



2014 Air Quality Report - Introduction

New Jersey Department of Environmental Protection



New Jersey Department of Environmental Protection
Bureau of Air Monitoring
Trenton, New Jersey

www.njaqinow.net

INTRODUCTION

This report summarizes the New Jersey air quality monitoring data for 2014. It contains information on the Air Quality Index (AQI), and concentrations of individual pollutants including carbon monoxide, nitrogen oxides, ozone, particulate matter, and sulfur dioxide. Data on atmospheric deposition, haze, speciation of fine particulates, ozone precursors, air toxics, and meteorological data are also provided.

The state of New Jersey has been monitoring air quality since 1965. During that time pollution levels have improved significantly, the result of state, regional and national air pollution reduction efforts.

Air quality problems still exist across the state. Ozone can reach significant levels in the summer months, and has been found to have serious health effects at lower levels than previously thought. In response, the United States Environmental Protection Agency (USEPA) revised the National Ambient Air Quality Standards (NAAQS) for ozone in 2008, and emission reduction strategies continue to be implemented to meet the new standards.

In addition to ozone, sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) are also known cause serious health problems, especially for sensitive individuals such as children, the elderly, and people with asthma. In 2010, USEPA revised the NAAQS for both SO₂ and NO₂ in response to new public health information. New Jersey continues to closely monitor these pollutants to keep them within the NAAQS.

Fine particles are defined as particles less than 2.5 micrometers in diameter and are referred to as PM_{2.5}. These small particles can be inhaled deep into the lungs, and are known to have a greater impact on public health than larger particles, which were the focus of previous particulate matter ambient air quality standards. Monitoring data indicate PM_{2.5} levels may be a problem in some areas of New Jersey.

Additionally, there is concern about a class of air pollutants referred to as “air toxics.” These pollutants can cause cancer or other serious health effects. The list of potential air toxics is very large and includes many different types of compounds, including heavy metals and toxic volatile organic compounds. New Jersey began measuring ambient levels of specific air toxics in 1989, and has expanded its network over the years to better understand the issues and protect the health of its residents.

2014 data from New Jersey’s extensive air monitoring network are summarized in the specific sections of this report. Questions or comments can be made by e-mailing us at bamweb@dep.nj.gov, by phone at (609) 292-0138, or by writing to us at:

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2014 Network Summary

New Jersey Department of Environmental Protection

NETWORK DESCRIPTION

In 2014, the New Jersey Department of Environmental Protection (NJDEP) Bureau of Air Monitoring operated 40 ambient air monitoring stations. The monitoring stations vary in terms of the number and type of monitors operating at each site. The NJDEP air monitoring program is primarily focused pollutants for which National Ambient Air Quality Standards (NAAQS) have been established, also known as criteria pollutants. Criteria pollutant monitoring is regulated by the United States Environmental Protection Agency (USEPA), which prescribes the design of the monitoring networks, the acceptable monitoring methods, and the minimum quality assurance activities. Data which meet USEPA requirements can then be used to determine compliance with the NAAQS. There are six criteria air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), and particulate matter (PM). Because particulate matter encompasses such a wide range of contaminants, there are NAAQS for two different size fractions of particles. There are separate standards for particles less than 10 microns (1 micron = one millionth of a meter), or inhalable particles (PM₁₀), and for particles less than 2.5 microns, or fine particles (PM_{2.5}).

In New Jersey, O₃, CO, NO₂, and SO₂ are measured using USEPA-approved continuous monitoring methods, and data collected for these pollutants are transmitted to a central data acquisition system in real-time. The Bureau of Air Monitoring posts air quality data updates to its web site (www.njaqinow.net) and to the USEPA's Air Now web site (www.airnow.gov) once every hour. To measure PM_{2.5}, particles are collected by pulling ambient air through a size-selective inlet onto a filter over a 24-hour period using an USEPA-approved sampler. The filters are manually transported to the Bureau of Air Monitoring's Technical Center for gravimetric analysis. In order to provide hourly particulate measurements that can be disseminated to the public in real time, the Bureau operates two types of continuous particulate monitors: the Tapered Element Oscillating Microbalance (TEOM) analyzer, and the PM_{2.5} Beta Attenuation Analyzer. These have been installed at many sites, such as the new Fort Lee Near Road site.

Figure 1
Rider University Air Monitoring Station
Lawrenceville, Mercer County



In addition to monitoring criteria pollutants, the NJDEP also measures non-criteria pollutants, or pollutants that currently do not have health standards. For convenience, several groups of non-criteria pollutants are labeled by their purpose. The Photochemical Assessment Monitoring Station (PAMS) program, for example, measures non-criteria pollutants that are important in the formation of ozone. Since most ozone is not directly emitted from sources but forms in the atmosphere when volatile organic compounds and oxides of nitrogen react in the presence of sunlight, it is important to know the levels of these “precursor” pollutants. The PAMS program is described in more detail in a separate section of this report.

Five sites in the monitoring network collect samples of particulate matter that are analyzed to determine the chemical makeup of the particles. These are termed “PM_{2.5} Speciation Sites” and are part of the USEPA’s Speciation Trends Network (STN). This data is used in helping to identify the primary sources of particles, and in assessing potential health effects.

At four monitoring sites, samples are taken and analyzed for non-criteria pollutants that are classified as “air toxics.” These are pollutants that have potential health effects but for which NAAQS have not been established. They can be carcinogenic or have other serious health effects, and are very diverse in their chemical composition.

Other non-criteria monitoring pollutants measured are a group of pollutants that are commonly emitted by motor vehicles and other combustion sources: benzene, toluene, ethylbenzene, ortho-xylene, meta-xylene, para-xylene and black carbon. In addition, the Bureau takes measurements of mercury, atmospheric deposition, visibility, and weather parameters such as wind speed and direction. An example of an air monitoring station is the Rider University site located in Lawrenceville, Mercer County, shown in Figure 1. This site measures criteria pollutant data as well as weather parameters. Figure 2 shows a USEPA-approved manual sampler to measure PM_{2.5} located on the roof of the Hooper Avenue Elementary School in Toms River, Ocean County.

The map in Figure 3 shows the locations of all the sites that operated in 2014, and Table 1 shows which parameters were measured at each site.

