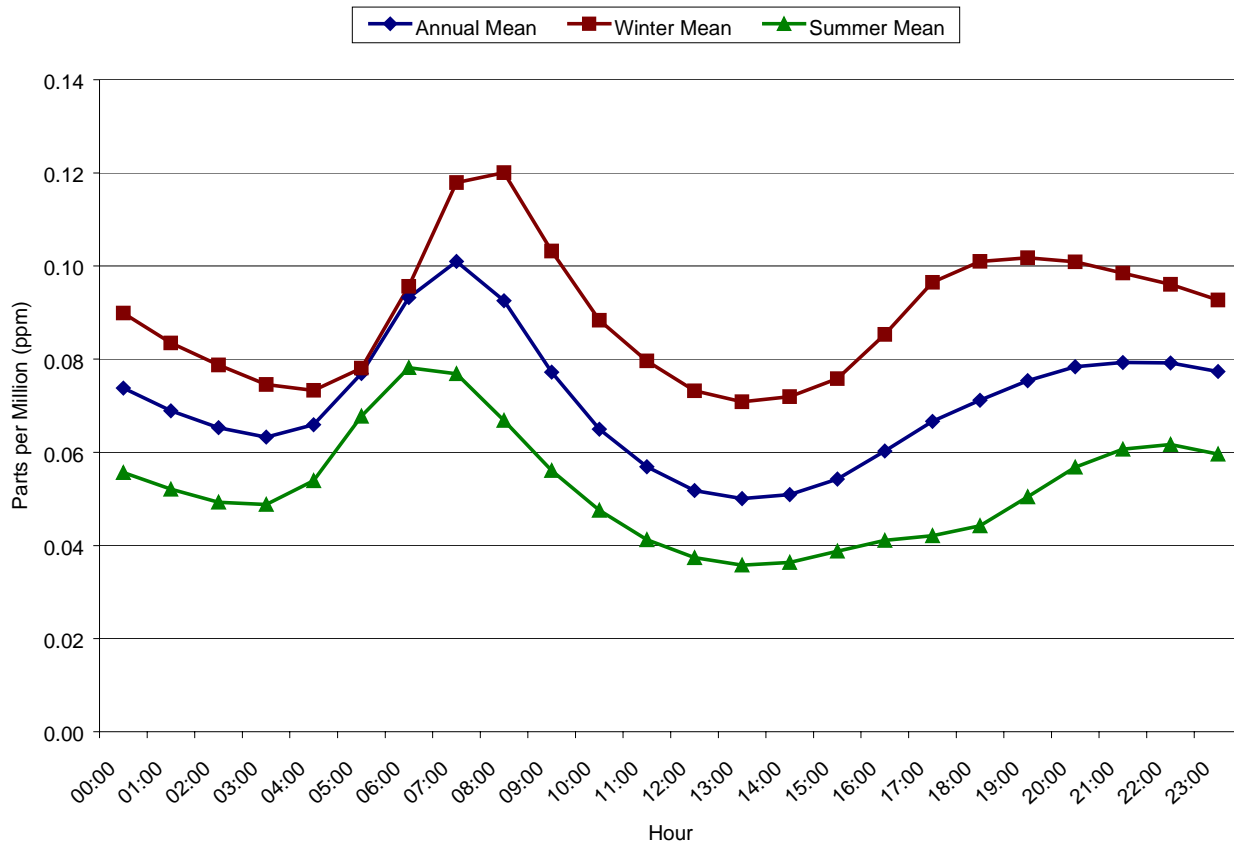
STANDARDS

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 2004. These sites are shown in the map to the right. The Camden Lab monitoring station was temporarily discontinued on September 22, 2003, and resumed operation on January 8, 2004.

NO₂ LEVELS IN 2004

None of the monitoring sites recorded exceedances of either the National or New Jersey Air Quality Standards for NO₂ during 2004. The maximum annual average concentration recorded was 0.030 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 2004 was 0.044 ppm, also at the Elizabeth Lab site (see Table 2 and Figure 4, page 4).

TRENDS

Since routine monitoring for NO₂ began in 1966, concentrations have never exceeded the NAAQS in New Jersey. A graph of NO₂ levels provided in Figure 5

Figure 3
2004 Oxides of Nitrogen
Monitoring Network

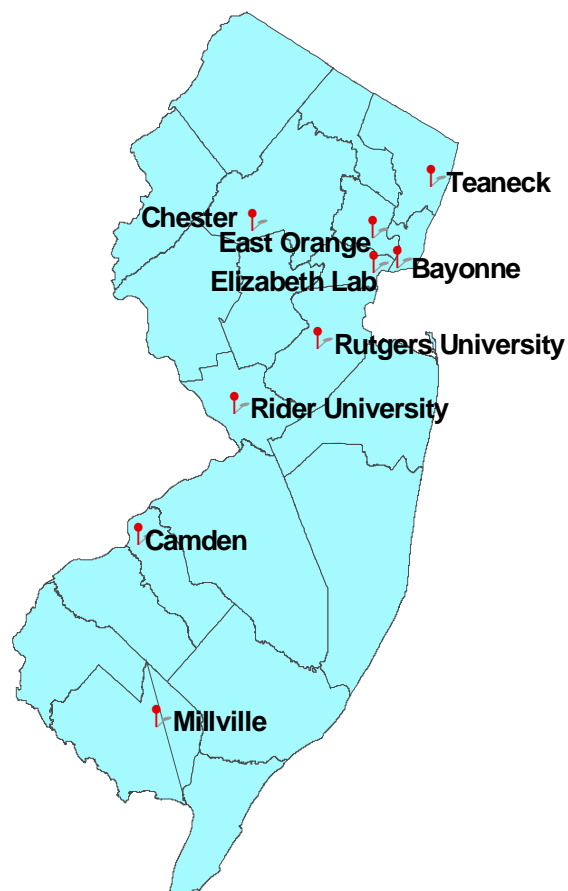
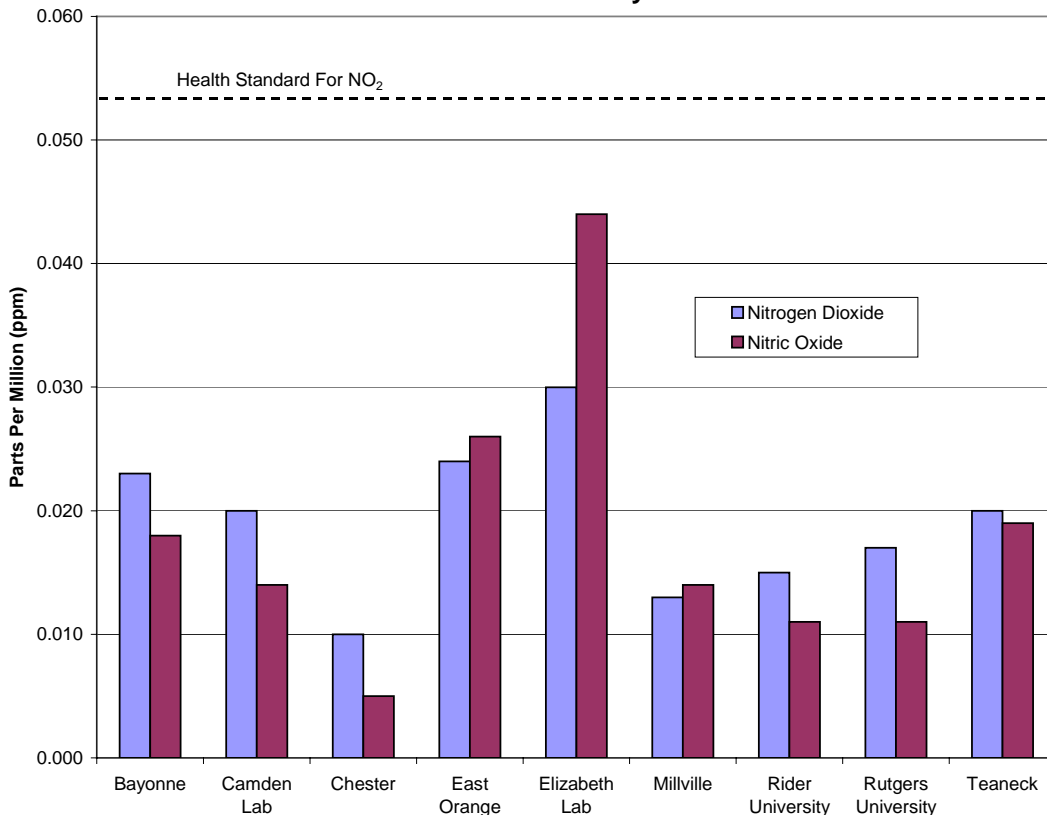


Table 2
Nitrogen Dioxide and Nitric Oxide Data-2004
1-Hour and 12-Month Averages

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	0.115	0.084	0.024	0.023	0.018
Camden Lab	0.078	0.074	0.020	0.020	0.014
Chester	0.063	0.062	0.012	0.010	0.005
East Orange	0.150	0.143	0.027	0.024	0.026
Elizabeth Lab	0.156	0.125	0.032	0.030	0.044
Millville	0.057	0.053	0.013	0.013	0.014
Rider University	0.054	0.054	0.015	0.015	0.011
Rutgers University	0.077	0.076	0.018	0.017	0.011
Teaneck	0.083	0.078	0.020	0.020	0.019

Figure 4
Annual Average NO and NO₂ Concentrations
in New Jersey - 2004



shows the statewide average annual mean concentrations recorded from 1975 to 2004 in the form of a trendline. The graph also includes the levels of the 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 nitroxy 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), peroxyacetic 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, an analyzer that measures total NO_y concentrations is commercially available and New Jersey has been evaluating its performance. The NJDEP began

monitoring for NO_y at the Rider University station in March 2002. Nitrogen oxides (NO_x) and a group of volatile organic compounds (VOCs) known as ground-level ozone precursors are also measured at this station.

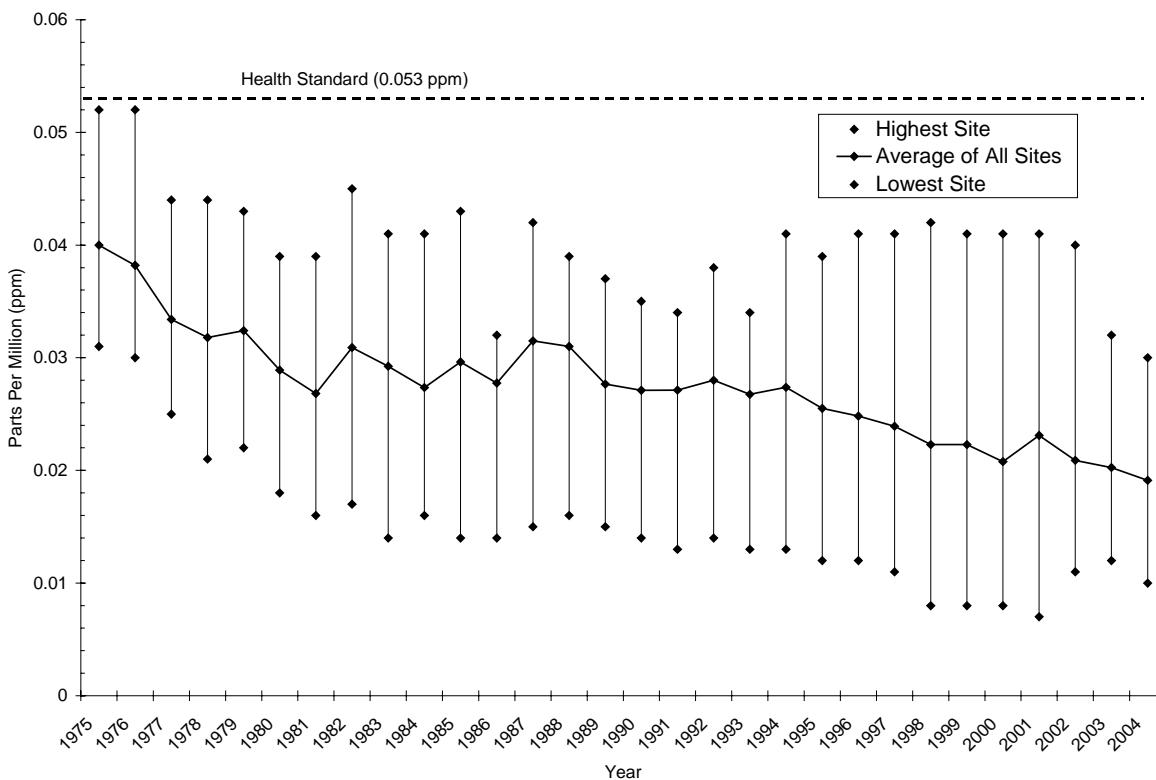
The monthly average NO_y concentrations for 2004 are presented in Table 3 along with the corresponding NO_x concentrations measured by the NO₂ analyzer at Rider University. Theoretically, concentrations of NO_y should be greater than NO_x when both are measured at the same monitoring location. Since several monthly average NO_y concentrations in 2004 are actually less than their corresponding NO_x monthly averages, and since there have been some technical difficulties with the method which indicate a lot of uncertainty in its measurements, the usefulness of the NO_y data is limited.

Table 3
Nitrogen Oxides (NO_x) and
Total Reactive Oxides of Nitrogen (NO_y) Data
Rider University - 2004
Monthly Average

Parts Per Million (ppm)		
	NO _x Monthly Average (ppm)	NO _y ¹ Monthly Average (ppm)
January	0.027	0.024
February	0.041	0.038
March	0.028	0.028
April	0.020	0.021
May	0.015	0.015
June	0.012	0.011
July	0.013	0.012
August	0.015	0.012
September	0.018	0.018
October	0.029	0.029
November	0.040	0.039
December	0.043	0.032

¹See text for explanation of NO_y measurement issues. It is presented here to show that the data are available and the range of concentrations recorded.

Figure 5
Nitrogen Dioxide Concentrations in New Jersey
1975-2004
12-Month (Calendar Year) Average



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2004 Ozone Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Ozone (O₃) 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.

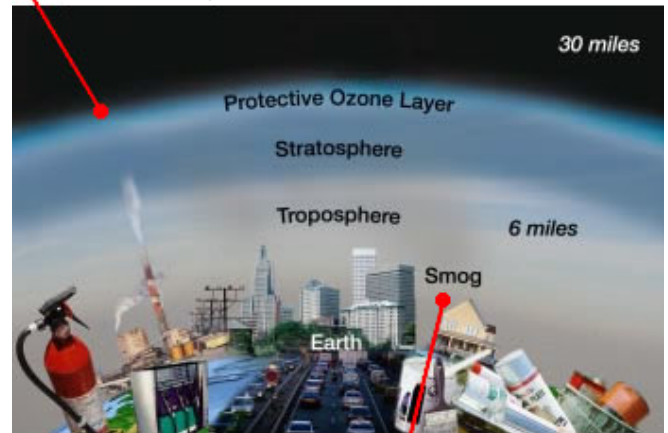
Since ground-level ozone needs sunlight to form, it is mainly a daytime problem during the summer months. Weather patterns have a significant effect on ozone formation and hot, dry summers will result in more ozone than cool, wet ones. In New Jersey, the ozone season runs from April 1st to October 31st, 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".

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 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

Figure 2: Ozone Damage to Blackberry Bush



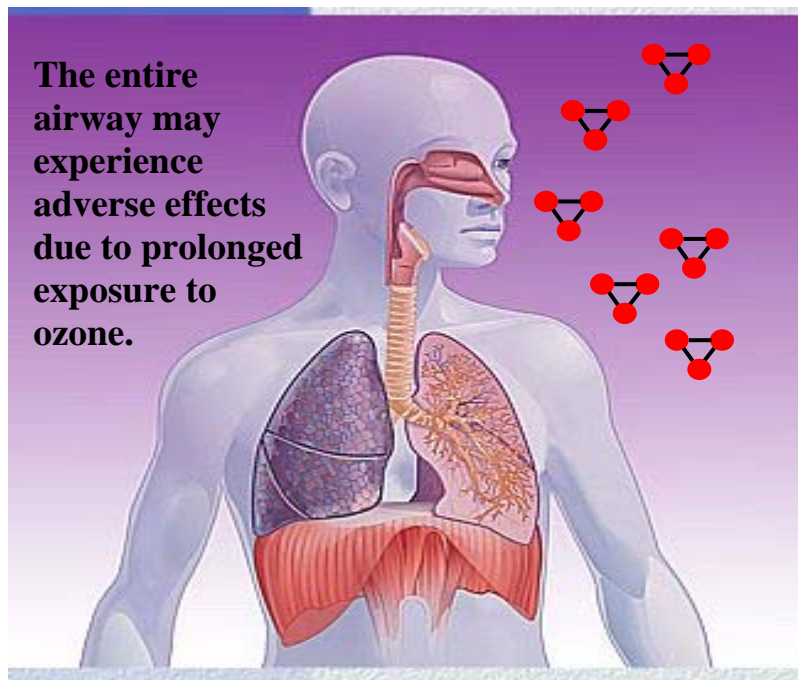
Figure 3: Ozone Damage to Sassafras Tree



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.

OZONE NETWORK

Ozone was monitored at 14 locations in New Jersey during 2004. 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.

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
2004 Ozone Monitoring Network



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 6 and 7 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 6
8-Hour Ozone Air Quality, 1986 - 2004

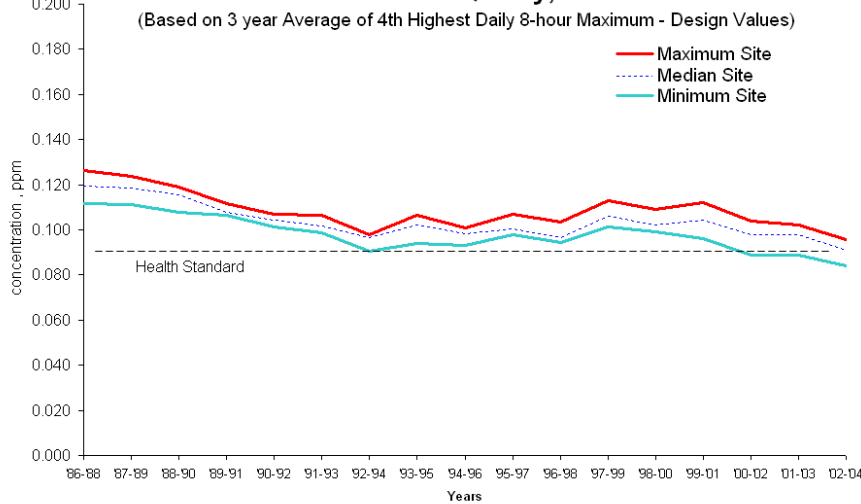
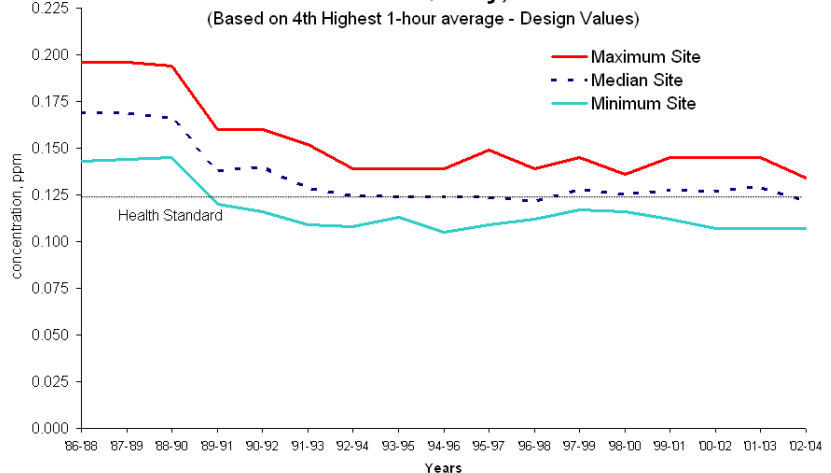


Figure 7
1-Hour Ozone Air Quality, 1986 - 2004



HOW THE CHANGES TO THE OZONE STANDARDS AFFECT AIR QUALITY RATINGS

In 2004 there were no days on which the old standard was exceeded in New Jersey and 14 days on which the new standard was exceeded. Significant progress was being made towards meeting the old standards (see Figure 8 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 0.119 ppm in 2004.

It is apparent, however, that the current standard is significantly more stringent than the old one (compare Figure 8 to Figure 9 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 8
Days on which the 1-Hour Ozone Standard
was Exceeded in New Jersey 1988-2004

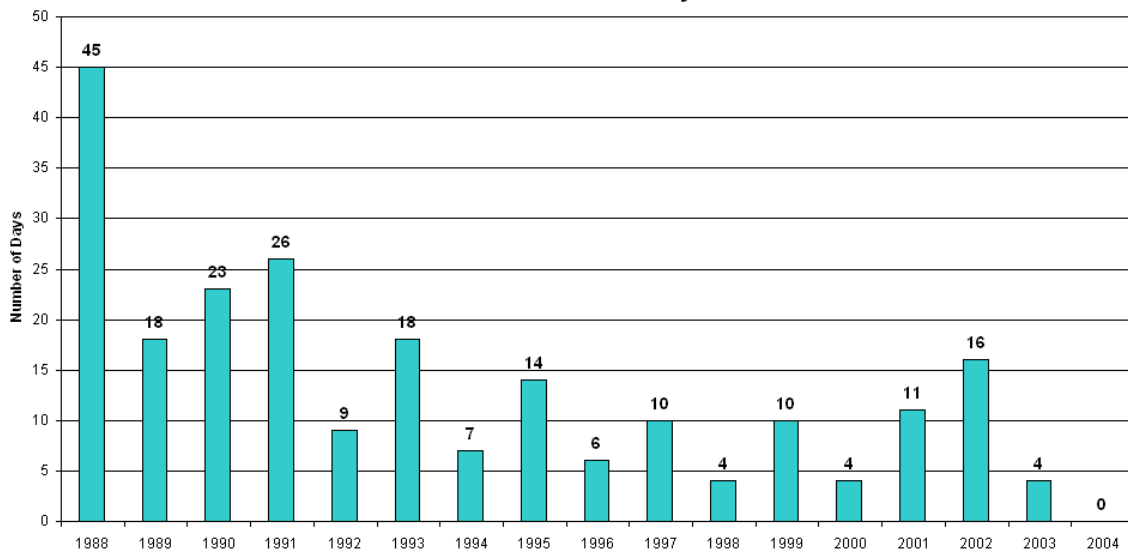
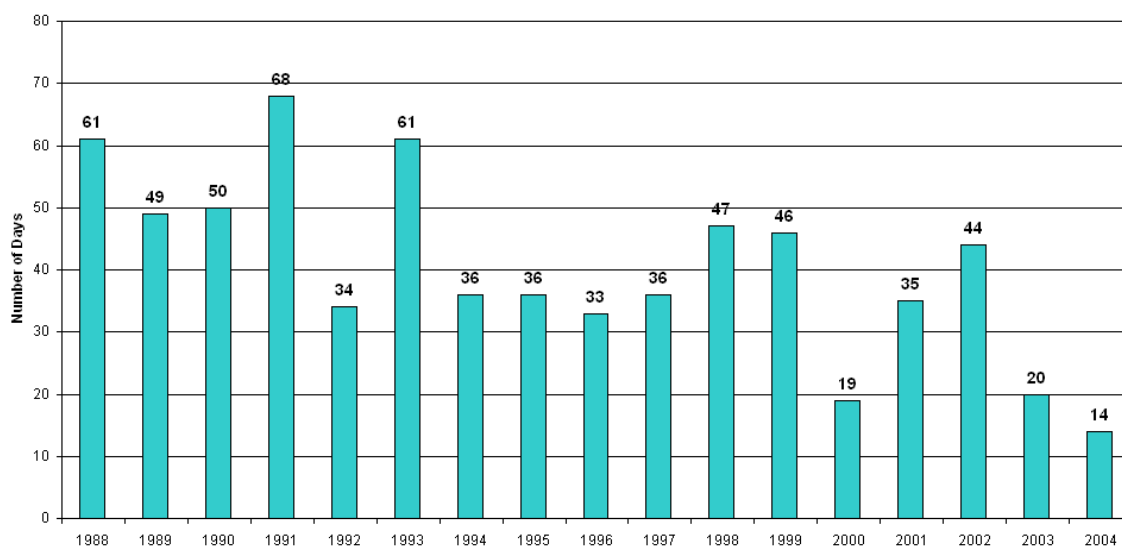


Figure 9
Days on which the 8-Hour Ozone Health Standard
was Exceeded in New Jersey 1988-2004



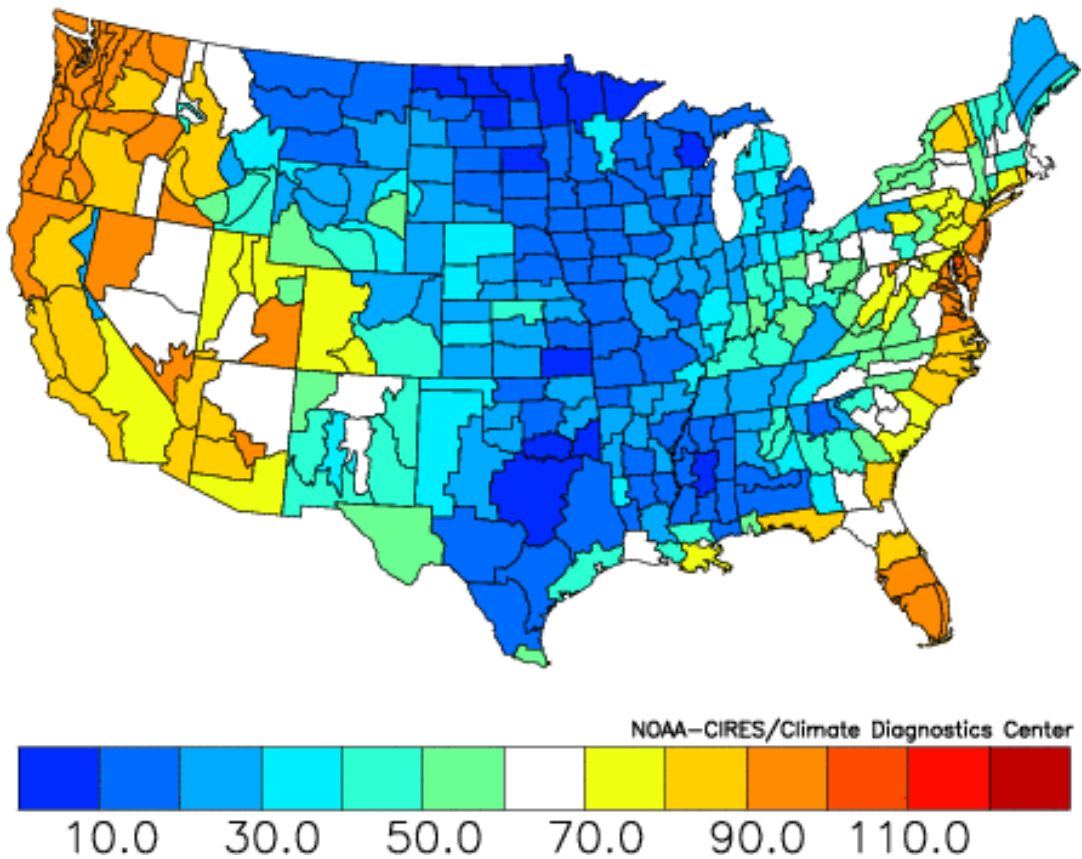
MAJOR OZONE EPISODES

Historically, several ozone episodes occur throughout the New Jersey summer. The 2004 ozone season, unlike any New Jersey ozone season to date, produced no ozone episodes. An ozone episode is loosely defined as two or more consecutive days of widespread ozone concentrations above the health standard. There were no recorded exceedances above the 0.12 ppm 1-hour health standard and no widespread exceedances of the 8-hour 0.085 ppm health standard. July 22nd produced the most single day exceedances as seven sites went above the 0.08 ppm standard with Flemington being the highest with 0.098 ppm 8-hour average. As recently as 1998, there were 47 days when ozone concentrations were above the 8-hour standard. Unlike 2004, the 1998 exceedance days were more widespread with typically more than half of the monitors exceeding the standard on each exceedance day. The summer of 2004 was noticeably cooler than most. The map below (Figure 10) illustrates the average temperature throughout the summer and how it deviated from typical averages. Aside from a few exceptions, the entire nation experienced a much cooler summer than usual. New Jersey's average summertime temperatures deviated from normal by 10 – 20%.

Atypical meteorological conditions obviously played a significant role in low ground level ozone concentrations in 2004, but those uncharacteristically low values should not be solely attributed to weather conditions. Significant reduction in the emissions of ground forming pollutants have been achieved. But there is still a long way to go and ground level ozone will remain a problem that requires both local and regional emission reduction strategies to control.