Figure 2
USEPA-approved PM_{2.5} Sampler in
Toms River, Ocean County



Figure 3

New Jersey Air Monitoring Sites 2014 Network Summary

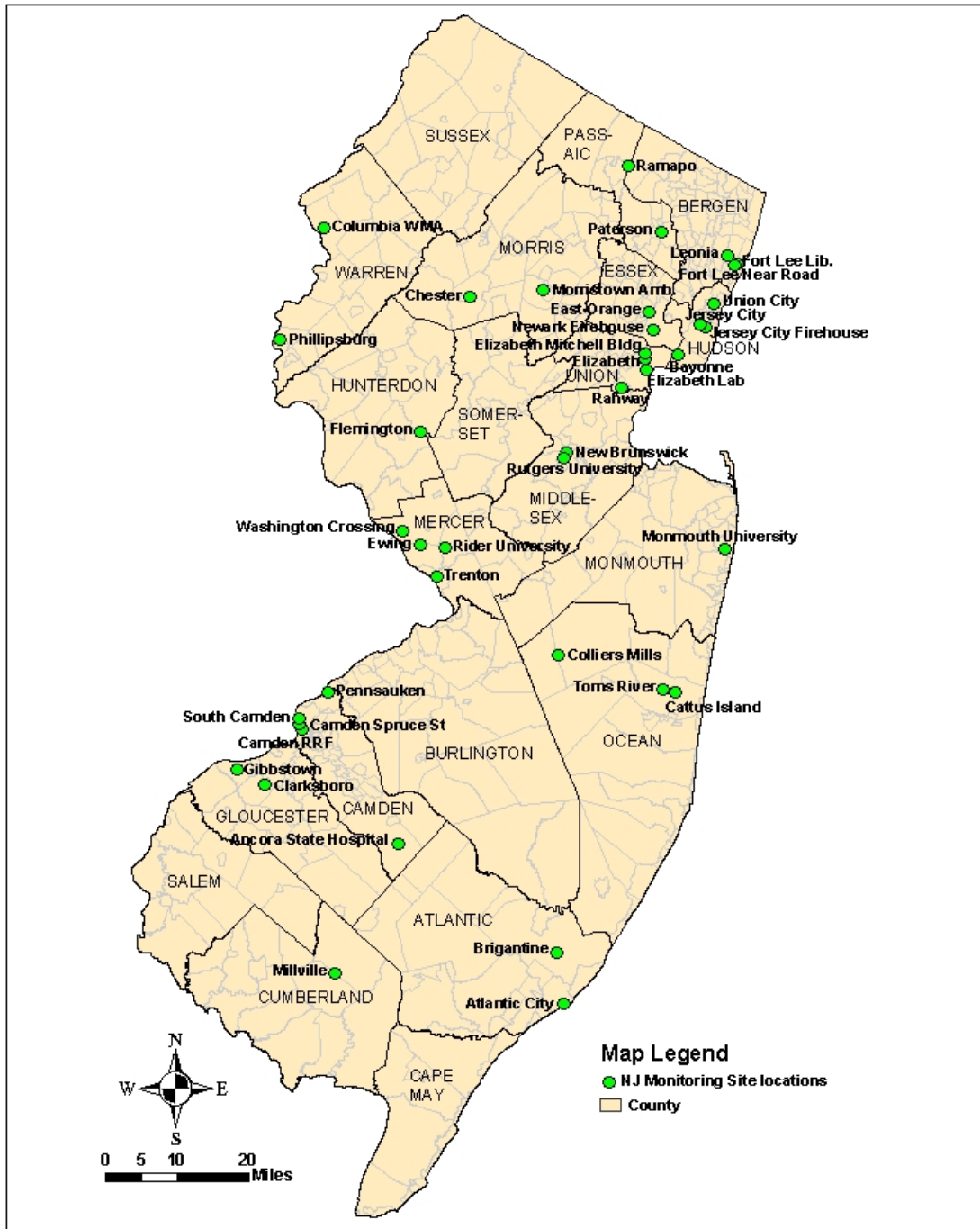



Table 1
2014 Monitoring Network Chart

	CO	NOx	NOy	O ₃	SO ₂	Smoke Shade	PM _{2.5}	PM _{2.5} -Speciation	Real-Time PM _{2.5} TEOM	Real-Time PM _{2.5} Beta	Visibility	PM ₁₀	O ₃ Precursors - PAMS	VOCs/ Carbonyls	BTEX/ Black Carbon	Lead	Acid Deposition	Mercury	Barometric Pres./ Relative Humidity	Solar Radiation	Temperature	Wind Speed/ Direction
Ancora State Hospital				Y																		
Atlantic City							Y															
Bayonne		Y		Y	Y										Y				Y		Y	Y
Brigantine				Y	Y		Y		Y	Y								Y				
Camden RRF												Y										
Camden Spruce Street	Y	Y		Y	Y		Y	Y		Y				Y	Y				Y		Y	Y
Cattus Island																	Y					
Chester		Y		Y	Y		Y	Y						Y				Y		Y		
Clarksboro				Y																		
Colliers Mills				Y																		
Columbia WMA		Y		Y	Y		Y			Y									Y		Y	Y
East Orange	Y	Y																	Y		Y	Y
Elizabeth	Y				Y	Y																
Elizabeth Lab	Y	Y			Y	Y	Y	Y		Y				Y	Y			Y				Y
Elizabeth Mitchell Bldg							Y															
Ewing									Y													
Flemington				Y					Y										Y	Y	Y	Y
Fort Lee Library							Y															
Fort Lee Near Road	Y	Y								Y												
Gibbstown							Y															
Jersey City	Y				Y	Y																
Jersey City Firehouse							Y		Y			Y										
Leonia				Y																		
Millville		Y		Y						Y												
Monmouth University				Y																		
Morristown Amb Squad							Y															
New Brunswick							Y	Y		Y				Y	Y			Y				
Newark Firehouse	Y	Y	Y	Y	Y		Y	Y		Y					Y	Y			Y	Y	Y	Y
Paterson							Y															
Pennsauken							Y															
Phillipsburg							Y															
Rahway							Y		Y													
Ramapo				Y																		
Rider University				Y															Y	Y	Y	Y
Rutgers University		Y		Y									Y						Y ²	Y ²	Y ²	Y ²
South Camden									Y													
Toms River							Y															
Trenton							Y															
Union City							Y															
Washington Crossing							Y										Y					
TOTAL	7	10	1	16	9	3	21	5	5	8	1	2	1	4	4	1	2	4	8	5	8	9

Y – Parameter measured in 2014

 Began measuring data in 2014. See Table 2 (page 5)

² - Meteorological measurements at the site are collected by Rutgers University

CHANGES TO THE NETWORK, 2014

In 2014, real-time PM_{2.5} Beta Attenuation analyzers were installed at the Columbia WMA and Camden Spruce Street monitoring sites. At the Bayonne site, BTEX and black carbon analyzers were installed, along with a meteorological sensor that measures wind speed, wind direction, temperature, relative humidity, and barometric pressure. The new Fort Lee Near Road site began operating in 2014 and measures nitrogen oxides, carbon monoxide, and real-time PM_{2.5} with a Beta Attenuation analyzer.

Table 2
2014 Network Changes (by Date)

Monitoring Site	Parameter(s)	Action	Date
Columbia WMA	Real-time PM _{2.5} (Beta analyzer)	Start-up	01/10/14
Bayonne	BTEX, black carbon, wind speed, wind direction, temperature, relative humidity, barometric pressure	Start-up	03/11/14
Fort Lee Near Road	NO _x , CO	Start-up	04/01/14
Camden Spruce Street	Real-time PM _{2.5} (Beta analyzer)	Start-up	04/04/14
Fort Lee Near Road	Real-time PM _{2.5} (Beta analyzer)	Start-up	04/21/14

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2014 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. These pollutants are ozone, particulate matter, nitrogen dioxide, sulfur dioxide, and carbon monoxide. Although air concentrations of pollutants have been dropping over the past few years, the U.S. Environmental Protection Agency (USEPA) must periodically review the NAAQS to make sure that they are protective of public health in response to new research. The nitrogen dioxide and sulfur dioxide NAAQS were revised in 2010, and the ozone NAAQS was most recently revised in 2008. It is currently under review.

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.airnow.gov.

Every morning a forecast for the current and following day is prepared by the New Jersey Department of Environmental Protection (NJDEP) using the AQI format. The forecast is provided to USEPA and is disseminated through the Enviroflash system to those who subscribe to receive air quality forecast and alert emails (www.enviroflash.info). Anyone can view the forecast and current air quality conditions at USEPA's AirNow website or on NJDEP's air monitoring webpage (www.njaqinow.net).

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

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
201-300	Very Unhealthy	Purple

Figure 1
Air Quality Index Regions

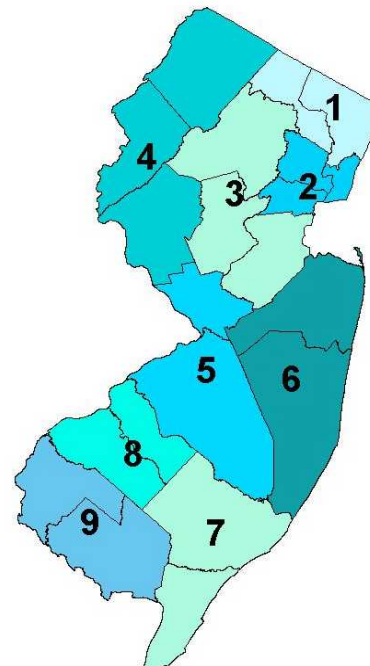
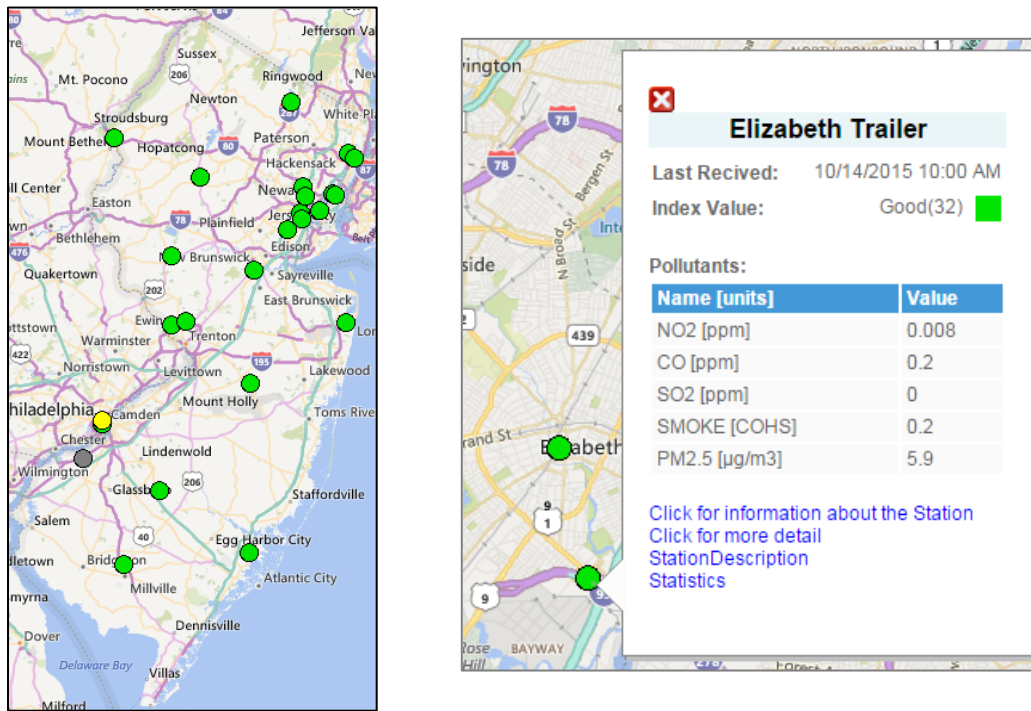


Table 2
Pollutants Monitored in Each Air Quality Index Reporting Region
in New Jersey – 2014

Reporting Region	Monitoring Site	Ozone	Particulate Matter	Sulfur Dioxide	Nitrogen Dioxide	Carbon Monoxide
1. Northern Metropolitan	Fort Lee Near Road		√		√	√
	Leonia	√				
	Ramapo	√				
2. Southern Metropolitan	Bayonne	√		√	√	
	East Orange				√	√
	Elizabeth		√	√		√
	Elizabeth Lab		√	√	√	√
	Jersey City		√	√		√
	Jersey City Firehouse		√			
	Newark Firehouse	√	√	√	√	√
	Rahway		√			
3. Suburban	Chester	√		√	√	
	New Brunswick		√			
	Rutgers University	√			√	
4. Northern Delaware Valley	Columbia WMA	√	√	√	√	
	Flemington	√	√			
5. Central Delaware Valley	Ewing		√			
	Rider University	√				
6. Northern Coastal	Colliers Mills	√				
	Monmouth University	√				
7. Southern Coastal	Brigantine	√	√	√		
8. Southern Delaware Valley	Ancora State Hospital	√				
	Camden Spruce St.	√	√	√	√	√
	Clarksboro	√				
	South Camden		√			
9. Delaware Bay	Millville	√	√		√	

On days when the air quality is expected to reach the unhealthy for sensitive groups range or above, cautionary statements are provided as part of the forecast. These air quality alerts are issued through Enviroflash emails, are displayed on the AirNow and NJDEP air monitoring websites, and can also be viewed on the National Weather Service page for the Philadelphia/Mount Holly area (www.erh.noaa.gov/er/phi/). Maps, charts and photos of the air quality information and sites from which data is collected are available on the NJDEP air monitoring web site as well, as shown in Figure 2 below:

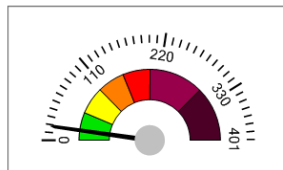
Figure 2
Examples of Information Available on NJDEP's Air Monitoring Website



Station Information



Elizabeth Trailer

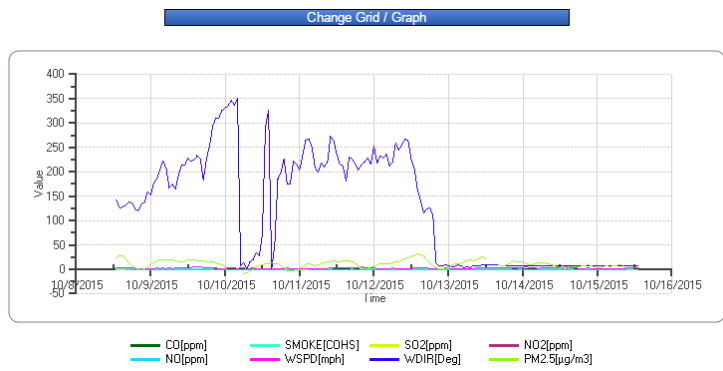
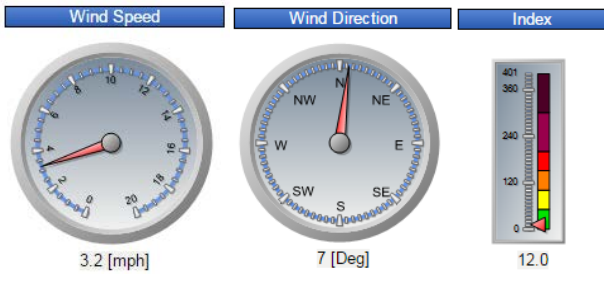


[Download API](#)
 Index Value : 18
 Pollutants : NO2, CO, SO2, SMOKE, PM 2.5
 Dominant Pollution : SMOKE

ViewStationInfo

Monitors		
<input checked="" type="checkbox"/>	Monitor	Value
<input checked="" type="checkbox"/>	CO[ppm]	0.2
<input checked="" type="checkbox"/>	SMOKE[COHS]	0.19
<input checked="" type="checkbox"/>	SO2[ppm]	0.000
<input checked="" type="checkbox"/>	NO2[ppm]	0.008
<input checked="" type="checkbox"/>	NO[ppm]	0.010
<input checked="" type="checkbox"/>	WSPD[mph]	3.3
<input checked="" type="checkbox"/>	WDIR[Deg]	8
<input checked="" type="checkbox"/>	PM2.5[µg/m3]	1.7

Real Time Condition: Elizabeth Trailer Last Received: 10/14/2015 1:00 PM Current Monitor: All Monitors



2014 AQI SUMMARY

A summary of the AQI ratings for New Jersey in 2014 is presented in the pie chart in Figure 3 below. In 2014, there were 181 “Good” days, 169 were “Moderate,” 15 were rated “Unhealthy for Sensitive Groups,” zero were considered “Unhealthy,” and zero were rated “Very Unhealthy.” This indicates that air quality in New Jersey is considered good or moderate most of the time, but that pollution is still bad enough to adversely affect some people on about one day in twenty-four. This is an improvement from last year when one in nineteen days was unhealthy for sensitive groups. It is also the second year in a row to have no days exceed the unhealthy limit for the general population. The only previous year to not have an exceedance for the general population was 2009, which was an unusually cool and wet summer accounting for much lower concentrations of pollutants. Table 3 lists the dates when the AQI reached 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.

Not all regions have 365 valid days of reported air quality index values. Both the Northern Coastal and Northern Metropolitan regions had several months without AQI values because the ozone monitors in these regions operate seasonally, typically from March to October. Total days without AQI values are reported by region Figure 5.