Figure 10

Temperature Percentile Value Relative to 1895–1999
May to Sep 2004



SUMMARY OF 2004 Ozone Data Relative to the 1-HOUR STANDARD

Of the 14 monitoring sites that were operated during the 2004 ozone season, none recorded levels above the old 1-hour standard of 0.12 ppm during the year. The highest 1-hour concentration was 0.119 ppm at both the Rutgers University and Clarksboro sites on June 8 and July 21, respectively. In contrast, during the 2003 ozone season there were 6 sites that recorded levels above the standard and the maximum was 0.151 ppm, recorded at Monmouth University.

Figure 11
2004 Highest and Second Highest Daily 1-Hour Averages

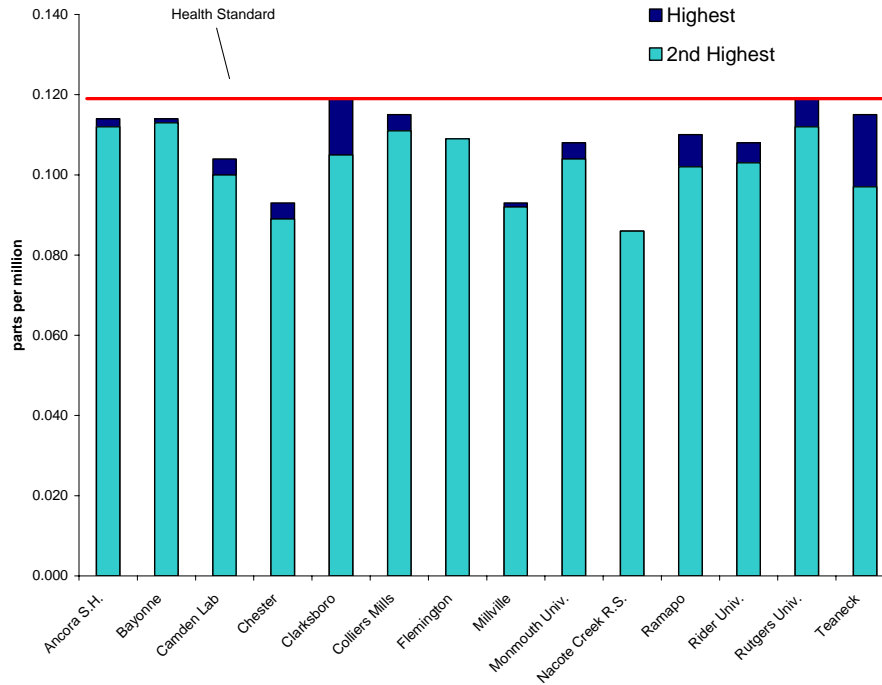


Table 3
Ozone Data – 2004
1-Hour Averages

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 2002-2004 ^a	# of days with 1-hour Averages above 0.12ppm
Ancora S.H.	0.114	0.112	0.122	0
Bayonne	0.114	0.113	0.130	0
Camden Lab	0.104	0.100	0.128	0
Chester	0.093	0.089	0.122	0
Clarksboro	0.119	0.105	0.127	0
Colliers Mills	0.115	0.111	0.134	0
Flemington	0.109	0.109	0.128	0
Millville	0.093	0.092	0.129	0
Monmouth Univ.	0.108	0.104	0.128	0
Nacote Creek R.S.	0.086	0.086	0.107	0
Ramapo	0.110	0.102	0.116	0
Rider University	0.108	0.103	0.133	0
Rutgers University	0.119	0.112	0.132	0
Teaneck	0.115	0.097	0.127	0
Statewide	0.119	0.119	0.144	0

^a Design Value calculations exclude data affected by the July 2002 Canadian forest fire episode. See 2002 Air Quality Report for details.

SUMMARY OF 2004 OZONE DATA RELATIVE TO THE 8-HOUR STANDARD

Only 12 of the 14 monitoring sites that were operated during the 2004 ozone season recorded levels above the 8-hour standard of 0.08 ppm. Nacote Creek R.S. and Chester did not record any 8-hour exceedances. Colliers Mills recorded the most exceedances with 8. The highest 8-hour concentration recorded was 0.103 ppm at the Colliers Mills and Ancora S.H. sites on June 9 and July 21, respectively. All sites recorded levels above the 8-hour standard in 2003, with a maximum concentration of 0.131 ppm, recorded at the Monmouth University site. Design values exceeded the 8-hour standard at all sites, except Bayonne and Ramapo, indicating that the ozone standard is being violated over most of New Jersey.

Figure 12
Ozone Design Values for 2002-2004

3 Year Average of the 4th Highest 8-Hour Value

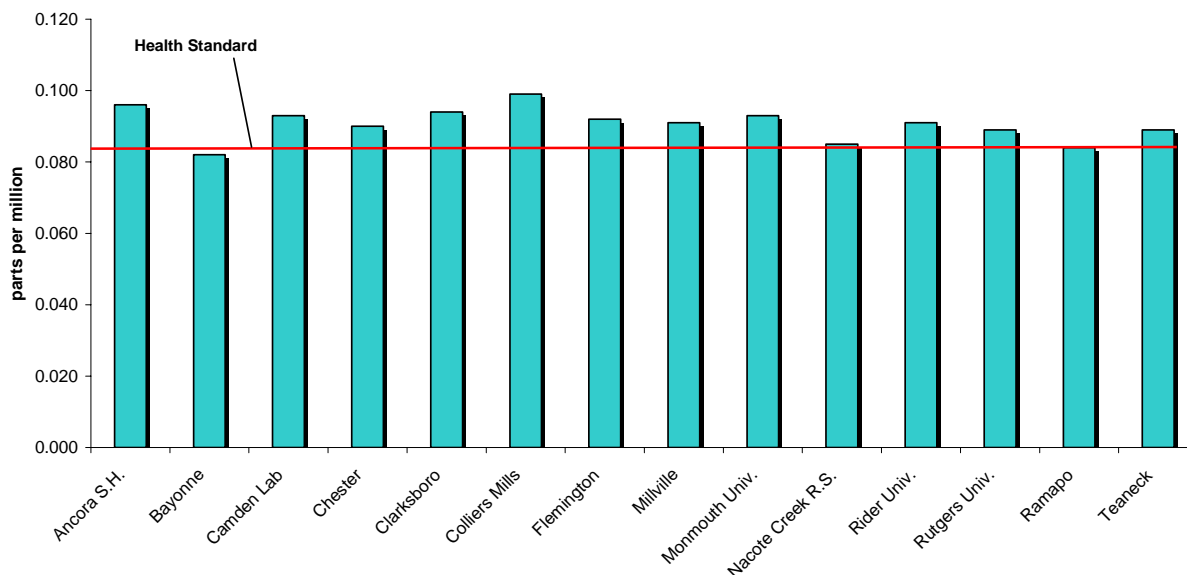


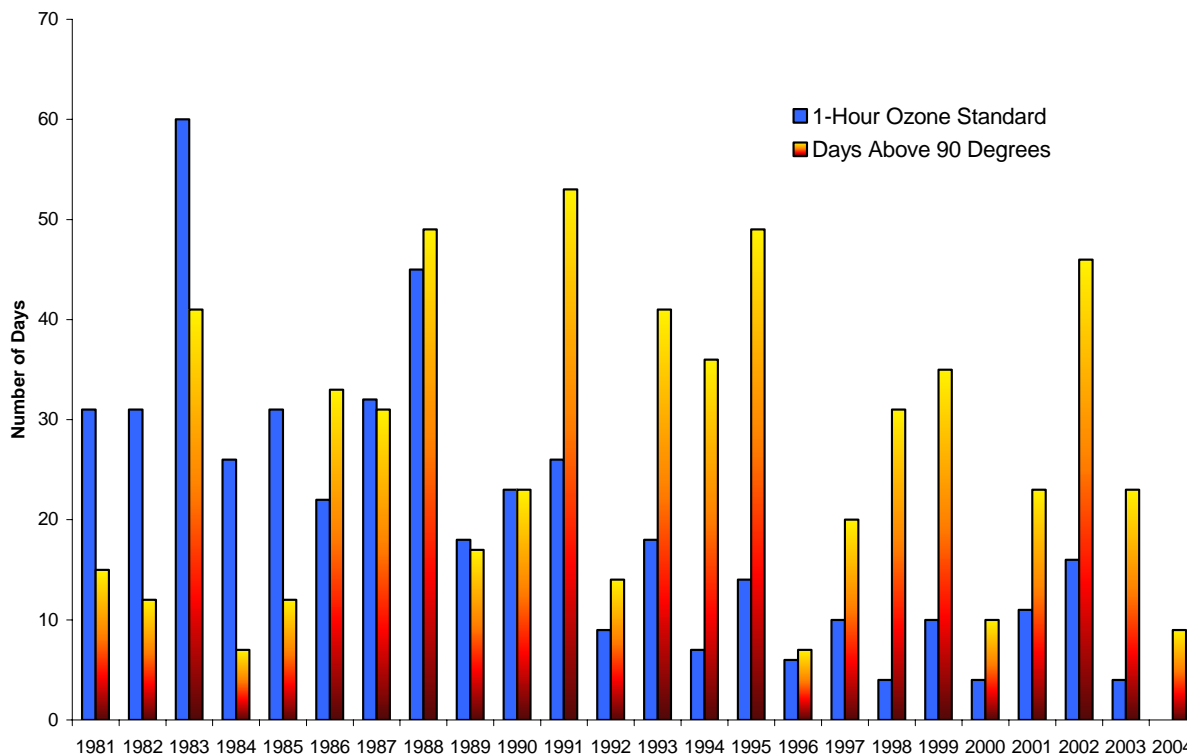
Table 4
Ozone Data – 2004
8-Hour Averages
Parts Per Million (ppm)

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 2002-2004 ^a	# of days with 8-hour above 0.08ppm
Ancora S.H.	0.103	0.092	0.090	0.088	0.096	6
Bayonne	0.088	0.082	0.081	0.080	0.082	1
Camden Lab	0.093	0.090	0.085	0.080	0.093	3
Chester	0.082	0.078	0.075	0.075	0.090	0
Clarksboro	0.096	0.092	0.092	0.085	0.094	4
Colliers Mills	0.103	0.094	0.092	0.088	0.099	8
Flemington	0.098	0.091	0.090	0.087	0.092	6
Millville	0.090	0.085	0.084	0.083	0.091	2
Monmouth Univ.	0.099	0.094	0.081	0.080	0.093	2
Nacote Creek R.S.	0.080	0.078	0.077	0.077	0.085	0
Ramapo	0.096	0.090	0.079	0.075	0.084	2
Rider University	0.093	0.083	0.082	0.082	0.091	1
Rutgers University	0.099	0.088	0.081	0.080	0.089	2
Teaneck	0.089	0.089	0.084	0.082	0.089	2
Statewide	0.103	0.103	0.099	0.099	0.107	14

^a Design Value calculations exclude data affected by the July 2002 Canadian forest fire episode. See 2002 Air Quality Report for details.

Figure 13
Number of Days 1-Hour Ozone Standard Was Exceeded
and Number of Days Above 90 Degrees
New Jersey 1981 - 2004



ACCOUNTING FOR THE INFLUENCE OF WEATHER

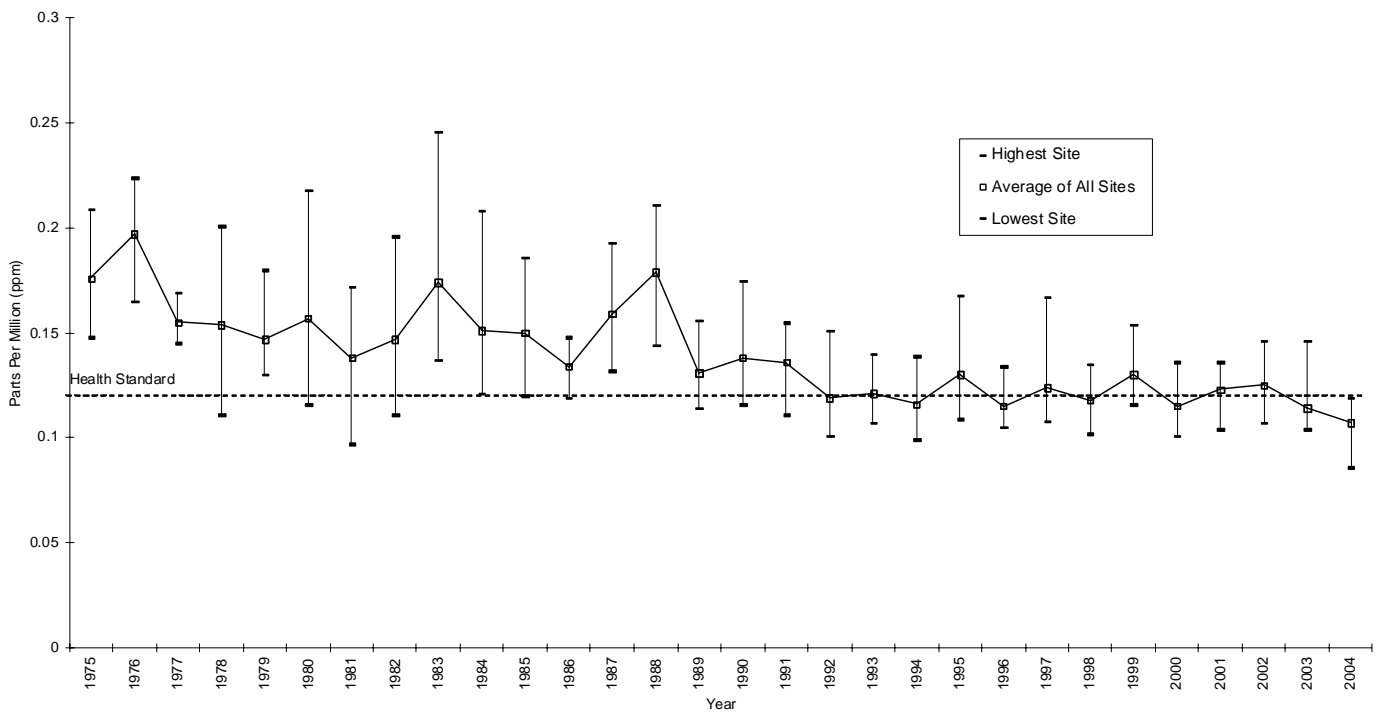
Trends in ground level ozone are influenced by many factors including weather conditions, transport, growth, and the state of the economy, in addition to changes brought about by regulatory control measures. Of these factors, weather probably has the most profound effect on year to year variations in 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 13. 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 14). 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 NOx. The NOx 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 14
Ozone Concentrations in New Jersey
1975 – 2004
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 for each of the National Ambient Air Quality Standards. Areas can also be found to be “unclassifiable” under certain circumstances. Designations are based, in part, on “design values”, which are the values that actually determines whether an area meets the standard. For the 8-hour ozone standard the design value is the 3-year average of the fourth highest daily maximum 8-hour average concentration recorded at a site each year. Based on the 3-year period from January 1, 2001 through December 31, 2003 the USEPA designated all of New Jersey as non-attainment with respect to the 8-hour ozone standard.

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2004 PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

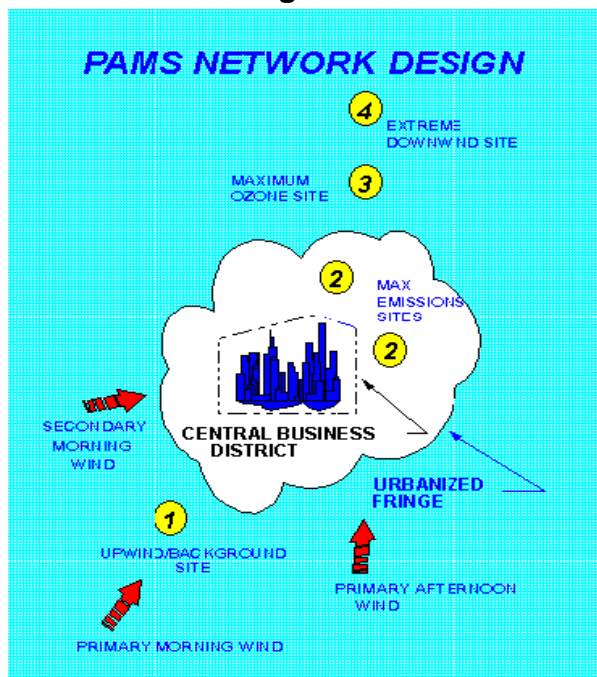
New Jersey Department of Environmental Protection

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

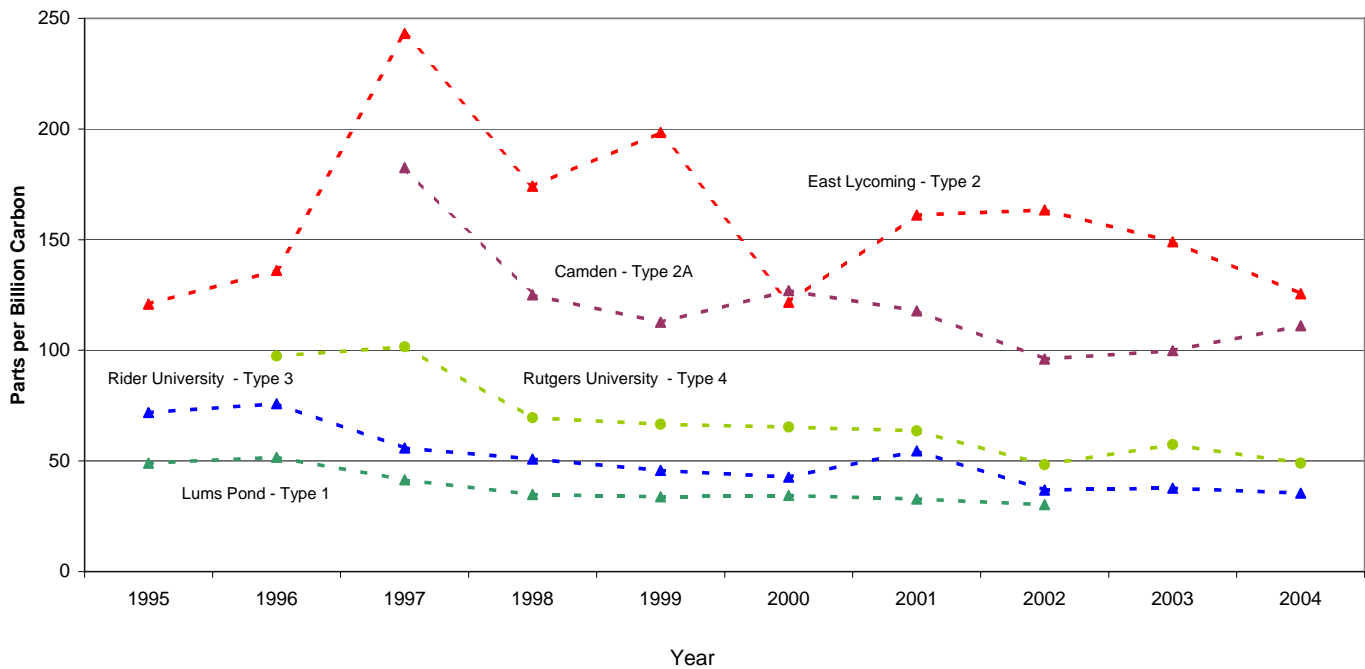


Note: Rutgers University PAMS site is both Type 4 for Philadelphia and Type 1 for New York City.

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 1995-2004



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 1995-2004

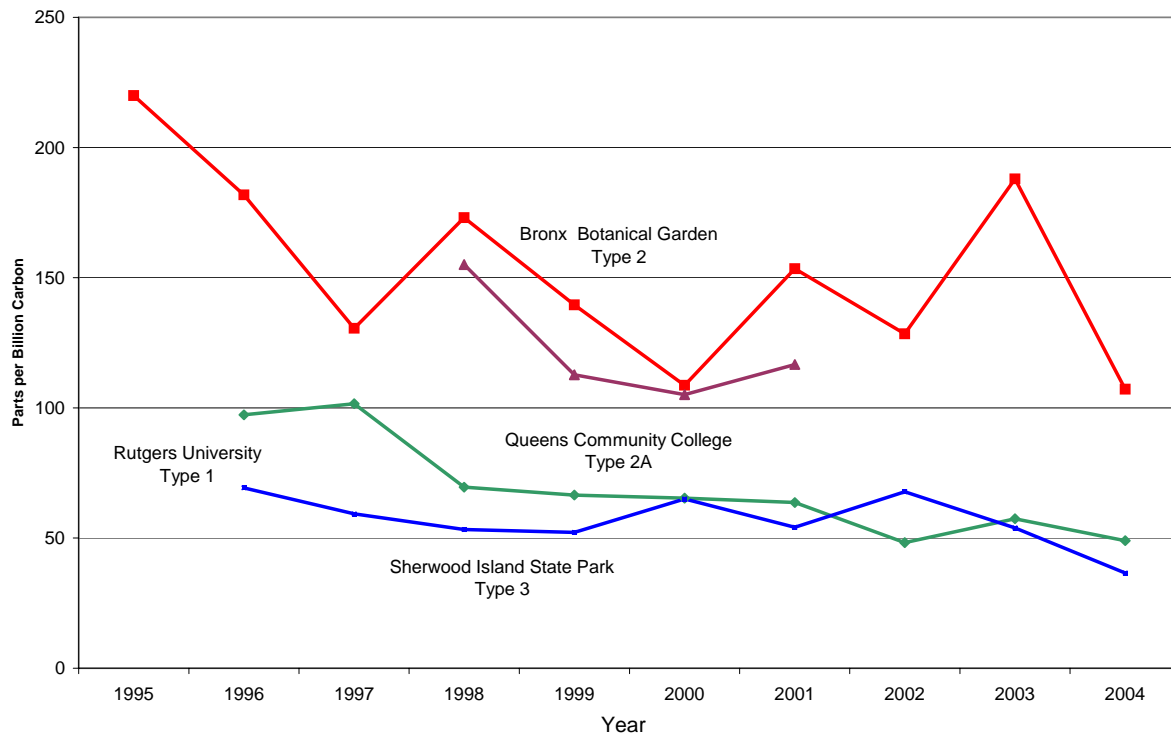


Table 1
Summary of Photochemical Assessment Monitoring (PAMS) Data
June, July, and August, 2004

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	1.99	0.24	3.97	0.49	2.58	0.19	5.15	0.37	3.47	0.24	6.93	0.47
Benzene	2.67	0.31	16.03	1.88	0.94	0.12	5.63	0.71	0.66	0.11	3.96	0.68
n-Butane	41.75	1.92	167.01	7.68	3.26	0.35	13.05	1.42	5.69	0.53	22.74	2.10
1-Butene	0.63	0.09	2.51	0.35	0.21	0.03	0.85	0.12	0.31	0.04	1.25	0.18
cis-2-Butene	0.62	0.07	2.48	0.26	0.12	0.03	0.49	0.13	0.28	0.03	1.12	0.14
trans-2-Butene	0.61	0.10	2.44	0.41	0.19	0.09	0.76	0.35	0.53	0.07	2.11	0.29
Cyclohexane	2.81	0.17	16.84	1.01	0.19	0.03	1.11	0.18	0.26	0.03	1.58	0.19
Cyclopentane	1.54	0.12	7.68	0.60	0.15	0.04	0.76	0.19	1.95	0.04	9.77	0.19
n-Decane	0.35	0.05	3.5	0.51	0.17	0.02	1.69	0.21	0.43	0.03	4.28	0.31
m-Diethylbenzene	0.06	0.01	0.56	0.12	0.17	0.01	1.72	0.14	0.25	0.01	2.53	0.12
p-Diethylbenzene	0.14	0.02	1.38	0.22	0.06	0.01	0.62	0.13	0.09	0.01	0.86	0.12
2,2-Dimethylbutane	2.88	0.20	14.42	1.02	0.39	0.04	1.94	0.20	0.66	0.04	3.31	0.20
2,3-Dimethylbutane	1.50	0.16	7.52	0.80	0.29	0.07	1.46	0.36	0.49	0.06	2.44	0.30
2,3-Dimethylpentane	0.73	0.07	5.1	0.49	0.19	0.04	1.34	0.27	0.53	0.04	3.68	0.25
2,4-Dimethylpentane	0.50	0.06	3.51	0.40	0.12	0.03	0.87	0.19	0.35	0.03	2.44	0.19
Ethane	20.93	3.00	41.85	5.99	9.57	2.02	19.13	4.04	8.75	2.30	17.49	4.61
Ethylbenzene	0.48	0.08	3.83	0.61	0.24	0.04	1.90	0.28	0.47	0.04	3.79	0.33
Ethylene (Ethene)	5.21	0.81	10.42	1.63	3.98	0.41	7.95	0.83	5.69	0.88	11.38	1.75
m/p-Ethyltoluene	0.70	0.10	6.3	0.87	0.49	0.03	4.43	0.30	0.88	0.07	7.89	0.60
o-Ethyltoluene	0.15	0.02	1.37	0.21	0.07	0.01	0.61	0.12	0.15	0.02	1.38	0.15
n-Heptane	4.99	0.30	34.92	2.07	0.58	0.05	4.04	0.35	0.42	0.06	2.93	0.39
Hexane	10.13	0.56	60.78	3.34	0.64	0.10	3.86	0.60	1.29	0.17	7.75	1.04
1-Hexene	0.74	0.05	4.41	0.31	0.27	0.01	1.60	0.07	0.35	0.02	2.12	0.13
Isobutane	18.41	1.02	73.64	4.06	2.93	0.25	11.72	1.01	3.40	0.34	13.59	1.35
Isopentane	21.87	1.52	109.33	7.59	2.94	0.43	14.68	2.15	7.66	0.59	38.29	2.96
Isoprene	1.24	0.29	6.21	1.45	3.58	0.28	17.92	1.41	3.18	0.50	15.92	2.51
Isopropylbenzene	0.60	0.04	5.36	0.37	0.16	0.01	1.42	0.13	0.13	0.01	1.2	0.12
Methylcyclohexane	3.95	0.23	27.66	1.63	0.43	0.04	2.98	0.29	0.38	0.04	2.63	0.28
Methylcyclopentane	3.30	0.24	19.79	1.45	0.33	0.06	2.00	0.36	0.74	0.07	4.44	0.44
2-Methylheptane	1.04	0.07	8.3	0.60	0.09	0.01	0.69	0.12	0.20	0.02	1.57	0.14
3-Methylheptane	0.85	0.06	6.81	0.51	0.10	0.02	0.77	0.15	0.22	0.02	1.79	0.16
2-Methylhexane	1.99	0.17	13.96	1.17	0.38	0.05	2.69	0.32	0.46	0.05	3.25	0.37

Table 1 (Continued)
 Summary of Photochemical Assessment Monitoring (PAMS) Data
 June, July, and August, 2004

	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	2.41	0.26	16.88	1.79	0.59	0.05	4.12	0.38	0.48	0.06	3.37	0.43
2-Methylpentane	6.64	0.49	39.85	2.95	0.76	0.12	4.54	0.73	1.28	0.15	7.68	0.88
3-Methylpentane	3.83	0.30	23	1.80	0.47	0.08	2.79	0.47	0.84	0.10	5.01	0.60
n-Nonane	0.67	0.07	6.04	0.66	0.17	0.02	1.53	0.20	0.32	0.03	2.92	0.24
n-Octane	2.13	0.14	17.06	1.14	0.16	0.02	1.29	0.20	0.48	0.03	3.82	0.26
n-Pentane	24.59	1.24	122.95	6.21	1.32	0.22	6.60	1.09	5.64	0.34	28.21	1.69
1-Pentene	0.32	0.05	1.61	0.26	0.14	0.02	0.68	0.10	0.31	0.03	1.54	0.14
cis-2-Pentene	0.35	0.04	1.77	0.22	0.10	0.02	0.48	0.08	0.35	0.02	1.77	0.11
trans-2-Pentene	0.67	0.08	3.36	0.38	0.19	0.02	0.94	0.11	0.68	0.03	3.4	0.17
Propane	53.45	3.45	160.35	10.35	7.97	1.24	23.90	3.71	13.15	1.43	39.46	4.30
n-Propylbenzene	0.14	0.03	1.26	0.29	0.08	0.01	0.72	0.11	0.13	0.02	1.17	0.15
Propylene (Propene)	7.80	2.29	23.39	6.87	1.41	0.25	4.24	0.76	4.25	0.32	12.74	0.95
Styrene	0.61	0.04	4.85	0.34	0.13	0.02	1.00	0.16	0.14	0.03	1.12	0.27
Toluene	4.46	0.62	31.22	4.37	4.48	0.31	31.34	2.20	67.11	0.77	469.74	5.39
1,2,3-Trimethylbenzene	0.37	0.07	3.32	0.59	0.49	0.05	4.42	0.42	1.44	0.09	12.99	0.84
1,2,4-Trimethylbenzene	0.69	0.10	6.18	0.94	0.32	0.03	2.92	0.29	0.68	0.05	6.12	0.43
1,3,5-Trimethylbenzene	0.26	0.03	2.31	0.28	0.17	0.02	1.53	0.17	0.24	0.02	2.13	0.16
2,2,4-Trimethylpentane	1.54	0.20	12.34	1.59	0.42	0.08	3.39	0.63	0.89	0.10	7.12	0.80
2,3,4-Trimethylpentane	0.39	0.05	3.09	0.41	0.13	0.02	1.01	0.20	0.25	0.03	2.02	0.26
n-Undecane	0.24	0.03	2.66	0.34	0.29	0.02	3.22	0.17	0.21	0.02	2.33	0.23
m/p-Xylene	1.67	0.24	13.35	1.94	0.78	0.09	6.21	0.73	1.80	0.14	14.42	1.12
o-Xylene	0.59	0.09	4.72	0.74	0.28	0.04	2.21	0.32	0.55	0.06	4.41	0.47

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2004 Particulate Summary

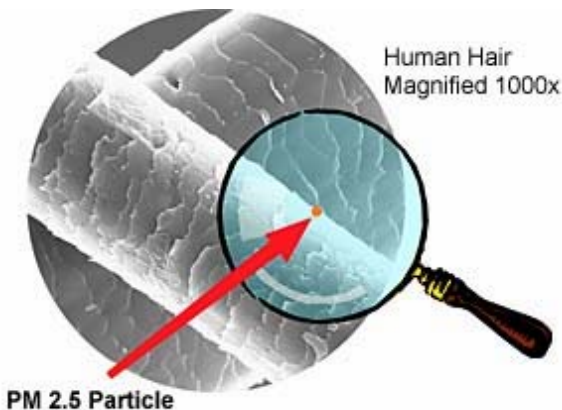
New Jersey Department of Environmental Protection

NATURE AND SOURCES

Particulate air pollution consists of both solid particles and liquid droplets suspended in the atmosphere. Suspended particles can range in size from 70 microns in diameter, approximately the size of a pinhead, to less than 1 micron in diameter. Particles can be directly emitted, or they can form in the atmosphere from gaseous emissions, such as sulfur dioxide (SO₂) and oxides of nitrogen (NO_x). Particles that originate as gases are referred to as secondary particulates.