Figure 3
2014 Air Quality Summary by Days

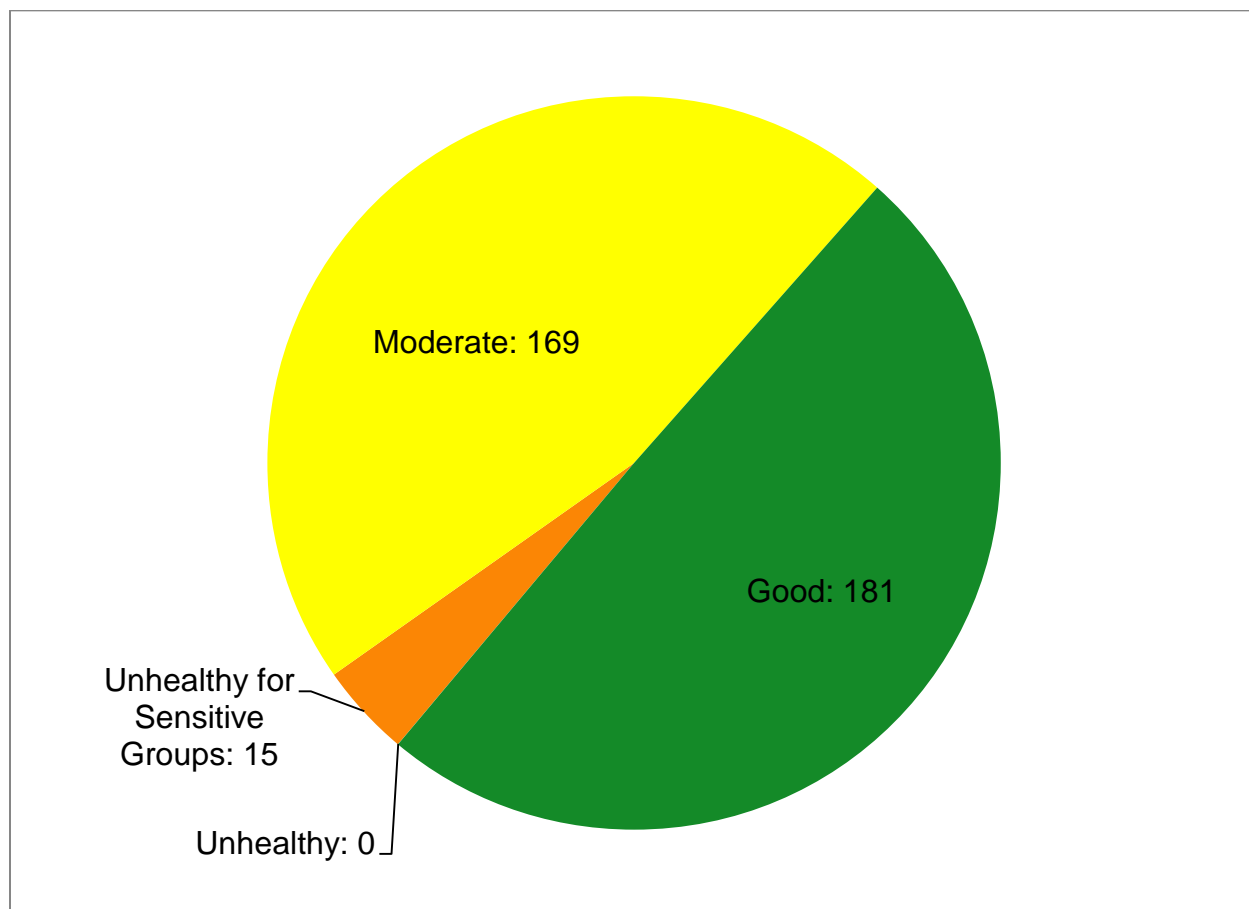


Table 3
Air Quality Index (AQI) Days Over 100 During 2014

Date	Highest Location	Highest AQI Value	Highest Pollutant	Highest Rating	All Pollutant(s) with AQI>100	Total No. of Sites with AQI>100
1/5/2014	Newark Fire House	106	PM	USG	PM	3
1/10/2014	Elizabeth Trailer	129	PM	USG	PM	1
2/1/2014	Columbia	103	PM	USG	PM	1
3/4/2014	Columbia	113	SO ₂	USG	SO ₂	1
4/1/2014	Columbia	102	SO ₂	USG	SO ₂	1
4/2/2014	Columbia	122	SO ₂	USG	SO ₂	1
4/7/2014	New Brunswick	115	PM	USG	PM	1
5/12/2014	Columbia	113	SO ₂	USG	SO ₂	1
5/22/2014	Columbia	102	SO ₂	USG	SO ₂	1
5/27/2014	Monmouth University	103	O ₃	USG	O ₃	1
7/7/2014	Rutgers University	113	O ₃	USG	O ₃	1
8/1/2014	Fort Lee Near Road	106	NO ₂	USG	NO ₂	1
8/14/2014	Fort Lee Near Road	130	NO ₂	USG	NO ₂	1
8/17/2014	Elizabeth Trailer	116	SO ₂	USG	SO ₂	1
8/27/2014	Rutgers University	145	O ₃	USG	O ₃	7

Ratings

USG – Unhealthy for sensitive groups

Pollutants

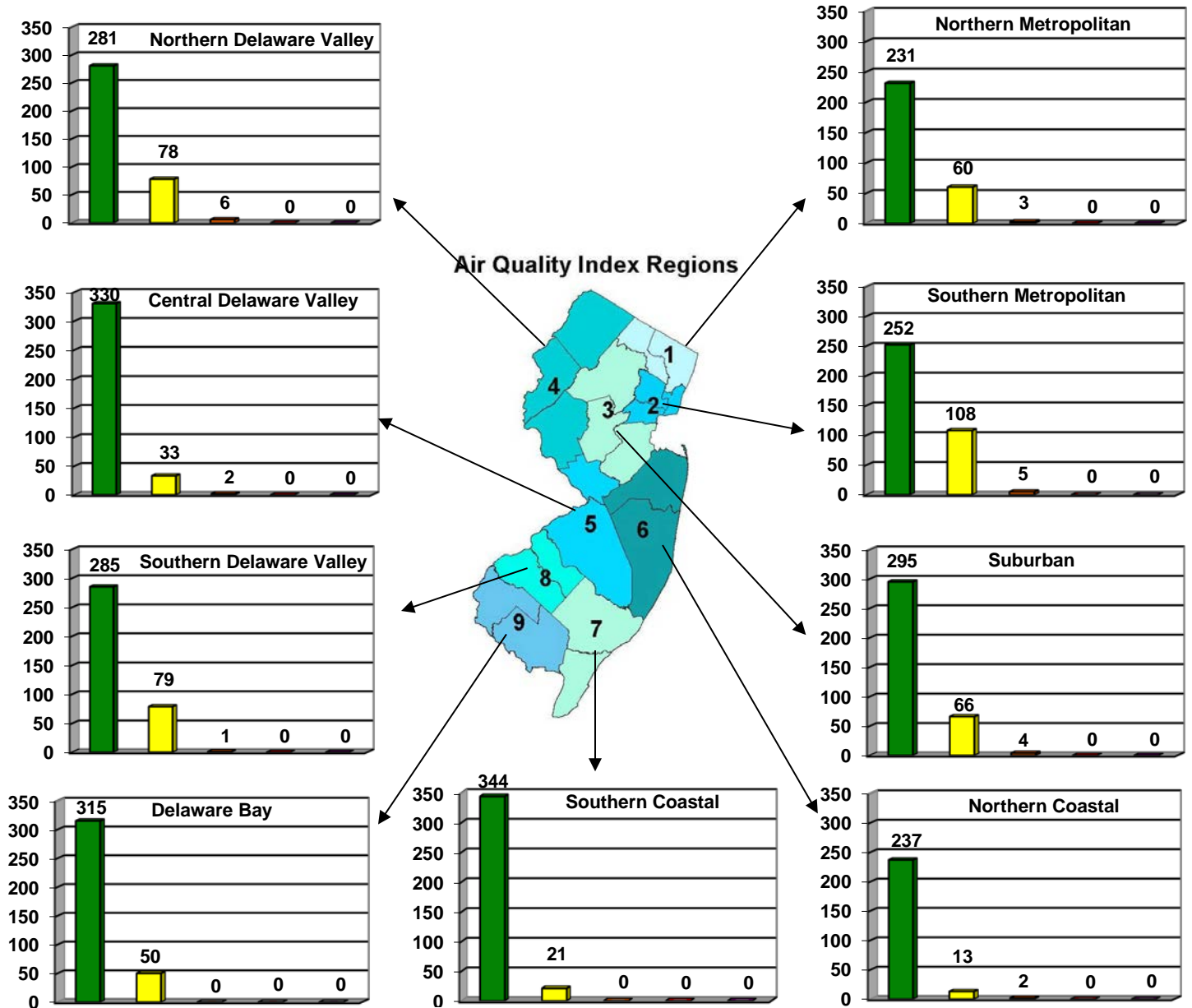
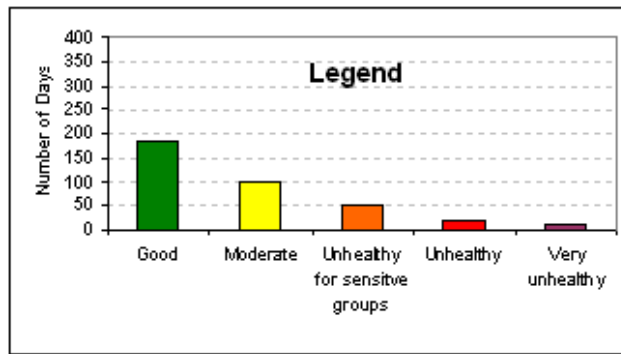
PM – Particulate matter