Particulate matter is generally categorized according to the size of the particles. Coarse particles are defined as particles greater than 2.5 microns in diameter, while particles less than 2.5 microns in diameter are referred to as fine particles (PM_{2.5}) (See Figure 1). Coarse particles are further subdivided into Total Suspended Particulates (TSP), which include all but the largest particles, and PM₁₀, which include particles less than 10 microns in diameter. The human respiratory tract will usually trap particles above about 10 microns in diameter before they reach the lungs. Particles smaller than 10 microns (PM₁₀) are inhalable and are considered to be more harmful to human health than larger particles; fine particles are considered to be even more harmful as they can reach the deep recesses of the lungs.

Figure 1
Size of PM_{2.5} Particle Compared to a Human Hair



Graphics Courtesy of the US Department of Energy

Both fine and coarse particles have anthropogenic, or man-made, as well as natural sources. Anthropogenic sources of coarse particles include industrial processes such as grinding operations, while anthropogenic sources of fine particles include soot from fuel combustion, and secondary particle formation from organic compounds, biomass burning, and emissions of sulfur dioxide (SO₂) and oxides of nitrogen (NO_x). Natural sources of coarse particles include windblown dust, sea salt, and biological debris; and natural sources of fine particles include biogenic gases, which result in the formation of secondary particles.

ENVIRONMENTAL EFFECTS

In addition to health effects, particulate matter is the major cause of reduced visibility in many parts of the United States. Figure 2 provides an example of reduced visibility recorded by our WebCam site in Newark (accessible via the Internet at www.state.nj.us/dep/airmon). Airborne particles can also impact vegetation and aquatic ecosystems, and can cause damage to paints and building materials. More information is provided in the Regional Haze section of this report.

Figure 2
Visibility WebCam



View of New York City Skyline from Newark

HEALTH EFFECTS

Inhalable particles (PM₁₀) and especially fine particles (PM_{2.5}) are a health concern because they easily reach the deepest recesses of the lungs. Various health problems are associated with both long and short-term exposures. When inhaled, these particles can accumulate in the respiratory system and are associated with increased hospital admissions and emergency room visits for heart and lung conditions, such as asthma, bronchitis, cardiac arrhythmias, heart attacks, and even premature death. Groups that appear to be at the greatest risk from particulates include children, the elderly, and individuals with heart and lung diseases, such as asthma (*US EPA, 2001*).

STANDARDS

In 1971, EPA set primary (health based) and secondary (welfare based) standards for total suspended particulate matter (TSP). These standards, known as the National Ambient Air Quality Standards (NAAQS), were based on maximum 24-hour and annual concentrations (*US EPA, 1997*). The annual standards were based on the geometric mean concentrations over a calendar year, and the 24-hour standards were based on the arithmetic average concentration from midnight to midnight. The primary 24-hour average standard for TSP was set at 260 micrograms per cubic meter (µg/m³) and the annual geometric mean health standard was set at 75 µg/m³. The 24-hour secondary standard was set at 150 µg/m³. While EPA did

not establish a secondary annual standard for TSP they did set a guideline of 60 µg/m³ to be used to ensure that the secondary 24-hour standard was being met throughout the year. Although New Jersey still maintains state standards for TSP, the national standards have been replaced with standards for smaller particles as described below. As a result, monitoring for TSP has largely been discontinued, with the exception of one station, where TSP samples are taken to analyze for lead (Pb). See the Lead Summary section for more details.

In 1987, EPA replaced the TSP standards with standards that focused only on inhalable particles. Inhalable particles are defined as particles less than 10 microns in diameter (PM₁₀). The 24-hour PM₁₀ primary and secondary standards were set at 150 µg/m³, and the annual primary and secondary standards were set at 50 µg/m³. The annual standard for PM₁₀ is based on the arithmetic mean, as opposed to the geometric mean that was used for TSP.

In 1997, EPA promulgated new standards for fine particulates, which it defined as particles less than 2.5 microns in diameter (PM_{2.5}). They kept the existing standards for PM₁₀ as well. The PM_{2.5} annual primary and secondary standards were set at 15 µg/m³ and the 24-hour standard was set at 65 µg/m³. Table 1 provides a summary of the Particulate Matter standards.

**Table 1
National and New Jersey
Ambient Air Quality Standards for Particulate Matter**

Micrograms Per Cubic Meter (µg/m³)

Standard	Averaging Period	Type	New Jersey	National
Total Suspended Particulates (TSP)	12-Month [‡]	Primary	75 µg/m ³	---
	24-Hour	Primary	260 µg/m ³	---
	12-Month [‡]	Secondary	60 µg/m ³	---
	24-Hour	Secondary	150 µg/m ³	---
Inhalable Particulates (PM ₁₀)	Annual [†]	Primary & Secondary	---	50 µg/m ³
	24-Hour Average	Primary & Secondary	---	150 µg/m ³
Fine Particulates (PM _{2.5})	Annual [†]	Primary & Secondary	----	15 µg/m ³
	24-Hour Average	Primary & Secondary	----	65 µg/m ³

[‡] Annual Geometric Mean

[†] Annual Arithmetic Mean

PARTICULATE MONITORING NETWORK

New Jersey's Particulate Monitoring Network consists of 19 fine particulate monitoring sites, 6 PM₁₀ monitoring sites, 1 TSP monitoring site, and 10 sites where smoke shade is monitored.

At some of these sites, samplers that comply with strict EPA specifications are used for collecting data that are submitted to a national database maintained by the EPA. These filter-based samplers, which are approved by the EPA and known as Federal Reference Method (FRM) samplers, collect particles on a filter over a 24-hour period. The filters are subsequently weighed under controlled environmental conditions. The data from the FRM samplers are used by the NJDEP and EPA to determine whether the state, or portions of the state, meet the federal health and welfare standards for particulate matter. Because the FRM samplers do not provide data in real time, the NJDEP employs additional samplers that continuously measure particulate concentrations. These samplers are used by the NJDEP

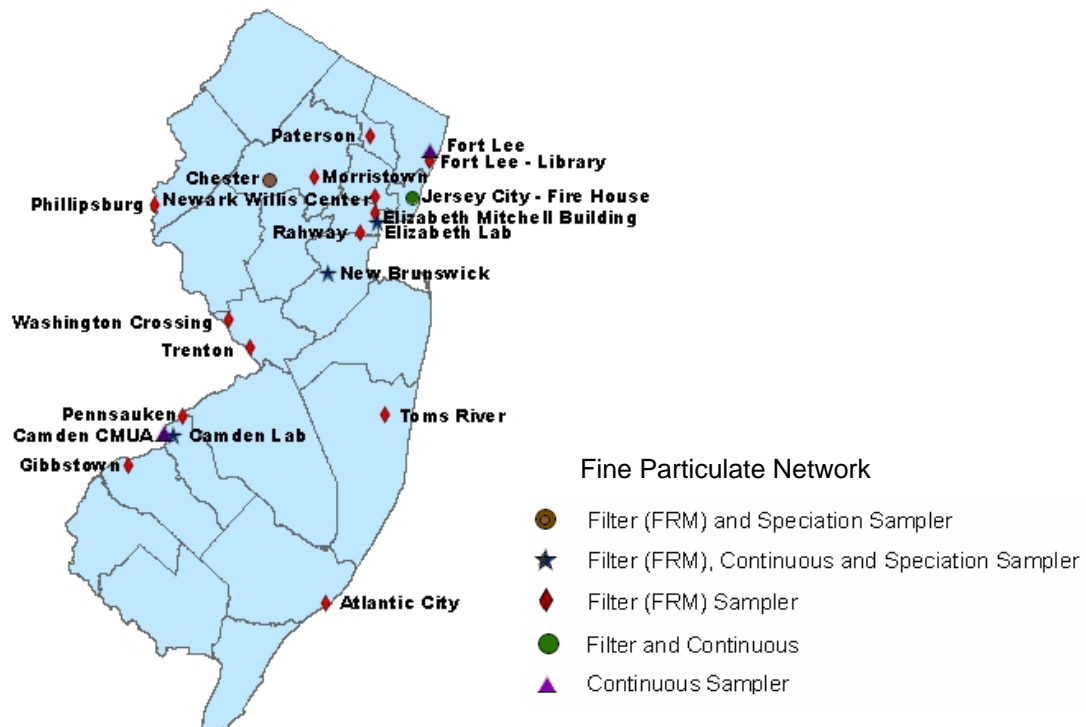
to report current air quality to the public through the Air Quality Index (www.state.nj.us/dep/airmon). The NJDEP uses Tapered Element Oscillating Microbalance (TEOM) analyzers and smoke shade instruments for real-time particle reporting. The TEOM analyzers collect a sample of fine particles on an oscillating filter, and determine the concentration based on the change in the frequency at which the filter oscillates. Smoke shade instruments collect a sample of particles on a paper tape for one hour. At the end of each hour the amount of light that will pass through the spot that has formed on the tape is measured, the tape advanced, and the cycle started over. The amount of light transmittance measured is used as an estimate of actual particle concentrations.

FINE PARTICLE SUMMARY

FINE PARTICLE MONITORING SITES

There are 18 monitoring sites in New Jersey where a filter-based (FRM) sampler routinely collects PM_{2.5} 24-hour samples (see Figure 3). At 6 sites, continuous

**Figure 3
2004 PM_{2.5}
Monitoring Network**



particulate monitors measure the concentration of fine particles every minute and transmit the data to the Bureau of Air Monitoring's central computer, where it is made available on the Bureau's Public Website (www.state.nj.us/dep/airmon). Additionally, at four of these locations a separate sampler collects fine particles on three types of filter media which are subsequently analyzed using ion chromatography (IC), X-ray fluorescence (XRF), and Thermal Optical Analysis (TOA) to determine the concentrations of the chemical analytes that constitute the sample.

FINE PARTICLE CONCENTRATION SUMMARY

The annual mean concentration of PM_{2.5} ranged from 10.2 µg/m³ in Chester to 15.2 µg/m³ at Elizabeth Lab. The maximum 24-hour concentrations ranged from 32.8 µg/m³ at Chester to 56.4 µg/m³ at Elizabeth Lab.

Figure 4 and Table 2 depicts the mean and maximum concentrations at each site.

None of the sites exceeded the 24-hour standard of 65 µg/m³. One site, Elizabeth Lab exceeded the annual standard of 15 µg/m³. **The annual mean concentration at Elizabeth Lab was 15.2 µg/m³.** Three years of data are required to determine compliance with the NAAQS for PM_{2.5}. NJDEP will be evaluating PM_{2.5} data collected to date in making its final determination as to whether the annual NAAQS are being met.

Figure 4
2004 Fine Particulate (PM^{2.5})

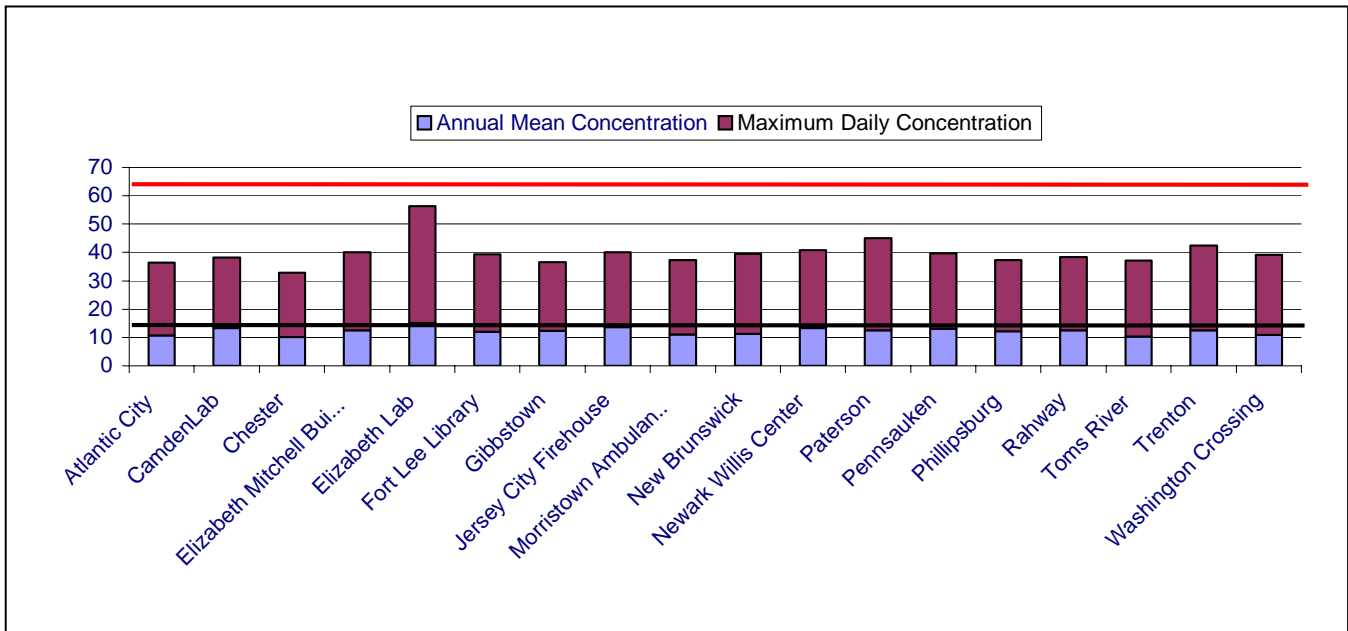


Table 2
PM_{2.5} Summary Data – 2004

Monitoring Site	Number of Samples	24-Hour Maximum µg/m³	Second Highest µg/m³	Annual Mean µg/m³
Atlantic City	89	36.3	29.6	10.6
Camden Lab	110	38.2	36.8	13.3
Chester	113	32.8	30.5	10.2
Elizabeth-Mitchell Building	113	40.1	35.7	12.6
Elizabeth Lab	327	56.4	46.0	15.2
Fort Lee-Library	112	39.3	36.6	12.0
Gibbstown	103	36.6	32.9	12.4
Jersey City-Firehouse	116	40.1	37.6	13.8
Morristown-Ambulance Squad	107	37.3	34.0	11.1
New Brunswick	118	39.5	35.5	11.2
Newark-Willis Center	112	40.9	36.9	13.3
Paterson	104	45.0	39.0	12.6
Pennsauken	109	39.7	38.5	13.2
Phillipsburg	110	37.3	35.6	12.2
Rahway	111	38.5	36.7	12.7
Toms River	106	37.1	35.3	10.4
Trenton	108	42.4	38.4	12.5
Washington Crossing	110	39.2	35.7	11.0

Table 3
2004 Summary of Continuous PM_{2.5} Data

Concentration in Micrograms Per Cubic Meter (µg/m³)

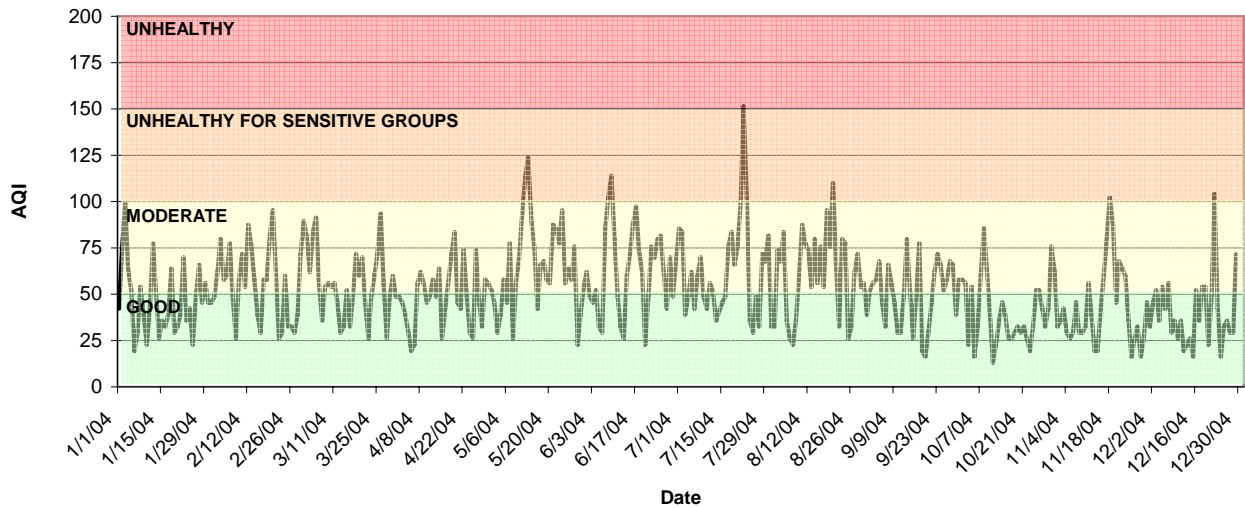
Monitoring Site	Annual Mean	Maximum Daily Concentration	2nd Highest Daily Concentration
Camden Lab	14	51	46
Elizabeth Lab	14	61	43
Fort Lee ^a	17	66	52
Jersey City-Firehouse	14	58	42
New Brunswick	12	47	42
South Camden	15	56	47

^aData Not Available after October

PM_{2.5} REAL-TIME MONITORING

New Jersey's continuous PM_{2.5} monitoring network consists of 6 sites: Camden Lab, Elizabeth Lab, Fort Lee, Jersey City, New Brunswick, and South Camden. The data is transmitted once a minute to a central computer in Trenton, where it is averaged and automatically updated on the bureau's website every hour. Table 3 provides a summary of the data from these sites, and Figure 5 depicts the health level associated with the maximum daily fine particulate concentration recorded in the state each day for the entire year.

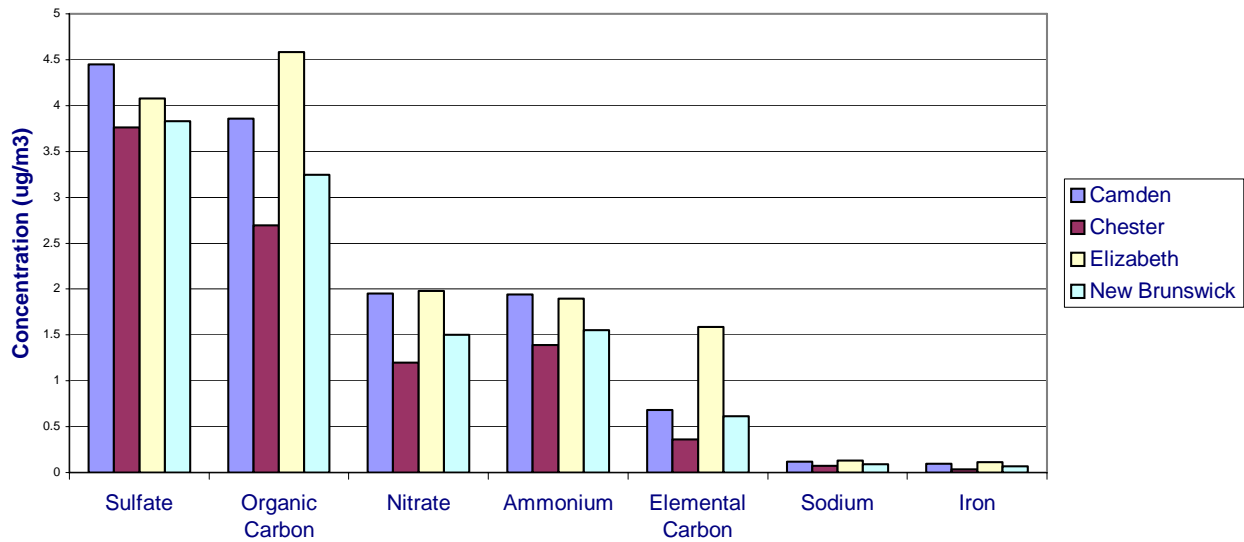
Figure 5
2004 Maximum Daily Fine Particulate Concentration
(Highest site)
Air Quality Index (AQI)



FINE PARTICLE SPECIATION SUMMARY

New Jersey's Fine Particulate Speciation Network consists of 4 monitoring sites: Camden Lab, Elizabeth Lab, New Brunswick, and Chester. Samplers run every third day on a schedule concurrent with the FRM sampling network. Of the 55 measured analytes, organic carbon and sulfate combined make up 59% of the total mass, and nitrate, ammonium, and elemental carbon make up an additional 35% of the particulate mass. Figure 6 depicts the average concentration of each analyte at all the sites, with only the seven most prevalent constituents depicted. Appendix B shows the average, maximum, and 2nd highest concentrations for each compound for 2004.

Figure 6
2004 Fine Particulate Analyte Composition
(Highest 7 Analytes Depicted)



2004 COARSE PARTICLE SUMMARY

COARSE PARTICLE MONITORING SITES

The coarse particulate monitoring network is composed of PM₁₀ sampling sites and TSP sampling sites. Samples are collected on a filter, which is weighed before and after sampling. The amounts of Sulfate and Nitrate are measured on some PM₁₀ samples and Lead is measured on the TSP samples. Figure 7 depicts the PM₁₀ particulate monitoring network in New Jersey.

Figure 7
2004 PM₁₀
Monitoring Network



TSP CONCENTRATION SUMMARY

New Jersey currently operates one site, located in New Brunswick, mainly for the purpose of determining the concentration of lead in the atmosphere. For more information, see the 2004 Lead Summary section. In 2004, the annual geometric mean concentration of TSP in New Brunswick was 25.7 $\mu\text{g}/\text{m}^3$, and the maximum 24-hour concentration recorded was 66 $\mu\text{g}/\text{m}^3$. The site was in attainment for the primary and secondary annual TSP standards of 75 $\mu\text{g}/\text{m}^3$ and 60 $\mu\text{g}/\text{m}^3$ respectively, and the site did not surpass the 24-hour primary standard of 260 $\mu\text{g}/\text{m}^3$ or the 150 $\mu\text{g}/\text{m}^3$ secondary standard.

PM₁₀ CONCENTRATION SUMMARY

In 2004, the annual mean concentration of PM₁₀ ranged from 18.8 $\mu\text{g}/\text{m}^3$ at Trenton to 41.3 $\mu\text{g}/\text{m}^3$ at Camden RRF. Table 4 shows the annual mean and 24-hour maximum PM₁₀ concentrations throughout the state. All areas of the state are in attainment for the annual PM₁₀ standard of 50 $\mu\text{g}/\text{m}^3$. Camden RRF measured one exceedance of the 24-hour standard of 150 $\mu\text{g}/\text{m}^3$.

The concentration of Sulfate and Nitrate were also analyzed on some PM₁₀ filters. The results showed that, on average, about 2% percent of PM₁₀ is nitrate and 15% percent is sulfate; however, these percentages vary across sites and sampling dates. The contributions of sulfate and nitrate to PM₁₀ are significantly less than their contributions to PM_{2.5}. This is because PM₁₀ is predominantly made up of larger particles most of which are directly emitted into the atmosphere. PM_{2.5} is predominantly a secondary pollutant, forming in the atmosphere from gaseous emissions, such as SO₂ and NO_x. For more details on the PM₁₀ sulfate and nitrate results, see the section on atmospheric deposition.

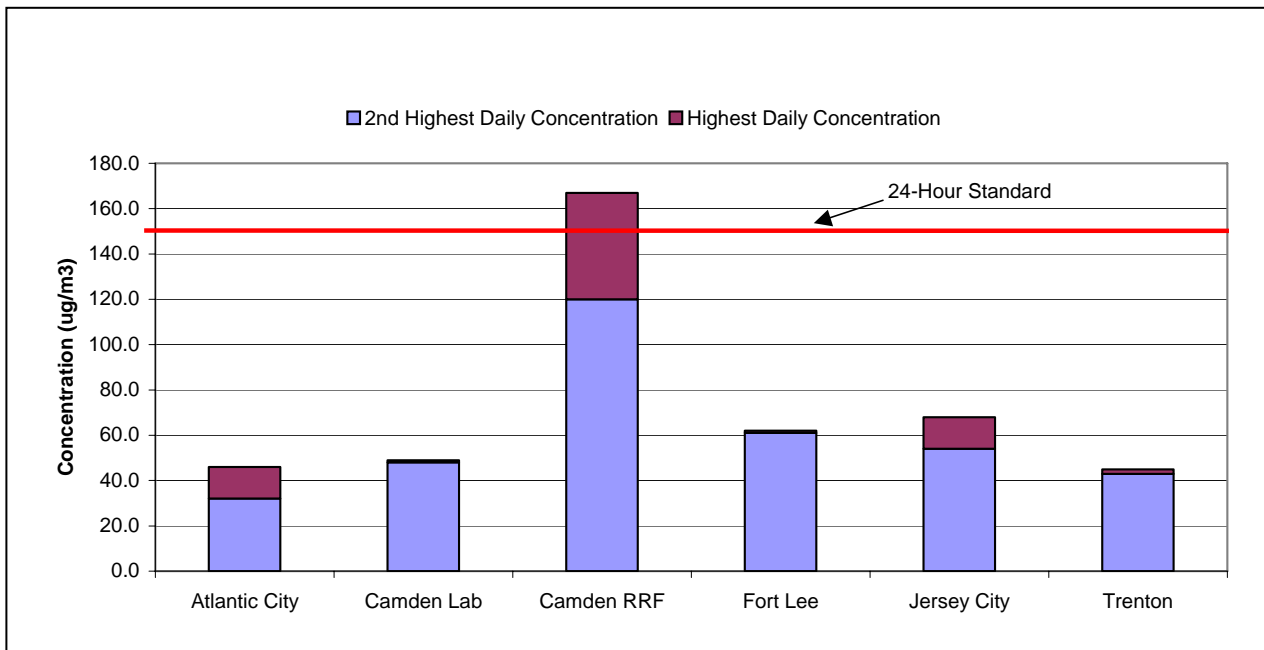
Table 4
PM10 Data - 2004
24-Hour and Annual Averages

Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)
 24-Hour Standard = $150 \mu\text{g}/\text{m}^3$
 Annual Standard = $50 \mu\text{g}/\text{m}^3$

Monitoring Site	Number of Samples	24-Hour Maximum	Second Highest	Annual Mean
Atlantic City	52	46	32	19.4
Camden Lab	48	49	49	20.8
Camden RRF	55	167	120	41.3
Fort Lee ^a	39	62	61	31.8
Jersey City-Firehouse	59	68	54	27.4
Trenton	57	45	43	18.8

^a Data Not Available after September

Figure 8
Summary of PM₁₀ Concentrations, New Jersey 2004



SMOKE SHADE SUMMARY

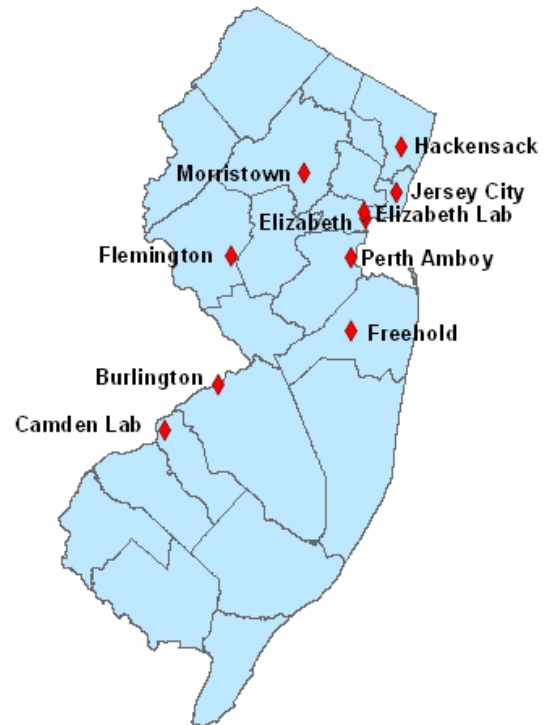
SMOKE SHADE MONITORING SITES

In addition to fine and coarse particulate monitoring, smoke shade is also monitored at 10 stations around the state. Smoke shade, which is an indirect measurement of particles in the atmosphere, has been monitored in New Jersey for over 30 years. Smoke shade is primarily used for the daily reporting of particulate levels in the Air Quality Index. The sites monitoring smoke shade are shown in Figure 9.

SMOKE SHADE CONCENTRATION SUMMARY

In 2004, the annual mean concentration of smoke shade ranged from 0.17 Coefficient of Haze units (COH) at Flemington and Camden Lab to 0.55 COH at Elizabeth Lab. COH are units of light transmittance and smoke shade is not a direct measure of particle mass. A 24-hour average level of 2.0 COH is used as a benchmark. Readings above the 2.0 COH benchmark are reported as Unhealthy for Sensitive Groups on the daily Air Quality Index. For more details see the Air Quality Index section of this report. Table 5 lists the maximum and second highest daily average and annual mean smoke shade levels recorded at the monitoring sites in 2004.

**Figure 9
2004 Smoke Shade
Monitoring Network**



**Table 5
Smoke Shade - 2004**

Coefficient of Haze (COHs)
No Standard

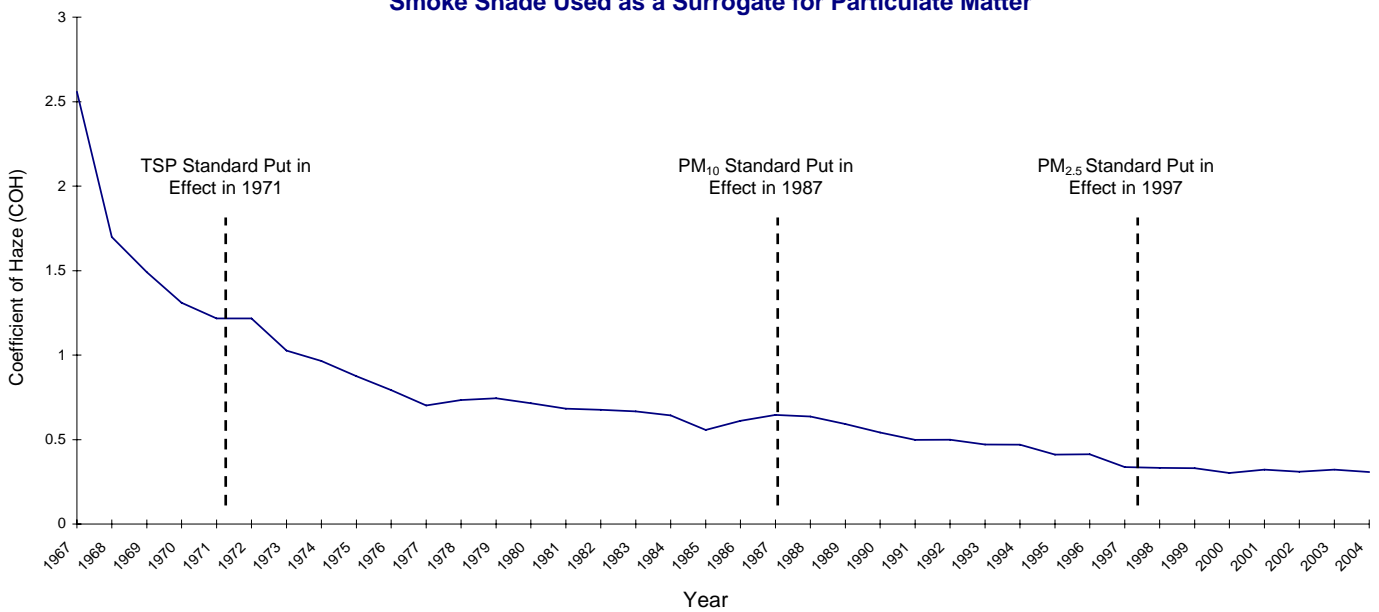
Site	Maximum Daily Average	2nd Highest	Annual Mean
Burlington	0.62	0.58	0.18
Camden Lab	0.84	0.82	0.17
Elizabeth	1.56	1.30	0.48
Elizabeth Lab	1.37	1.37	0.55
Flemington	0.68	0.50	0.17
Freehold	0.62	0.55	0.21
Hackensack	1.13	0.95	0.24
Jersey City	1.65	1.22	0.48
Morristown	0.51	0.42	0.19
Perth Amboy	0.88	0.85	0.27

TRENDS IN PARTICULATE CONCENTRATIONS

The longest continuously operating particle monitoring network in the state that is suitable for looking at trends is the smoke shade network. As noted earlier, this monitoring program has been in effect for over thirty years and still has 10 active sites. The trend graph for smoke shade, shown in Figure 10 indicates that particulate levels have steadily declined over the past thirty years. Smoke shade is not a direct measurement of particle mass, but can be related to TSP, PM₁₀ and PM_{2.5} health standards.

Figure 10
Long Term Trend in Particulate Levels
1967- 2004

Smoke Shade Used as a Surrogate for Particulate Matter



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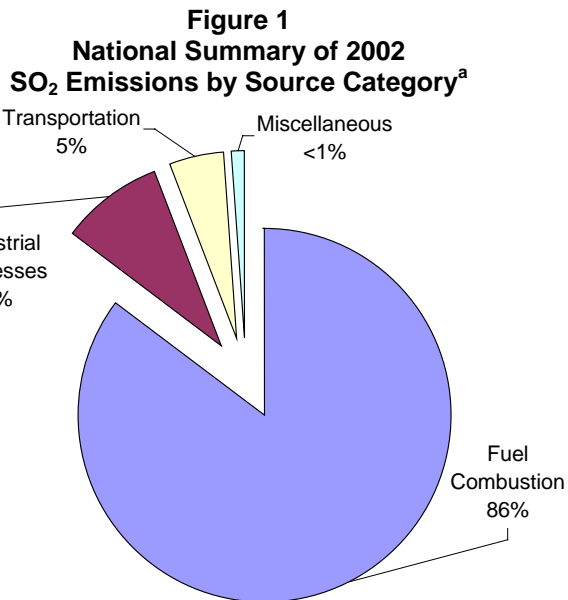


2004 Sulfur Dioxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Sulfur dioxide (SO₂) is a heavy, colorless gas with a suffocating odor that easily dissolves in water to form sulfuric acid. SO₂ 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 SO₂. A pie chart summarizing the major sources of SO₂ is shown in Figure 1.



^a - sums do not equal 100 due to rounding
Source: USEPA National Air Quality Emissions Trends Report, 2003 Special Studies, September 2003

SO₂ 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 SO₂ 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 SO₂ dissolves at the surface of the membranes. Groups that are especially susceptible to the harmful health effects of SO₂ include children, the elderly, and people with heart or lung disorders such as asthma. When SO₂ 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 SO₂ and based on available information, determined that no conclusion can be made as to the carcinogenicity of SO₂ 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. SO₂ 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 SO₂. 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 SO₂. They are similar to the federal standards but are expressed in micrograms per cubic meter (µg/m³) 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

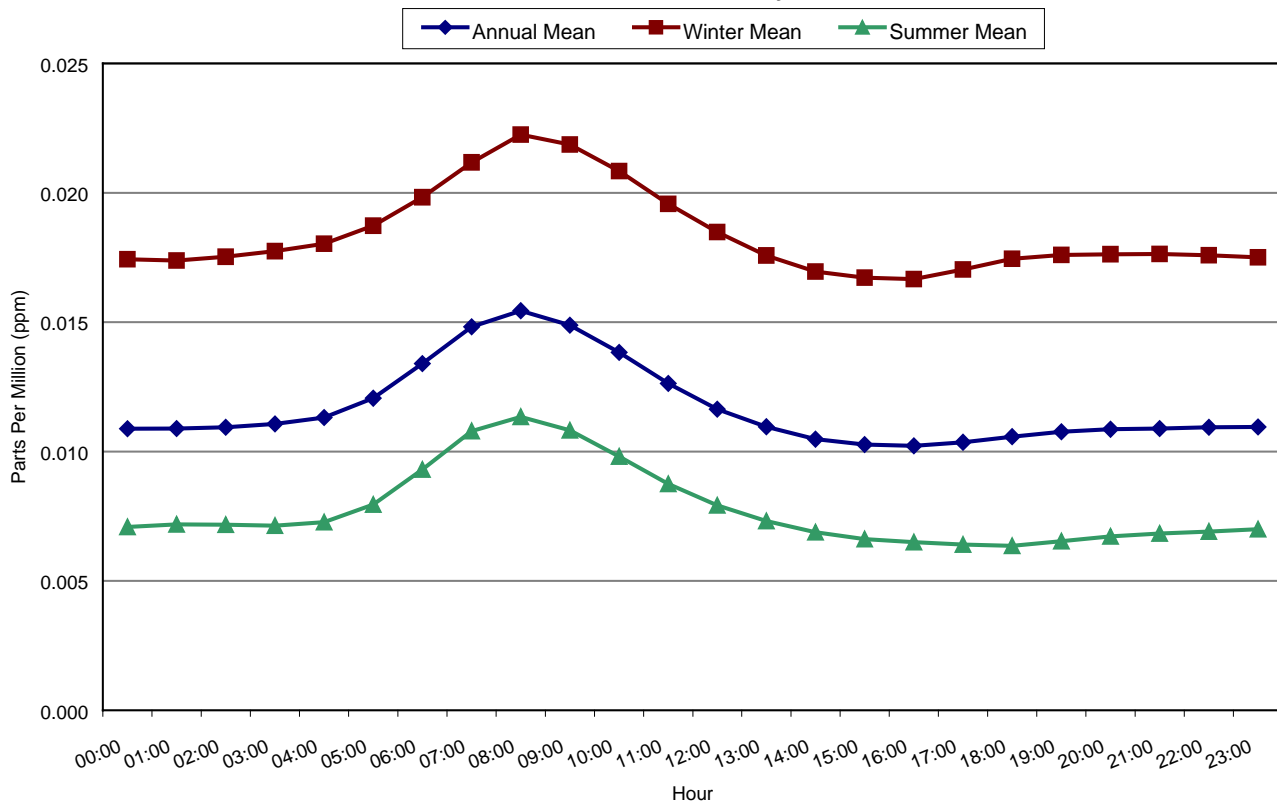
year average. The state also has secondary 12-month, 24-hour, and 3-hour average standards. Table 1 summarizes the NAAQS and the New Jersey Ambient Air Quality Standards (NJAAQS) for SO₂.

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

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



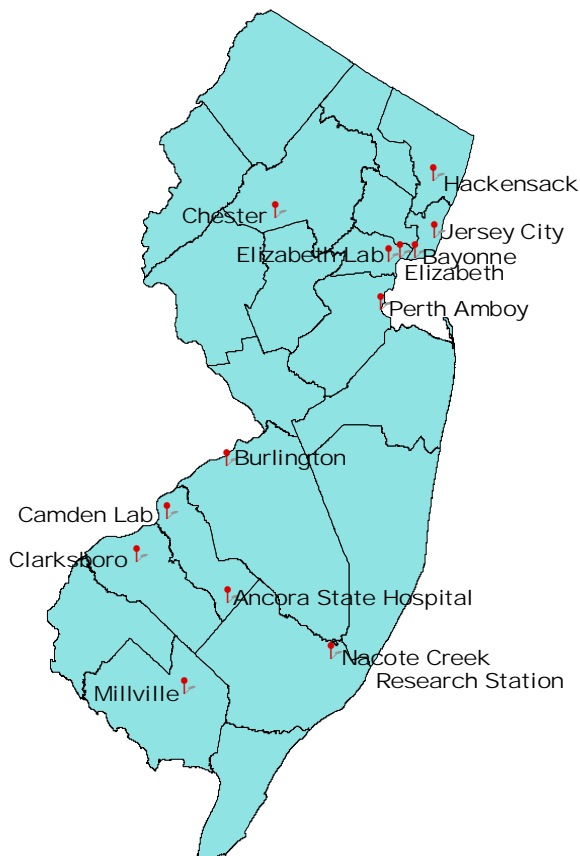
MONITORING LOCATIONS

The state monitored SO₂ levels at 13 locations in 2004. These sites are shown in the map in Figure 3. The Camden Lab monitoring station was temporarily discontinued on September 22, 2003, and resumed operation on January 8, 2004

SO₂ LEVELS IN 2004

None of the monitoring sites recorded exceedances of the primary or secondary SO₂ standards during 2004. The maximum 12-month average concentration recorded was 0.009 ppm in Jersey City. The maximum 24-hour average level recorded was 0.033 ppm which was recorded in Jersey City. The highest 3-hour average recorded was 0.069 ppm at Elizabeth Lab. Summaries of the 2004 data are provided in Table 2, Table 3 (page 4) and Figure 4 (page 4).

**Figure 3
2004 Sulfur Dioxide
Monitoring Network**



**Table 2
Sulfur Dioxide Data – 2004
3-Hour and Annual Averages**

Parts Per Million (ppm)

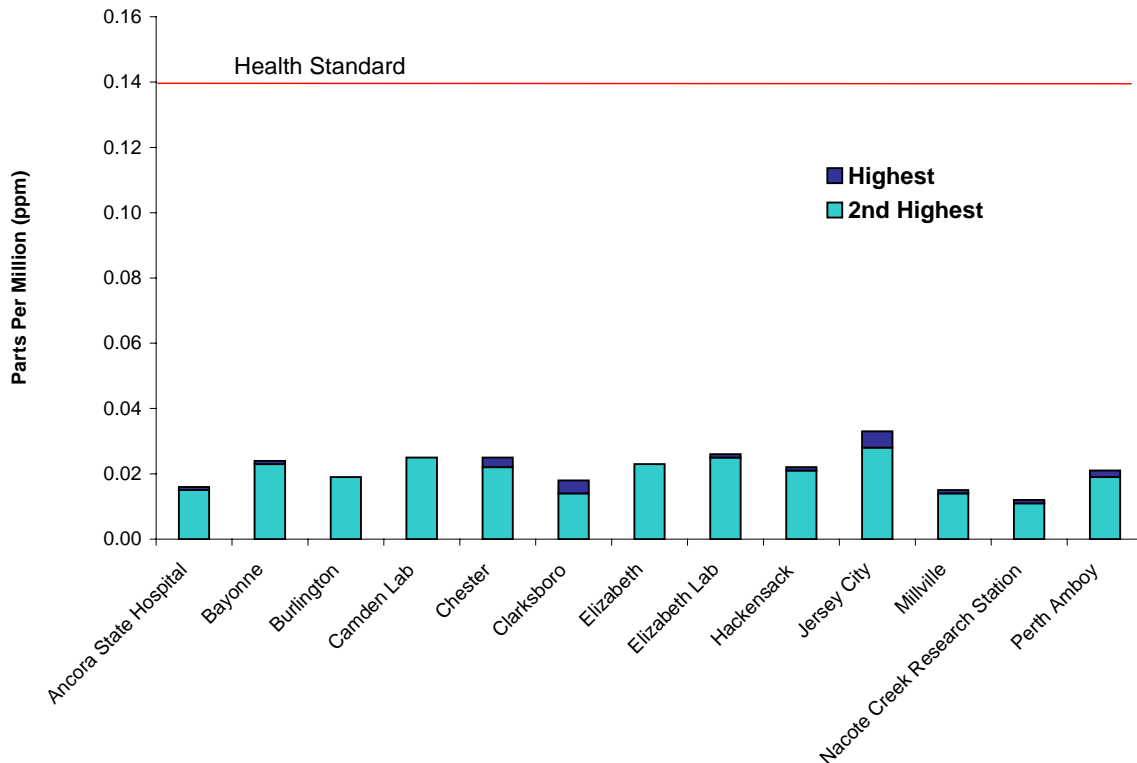
Monitoring Sites	3-Hour Average Maximum	3-Hour Average 2 nd Highest	12-Month Average Maximum	Average Calendar Year
Ancora State Hospital	0.027	0.024	0.004	0.004
Bayonne	0.051	0.047	0.007	0.007
Burlington	0.032	0.031	0.004	0.004
Camden Lab	0.050	0.044	0.006	0.006
Chester	0.049	0.038	0.004	0.004
Clarksboro	0.031	0.029	0.004	0.004
Elizabeth	0.036	0.036	0.006	0.005
Elizabeth Lab	0.069	0.062	0.008	0.008
Hackensack	0.045	0.039	0.004	0.004
Jersey City	0.057	0.049	0.009	0.008
Millville	0.035	0.025	0.004	0.004
Nacote Creek Research Center	0.023	0.017	0.003	0.002
Perth Amboy	0.035	0.034	0.005	0.005

Table 3
Sulfur Dioxide Data – 2004
24-Hour and Daily Averages

Parts Per Million (ppm)

Monitoring Sites	24-Hour Average Maximum	24-Hour Average 2 nd Highest	Daily Average Maximum	Daily Average 2 nd Highest
Ancora State Hospital	0.016	0.015	0.015	0.012
Bayonne	0.024	0.023	0.024	0.022
Burlington	0.019	0.019	0.019	0.019
Camden Lab	0.025	0.025	0.024	0.023
Chester	0.025	0.022	0.023	0.021
Clarksboro	0.018	0.014	0.017	0.013
Elizabeth	0.023	0.023	0.023	0.023
Elizabeth Lab	0.026	0.025	0.025	0.023
Hackensack	0.022	0.021	0.021	0.021
Jersey City	0.033	0.028	0.030	0.028
Millville	0.015	0.014	0.013	0.013
Nacote Creek Research Station	0.012	0.011	0.012	0.010
Perth Amboy	0.021	0.019	0.020	0.018

Figure 4
Highest and 2nd Highest Daily Averages
Of SO₂ in New Jersey - 2004



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
1975-2004
Second Highest Daily Average

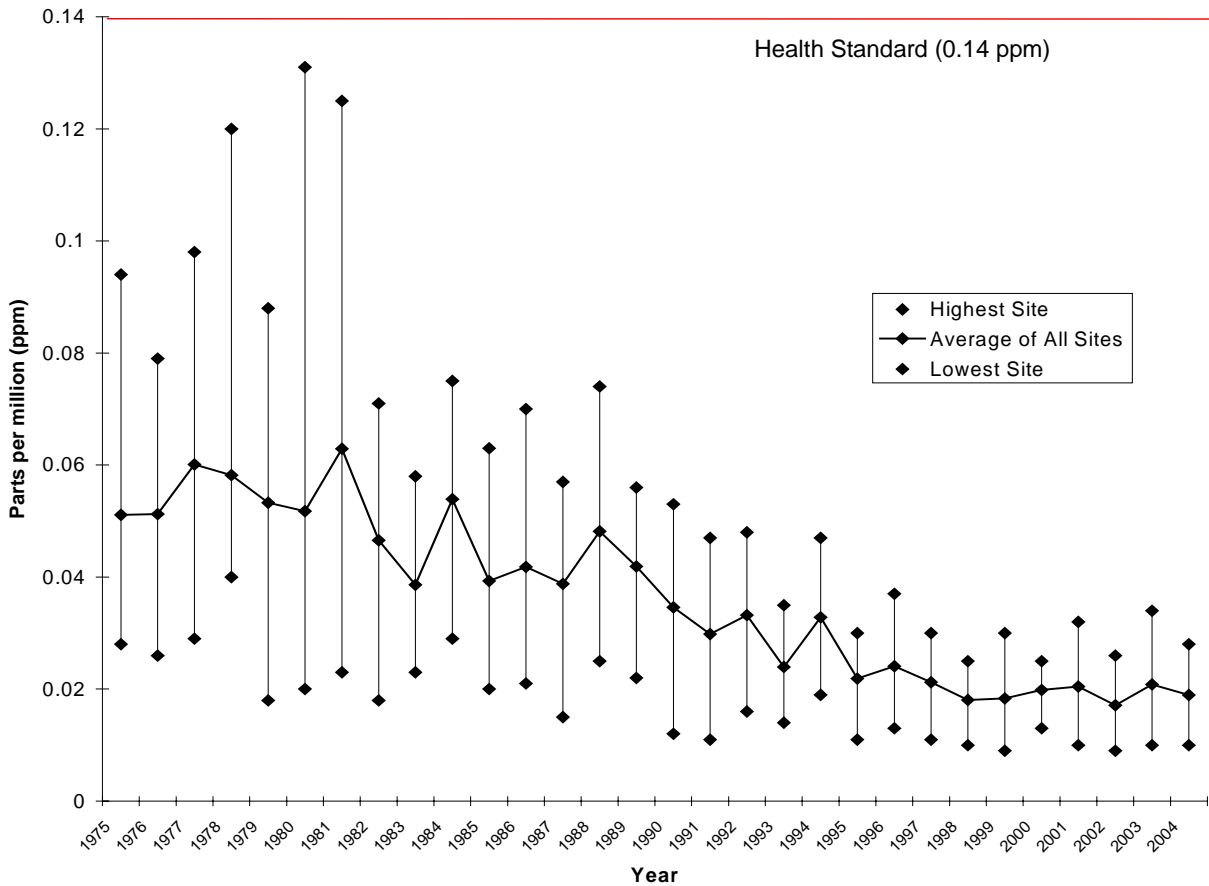
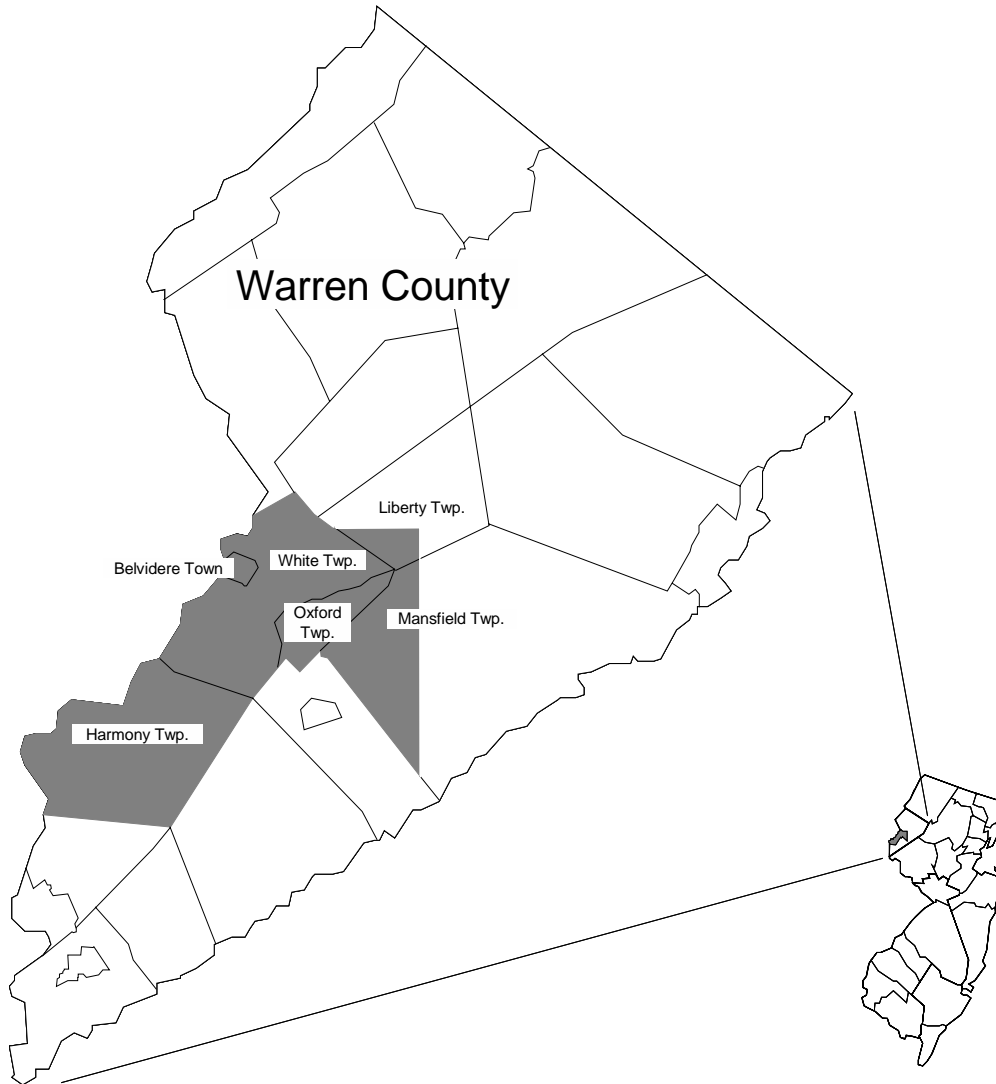


Figure 6
Sulfur Dioxide Non-Attainment Areas* in New Jersey



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

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2004 Air Toxics Summary

New Jersey Department of Environmental Protection

INTRODUCTION

Air pollutants can be divided into two categories: the criteria pollutants (ozone, sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, and lead); and air toxics. The criteria pollutants have been addressed at the national level for many years. The United States Environmental Protection Agency (USEPA) has set National Ambient Air Quality Standards (NAAQS) for them, and they are subject to a standard planning process that includes monitoring, reporting, and control requirements. Each of these pollutants is discussed in its own section of this NJDEP 2004 Air Quality Report.

Air toxics are basically all the other chemicals released into the air that have the potential to cause adverse health effects in humans. These effects cover a wide range of conditions, from lung irritation to birth defects to cancer. There are no NAAQS for these pollutants, but in 1990 the U.S. Congress directed the USEPA to begin to address a list of almost 200 air toxics by developing control technology standards for specific categories of sources that emit them. These air toxics are known as the Clean Air Act Hazardous Air Pollutants (HAPs). You can get more information about HAPs at the USEPA Air Toxics web site at www.epa.gov/ttn/atw. NJDEP also has several web pages dedicated to air toxics. They can be accessed at www.state.nj.us/dep/airmon/airtoxics.

HEALTH EFFECTS

People exposed to significant amounts of air toxics may have an increased chance of getting cancer or experiencing other serious health effects. The non-cancer health effects can range from respiratory, neurological, reproductive, developmental, or immune system damage, to irritation and effects on specific organs. In addition to inhalation exposure, there can be risks from the deposition of toxic pollutants onto soils or surface waters. There, they can be taken up by plants and animals, which are later consumed by humans.

The effects on human health resulting from exposure to specific air toxics can be estimated by using chemical-

specific "health benchmarks." These are developed by the USEPA and other agencies by looking at numerous health studies for a chemical. For carcinogens, the health benchmark is set at the concentration of the pollutant that corresponds to a one in a million increase in the risk of getting cancer if a person was to breathe that concentration over his or her entire lifetime. The health benchmark for non-carcinogens is set at a concentration not expected to have any adverse health effects, also known as the reference concentration. Health benchmarks for each of the air toxics are listed in Table 4 (see page 10-11). If ambient air concentrations exceed the set benchmarks then further action is warranted.

SOURCES OF AIR TOXICS

A few years ago, USEPA began a national study of air toxics, the National-Scale Air Toxics Assessment (NATA). In an effort to determine people's exposure to air toxics around the country, USEPA first prepared a comprehensive inventory of air toxics emissions from all man-made sources in 1996. The 1996 emissions inventory for New Jersey was briefly reviewed and revised by NJDEP before being finalized. Although there are likely to be some errors in the details of such a massive undertaking, the emissions inventory still can give us an indication of the most important sources of air toxic emissions in our state. The pie chart in Figure 1 (see page 2), based on the 1996 NATA emissions estimates, shows that mobile sources are the largest contributors of air toxics emissions in New Jersey.

On-road mobile sources (cars, and trucks) account for 35% of the emissions, and off-road mobile sources (airplanes, trains, construction equipment, lawnmowers, boats, dirt bikes, etc.) contribute 33%. Area sources (residential, commercial, and small industrial sources) represent 25% of the inventory, and major point sources (such as factories and power plants) account for the remaining 7%.