SO₂ – Sulfur dioxide

O₃ – Ozone

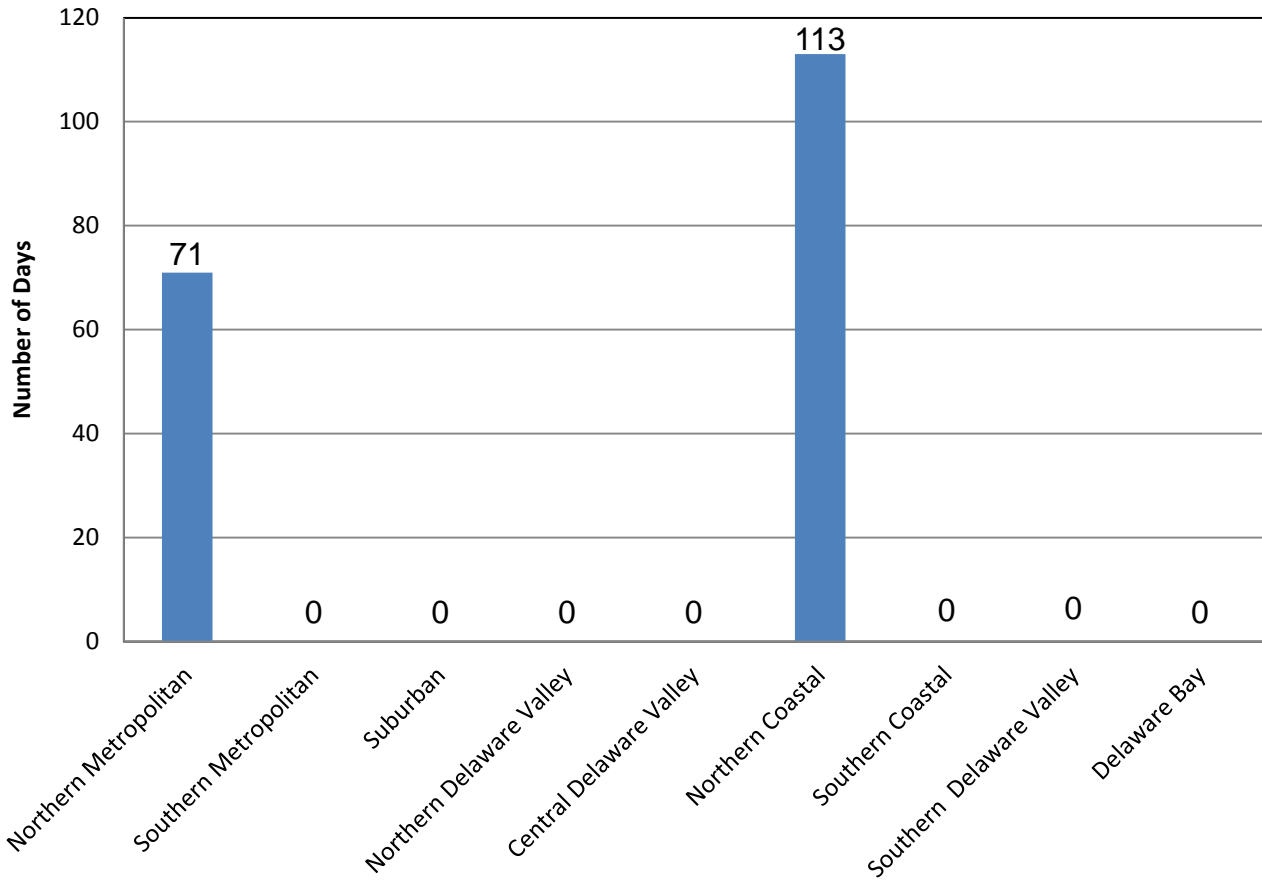
NO₂ – Nitrogen dioxide

Figure 4
 2014 Air Quality Index Summary
 Number of Days by Reporting Region ^a



^a Some days there was no index available (see Figure 5).

Figure 5
Days in 2014 Without Index Values
by Reporting Region



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2014 Ozone Summary

New Jersey Department of Environmental Protection

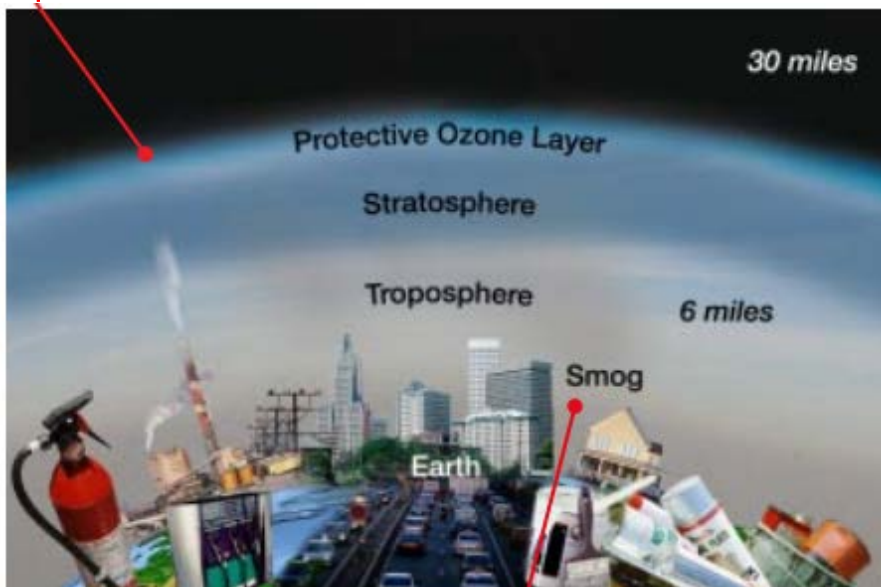
NATURE AND SOURCES

Ozone (O_3) is a gas consisting of three oxygen atoms. It occurs naturally in the upper atmosphere (stratospheric ozone) where it protects us from harmful ultraviolet rays (see Figure 1). However, at ground-level (tropospheric ozone), it is considered an air pollutant and can have serious adverse health effects. Ground-level ozone is created when nitrogen oxides (NO_x) and volatile organic compounds (VOCs) react in the presence of sunlight (see Figure 2). NO_x is primarily emitted by motor vehicles, power plants, and other sources of combustion. VOCs are emitted from sources such as motor vehicles, chemical plants, factories, consumer and commercial products, and even natural sources such as trees. The pollutants that form ozone, referred to as “precursor” pollutants, and ozone itself can also be transported into an area from sources hundreds of miles upwind.

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

Figure 1: Good and Bad Ozone

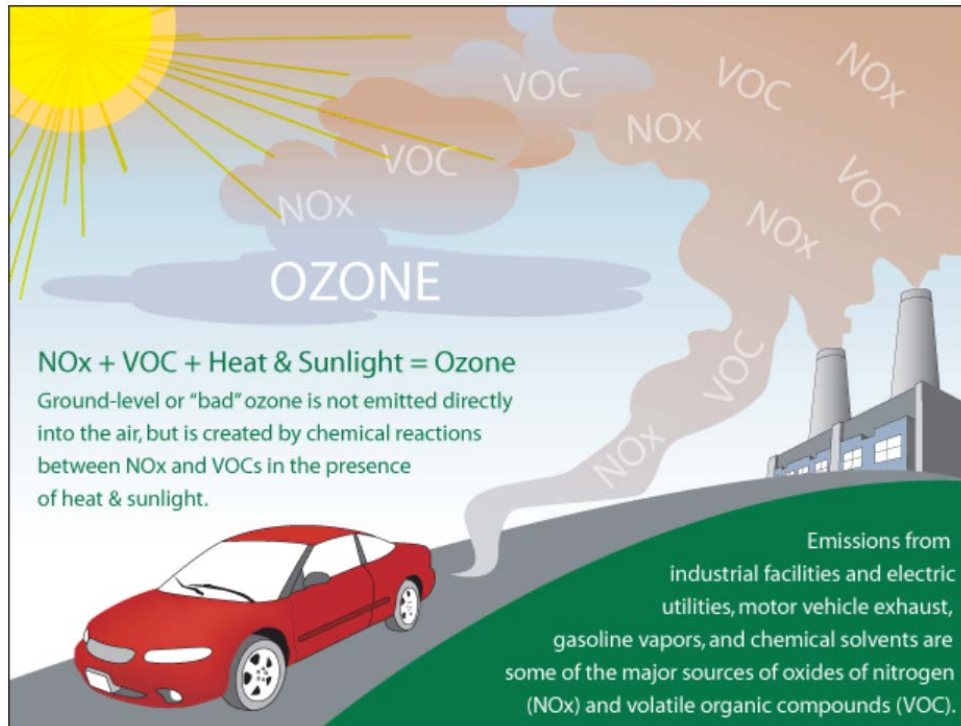
OZONE IS GOOD UP HERE...MANY POPULAR CONSUMER PRODUCTS LIKE AIR CONDITIONERS AND REFRIGERATORS INVOLVE CFCs OR HALONS DURING EITHER MANUFACTURING OR USE. OVER TIME, THESE CHEMICALS DAMAGE THE EARTH'S PROTECTIVE OZONE LAYER.



OZONE IS BAD DOWN HERE... CARS, TRUCKS, POWER PLANTS AND FACTORIES ALL EMIT AIR POLLUTION THAT FORMS GROUND-LEVEL OZONE, A PRIMARY COMPONENT OF SMOG.

Source:USEPA

Figure 2
Ozone Formation

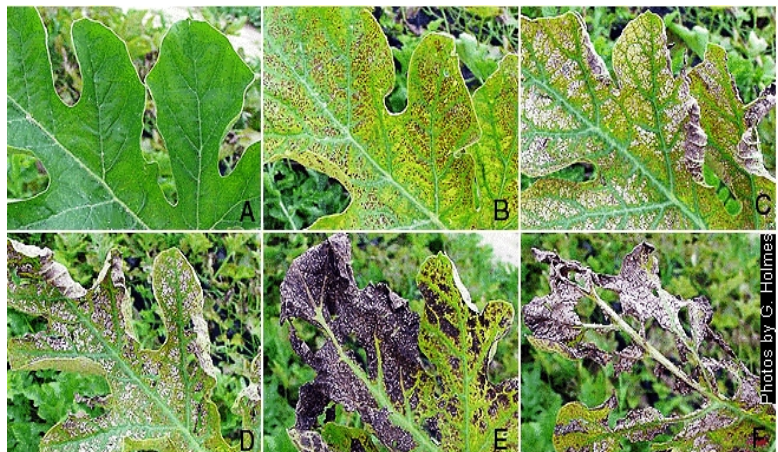


Source: USEPA

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 watermelon plant, shown in Figure 3, are damage caused by exposure to ground-level ozone.

Figure 3
Leaf Damage Caused by Ozone

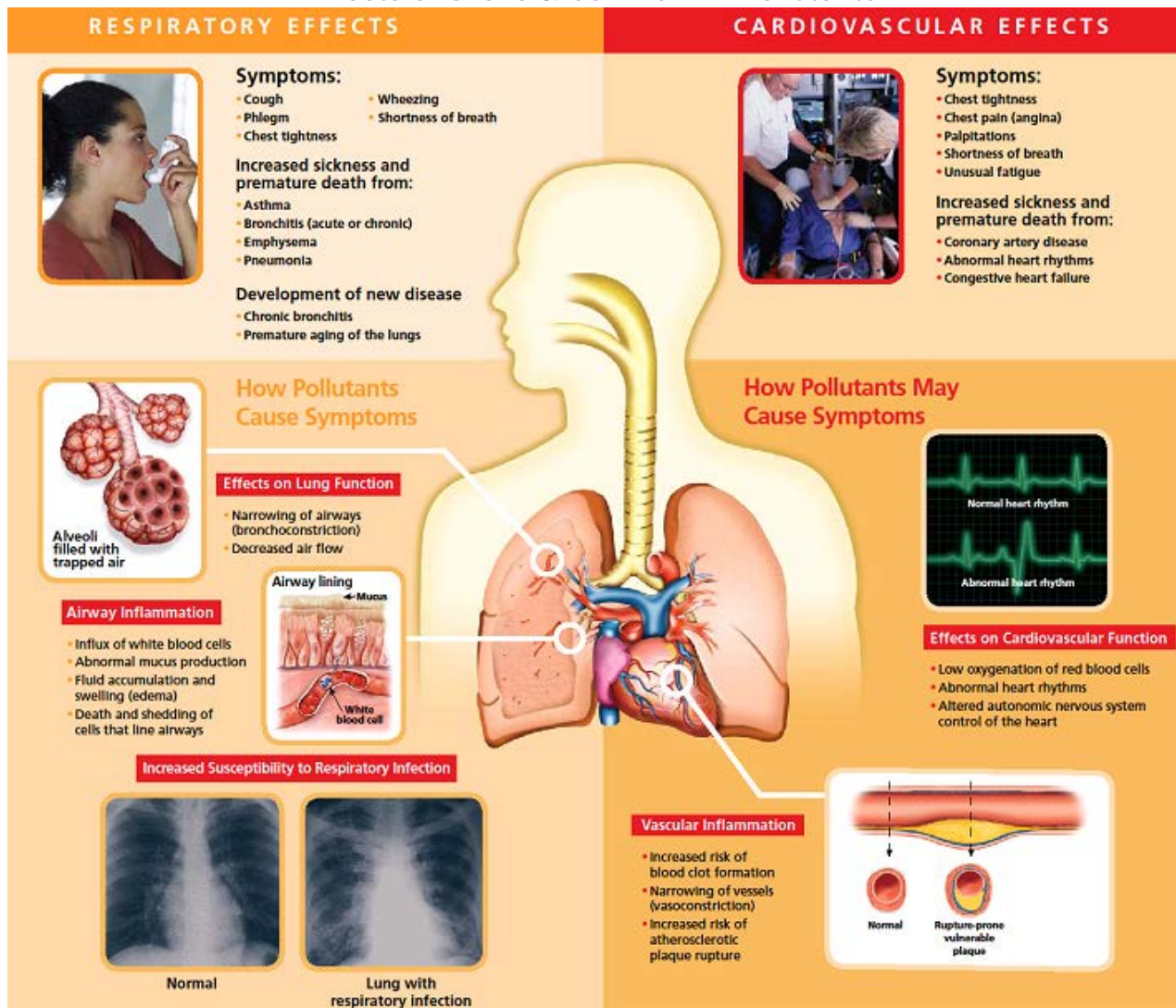


Photos: Gerald Holmes, NCSU Dept. of Horticulture

HEALTH EFFECTS

Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present at 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 special 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 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
Effects of Ozone & Common Air Pollutants



Source: www.airnow.gov

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 (such as 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 most recently revised by USEPA in 2008 because it was determined that the old standard of 0.08 parts per million (ppm) maximum daily eight-hour average was not sufficiently protective of public health. The revised standard of 0.075 ppm maximum daily 8-hour average went into effect on May 27, 2008. The revoked primary 1-hour NAAQS has been retained to compare current data with historical data.

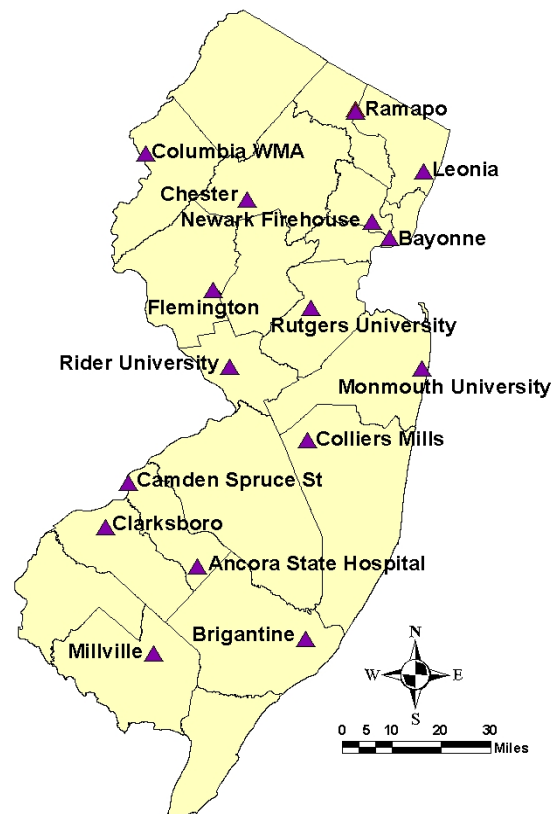
Table 1
National and New Jersey Ambient Air Quality Standards for Ozone
Parts per Million (ppm)

Averaging Period	Type	New Jersey	National
1-Hour	Primary	0.12 ppm	---
8-Hour	Primary	---	0.075 ppm
8-Hour	Secondary	---	0.075 ppm

OZONE MONITORING NETWORK

Ozone was measured at 16 monitoring stations in New Jersey during 2014 (see Figure 5). Of those 16 sites, ten operated year-round and six operated only during the ozone season, which is April 1st through October 31st. Bayonne, Brigantine, Camden Spruce Street, Chester, Columbia WMA, Flemington, Millville, Newark Firehouse, Rider University and Rutgers University operate year-round. Ancora, Clarksboro, Colliers Mills, Leonia, Monmouth University, and Ramapo sites operate only during the ozone season.

Figure 5
2014 Ozone Monitoring Network



DESIGN VALUE

USEPA defines a design value as the mathematically-determined pollutant concentration at a particular site that determines whether that site (and the corresponding state) is in attainment with the NAAQS for that pollutant. In other words, it is a statistic that describes the air quality status of a given location relative to the level of the NAAQS.

The NAAQS for ozone are set in such a way that determining compliance is based a two-step process using data from the most recent three years. The first step involves determining the fourth highest daily maximum 8-hour average concentration for each site for each of the three years. These three values are then averaged, for each site. If this value, at any site in the state, exceeds the NAAQS, the state is determined to be in nonattainment.