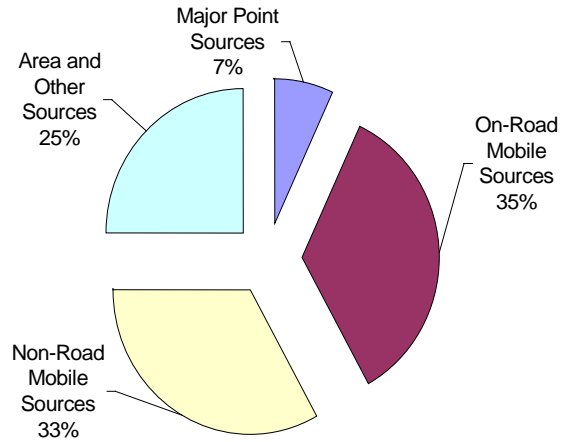
Air toxics come from many different sources - not only manufacturing, but also other kinds of human activity. When New Jersey's emissions estimates are broken down

by county (see Figure 2) it is evident that the areas with the largest air toxic emissions are generally those with the largest populations. This is directly related to high levels of vehicle use, solvent use, heating, and other population-related activities in those counties.

ESTIMATING AIR TOXICS EXPOSURE

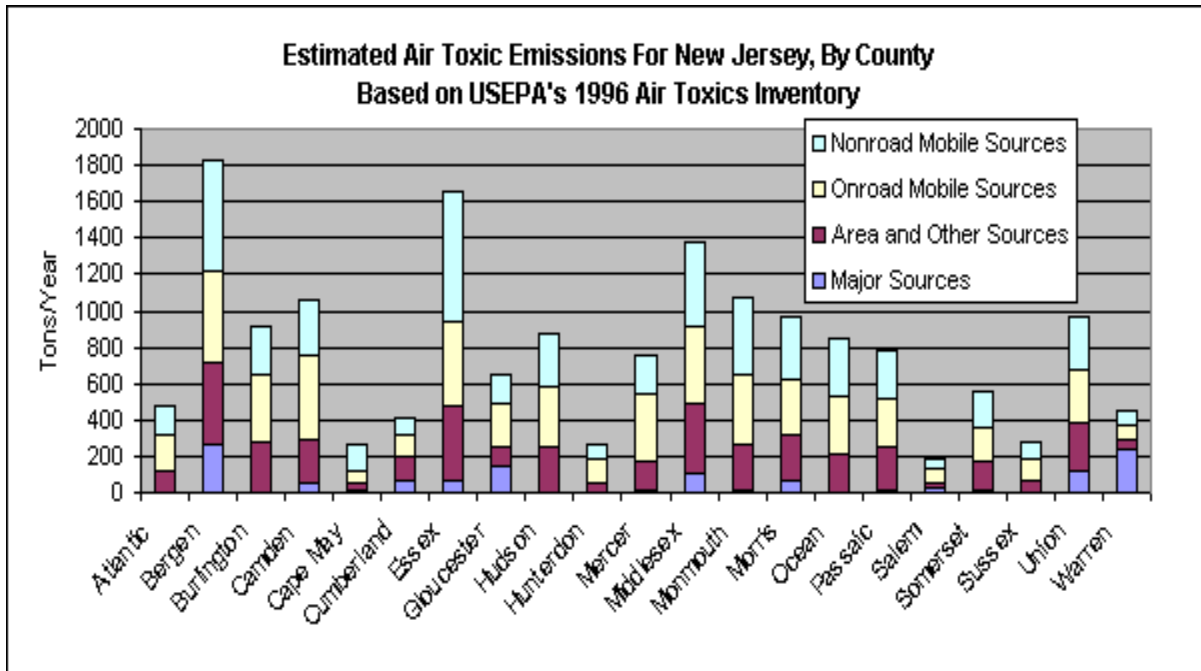
The next step in USEPA's NATA project was to use the emissions information in an air dispersion model. The model estimates the concentrations of air toxics that people may be exposed to in different parts of the country. The map in Figure 3 shows the predicted concentrations of benzene throughout New Jersey. The high concentration areas tend to overlap the more densely populated areas of the state, following the pattern of emissions. Not all air toxics follow this pattern, as some are more closely associated with individual point sources, but in general, larger populations result in greater emissions of, and exposure to, air toxics.

Figure 1
1996 Air Toxics Emissions Estimates for New Jersey



Source: USEPA's National Air Toxics Assessment, 1996

Figure 2



Our preliminary analysis of the state and county NATA indicates that nineteen chemicals were predicted to exceed their health benchmarks in one or more counties in 1996. Eighteen of these are considered to be cancer causing (carcinogenic) chemicals, and one (acrolein) is not. Estimated air concentrations of these 19 pollutants vary around the state, depending on the type of sources that emit them. This is summarized in Table 1.

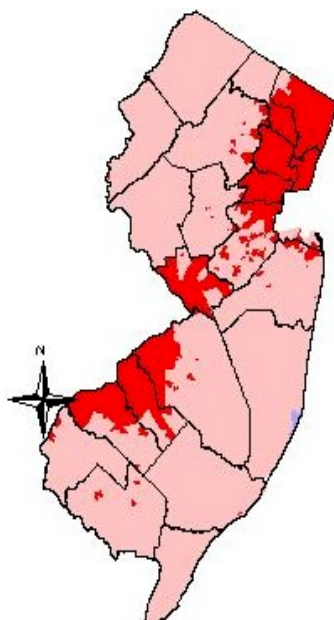
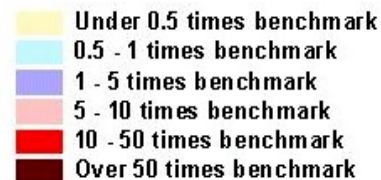


Figure 3
NATA PREDICTED CONCENTRATIONS
IN NEW JERSEY FOR 1996

Benzene



Maximum concentration is 4.5 micrograms per cubic meter, or 35 times the health benchmark

Health Benchmark = 0.13ug/m³

Table 1

Air Toxics of Greatest Concern in New Jersey
Based on 1996 National Air Toxics Assessment

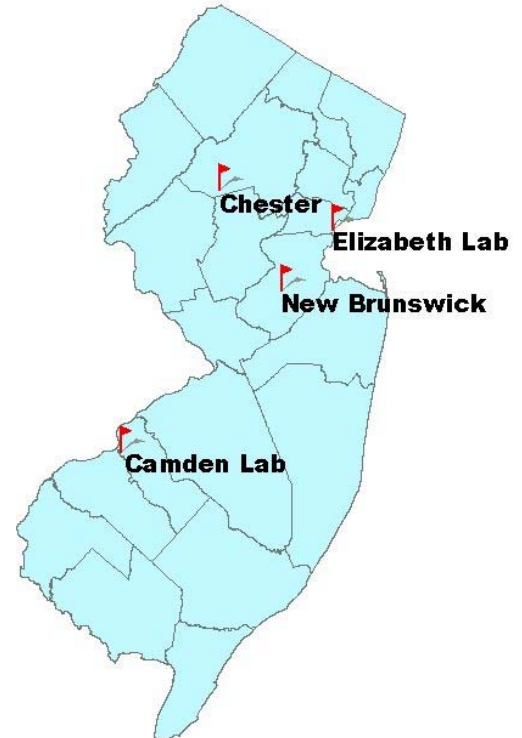
Pollutant of Concern	Extent	Primary Source of Emissions
Benzene	Statewide	Mobile; Background Concentration
1,3-Butadiene	Statewide	On-Road Mobile
Carbon tetrachloride	Statewide	Background Concentration
Chloroform	Statewide	Background Concentration; Point
Diesel particulate matter	Statewide	Off-Road Mobile
Ethylene dibromide	Statewide	Background Concentration
Ethylene dichloride	Statewide	Background Concentration
Formaldehyde	Statewide	Mobile
Acrolein	20 Counties	Mobile
Polycyclic organic matter	20 Counties	Area
Chromium compounds	17 Counties	Area
Acetaldehyde	13 Counties	Mobile
Tetrachloroethylene	11 Counties	Area; Background Concentration
7-PAH	5 Counties	Area
Arsenic compounds	4 Counties	Area; Point
Cadmium compounds	4 Counties	Area
Nickel compounds	4 Counties	Area
Beryllium compounds	1 County	Area
Hydrazine	1 County	Area

AIR TOXICS MONITORING PROGRAM

NJDEP has established four air toxics monitoring sites around the state. They are located in Camden, Elizabeth, New Brunswick and Chester (see Figure 4). The Camden Lab site has been measuring several toxic volatile organic compounds (VOCs) since 1989. The Elizabeth Lab site began measuring VOCs in 2000, and the New Brunswick and Chester sites became operational in July 2001. Analysis of toxic metals at all four sites also began in 2001.

A comparison of the concentrations predicted by NATA and actual monitored levels can be made for the Camden Lab site. In 1996, thirteen of the compounds evaluated in NATA were measured in Camden. Table 2 compares the NATA predictions with the measured concentrations for 1996. Measured 2004 levels, and the percent of change from 1996, are also shown. Figure 5 also shows the comparison of predicted values for some toxic compounds and actual measured concentrations at Camden in 1996. It appears from this analysis that the agreement between predicted and monitored concentrations is remarkably good. Also, for most of the thirteen air toxics in Table 2, the 2004 levels measured at the Camden Lab were substantially lower than the concentrations measured in 1996.

**Figure 4
2004 Air Toxics
Monitoring Network**



**Figure 5
Air Toxics Levels Measured in 1996 at Camden,
New Jersey Compared to NATA Predicted Levels**

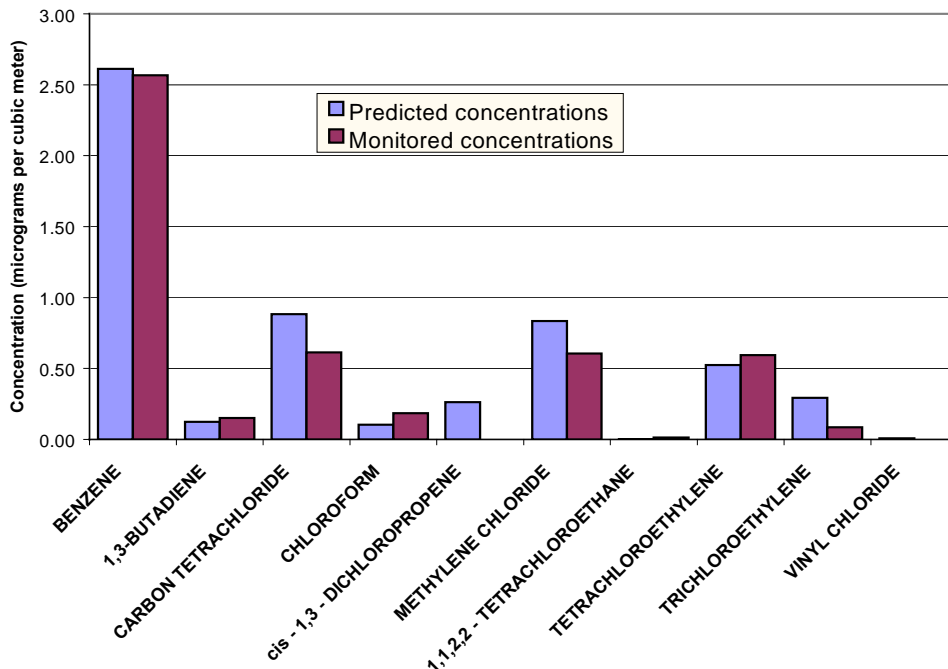


Table 2
Comparison of NATA Predicted to Measured Levels in Camden, NJ

NA – Not Available
 $\mu\text{g}/\text{m}^3$ - Micrograms Per Cubic Meter

Pollutant (HAP)	NATA Predicted 1996, $\mu\text{g}/\text{m}^3$	Measured 1996 Level, $\mu\text{g}/\text{m}^3$	Measured 2004 Level, $\mu\text{g}/\text{m}^3$	Percent Change in Measured Levels in 1996 and 2004
Acetaldehyde	1.74	4.53	9.12	+101.3%
Acrylonitrile	0.003	NA	0.02 ^a	NA
Benzene	2.61	2.57	1.45	-43.6% ^b
1,3-Butadiene	0.12	0.15	0.06 ^a	-60.0% ^b
Carbon Tetrachloride	0.88	0.61	0.53	-13.1% ^b
Chloroform	0.10	0.18	0.02 ^a	-88.9% ^b
cis-1,3-Dichloropropene	0.26	0.00 ^a	0.00 ^a	00.0%
Formaldehyde	2.20	14.63	7.43	-49.2% ^b
Methylene Chloride	0.83	0.61	0.39	-36.1% ^b
1,1,2,2-Tetrachloroethane	0.00	0.01 ^a	0.00 ^a	-100.0% ^b
Tetrachloroethylene	0.52	0.59	0.26	-55.9% ^b
Trichloroethylene	0.29	0.09	0.27	+200.0%
Vinyl Chloride	0.01	0.00 ^a	0.01 ^a	+100.0%

^a Measurement fell below detection limits.

^b Negative values for percent change mean measured levels went down from 1996 to 2004

AIR TOXICS MONITORING RESULTS FOR 2004

The results of the air toxics monitoring program for 2004 are shown in Table 3. This table shows the average concentration for each air toxic measured at the four New Jersey monitoring sites. All values are in parts per billion by volume (ppbv). More detailed tables (Tables 4-7) that show additional statistics, detection limit information, health benchmarks used by NJDEP, and levels in both ppbv and micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) can be found at the end of this section. The ppbv units are more common for monitoring results, while $\mu\text{g}/\text{m}^3$ units are generally used in

modeling and health studies. Note that many of the compounds that were tested were often below the detection limit of the method used. Concentrations below the detection limit, including zero values, were used in the calculation of the annual average concentrations.

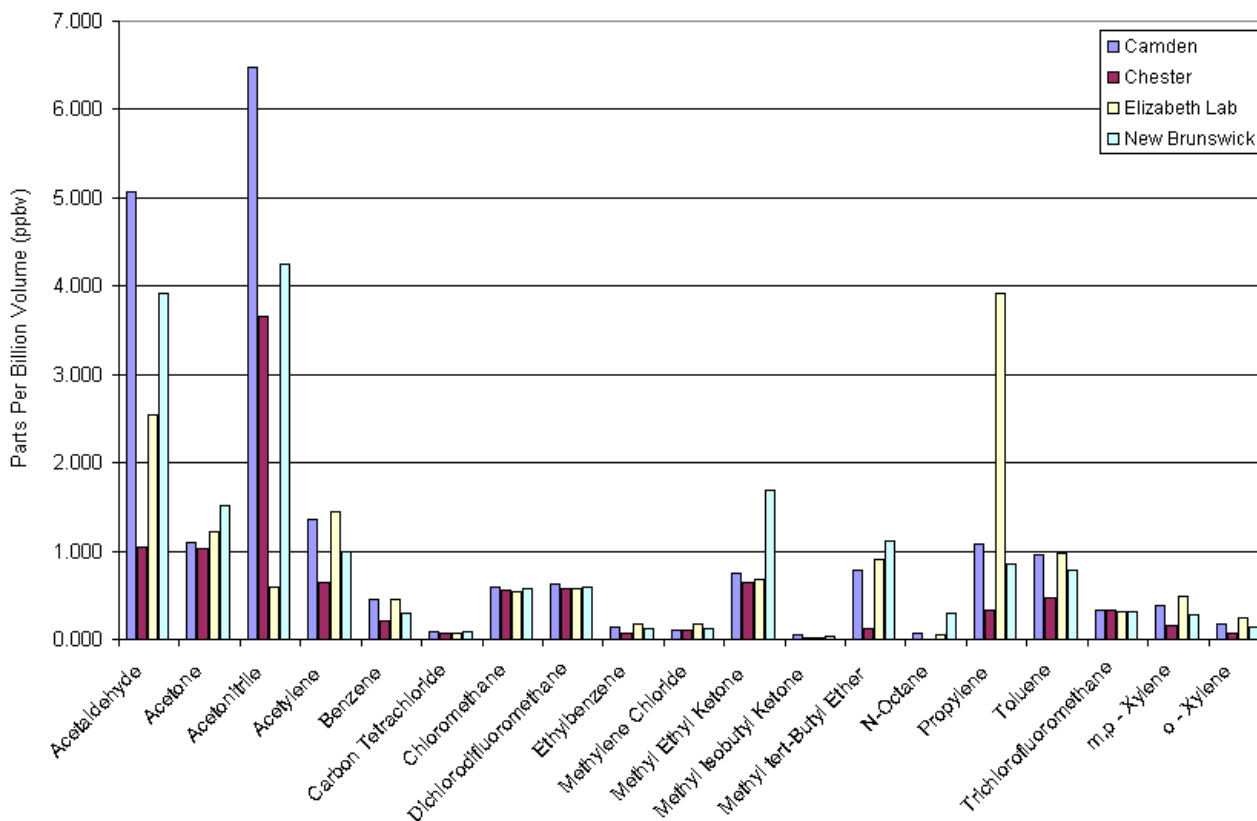
Reported averages for which a significant portion of the data (more than 50%) was below the detection limit should be viewed with extreme caution. Median values (the value of the middle sample value when the results are ranked) are reported along with the mean (average) concentrations, because for some compounds only a

single or very few high values were recorded. These high values will tend to increase the average concentration significantly but would have less effect on the median value. In such cases, the median value may be a better indicator of long term exposures, on which most of the health benchmarks for air toxics are based. The average concentrations for some of the more prevalent air toxics are graphed in Figure 6.

The Chester site has the lowest concentrations for the

majority of the prevalent air toxics. In contrast Camden and Elizabeth had the highest number of compounds (eight) with average concentrations that exceeded their health benchmark. The toxic air pollutants that exceeded the health benchmark at all sites included acetaldehyde, benzene, carbon tetrachloride, chloromethane, and formaldehyde. New Brunswick was the only site to exceed the Methyl Tert-butyl Ether benchmark while only Camden and Elizabeth exceeded benchmarks for 1,3 Butadiene and Tetrachloroethylene.

Figure 6
Selected Toxic Volatile Organics
2004 Annual Averages
New Jersey



**Table 3
New Jersey Air Toxics Summary – 2004**

**Annual Average Concentration
ppbv – Parts Per Billion by Volume**

Pollutant	Camden Lab	Chester	Elizabeth Lab	New Brunswick
Acetaldehyde	5.06	1.04	2.55	3.92
Acetone	1.10	1.03	1.22	1.52
Acetonitrile	6.48	3.66	0.60	4.25
Acetylene	1.35	0.65	1.45	1.00
Acrylonitrile	0.01	0.01	0.01	0.01
tert-Amyl Methyl Ether	0.00	0.00	0.00	0.00
Benzaldehyde	0.07	0.03	0.04	0.03
Benzene	0.45	0.21	0.45	0.30
Bromochloromethane	0.00	0.00	0.00	0.00
Bromodichloromethane	0.00	0.00	0.00	0.00
Bromoform	0.00	0.00	0.00	0.00
Bromomethane	0.02	0.00	0.00	0.00
1,3-Butadiene	0.03	0.00	0.05	0.00
Butyraldehyde	0.15	0.12	0.15	0.23
Carbon Tetrachloride	0.08	0.07	0.07	0.08
Chlorobenzene	0.00	0.00	0.00	0.00
Chloroethane	0.00	0.00	0.00	0.12
Chloroform	0.00	0.00	0.01	0.01
Chloromethane	0.59	0.56	0.55	0.57
Chloromethylbenzene	0.00	0.00	0.00	0.00
Chloroprene	0.00	0.00	0.00	0.00
Crotonaldehyde	0.06	0.13	0.08	0.15
Dibromochloromethane	0.00	0.00	0.00	0.00
1,2-Dibromoethane	0.00	0.00	0.00	0.00
m-Dichlorobenzene	0.00	0.00	0.00	0.00
o-Dichlorobenzene	0.00	0.00	0.00	0.00
p-Dichlorobenzene	0.01	0.00	0.00	0.00
1,1-Dichloroethane	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.01	0.00	0.00	0.00
cis-1,2-Dichloroethylene	0.00	0.00	0.00	0.00
trans-1,2-Dichloroethylene	0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.63	0.57	0.58	0.60
1,2-Dichloroethane	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.00	0.00	0.00	0.00
cis-1,3-Dichloropropene	0.00	0.00	0.00	0.00
trans-1,3-Dichloropropene	0.00	0.01	0.00	0.00
Dichlorotetrafluoroethane	0.00	0.00	0.00	0.00
2,5-Dimethylbenzaldehyde	0.01	0.00	0.01	0.00
Ethyl Acrylate	0.00	0.00	0.00	0.00
Ethylbenzene	0.14	0.06	0.17	0.12
Ethyl tert-Butyl Ether	0.00	0.00	0.00	0.00
Formaldehyde	6.05	2.65	3.58	4.69

Table 3 (Continued)
New Jersey Air Toxics Summary – 2004

Annual Average Concentration
ppbv – Parts Per Billion by Volume

Pollutant	Camden Lab	Chester	Elizabeth Lab	New Brunswick
Hexachloro-1,3-butadiene	0.00	0.00	0.00	0.00
Hexaldehyde	0.04	0.03	0.05	0.03
Isovaleraldehyde	0.00	0.00	0.00	0.02
Methylene Chloride	0.11	0.11	0.18	0.11
Methyl Ethyl Ketone	0.74	0.64	0.69	1.69
Methyl Isobutyl Ketone	0.05	0.02	0.02	0.04
Methyl Methacrylate	0.00	0.00	0.28	0.01
Methyl tert-Butyl Ether	0.78	0.11	0.91	1.11
n-Octane	0.07	0.01	0.06	0.29
Propionaldehyde	0.14	0.11	0.12	0.25
Propylene	1.08	0.33	3.92	0.85
Styrene	0.08	0.03	0.04	0.04
1,1,2,2-Tetrachloroethane	0.00	0.00	0.00	0.00
Tetrachloroethylene	0.04	0.01	0.04	0.02
Tolualdehydes	0.05	0.02	0.03	0.03
Toluene	0.95	0.47	0.97	0.79
1,2,4-Trichlorobenzene	0.00	0.00	0.00	0.00
1,1,1-Trichloroethane	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	0.00	0.00	0.00	0.00
Trichloroethylene	0.05	0.00	0.00	0.00
Trichlorofluoromethane	0.33	0.34	0.31	0.31
Trichlorotrifluoroethane	0.09	0.08	0.08	0.08
1,2,4-Trimethylbenzene	0.17	0.03	0.14	0.13
1,3,5-Trimethylbenzene	0.05	0.01	0.04	0.04
Valeraldehyde	0.04	0.02	0.11	0.05
Vinyl chloride	0.00	0.00	0.00	0.00
m,p-Xylene	0.39	0.16	0.49	0.28
o-Xylene	0.17	0.07	0.24	0.13

TRENDS

The site in Camden is the only monitoring location that has been measuring air toxics for an extended period. The graph in Figure 7 shows the change in concentrations for three of the most prevalent air toxics (benzene, toluene, and xylene) from 1990 to 2004. The graph shows that while average concentrations can vary significantly from year to year, the overall trend is downward. High individual

samples may also result in high annual averages in some years. Concentrations of most air toxics have declined significantly over the last ten years. Because air toxics comprise such a large and diverse group of compounds, however, these general trends may not hold for other pollutants in different areas of the state.

Figure 7
Annual Averages for Selected Hazardous Air
Pollutants (HAPs) at Camden Lab from 1990-2004

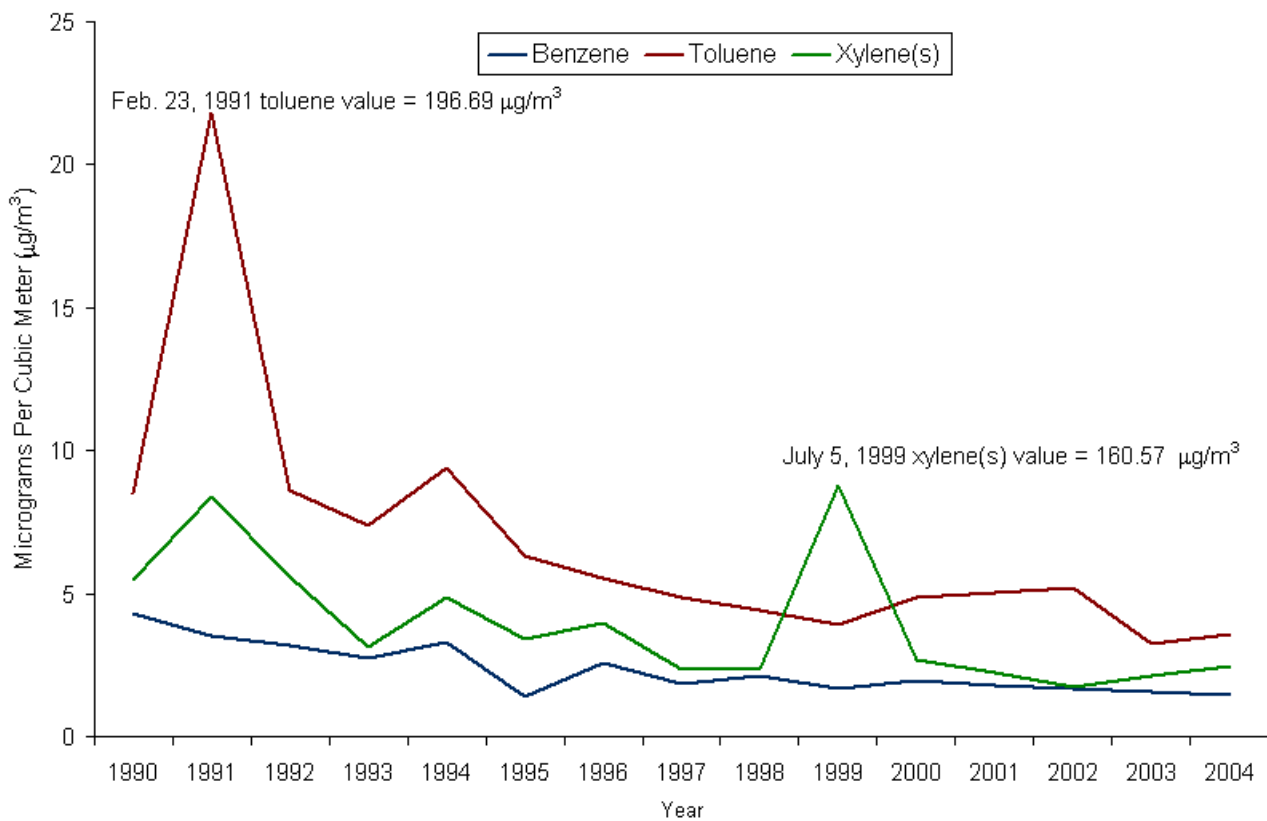


Table 4
Air Toxics Data 2004
January – September
Camden Lab, New Jersey

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Acetaldehyde	0.005	100.0	0.45	9.12	5.06	1.84	29.10
Acetone	0.002	100.0	31000	2.60	1.10	0.76	7.09
Acetonitrile	0.25	47.5	60	10.88	6.48	0.00	83.00
Acetylene	0.13	100.0		1.44	1.35	1.16	9.71
Acrylonitrile	0.21	4.9	0.015	0.02	0.01	0.00	0.18
tert-Amyl Methyl Ether	0.12	3.3		0.02	0.00	0.00	0.18
Benzaldehyde	0.003	98.1		0.29	0.07	0.03	0.71
Benzene	0.04	100.0	0.13	1.45	0.45	0.39	2.13
Bromochloromethane	0.12	0.0		0.00	0.00	0.00	0.00
Bromodichloromethane	0.06	0.0		0.00	0.00	0.00	0.00
Bromoform	0.08	0.0	0.91	0.00	0.00	0.00	0.00
Bromomethane	0.09	14.8	5	0.10	0.02	0.00	0.31
1,3-Butadiene	0.07	27.9	0.033	0.06	0.03	0.00	0.22
Butyraldehyde	0.011	100.0		0.44	0.15	0.04	1.33
Carbon Tetrachloride	0.08	91.8	0.067	0.53	0.08	0.09	0.15
Chlorobenzene	0.06	0.0	1000	0.00	0.00	0.00	0.00
Chloroethane	0.08	1.6		0.01	0.00	0.00	0.24
Chloroform	0.05	6.6	0.043	0.02	0.00	0.00	0.07
Chloromethane	0.05	98.4	0.56	1.23	0.59	0.60	0.89
Chloromethylbenzene	0.07	0.0		0.00	0.00	0.00	0.00
Chloroprene	0.01	0.0	1	0.00	0.00	0.00	0.00
Crotonaldehyde	0.005	98.1		0.18	0.06	0.02	0.43
Dibromochloromethane	0.08	0.0		0.00	0.00	0.00	0.00
1,2-Dibromoethane	0.08	0.0	0.0017	0.00	0.00	0.00	0.00
m-Dichlorobenzene	0.05	0.0		0.00	0.00	0.00	0.00
o-Dichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
p-Dichlorobenzene	0.09	13.1	0.091	0.08	0.01	0.00	0.19
1,1-Dichloroethane	0.08	0.0	0.63	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.1	1.6	200	0.02	0.01	0.00	0.31
cis-1,2-Dichloroethylene	0.1	0.0		0.00	0.00	0.00	0.00
trans-1,2-Dichloroethylene	0.06	0.0		0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.04	100.0	200	3.10	0.63	0.62	0.84
1,2-Dichloroethane	0.06	0.0	0.038	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.07	0.0	0.1	0.00	0.00	0.00	0.00
cis-1,3-Dichloropropene	0.1	0.0	0.25	0.00	0.00	0.00	0.00
trans-1,3-Dichloropropene	0.11	4.9	0.25	0.02	0.00	0.00	0.10
Dichlorotetrafluoroethane	0.05	0.0		0.00	0.00	0.00	0.00
2,5-Dimethylbenzaldehyde	0.004	18.9		0.06	0.01	0.00	0.10

**Table 4 – (Continued)
Air Toxics Data – 2004
Camden, New Jersey**

$\mu\text{g}/\text{m}^3$ - Micrograms Per Cubic Meter
ppbv - Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit Ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Ethyl Acrylate	0.16	0.0	2	0.00	0.00	0.00	0.00
Ethylbenzene	0.04	100.0		0.60	0.14	0.11	0.66
Ethyl tert-Butyl Ether	0.15	0.0		0.00	0.00	0.00	0.00
Formaldehyde	0.016	100.0	0.077	7.43	6.05	0.72	40.30
Hexachloro-1,3-butadiene	0.06	0.0	0.045	0.00	0.00	0.00	0.00
Hexaldehyde	0.003	100.0		0.18	0.04	0.02	0.78
Isovaleraldehyde	0.004	9.4		0.01	0.00	0.00	0.04
Methylene Chloride	0.06	65.6	2.1	0.39	0.11	0.09	0.88
Methyl Ethyl Ketone	0.15	88.5		2.19	0.74	0.58	3.20
Methyl Isobutyl Ketone	0.15	29.5		0.22	0.05	0.00	0.38
Methyl Methacrylate	0.18	0.0	700	0.00	0.00	0.00	0.00
Methyl tert-Butyl Ether	0.18	93.4	3.8	2.82	0.78	0.56	5.02
n-Octane	0.06	47.5		0.33	0.07	0.00	0.86
Propionaldehyde	0.005	60.4		0.33	0.14	0.01	1.00
Propylene	0.05	100.0	3000	1.86	1.08	0.78	5.31
Styrene	0.07	77.0	1.8	0.33	0.08	0.06	1.23
1,1,2,2-Tetrachloroethane	0.06	0.0	0.017	0.00	0.00	0.00	0.00
Tetrachloroethylene	0.06	37.7	0.17	0.26	0.04	0.00	0.44
Tolualdehydes	0.009	67.9		0.26	0.05	0.01	0.38
Toluene	0.06	98.4	400	3.59	0.95	0.74	4.39
1,2,4-Trichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
1,1,1-Trichloroethane	0.06	1.6	1000	0.01	0.00	0.00	0.08
1,1,2-Trichloroethane	0.06	0.0	0.063	0.00	0.00	0.00	0.00
Trichloroethylene	0.07	32.8	0.5	0.27	0.05	0.00	0.47
Trichlorofluoromethane	0.04	98.4	700	1.84	0.33	0.33	0.57
Trichlorotrifluoroethane	0.07	86.9		0.67	0.09	0.09	0.27
1,2,4-Trimethylbenzene	0.07	96.7		0.81	0.17	0.14	0.91
1,3,5-Trimethylbenzene	0.07	73.8		0.25	0.05	0.05	0.29
Valeraldehyde	0.05	67.9		0.14	0.04	0.01	0.53
Vinyl chloride	0.06	3.3	0.11	0.01	0.00	0.00	0.17
m,p-Xylene	0.05	100.0	100	1.69	0.39	0.30	2.13
o-Xylene	0.05	100.0	100	0.75	0.17	0.14	0.94

^{1,2,3} See table end notes on Air Toxics page 18

**Table 5
Air Toxics Data – 2004
Chester, New Jersey**

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Acetaldehyde	0.005	100.0	0.45	1.88	1.04	0.68	16.10
Acetone	0.002	100.0	31000	2.44	1.03	0.90	9.22
Acetonitrile	0.25	57.9	60	6.15	3.66	0.35	38.70
Acetylene	0.13	98.2		0.69	0.65	0.55	1.84
Acrylonitrile	0.21	3.5	0.015	0.02	0.01	0.00	0.47
tert-Amyl Methyl Ether	0.12	0.0		0.00	0.00	0.00	0.00
Benzaldehyde	0.003	94.4		0.13	0.03	0.02	0.37
Benzene	0.04	96.5	0.13	0.67	0.21	0.19	0.52
Bromochloromethane	0.12	0.0		0.00	0.00	0.00	0.00
Bromodichloromethane	0.06	0.0		0.00	0.00	0.00	0.00
Bromoform	0.08	0.0	0.91	0.00	0.00	0.00	0.00
Bromomethane	0.09	1.8	5	0.01	0.00	0.00	0.12
1,3-Butadiene	0.07	3.5	0.033	0.01	0.00	0.00	0.10
Butyraldehyde	0.011	100.0		0.37	0.12	0.09	1.37
Carbon Tetrachloride	0.08	78.9	0.067	0.47	0.07	0.08	0.18
Chlorobenzene	0.06	0.0	1000	0.00	0.00	0.00	0.00
Chloroethane	0.08	1.8		0.01	0.00	0.00	0.23
Chloroform	0.05	3.5	0.043	0.01	0.00	0.00	0.09
Chloromethane	0.05	100.0	0.56	1.16	0.56	0.55	1.46
Chloromethylbenzene	0.07	0.0		0.00	0.00	0.00	0.00
Chloroprene	0.01	0.0	1	0.00	0.00	0.00	0.00
Crotonaldehyde	0.005	98.1		0.37	0.13	0.03	2.91
Dibromochloromethane	0.08	0.0		0.00	0.00	0.00	0.00
1,2-Dibromoethane	0.08	0.0	0.0017	0.00	0.00	0.00	0.00
m-Dichlorobenzene	0.05	0.0		0.00	0.00	0.00	0.00
o-Dichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
p-Dichlorobenzene	0.09	0.0	0.091	0.00	0.00	0.00	0.00
1,1-Dichloroethane	0.08	0.0	0.63	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.1	0.0	200	0.00	0.00	0.00	0.00
cis-1,2-Dichloroethylene	0.1	0.0		0.00	0.00	0.00	0.00
trans-1,2-Dichloroethylene	0.06	0.0		0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.04	98.2	200	2.82	0.57	0.60	0.81
1,2-Dichloroethane	0.06	0.0	0.038	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.07	0.0	0.1	0.00	0.00	0.00	0.00
cis-1,3-Dichloropropene	0.1	0.0	0.25	0.00	0.00	0.00	0.00
trans-1,3-Dichloropropene	0.11	7.0	0.25	0.03	0.01	0.00	0.12
Dichlorotetrafluoroethane	0.05	0.0		0.00	0.00	0.00	0.00
2,5-Dimethylbenzaldehyde	0.004	3.7		0.01	0.00	0.00	0.11

**Table 5 – (Continued)
Air Toxics Data – 2004
Chester, New Jersey**

$\mu\text{g}/\text{m}^3$ - Micrograms Per Cubic Meter
ppbv - Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Ethyl Acrylate	0.16	0.0	2	0.00	0.00	0.00	0.00
Ethylbenzene	0.04	78.9		0.27	0.06	0.06	0.53
Ethyl tert-Butyl Ether	0.15	0.0		0.00	0.00	0.00	0.00
Formaldehyde	0.016	100.0	0.077	3.25	2.65	1.14	46.50
Hexachloro-1,3-butadiene	0.06	0.0	0.045	0.00	0.00	0.00	0.00
Hexaldehyde	0.003	98.1		0.14	0.03	0.03	0.31
Isovaleraldehyde	0.004	29.6		0.01	0.00	0.00	0.04
Methylene Chloride	0.06	45.6	2.1	0.38	0.11	0.00	1.59
Methyl Ethyl Ketone	0.15	80.7		1.89	0.64	0.47	8.30
Methyl Isobutyl Ketone	0.15	8.8		0.08	0.02	0.00	0.31
Methyl Methacrylate	0.18	0.0	700	0.00	0.00	0.00	0.00
Methyl tert-Butyl Ether	0.18	54.4	3.8	0.41	0.11	0.08	0.45
n-Octane	0.06	8.8		0.03	0.01	0.00	0.09
Propionaldehyde	0.005	98.1		0.27	0.11	0.06	1.79
Propylene	0.05	98.2	3000	0.57	0.33	0.27	1.00
Styrene	0.07	29.8	1.8	0.14	0.03	0.00	0.78
1,1,2,2-Tetrachloroethane	0.06	0.0	0.017	0.00	0.00	0.00	0.00
Tetrachloroethylene	0.06	17.5	0.17	0.09	0.01	0.00	0.12
Tolualdehydes	0.009	87.0		0.11	0.02	0.02	0.20
Toluene	0.06	100.0	400	1.76	0.47	0.28	6.41
1,2,4-Trichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
1,1,1-Trichloroethane	0.06	1.8	1000	0.01	0.00	0.00	0.10
1,1,2-Trichloroethane	0.06	0.0	0.063	0.00	0.00	0.00	0.00
Trichloroethylene	0.07	3.5	0.5	0.01	0.00	0.00	0.05
Trichlorofluoromethane	0.04	100.0	700	1.88	0.34	0.30	1.30
Trichlorotrifluoroethane	0.07	78.9		0.59	0.08	0.09	0.19
1,2,4-Trimethylbenzene	0.07	29.8		0.16	0.03	0.00	0.27
1,3,5-Trimethylbenzene	0.07	10.5		0.03	0.01	0.00	0.08
Valeraldehyde	0.05	83.3		0.08	0.02	0.02	0.38
Vinyl chloride	0.06	0.0	0.11	0.00	0.00	0.00	0.00
M,p-Xylene	0.05	94.7	100	0.68	0.16	0.13	0.89
o-Xylene	0.05	86.0	100	0.30	0.07	0.06	0.35

^{1,2,3} See table end notes on Air Toxics page 18

**Table 6
Air Toxics Data – 2004
Elizabeth Lab, New Jersey**

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Acetaldehyde	0.005	100.0	0.45	4.59	2.55	2.36	6.24
Acetone	0.002	100.0	31000	2.91	1.22	1.05	4.15
Acetonitrile	0.25	44.1	60	1.00	0.60	0.00	4.78
Acetylene	0.13	98.3		1.54	1.45	1.42	5.96
Acrylonitrile	0.21	6.8	0.015	0.02	0.01	0.00	0.32
tert-Amyl Methyl Ether	0.12	3.4		0.01	0.00	0.00	0.10
Benzaldehyde	0.003	100.0		0.17	0.04	0.04	0.11
Benzene	0.04	98.3	0.13	1.45	0.45	0.41	1.30
Bromochloromethane	0.12	0.0		0.00	0.00	0.00	0.00
Bromodichloromethane	0.06	0.0		0.00	0.00	0.00	0.00
Bromoform	0.08	0.0	0.91	0.00	0.00	0.00	0.00
Bromomethane	0.09	0.0	5	0.00	0.00	0.00	0.00
1,3-Butadiene	0.07	44.1	0.033	0.11	0.05	0.00	0.23
Butyraldehyde	0.011	100.0		0.44	0.15	0.11	0.81
Carbon Tetrachloride	0.08	84.7	0.067	0.46	0.07	0.08	0.14
Chlorobenzene	0.06	0.0	1000	0.00	0.00	0.00	0.00
Chloroethane	0.08	0.0		0.00	0.00	0.00	0.00
Chloroform	0.05	11.9	0.043	0.03	0.01	0.00	0.08
Chloromethane	0.05	96.6	0.56	1.13	0.55	0.56	0.81
Chloromethylbenzene	0.07	0.0		0.00	0.00	0.00	0.00
Chloroprene	0.01	0.0	1	0.00	0.00	0.00	0.00
Crotonaldehyde	0.005	100.0		0.23	0.08	0.05	0.29
Dibromochloromethane	0.08	0.0		0.00	0.00	0.00	0.00
1,2-Dibromoethane	0.08	0.0	0.0017	0.00	0.00	0.00	0.00
m-Dichlorobenzene	0.05	0.0		0.00	0.00	0.00	0.00
o-Dichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
p-Dichlorobenzene	0.09	5.1	0.091	0.03	0.00	0.00	0.13
1,1-Dichloroethane	0.08	0.0	0.63	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.1	0.0	200	0.00	0.00	0.00	0.00
cis-1,2-Dichloroethylene	0.1	1.7		0.01	0.00	0.00	0.12
trans-1,2-Dichloroethylene	0.06	0.0		0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.04	100.0	200	2.86	0.58	0.60	0.85
1,2-Dichloroethane	0.06	0.0	0.038	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.07	0.0	0.1	0.00	0.00	0.00	0.00
cis-1,3-Dichloropropene	0.1	0.0	0.25	0.00	0.00	0.00	0.00
trans-1,3-Dichloropropene	0.11	5.1	0.25	0.02	0.00	0.00	0.10
Dichlorotetrafluoroethane	0.05	0.0		0.00	0.00	0.00	0.00
2,5-Dimethylbenzaldehyde	0.004	44.1		0.03	0.01	0.00	0.13

**Table 6 – (Continued)
Air Toxics Data – 2004
Elizabeth Lab, New Jersey**

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Ethyl Acrylate	0.16	0.0	2	0.00	0.00	0.00	0.00
Ethylbenzene	0.04	96.6		0.72	0.17	0.15	0.55
Ethyl tert-Butyl Ether	0.15	0.0		0.00	0.00	0.00	0.00
Formaldehyde	0.016	100.0	0.077	4.39	3.58	3.30	9.46
Hexachloro-1,3-butadiene	0.06	0.0	0.045	0.00	0.00	0.00	0.00
Hexaldehyde	0.003	100.0		0.19	0.05	0.04	0.19
Isovaleraldehyde	0.004	27.1		0.01	0.00	0.00	0.02
Methylene Chloride	0.06	83.1	2.1	0.63	0.18	0.15	0.55
Methyl Ethyl Ketone	0.15	84.7		2.02	0.69	0.62	4.04
Methyl Isobutyl Ketone	0.15	18.6		0.10	0.02	0.00	0.25
Methyl Methacrylate	0.18	6.8	700	0.98	0.28	0.00	10.20
Methyl tert-Butyl Ether	0.18	91.5	3.8	3.29	0.91	0.65	4.04
n-Octane	0.06	49.2		0.28	0.06	0.00	0.27
Propionaldehyde	0.005	93.2		0.28	0.12	0.10	0.67
Propylene	0.05	100.0	3000	6.75	3.92	1.56	17.30
Styrene	0.07	69.5	1.8	0.18	0.04	0.05	0.13
1,1,2,2-Tetrachloroethane	0.06	0.0	0.017	0.00	0.00	0.00	0.00
Tetrachloroethylene	0.06	42.4	0.17	0.24	0.04	0.00	0.19
Tolualdehydes	0.009	96.6		0.15	0.03	0.03	0.08
Toluene	0.06	100.0	400	3.67	0.97	0.85	3.56
1,2,4-Trichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
1,1,1-Trichloroethane	0.06	5.1	1000	0.01	0.00	0.00	0.06
1,1,2-Trichloroethane	0.06	0.0	0.063	0.00	0.00	0.00	0.00
Trichloroethylene	0.07	6.8	0.5	0.02	0.00	0.00	0.06
Trichlorofluoromethane	0.04	98.3	700	1.76	0.31	0.32	0.68
Trichlorotrifluoroethane	0.07	81.4		0.59	0.08	0.09	0.13
1,2,4-Trimethylbenzene	0.07	91.5		0.69	0.14	0.13	0.48
1,3,5-Trimethylbenzene	0.07	71.2		0.22	0.04	0.04	0.15
Valeraldehyde	0.05	100.0		0.38	0.11	0.04	1.20
Vinyl chloride	0.06	0.0	0.11	0.00	0.00	0.00	0.00
m,p-Xylene	0.05	98.3	100	2.14	0.49	0.44	1.55
o-Xylene	0.05	98.3	100	1.02	0.24	0.22	0.68

^{1,2,3} See table end notes on Air Toxics page 18

Table 7
Air Toxics Data – 2004
New Brunswick, New Jersey

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Acetaldehyde	0.005	100.0	0.45	7.06	3.92	2.31	61.60
Acetone	0.002	100.0	31000	3.61	1.52	1.24	14.70
Acetonitrile	0.25	61.7	60	7.14	4.25	0.82	140.00
Acetylene	0.13	100.0		1.06	1.00	0.87	4.12
Acrylonitrile	0.21	3.3	0.015	0.01	0.01	0.00	0.23
tert-Amyl Methyl Ether	0.12	0.0		0.00	0.00	0.00	0.00
Benzaldehyde	0.003	88.1		0.14	0.03	0.02	0.49
Benzene	0.04	100.0	0.13	0.95	0.30	0.27	0.88
Bromochloromethane	0.12	0.0		0.00	0.00	0.00	0.00
Bromodichloromethane	0.06	0.0		0.00	0.00	0.00	0.00
Bromoform	0.08	0.0	0.91	0.00	0.00	0.00	0.00
Bromomethane	0.09	0.0	5	0.00	0.00	0.00	0.00
1,3-Butadiene	0.07	6.7	0.033	0.01	0.00	0.00	0.07
Butyraldehyde	0.011	100.0		0.69	0.23	0.13	3.72
Carbon Tetrachloride	0.08	91.7	0.067	0.52	0.08	0.09	0.14
Chlorobenzene	0.06	0.0	1000	0.00	0.00	0.00	0.00
Chloroethane	0.08	1.7		0.31	0.12	0.00	7.09
Chloroform	0.05	13.3	0.043	0.03	0.01	0.00	0.06
Chloromethane	0.05	98.3	0.56	1.18	0.57	0.56	1.94
Chloromethylbenzene	0.07	0.0		0.00	0.00	0.00	0.00
Chloroprene	0.01	0.0	1	0.00	0.00	0.00	0.00
Crotonaldehyde	0.005	100.0		0.43	0.15	0.05	3.52
Dibromochloromethane	0.08	0.0		0.00	0.00	0.00	0.00
1,2-Dibromoethane	0.08	0.0	0.0017	0.00	0.00	0.00	0.00
m-Dichlorobenzene	0.05	0.0		0.00	0.00	0.00	0.00
o-Dichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
p-Dichlorobenzene	0.09	0.0	0.091	0.00	0.00	0.00	0.00
1,1-Dichloroethane	0.08	0.0	0.63	0.00	0.00	0.00	0.00
1,1-Dichloroethene	0.1	0.0	200	0.00	0.00	0.00	0.00
cis-1,2-Dichloroethylene	0.1	0.0		0.00	0.00	0.00	0.00
trans-1,2-Dichloroethylene	0.06	0.0		0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.04	100.0	200	2.95	0.60	0.58	0.83
1,2-Dichloroethane	0.06	0.0	0.038	0.00	0.00	0.00	0.00
1,2-Dichloropropane	0.07	1.7	0.1	0.01	0.00	0.00	0.07
cis-1,3-Dichloropropene	0.1	0.0	0.25	0.00	0.00	0.00	0.00
trans-1,3-Dichloropropene	0.11	5.0	0.25	0.02	0.00	0.00	0.10
Dichlorotetrafluoroethane	0.05	0.0		0.00	0.00	0.00	0.00
2,5-Dimethylbenzaldehyde	0.004	25.4		0.01	0.00	0.00	0.03

Table 7 – (Continued)
Air Toxics Data – 2004
New Brunswick, New Jersey

$\mu\text{g}/\text{m}^3$ – Micrograms Per Cubic Meter
ppbv – Parts Per Billion by Volume

Compounds in Bold had Annual Mean Concentrations Greater Than Their Accepted Health Benchmark

Pollutant	Detection Limit ppbv	% Detects	Benchmark ¹ $\mu\text{g}/\text{m}^3$	Mean ^{2,3} $\mu\text{g}/\text{m}^3$	Mean ppbv	Median ppbv	Max. ppbv
Ethyl Acrylate	0.16	0.0	2	0.00	0.00	0.00	0.00
Ethylbenzene	0.04	96.7		0.52	0.12	0.10	0.78
Ethyl tert-Butyl Ether	0.15	0.0		0.00	0.00	0.00	0.00
Formaldehyde	0.016	100.0	0.077	5.76	4.69	2.66	78.10
Hexachloro-1,3-butadiene	0.06	0.0	0.045	0.00	0.00	0.00	0.00
Hexaldehyde	0.003	86.4		0.12	0.03	0.02	0.46
Isovaleraldehyde	0.004	49.2		0.06	0.02	0.00	0.40
Methylene Chloride	0.06	81.7	2.1	0.40	0.11	0.10	0.44
Methyl Ethyl Ketone	0.15	86.7		4.98	1.69	0.44	56.70
Methyl Isobutyl Ketone	0.15	5.0		0.18	0.04	0.00	2.39
Methyl Methacrylate	0.18	1.7	700	0.04	0.01	0.00	0.75
Methyl tert-Butyl Ether	0.18	90.0	3.8	4.00	1.11	0.26	48.60
n-Octane	0.06	20.0		1.37	0.29	0.00	16.60
Propionaldehyde	0.005	94.9		0.60	0.25	0.11	4.77
Propylene	0.05	100.0	3000	1.47	0.85	0.47	18.40
Styrene	0.07	51.7	1.8	0.17	0.04	0.04	0.91
1,1,2,2-Tetrachloroethane	0.06	0.0	0.017	0.00	0.00	0.00	0.00
Tetrachloroethylene	0.06	28.3	0.17	0.16	0.02	0.00	0.21
Tolualdehydes	0.009	81.4		0.14	0.03	0.02	0.39
Toluene	0.06	100.0	400	2.98	0.79	0.57	6.30
1,2,4-Trichlorobenzene	0.06	0.0	200	0.00	0.00	0.00	0.00
1,1,1-Trichloroethane	0.06	0.0	1000	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	0.06	0.0	0.063	0.00	0.00	0.00	0.00
Trichloroethylene	0.07	3.3	0.5	0.01	0.00	0.00	0.11
Trichlorofluoromethane	0.04	100.0	700	1.73	0.31	0.30	0.85
Trichlorotrifluoroethane	0.07	86.7		0.64	0.08	0.10	0.13
1,2,4-Trimethylbenzene	0.07	80.0		0.65	0.13	0.09	2.50
1,3,5-Trimethylbenzene	0.07	53.3		0.20	0.04	0.04	0.75
Valeraldehyde	0.05	89.8		0.18	0.05	0.02	0.88
Vinyl chloride	0.06	0.0	0.11	0.00	0.00	0.00	0.00
m,p-Xylene	0.05	98.3	100	1.23	0.28	0.22	2.71
o-Xylene	0.05	98.3	100	0.57	0.13	0.11	1.48

^{1,2,3} See table end notes on Air Toxics page 18

END NOTES FOR TABLES 4-7

¹ The Heath Benchmark is defined as the chemical-specific air concentration above which there may be human health concerns. For a carcinogen (cancer-causing chemical), the health benchmark is set at the air concentration that would cause no more than a one in a million increase in the likelihood of getting cancer, even after a lifetime of exposure. For a non-carcinogen, the health benchmark is the maximum air concentration to which exposure is likely to cause no harm, even if that exposure occurs on a daily basis for a lifetime.

² Individual 24-hour pollutant concentrations were reported by the analyzing laboratory in ppbv (parts per billion by volume) and were converted to $\mu\text{g}/\text{m}^3$ using the following formula:

$$\frac{\mu\text{g}}{\text{m}^3} = \frac{(\text{ppbv})(\text{MolecularWeight})}{24.45}$$

where Molecular Weight is the molecular weight of a pollutant in grams, and 24.45 is the molar volume of an ideal gas in liters at the standard temperature of 25°C.

³ For a valid 24-hour sampling event when the analyzing laboratory reports the term “Not Detected” for a particular pollutant, the concentration of 0.0 ppbv is assigned to that pollutant. These zero concentrations were included in the calculation of annual averages and medians for each pollutant regardless of percent detection.

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2004 Atmospheric Deposition Summary

New Jersey Department of Environmental Protection

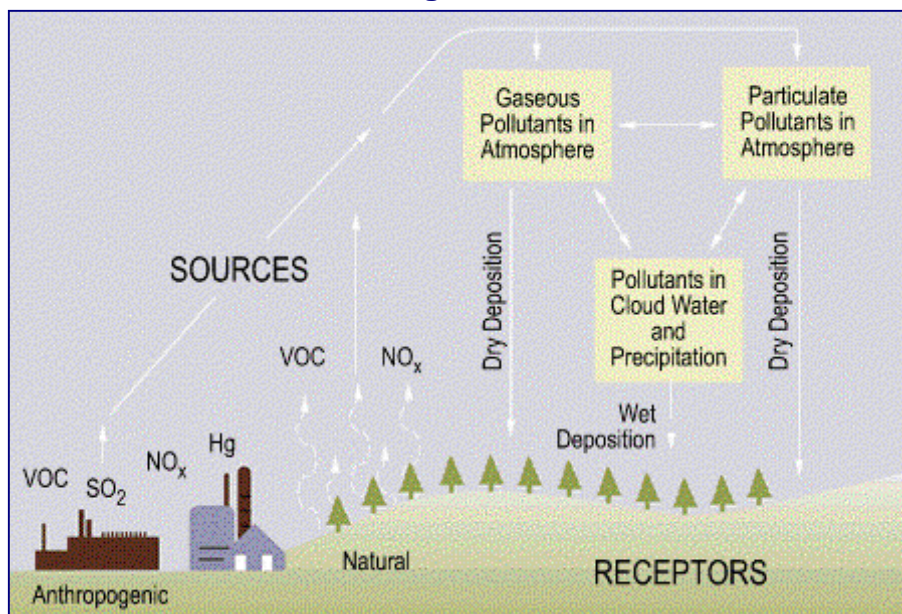
Nature and Sources

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 (SO₂), nitrogen oxides (NO_x), mercury (Hg), and volatile organic compounds (VOCs). SO₂ 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>

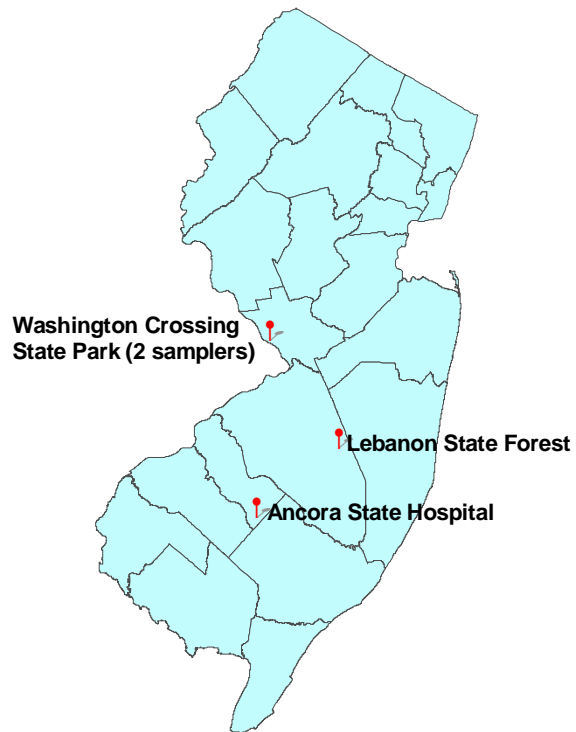
MONITORING LOCATIONS

The state monitored wet deposition levels at 3 locations in 2004. These sites are shown in Figure 2. A sample is collected each week from all of the 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.

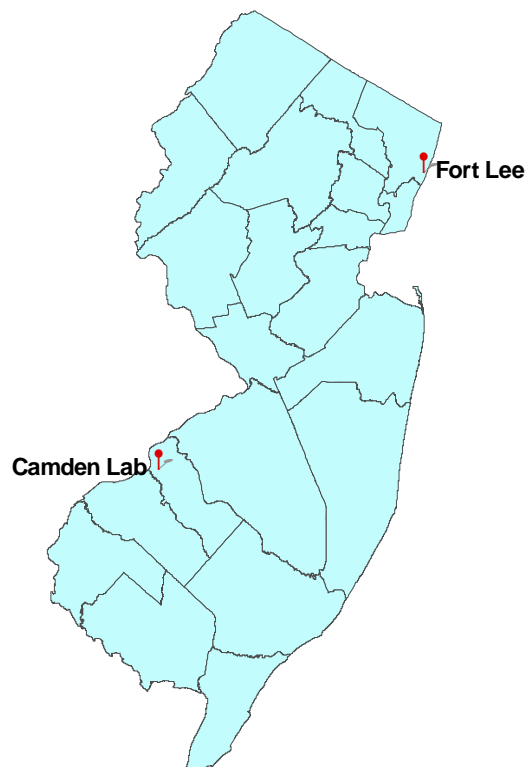
Each of the sites shown in Figure 2 has a sampler for collecting wet deposition (rain and snow) and a rain gauge for determining precipitation amounts. Due to the Lebanon monitor's remote location, it has been phased out of operation during 2004, providing approximately 20 weeks of viable data.