OZONE LEVELS IN 2014

Of the 16 monitoring sites that were operating during the 2014 ozone season, none recorded levels above the old 1-hour standard of 0.12 ppm. The highest 1-hour concentration was 0.115 ppm, recorded at Rutgers University on August 27th.

Eight of sixteen monitoring sites operating during the 2014 ozone season recorded levels above the 8-hour NAAQS of 0.075 ppm. The highest daily maximum 8-hour concentration was 0.095 at Rutgers University on August 27th. 2014 design values for the 8-hour standard (based on data from 2012 through 2014) were above the NAAQS at just two of sixteen sites, Ancora and Clarksboro.

Figure 6 on the following page shows the 8-hour design values for the 2012-2014 period. Table 2 summarizes the 1-hour and 8-hour maximum and fourth-highest ozone concentrations at each monitoring station for 2014. It also lists the design values for each site for 2012-2014. .

Figure 6
 New Jersey Ozone Design Values for 2012-2014
 3-Year Average of the 4th Highest Daily Maximum 8-hour Average

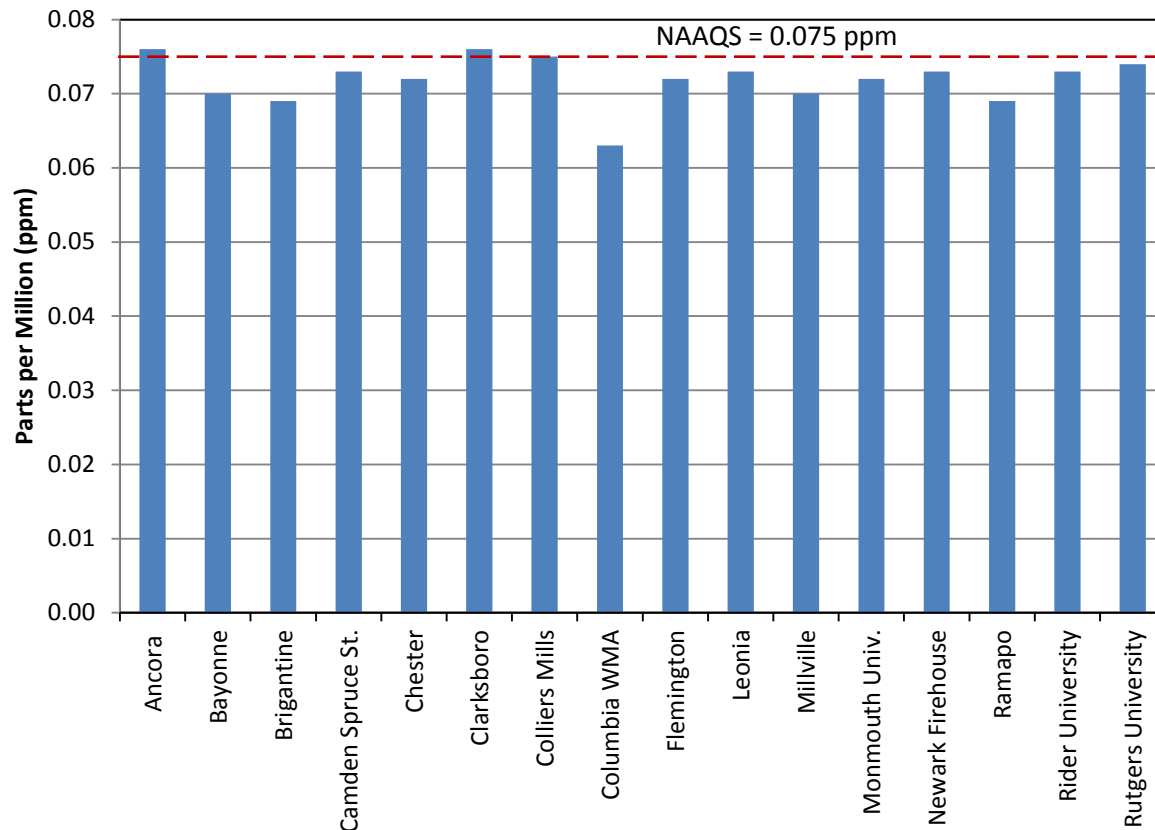


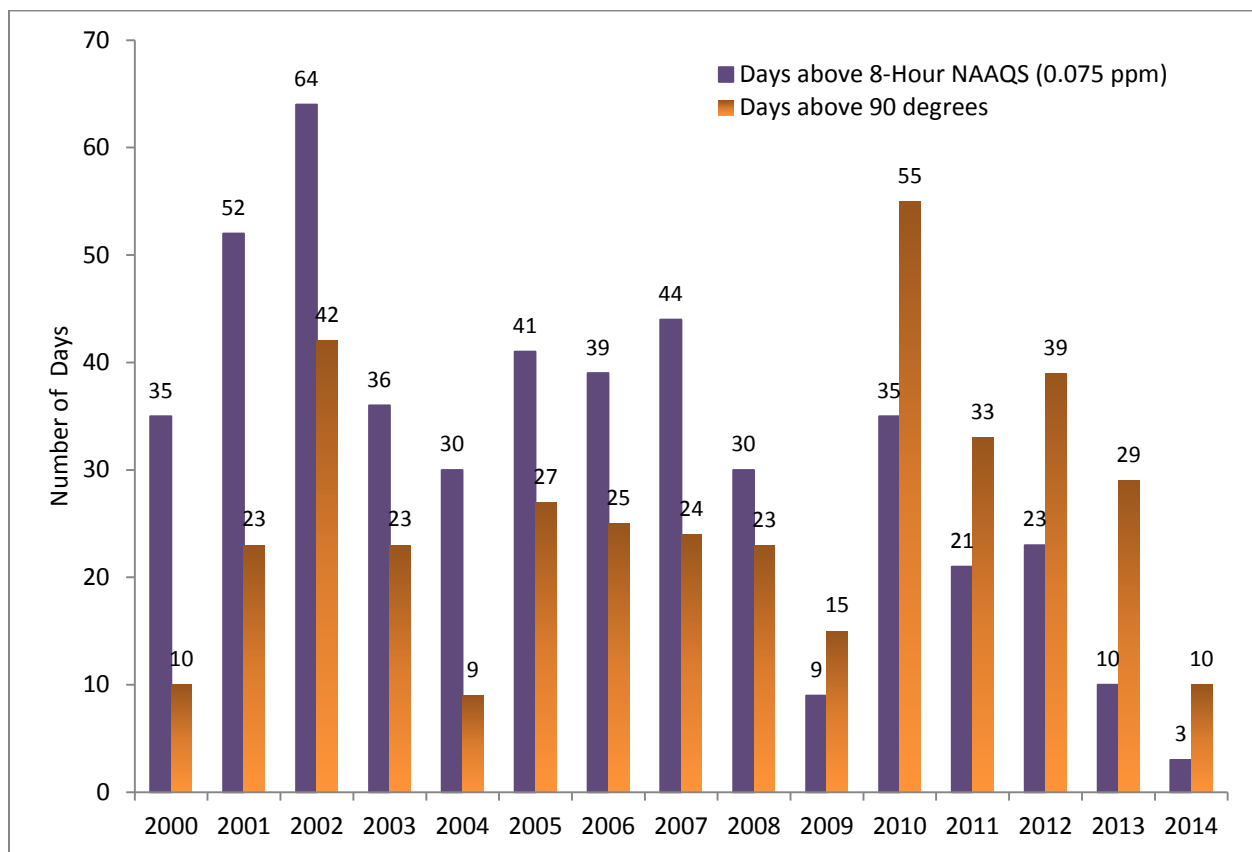
Table 2
 2014 New Jersey Ozone Concentrations
 Parts per Million (ppm)

Monitoring Site	1-Hour Average Concentrations		8-Hour Average Concentrations		
	Maximum	4th-Highest	Highest Daily Maximum	4th-Highest Daily Maximum	2012-2014 Average of 4th-Highest Daily Max.
Ancora	0.081	0.080	0.076	0.068	0.076
Bayonne	0.102	0.091	0.085	0.072	0.070
Brigantine	0.073	0.071	0.070	0.061	0.069
Camden Spruce St.	0.087	0.084	0.075	0.068	0.073
Chester	0.086	0.078	0.074	0.068	0.072
Clarksboro	0.089	0.083	0.077	0.070	0.076
Colliers Mills	0.087	0.085	0.076	0.072	0.075
Columbia WMA	0.082	0.070	0.063	0.060	0.063
Flemington	0.084	0.079	0.072	0.065	0.072
Leonia	0.093	0.089	0.080	0.073	0.073
Millville	0.076	0.074	0.071	0.067	0.070
Monmouth Univ.	0.086	0.080	0.077	0.064	0.072
Newark Firehouse	0.090	0.084	0.075	0.070	0.073
Ramapo	0.086	0.083	0.069	0.067	0.069
Rider University	0.090	0.087	0.076	0.071	0.073
Rutgers University	0.115	0.089	0.095	0.071	0.074

ACCOUNTING FOR THE INFLUENCE OF WEATHER

Trends in concentrations of 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 simplified way of showing the changing effect of weather on ozone is shown in Figure 7. 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 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.