In addition to the wet deposition monitoring, dry (particulate) sulfate and nitrate are measured at 2 sites as shown in Figure 3. These measurements are taken by analyzing filters used in the PM₁₀ monitoring network (see section on Particulate Matter). Dry sulfate and nitrate are pollutants that form in the atmosphere and can react with water, creating acids that affect the pH of lakes and streams. When added to water bodies, nitrates can eventually lead to eutrophication (excessive growth of plant life).

**Figure 2
Acid Precipitation Monitoring
Network - 2004**



**Figure 3
Sulfate and Nitrate
Monitoring Network - 2004**



SUMMARY OF 2004 DATA

A summary of the 2004 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 4.42. The Ancora State Hospital sampler recorded a mean pH of 4.42 and the Lebanon State Forest sampler recorded a mean pH of 4.51.

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.

Table 2 shows the concentrations of sulfate and nitrate found on samples of particulate matter collected at two sites. In particulate form, sulfate and nitrate can significantly affect the acidity and nutrient content of water bodies. These two ions make up, on average, about 17% of the total mass of PM₁₀ collected.

Table 1
Acid Precipitation Monitoring Network - 2004
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	7.49	4.35	28.1	0.125	4.925	0.054	0.415	0.314	2.061	0.731	1.915	< MDL
Spring	10.51	4.36	27.0	0.117	0.039	0.067	0.169	0.502	1.956	0.288	2.272	< MDL
Summer	12.63	4.42	53.0	0.054	0.032	0.032	0.211	0.312	1.077	0.396	1.938	< MDL
Fall	13.59	4.52	20.0	0.065	0.077	0.041	0.607	0.220	1.111	1.073	1.452	< MDL
Annual	44.22	4.42	32.5	0.085	0.881	0.047	0.357	0.329	1.463	0.635	1.864	< MDL

Lebanon State Forest – 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	-	-	-	-	-	-	-	-	-	-	-	-
Spring	8.22	4.44	22.4	0.124	0.043	0.076	0.249	0.440	1.713	0.399	2.082	< MDL
Summer	12.75	4.57	15.1	0.025	0.022	0.020	0.178	0.200	0.750	0.321	1.354	< MDL
Fall	0.15	4.80	16.2	0.358	0.053	0.075	0.206	0.691	1.880	0.306	1.756	< MDL
Annual	21.12	4.51	18.0	0.066	0.030	0.042	0.206	0.297	1.133	0.352	1.640	< MDL

* Lebanon was phased out operation during 2004, providing approximately 20 weeks of data.

Table 1 (Continued)
Acid Precipitation Monitoring Network – 2004
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 – 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	7.41	4.43	20.6	0.068	0.014	0.010	0.112	0.217	1.722	0.229	1.239	< MDL
Spring	11.03	4.35	26.2	0.141	0.029	0.023	0.092	0.425	1.903	0.191	2.329	< MDL
Summer	9.96	4.29	28.5	0.088	0.025	0.018	0.103	0.414	1.490	0.246	2.735	< MDL
Fall	15.28	4.61	14.1	0.041	0.029	0.013	0.250	0.088	0.713	0.455	0.909	< MDL
Annual	43.68	4.42	21.6	0.082	0.026	0.016	0.153	0.269	1.362	0.302	1.740	< MDL

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	6.58	4.39	22.4	0.086	0.022	0.028	0.135	0.282	1.919	0.279	1.428	< MDL
Spring	9.89	4.34	27.2	0.157	0.038	0.080	0.118	0.534	2.037	0.237	2.465	< MDL
Summer	9.55	4.30	28.0	0.080	0.028	0.039	0.147	0.436	1.465	0.327	2.561	< MDL
Fall	15.38	4.61	14.1	0.050	0.032	0.038	0.254	0.126	0.872	0.484	1.040	< MDL
Annual	41.40	4.42	21.7	0.088	0.031	0.047	0.178	0.320	1.453	0.356	1.793	< MDL

Table 2
Acid Deposition Particulate Matter – 2004
 Micrograms per Cubic Meter

N – Number of samples
 Min – Minimum
 Max – Maximum

Sampling Location	Site No.	N	Particulates			Sulfate (SO ₄)			Nitrate (NO ₃)			SO ₄ & NO ₃ % of Particulates
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
Camden Lab	IP02	48	20.8	4.7	49.4	3.54	0.58	13.70	0.37	0.03	2.48	18.8
Fort Lee	IP14	39	31.7	9.1	62.0	3.87	0.52	16.65	0.60	0.09	3.86	14.1

TRENDS

Figure 4 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.

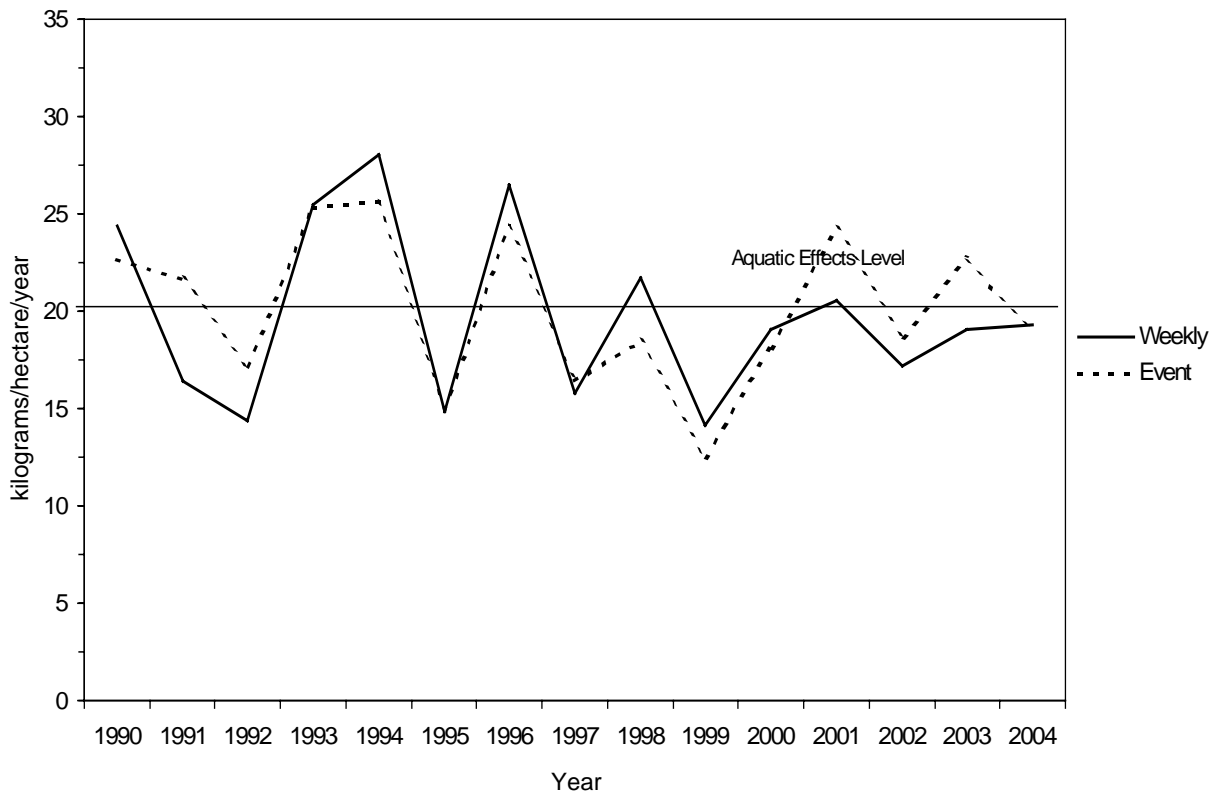
The factors controlling the trend are the sulfate concentrations in air and cloud droplets and the total amount of precipitation in a given year. For example, in 1991 and 1992, both the sulfate concentrations and the total precipitation were below normal, while they were high in 1993 and 1994. Since 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. However, there are no national or New Jersey standards for sulfate deposition.

Sulfate deposition in rain and snow is expressed as mass per unit land area over time. To convert the values shown in Figure 4 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 4
Trend in Sulfate Deposition in Precipitation at
Washington Crossing State Park, New Jersey, 1990-2004:
Annual Loading



REFERENCES

USEPA Clean Air Market, URL: www.epa.gov/airmarkets/acidrain/index.html#what

A Guide to Health Advisories for Eating Fish and Crabs Caught in New Jersey Waters, NJDEP, Division of Science and Technology, Trenton, NJ, URL: www.state.nj.us/dep/dsr/njmainfish.htm



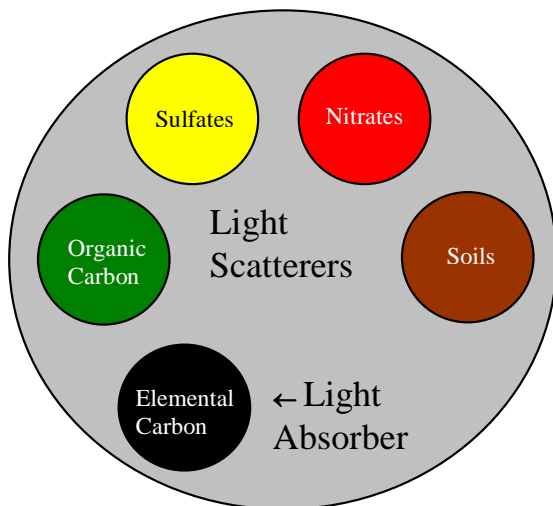
2004 Regional Haze & Visibility Summary

New Jersey Department of Environmental Protection

THE BASICS OF HAZE

Haze is caused when sunlight encounters tiny pollution particles in the air. Some light is absorbed by particles; other light is scattered away before it reaches an observer. Small particles and certain gaseous molecules in the atmosphere cause poor visibility by scattering or absorbing light (see Figure 1). More pollutants mean more absorption and scattering of light, which reduce the clarity and color of what we see. When high concentrations of such pollutants are well mixed in the atmosphere, they form a uniform haze that can obscure distant objects. Some types of particles such as sulfates scatter more light, particularly during humid conditions. Sometimes haze is the result of pollutants that have been transported considerable distances on the prevailing winds. While some visibility impairment occurs even under natural conditions, man-made aerosols are the primary cause. Air pollutants come from a variety of natural and manufactured sources. Natural sources can include windblown dust, and soot from wildfires. Man-made sources can include motor vehicles, electric utility and industrial fuel burning, and manufacturing operations.

**Figure 1
Contributors to Visibility Impairment**



ANATOMY OF REGIONAL HAZE

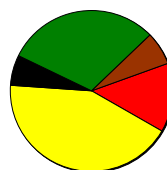
Data collected over the last decade show that fine particle concentrations, and hence visibility impairment, are highest in the industrialized and densely populated areas of the Northeast and Mid-Atlantic. Sulfate (SO₄) is the primary culprit and typically constitutes 40% of the total fine mass in the region even on clear days. It can account for 60-80% of the total fine mass on very hazy days. Organic carbon usually accounts for the next largest portion of total fine particle mass. It can account for 20-30% on the haziest days. The remainder of the mass is made up primarily of nitrate (NO₃), elemental carbon, and fine soil particles.

PARTICLES AND VISIBILITY

Figure 2 shows the makeup of fine particles collected at the IMPROVE (Interagency Monitoring of Protective Visual Environments) site located north of Atlantic City in the Edwin B. Forsythe Wildlife Refuge (Brigantine).

**Figure 2
Composition of Fine Particles on
Days With Good Visibility Compared
to Days with Poor Visibility
Brigantine,
New Jersey, 2004**

Average Fine Mass Composition on Days with Good Visibility



Ammonium Nitrate	0.55 $\mu\text{g}/\text{m}^3$	13.9%
Ammonium Sulfate	1.69 $\mu\text{g}/\text{m}^3$	42.8%
Elemental Carbon	0.24 $\mu\text{g}/\text{m}^3$	6.1%
Organic Carbon	1.21 $\mu\text{g}/\text{m}^3$	30.7%
Soils	0.26 $\mu\text{g}/\text{m}^3$	6.5%
Total 4.0 $\mu\text{g}/\text{m}^3$		

Average Fine Mass Composition on Days with Poor Visibility



Ammonium Nitrate	1.26 $\mu\text{g}/\text{m}^3$	6.9%
Ammonium Sulfate	11.6 $\mu\text{g}/\text{m}^3$	63.5%
Elemental Carbon	0.53 $\mu\text{g}/\text{m}^3$	2.9%
Organic Carbon	3.79 $\mu\text{g}/\text{m}^3$	20.7%
Soils	1.11 $\mu\text{g}/\text{m}^3$	6.0%
Total 18.3 $\mu\text{g}/\text{m}^3$		

Evaluations of the data for 2004 indicate that sulfates made up more than half of the fine mass in the best conditions. Most visibility impairment is due to sulfate, which can have a greater effect on light extinction (a measure of visibility impairment) than all other types of fine particles combined. Higher sulfate values in the summer can be attributed to the greater photochemical conversion of SO₂ to SO₄ that results from the increased sunlight during the summertime. (Malm, 1999)

HOW IS HAZE REGULATED?

In 1999, the U.S. Environmental Protection Agency announced a major effort to improve air quality in national parks and wilderness areas aimed at achieving national visibility goals by 2064. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156 National Parks and wilderness areas such as the Grand Canyon, Yosemite, the Great Smokies and Shenandoah. This "regional haze rule" addresses the combined visibility effects of numerous pollution sources over a wide geographic region and how they impact Class I areas. Class I areas as defined by the Clean Air Act, include national parks greater than 6,000 acres, wilderness areas and national memorial parks greater than 5,000 acres, and international parks that existed as of August 1977. The rule requires the states, in coordination with the Environmental Protection Agency, the National Park Service, U.S. Fish and Wildlife Service, the U.S. Forest Service, and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment. The first State plans for regional haze is due in the 2003-2008 timeframe. Five multi-state regional planning organizations are working together now to develop the technical basis for these plans.

SOURCES OF HAZE CONTRIBUTORS

The following categories of air pollutants are the major contributors to haze.

Sulfate particles form in the air from sulfur dioxide gas. Most of this gas is released from coal-burning power plants and other industrial sources, such as smelters, industrial boilers, and oil refineries. Sulfates are the largest contributor to haze in the eastern U.S., due to the large number of coal-fired power plants that affect the region. In humid environments, sulfate particles grow rapidly to a

size that is very efficient at scattering light, thereby exacerbating the problem in the East.

Organic carbon particles are emitted directly into the air and are also formed by the reaction of various gaseous hydrocarbons. Sources of direct and indirect organic carbon particles include vehicle exhaust, vehicle refueling, solvent evaporation (e.g., paints), food cooking, and various commercial and industrial sources. Gaseous hydrocarbons are also emitted naturally from trees and from fires, but these sources usually have only a small or short-term effect on overall visibility.

Nitrate particles form in the air from nitrogen oxide gas. This gas is released from virtually all combustion activities, especially those involving cars, trucks, off-road engines (e.g., construction equipment, lawn mowers, and boats), power plants, and other industrial sources. Like sulfates, nitrates scatter more light in humid environments.

Elemental carbon particles are very similar to soot. They are smaller than most other particles and tend to absorb rather than scatter light. The "brown clouds" often seen in winter over urban areas and in mountain valleys can be largely attributed to elemental carbon. These particles are emitted directly into the air from virtually all combustion activities, but are especially prevalent in diesel exhaust and smoke from the burning of wood and wastes.

Soils are very similar to dust. It enters the air from dirt roads, fields, and other open spaces as a result of wind, traffic, and other surface activities. Whereas other types of particles form from the condensation and growth of microscopic particles and gasses, crustal material results from the crushing and grinding of larger, earth-born material. Because it is difficult to reduce this material to microscopic sizes, crustal material tends to be larger than other particles and tends to fall from the air sooner, contributing less to the overall effect of haze.

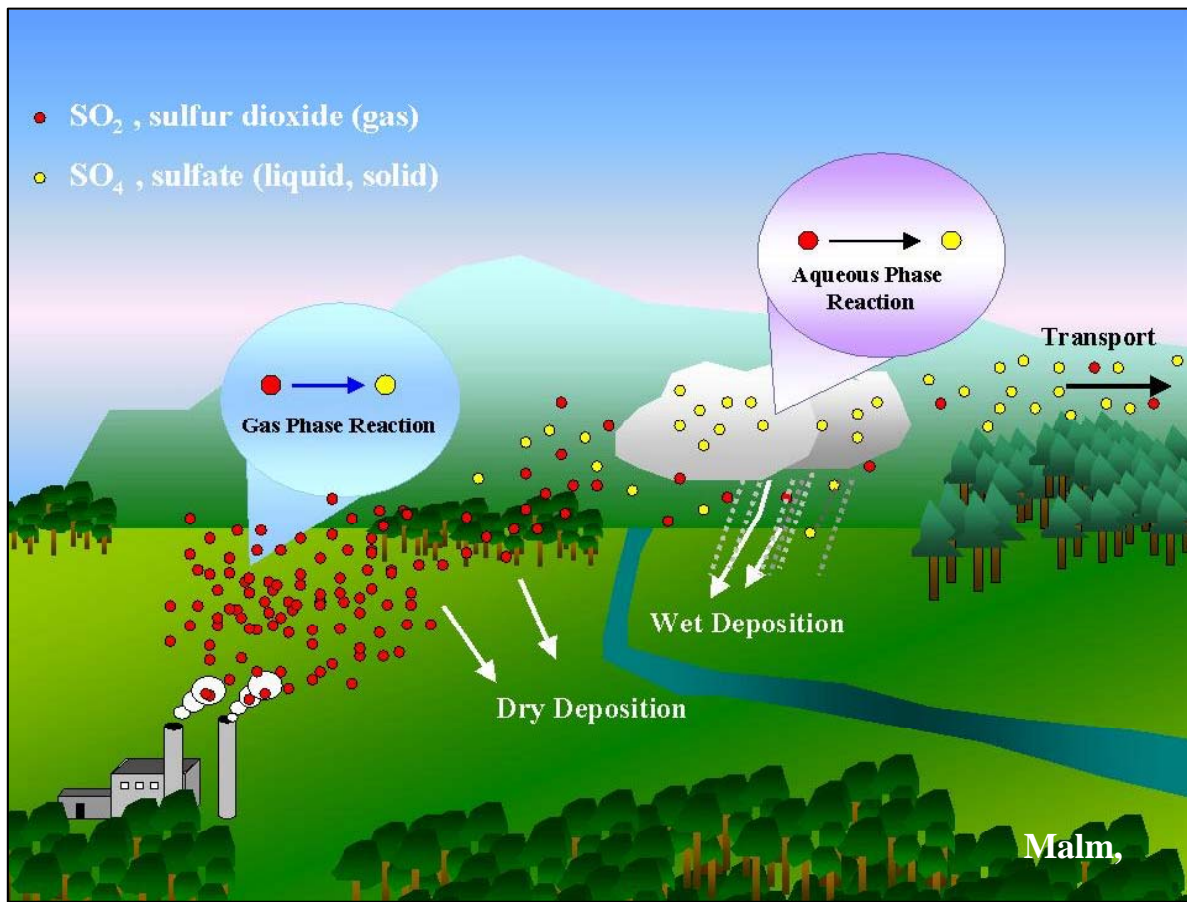
Source – www.hazecam.net

ENVIRONMENTAL EFFECTS

Regional haze is probably most closely associated with its effects on prized vistas such as the Grand Canyon or Acadia National Park. Its impacts may be difficult to quantify but it certainly has a negative overall effect on aesthetics and the outdoors, and how natural areas throughout the nation are enjoyed. But haze also affects urban area and scenes, and can obscure or eclipse the view of an urban skyline (see Figures 5 and 6) or other important urban landmarks such as the Washington Monument.

The pollution that causes regional haze has additional, multifaceted effects on the environment. The most abundant contributors to regional haze, sulfates and nitrates, eventually make their way into the ecosystem through deposition - that is, they are transferred from the air into the water and soils (see Figure 4). Too much deposition can have adverse environmental effects, upsetting the delicate balance of the ecosystem. Increased sulfates in the atmosphere leads to acid rain while increased nitrates promote eutrophication of streams and lakes by depleting available oxygen (see section on Atmospheric Deposition)

Figure 4
Illustration of How Sulfates and Nitrates Enter the Ecosystem by way of Deposition



MONITORING OF HAZE IN NEW JERSEY

Typical visual range in the eastern U.S. is 15 to 30 miles, or about one-third of what it would be without man-made air pollution. In the West, the typical visual range is 60 to 90 miles, or about one-half of the visual range under natural conditions. Haze diminishes the natural visual range. (www.hazecam.net)

Visibility and haze are monitored in two locations in New Jersey; Newark and Brigantine. The monitor in Newark measures the impact of haze on visibility by using a digital camera. The camera is located inside the New Jersey Transit building and is pointed at the New York City skyline. On clear days the entire skyline, as well as each individual building, is easily distinguishable (Figure 5). The Manhattan skyline appears non-existent when conditions conducive to haze formation are in place (Figure 6).

Visibility Camera – New Jersey Transit Building

Figure 5



Figure 6



The IMPROVE site located within the Brigantine National Wildlife Refuge monitors haze and visibility using several types of instruments. Figure 7 below is an example of a clear day in Brigantine as the Atlantic City skyline is easily distinguishable along the horizon. The example of a hazy

day in Brigantine is illustrated below in Figure 8 and not only has the skyline disappeared but the water that was visible in the foreground in the clear picture also seems to have vanished in the haze.

Visibility Camera – Brigantine National Wildlife Refuge

Figure 7



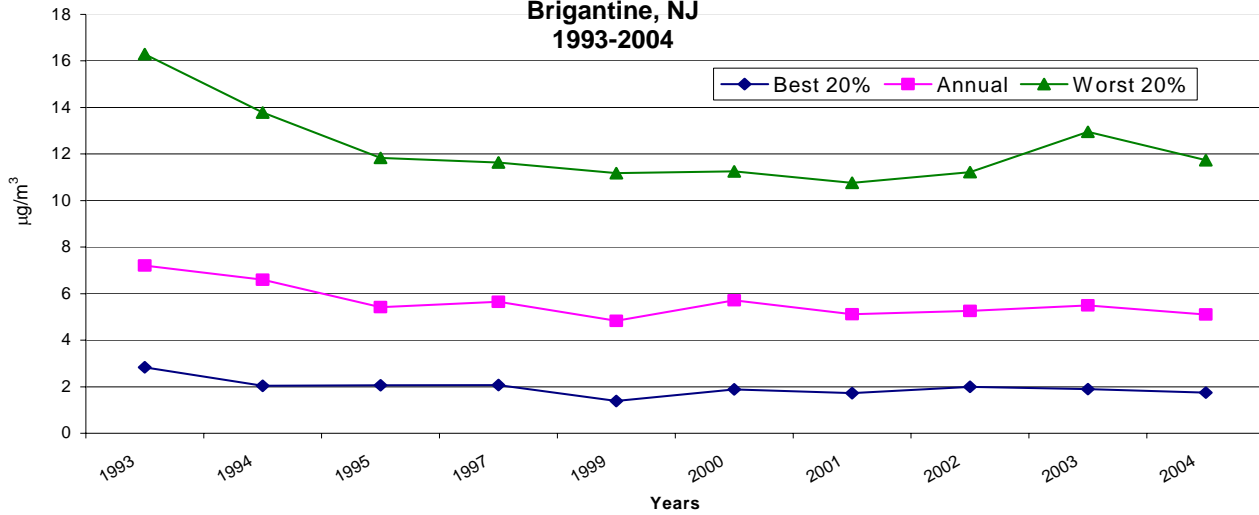
Figure 8



This last graph (Figure 9) represents the annual trend of sulfates expressed in micrograms per cubic meter measured at the Brigantine National Wildlife Refuge.

Besides the trend in annual average sulfate concentrations, the graph illustrates the trend in average sulfate concentrations for the 20 percent worst and 20 percent best visibility days.

Figure 9
Trend in Sulfate Concentration
Brigantine, NJ
1993-2004



In sufficient data available for 1996 and 1998

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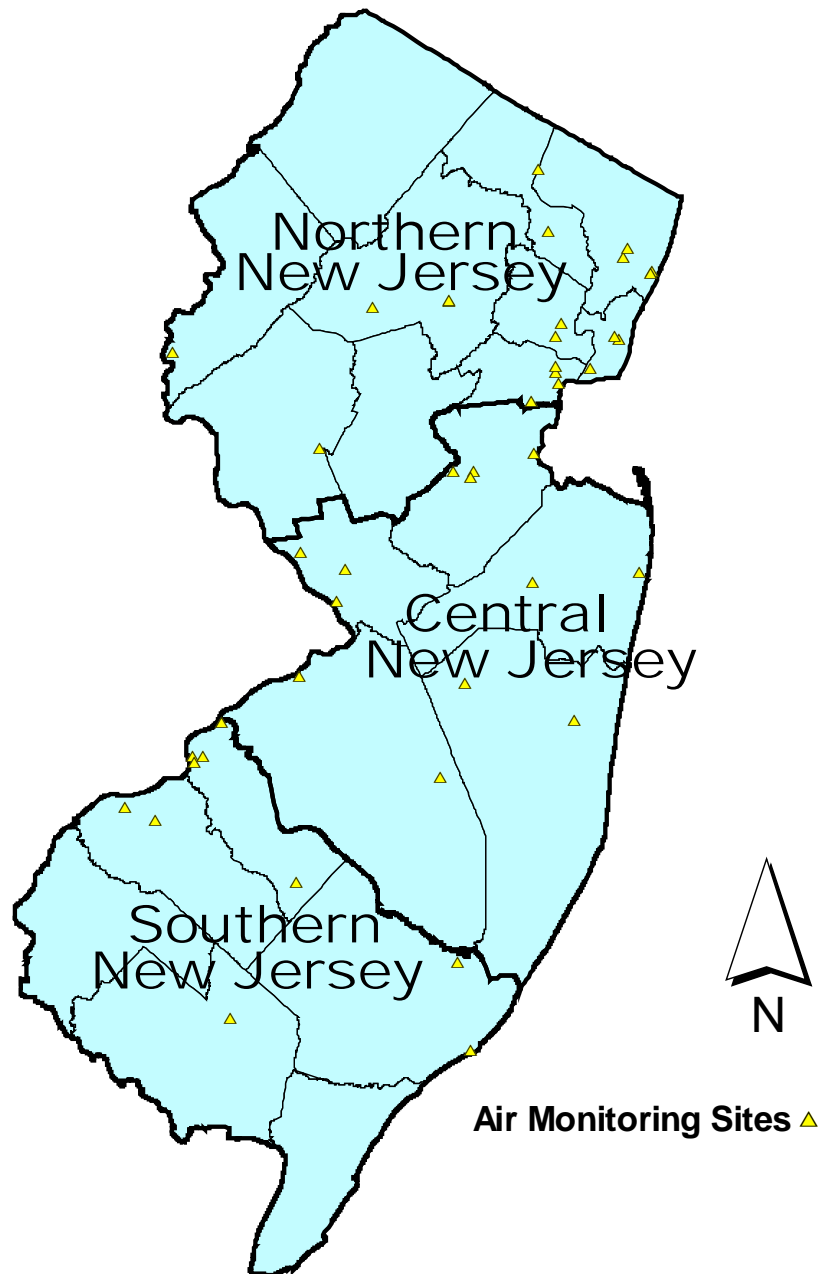
www.hazecam.net



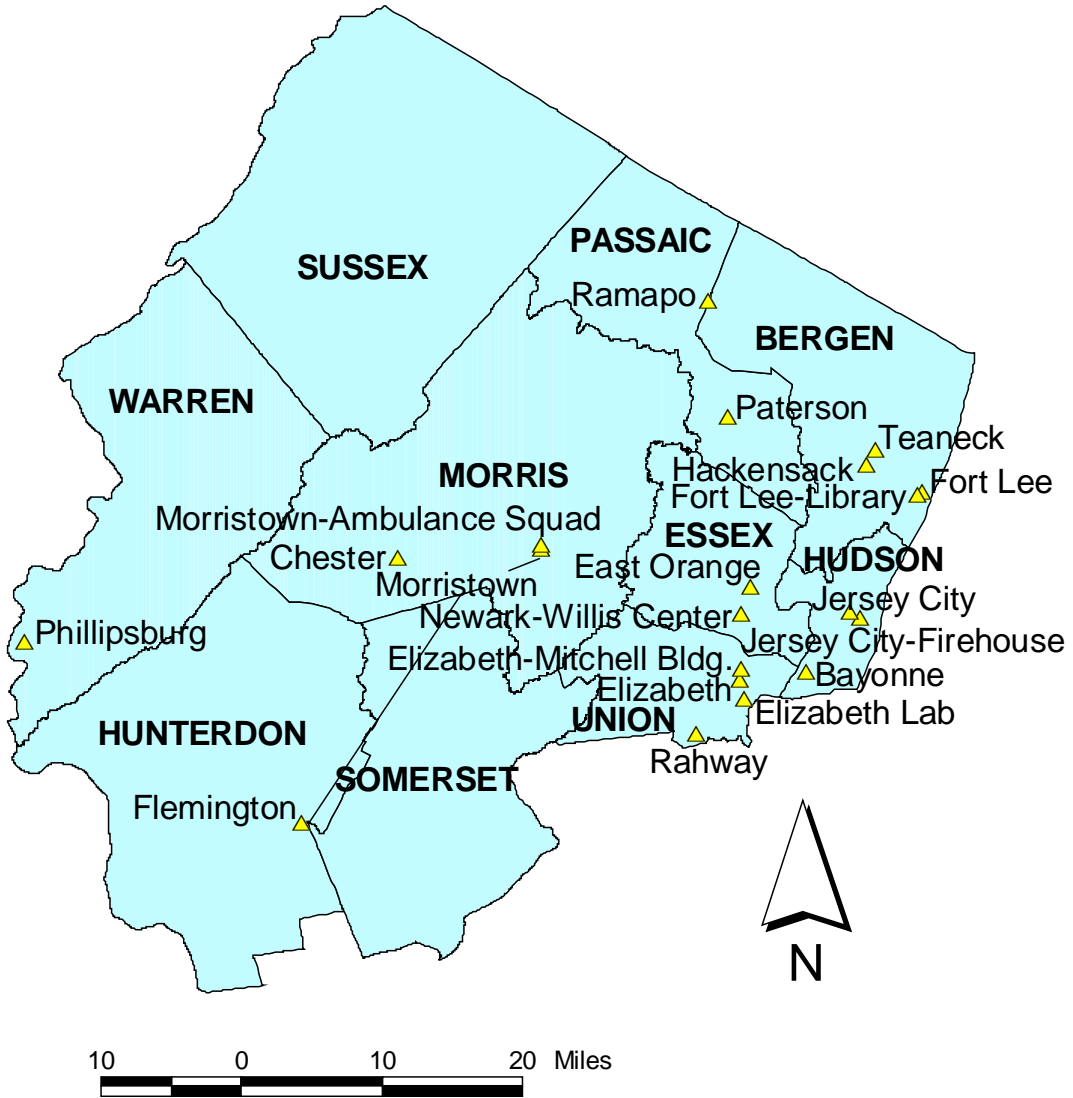
Appendix A

2004 Air Monitoring Sites

New Jersey Department of Environmental Protection



**Figure 1
Northern New Jersey
Air Monitoring Sites**

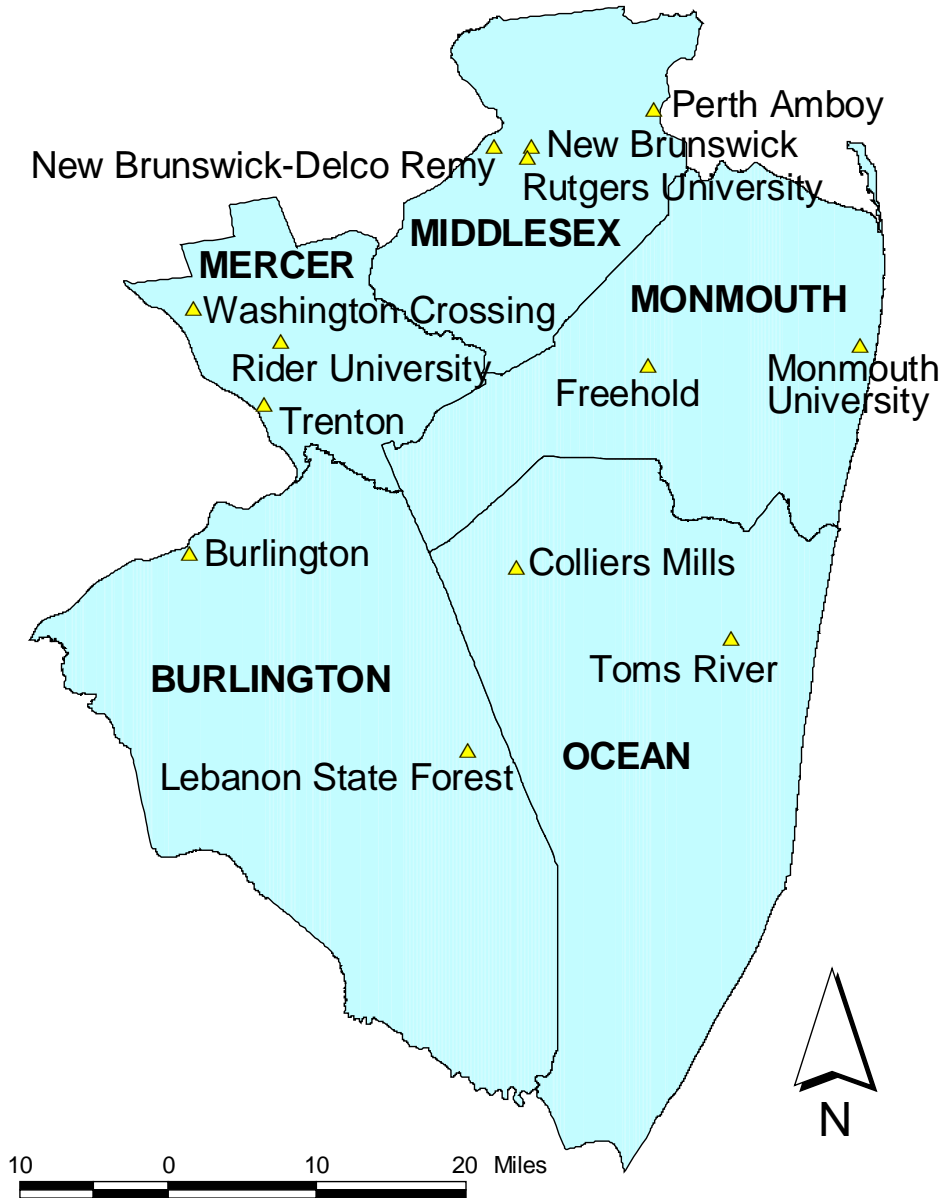


**Table 1
Northern New Jersey Air Monitoring Sites**

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Degrees-minutes-seconds)		Address
				Latitude	Longitude	
BERGEN	Fort Lee	34 003 0004	CO, TEOM, PM ₁₀ , ACID	40 51 16	- 73 58 06	Lemoine Avenue Overpass over I-95
	Fort Lee-Library	34 003 0003	PM _{2.5}	40 51 08	- 73 58 24	Fort Lee Public Library, 320 Main Street
	Hackensack	34 003 5001	CO, SO ₂ , SS	40 52 57	- 74 02 32	133 River St. near Moore & Mercer Streets
	Teaneck	34 003 0005	NO _x , O ₃	40 53 55	- 74 01 48	1000 River Road, Fairleigh Dickinson University
ESSEX	East Orange	34 013 1003	CO, NO _x , MET	40 45 27	- 74 12 02	Engine No. 2, Main Street & Greenwood
	Newark-Willis Center	34 013 0015	PM _{2.5}	40 43 49	- 74 12 46	Mary Willis Cultural Center 447 18 th Ave.
HUDSON	Bayonne	34 017 0006	NO _x , O ₃ , SO ₂	40 40 13	- 74 07 34	Veterans Park, 25 th St. near Park Road
	Jersey City	34 017 1002	CO, SO ₂ , SS	40 43 54	- 74 03 60	2828 Kennedy Blvd.
	Jersey City-Firehouse	34 017 1003	PM _{2.5} , PM ₁₀ , TEOM	40 43 32	- 74 03 08	Firehouse, 355 Newark Ave.
HUNTERDON	Flemington	34 019 0001	O ₃ , SS, MET	40 30 55	- 74 48 24	Raritan Twp. Sewage Treatment Plant, Three Bridges
MORRIS	Chester	34 027 3001	NO _x , O ₃ , SO ₂ , MET, PM _{2.5} , TOXICS	40 47 15	- 74 40 35	Bldg. #1, Lucent Tech., Route 513
	Morristown	34 027 0003	CO, SS	40 47 52	- 74 28 58	11 Washington St.
	Morristown-Ambulance Squad	34 027 0004	PM _{2.5}	40 48 06	- 74 29 02	Ambulance Squad, 16 Early St.
PASSAIC	Paterson	34 031 0005	PM _{2.5}	40 55 60	- 74 13 52	Health Department, 176 Broadway Ave.
	Ramapo	34 031 5001	O ₃	41 03 08	- 74 15 23	Access Road, off Skyline Drive, Wanaque Borough
UNION	Elizabeth	34 039 0003	CO, SO ₂ , SS	40 39 45	- 74 12 53	7 Broad St.
	Elizabeth Lab	34 039 0004	CO, NO _x , SO ₂ , SS, TEOM, MET, PM _{2.5} , TOXICS	40 38 29	- 74 12 30	Interchange 13, NJTP
	Elizabeth-Mitchell Building	34 039 0006	PM _{2.5}	40 40 24	- 74 12 51	Mitchell Bldg., 500 North Broad Street
	Rahway	34 039 2003	PM _{2.5} , TEOM	40 36 22	- 74 16 30	Fire Dept. Bldg., 1300 Main Street
WARREN	Phillipsburg	34 041 0006	PM _{2.5}	40 41 57	- 75 10 50	Municipal Bldg., 675 Corliss Avenue

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

Figure 2
Central New Jersey Air
Monitoring Sites

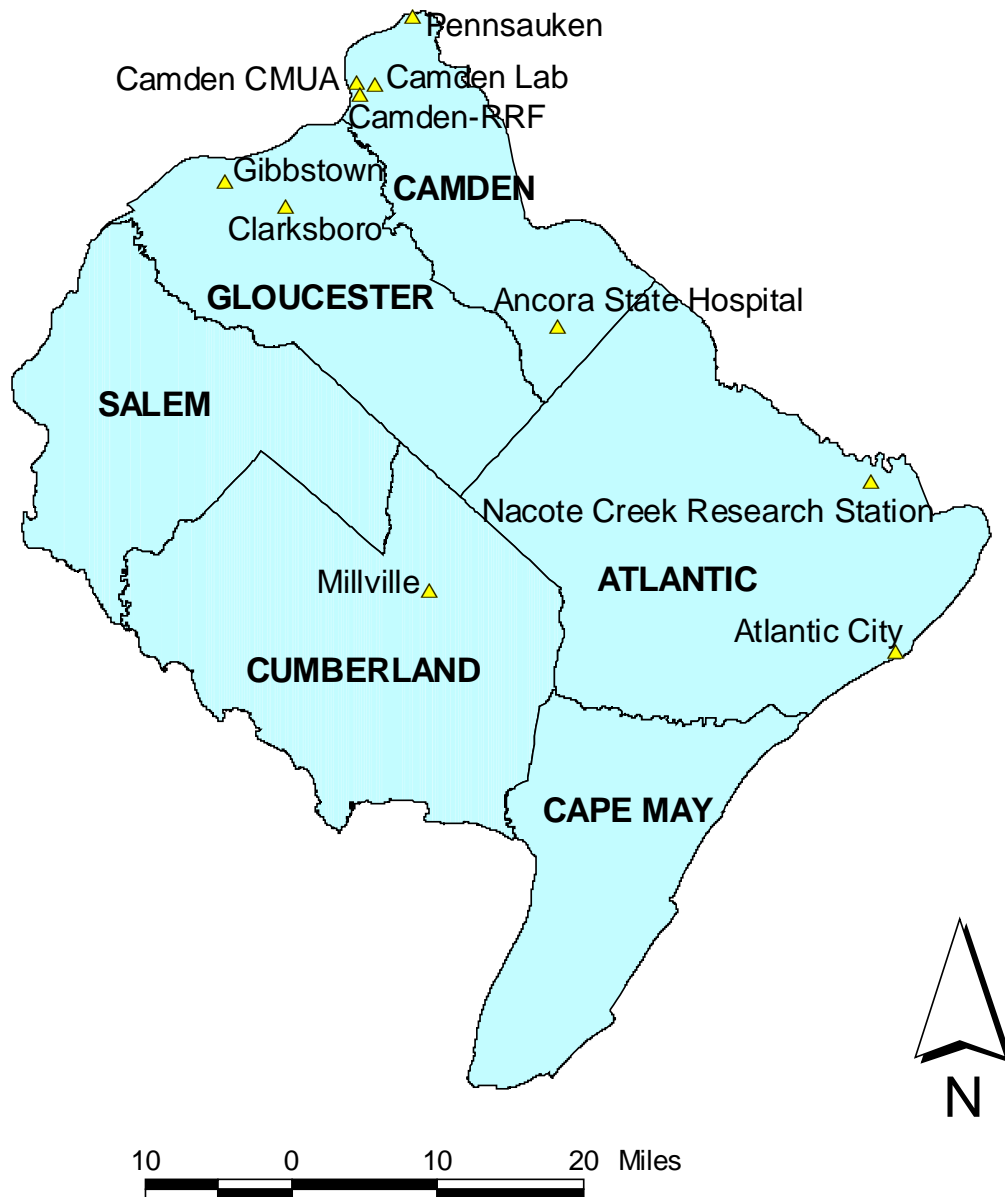


**Table 2
Central New Jersey Air Monitoring Sites**

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Degrees-minutes-seconds)		Address
				Latitude	Longitude	
BURLINGTON	Burlington	34 005 1001	CO, SO ₂ , SS	40 04 41	- 74 51 28	1 East Broad Street
	Lebanon State Forest	N/A	ACID	39 53 08	- 74 30 18	Lebanon State Forest
MERCER	Rider University	34 021 0005	NO _x , O ₃ , PAMS, MET	40 16 59	- 74 44 34	Athletic Fields, Route 206 South, Lawrenceville
	Trenton	34 021 0008	PM _{2.5} , PM ₁₀	40 13 20	- 74 45 47	Trenton Library, 120 Academy Street
	Washington Crossing	34 021 8001	PM _{2.5} , ACID	40 18 56	- 74 51 14	Washington Crossing State Park, off Church Road, Titusville
MIDDLESEX	New Brunswick	34 023 0006	TEOM, PM _{2.5} , TOXICS	40 28 22	- 74 25 21	Cook College, Log Cabin Road
	New Brunswick-Delco Remy	34 023 1003	Pb, TSP	40 28 23	- 74 28 15	12 th Street & Livingston Avenue
	Perth Amboy	34 023 2003	CO, SO ₂ , SS	40 30 32	- 74 16 06	130 Smith Street, Perth Amboy
	Rutgers University	34 023 0011	NO _x , O ₃ , MET, PAMS	40 27 44	- 74 25 46	Horticultural Farm #3, off Ryder's Lane, New Brunswick
MONMOUTH	Freehold	34 025 2001	CO, SS	40 15 36	- 74 16 29	5 West Main Street
	Monmouth University	34 025 0005	O ₃	40 16 42	- 74 00 19	Edison Science Bldg., West Long Branch
OCEAN	Colliers Mills	34 029 0006	O ₃	40 03 53	- 74 26 39	Colliers Mills Wildlife Management Area
	Toms River	34 029 2002	PM _{2.5}	39 59 41	- 74 10 12	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-seconds)		Address
				Latitude	Longitude	
ATLANTIC	Atlantic City	34 001 1006	PM _{2.5} , PM ₁₀	39 21 46	- 74 25 46	1433 Bacharach Blvd., Atlantic City
	Nacote Creek Research Station	34 001 0005	O ₃ , SO ₂	39 31 49	- 74 27 38	Brigantine National Wildlife Refuge near Smithville
CAMDEN	Ancora State Hospital	34 007 1001	CO, O ₃ , SO ₂ , ACID	39 41 03	- 74 51 41	Ancora State Hospital, Winslow Twp.
	Camden CMUA	N/A	TEOM	39 55 26	- 75 07 21	1645 Ferry Avenue, Camden County Sewage Treatment Plant
	Camden Lab	34 007 0003	CO, NO _x , O ₃ , SO ₂ , SS, TEOM, MET, PAMS, PM _{2.5} , ACID, TOXICS	39 55 23	- 75 05 51	1667 Davis Street, corner of Copewood St.
	Camden-RRF	34 007 0009	PM ₁₀	39 54 45	- 75 07 04	Camden RRF, Morgan Blvd. & I-676
	Pennsauken	34 007 1007	PM _{2.5}	39 59 20	- 75 02 57	9800 Zimmerman Ave, near Griffith-Morgan Lane
CUMBERLAND	Millville	34 011 0007	NO _x , O ₃ , SO ₂	39 25 20	- 75 01 31	Lincoln Avenue & Route 55
GLOUCESTER	Clarksboro	34 015 0002	O ₃ , SO ₂	39 48 01	- 75 12 44	Clarksboro Shady Lane Rest Home, County House Road
	Gibbstown	34 015 5001	PM _{2.5}	39 49 33	- 75 17 22	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 Federally 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 Federally Reference Method PM ₁₀ Sampler	TSP	Total Suspended Particulates



Appendix B

Fine Particulate Speciation Summary- 2004

New Jersey Department of Environmental Protection

Table 1
Fine Particulate Speciation Data – 2004
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	0.0217	0.1650	0.1429
Ammonium	1.9408	6.0937	6.0451
Antimony	0.0041	0.0653	0.0443
Arsenic	0.0013	0.0069	0.0059
Barium	0.0117	0.0579	0.0556
Bromine	0.0041	0.0610	0.0308
Cadmium	0.0027	0.0226	0.0192
Calcium	0.0493	0.3020	0.2912
Cerium	0.0074	0.0792	0.0669
Cesium	0.0045	0.0428	0.0371
Chlorine	0.0250	0.6202	0.2736
Chromium	0.0031	0.0473	0.0154
Cobalt	0.0002	0.0032	0.0030
Copper	0.0043	0.0329	0.0240
Elemental carbon	0.6806	2.6376	2.0073
Europium	0.0012	0.0163	0.0138
Gallium	0.0002	0.0017	0.0015
Gold	0.0015	0.0108	0.0101
Hafnium	0.0013	0.0204	0.0097
Indium	0.0018	0.0162	0.0136
Iridium	0.0010	0.0093	0.0052
Iron	0.0973	0.7001	0.3340
Lanthanum	0.0068	0.0558	0.0447
Lead	0.0043	0.0193	0.0176
Magnesium	0.0091	0.1092	0.0643
Manganese	0.0017	0.0083	0.0069
Mercury	0.0022	0.0437	0.0184
Molybdenum	0.0010	0.0127	0.0092
Nickel	0.0039	0.0217	0.0192
Niobium	0.0003	0.0046	0.0030
Nitrate	1.9539	7.3566	6.7493

Table 1 (Continued)
Fine Particulate Speciation Data – 2004
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	3.8585	10.0783	9.7288
Phosphorus	0.0048	0.0635	0.0466
Potassium	0.0521	0.1964	0.1652
Rubidium	0.0002	0.0020	0.0019
Samarium	0.0009	0.0197	0.0077
Scandium	0.0001	0.0013	0.0010
Selenium	0.0013	0.0065	0.0055
Silicon	0.0940	0.5370	0.4107
Silver	0.0018	0.0265	0.0147
Sodium	0.1184	0.8200	0.6173
Strontium	0.0007	0.0047	0.0043
Sulfate	4.4465	16.8402	16.7648
Sulfur	1.4255	5.8917	5.0108
Tantalum	0.0017	0.0172	0.0136
Terbium	0.0006	0.0122	0.0106
Tin	0.0031	0.0357	0.0353
Titanium	0.0042	0.0270	0.0213
Total mass	14.6567	37.9891	36.4745
Vanadium	0.0045	0.0420	0.0205
Wolfram	0.0023	0.0176	0.0168
Yttrium	0.0004	0.0038	0.0027
Zinc	0.0119	0.0840	0.0420
Zirconium	0.0016	0.0283	0.0214

Table 2
Fine Particulate Speciation Data – 2004
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	0.0131	0.1086	0.0629
Ammonium	1.3892	5.3308	5.1878
Antimony	0.0065	0.0571	0.0537
Arsenic	0.0012	0.0080	0.0055
Barium	0.0091	0.0608	0.0571
Bromine	0.0022	0.0112	0.0084
Cadmium	0.0024	0.0227	0.0206
Calcium	0.0166	0.0519	0.0512
Cerium	0.0075	0.0786	0.0766
Cesium	0.0040	0.0471	0.0273
Chlorine	0.0071	0.0924	0.0558
Chromium	0.0022	0.0135	0.0121
Cobalt	0.0003	0.0022	0.0019
Copper	0.0014	0.0132	0.0069
Elemental carbon	0.3601	1.3684	1.1299
Europium	0.0004	0.0051	0.0037
Gallium	0.0002	0.0035	0.0031
Gold	0.0019	0.0117	0.0102
Hafnium	0.0020	0.0333	0.0239
Indium	0.0022	0.0174	0.0168
Iridium	0.0017	0.0152	0.0115
Iron	0.0349	0.1148	0.1058
Lanthanum	0.0075	0.0731	0.0627
Lead	0.0023	0.0139	0.0109
Magnesium	0.0055	0.0517	0.0448
Manganese	0.0014	0.0052	0.0047
Mercury	0.0014	0.0090	0.0080
Molybdenum	0.0006	0.0069	0.0068
Nickel	0.0021	0.0151	0.0133
Niobium	0.0003	0.0047	0.0036
Nitrate	1.1976	6.4024	4.6470
Organic carbon	2.6933	6.8627	6.0160
Phosphorus	0.0028	0.0543	0.0492
Potassium	0.0343	0.2742	0.1387
Rubidium	0.0003	0.0036	0.0023
Samarium	0.0008	0.0069	0.0067
Scandium	0.0001	0.0023	0.0011
Selenium	0.0013	0.0062	0.0057

Table 2 (Continued)
Fine Particulate Speciation Data – 2004
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	0.0402	0.2537	0.2120
Silver	0.0023	0.0188	0.0160
Sodium	0.0751	0.6008	0.4411
Strontium	0.0006	0.0043	0.0034
Sulfate	3.7631	17.1732	16.8490
Sulfur	1.1986	5.4171	4.8540
Tantalum	0.0031	0.0245	0.0232
Terbium	0.0004	0.0077	0.0040
Tin	0.0031	0.0301	0.0246
Titanium	0.0020	0.0090	0.0089
Total mass	10.8313	34.9137	31.6462
Vanadium	0.0018	0.0098	0.0095
Wolfram	0.0028	0.0220	0.0149
Yttrium	0.0004	0.0037	0.0024
Zinc	0.0062	0.0770	0.0288
Zirconium	0.0004	0.0061	0.0047

Table 3
Fine Particulate Speciation Data – 2004
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	0.0155	0.1137	0.0729
Ammonium	1.8950	7.4937	7.4037
Antimony	0.0058	0.0513	0.0501
Arsenic	0.0012	0.0075	0.0052
Barium	0.0154	0.0835	0.0698
Bromine	0.0034	0.0163	0.0132
Cadmium	0.0027	0.0319	0.0306
Calcium	0.0367	0.3024	0.0944
Cerium	0.0090	0.0772	0.0725
Cesium	0.0038	0.0402	0.0375
Chlorine	0.0447	1.0502	0.4389
Chromium	0.0042	0.0566	0.0384
Cobalt	0.0002	0.0016	0.0015
Copper	0.0049	0.0237	0.0174
Elemental carbon	1.5842	5.0086	4.6243
Europium	0.0010	0.0156	0.0145
Gallium	0.0002	0.0018	0.0013
Gold	0.0013	0.0097	0.0072
Hafnium	0.0018	0.0307	0.0220
Indium	0.0024	0.0319	0.0244
Iridium	0.0010	0.0111	0.0063
Iron	0.1128	0.4380	0.3843
Lanthanum	0.0068	0.0967	0.0463
Lead	0.0036	0.0161	0.0152
Magnesium	0.0081	0.0905	0.0605
Manganese	0.0021	0.0174	0.0078
Mercury	0.0017	0.0091	0.0086
Molybdenum	0.0009	0.0141	0.0083
Nickel	0.0049	0.0260	0.0145
Niobium	0.0004	0.0050	0.0043
Nitrate	1.9781	10.2563	5.9103
Organic carbon	4.5862	11.4540	10.3458
Phosphorus	0.0045	0.0745	0.0587
Potassium	0.0385	0.1469	0.1068
Rubidium	0.0004	0.0033	0.0024
Samarium	0.0009	0.0189	0.0084
Scandium	0.0001	0.0018	0.0014
Selenium	0.0013	0.0078	0.0057

Table 3 (Continued)
Fine Particulate Speciation Data – 2004
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	0.0615	0.3254	0.2325
Silver	0.0023	0.0241	0.0155
Sodium	0.1301	1.5432	0.6742
Strontium	0.0008	0.0033	0.0032
Sulfate	4.0757	18.9489	17.5276
Sulfur	1.2657	5.6887	5.4056
Tantalum	0.0022	0.0172	0.0142
Terbium	0.0006	0.0256	0.0158
Tin	0.0036	0.0484	0.0382
Titanium	0.0035	0.0121	0.0097
Total mass	15.6685	48.4354	46.2571
Vanadium	0.0057	0.0326	0.0256
Wolfram	0.0021	0.0132	0.0129
Yttrium	0.0005	0.0038	0.0025
Zinc	0.0140	0.0644	0.0605
Zirconium	0.0008	0.0090	0.0070

Table 4
Fine Particulate Speciation Data – 2004
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	0.0181	0.1337	0.1015
Ammonium	1.5497	7.0541	5.4807
Antimony	0.0057	0.0630	0.0619
Arsenic	0.0012	0.0054	0.0047
Barium	0.0111	0.0524	0.0514
Bromine	0.0026	0.0086	0.0084
Cadmium	0.0024	0.0253	0.0218
Calcium	0.0234	0.0954	0.0649
Cerium	0.0061	0.0880	0.0557
Cesium	0.0036	0.0383	0.0347
Chlorine	0.0161	0.1939	0.1166
Chromium	0.0021	0.0159	0.0155
Cobalt	0.0002	0.0015	0.0013
Copper	0.0036	0.0125	0.0105
Elemental carbon	0.6115	1.9977	1.6064
Europium	0.0007	0.0096	0.0093
Gallium	0.0002	0.0016	0.0016
Gold	0.0017	0.0115	0.0107
Hafnium	0.0018	0.0257	0.0190
Indium	0.0016	0.0215	0.0210
Iridium	0.0011	0.0100	0.0063
Iron	0.0682	0.1825	0.1694
Lanthanum	0.0054	0.0567	0.0472
Lead	0.0037	0.0200	0.0194
Magnesium	0.0071	0.0913	0.0793
Manganese	0.0026	0.0203	0.0161
Mercury	0.0015	0.0073	0.0061
Molybdenum	0.0005	0.0075	0.0053
Nickel	0.0026	0.0228	0.0110
Niobium	0.0004	0.0072	0.0068
Nitrate	1.5009	7.5874	5.1400
Organic carbon	3.2441	6.3656	6.2458
Phosphorus	0.0027	0.0482	0.0385
Potassium	0.0401	0.1459	0.1382
Rubidium	0.0002	0.0022	0.0017
Samarium	0.0010	0.0092	0.0068
Scandium	0.0002	0.0028	0.0022
Selenium	0.0011	0.0063	0.0049

Table 4 (Continued)
Fine Particulate Speciation Data – 2004
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	0.0504	0.2952	0.1971
Silver	0.0029	0.0362	0.0171
Sodium	0.0904	0.6506	0.3399
Strontium	0.0009	0.0043	0.0043
Sulfate	3.8279	18.0431	16.9728
Sulfur	1.1937	5.1220	5.0887
Tantalum	0.0030	0.0316	0.0209
Terbium	0.0003	0.0093	0.0071
Tin	0.0032	0.0286	0.0240
Titanium	0.0033	0.0476	0.0154
Total mass	12.5153	41.4128	37.2741
Vanadium	0.0026	0.0127	0.0107
Wolfram	0.0032	0.0197	0.0175
Yttrium	0.0004	0.0029	0.0028
Zinc	0.0119	0.0714	0.0613
Zirconium	0.0005	0.0056	0.0056