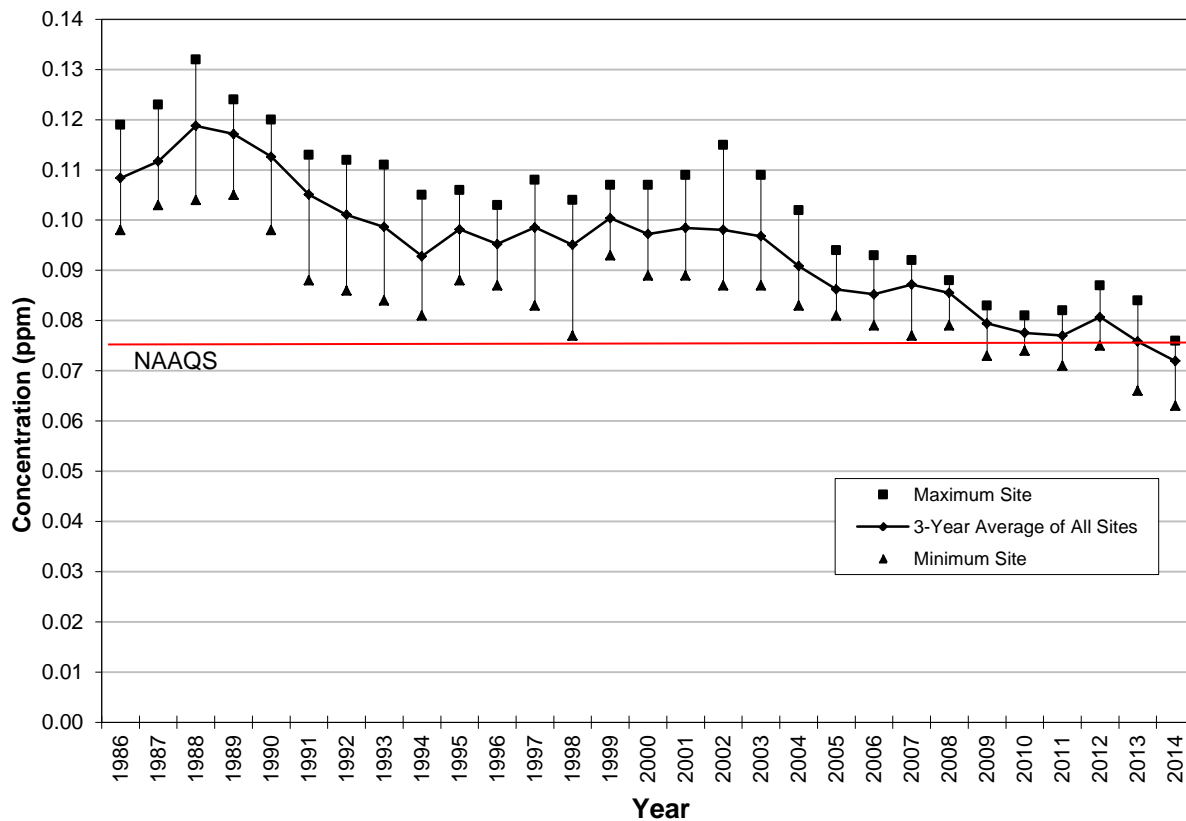
Figure 7
Number of Days above the 8-Hour Ozone Standard of 0.075 ppm and
Number of Days Above 90 Degrees in New Jersey, 2000-2014



OZONE TRENDS

Efforts to reduce concentrations of ground-level ozone in New Jersey have been focused on reducing emissions of VOCs and NO_x. Studies have shown that such an approach should lower peak ozone concentrations, and it does appear to have been effective in achieving that goal. The chart in Figure 8 is based on the fourth-highest 8-hour average concentrations recorded each year, which is the basis of the ozone NAAQS. As Figure 8 illustrates, the maximum 8-hour concentrations have decreased fairly steadily since 1988, with the maximum site for 2014 just barely exceeding 0.075 ppm. Further improvements will require more reductions in both VOCs and NO_x. Ozone levels in New Jersey are greatly impacted by emissions from upwind sources in other states, so reductions will have to be achieved over a region beyond state borders.

Figure 8
4th-Highest 8-Hour Ozone Averages
in New Jersey 1986-2014

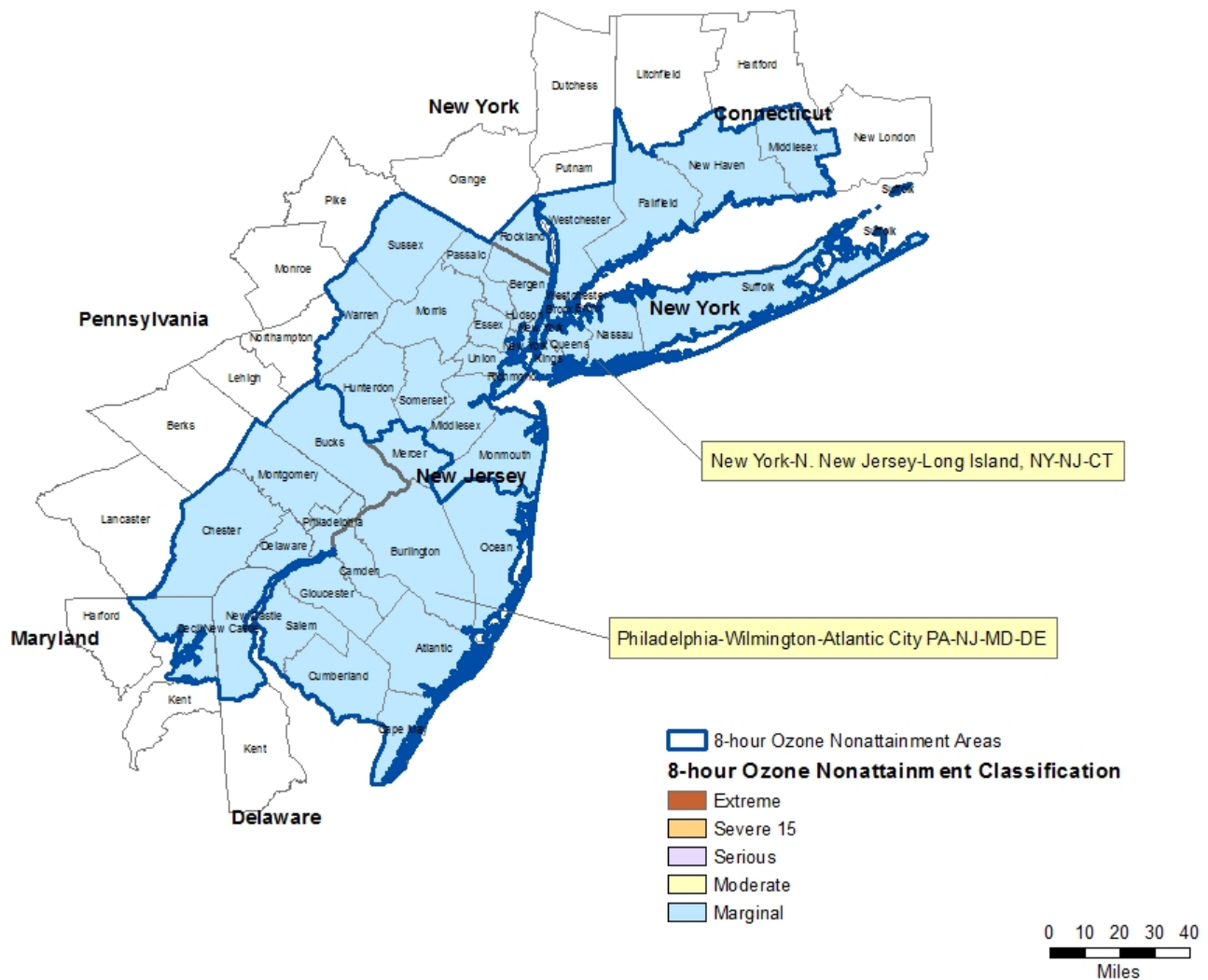


OZONE NONATTAINMENT AREAS IN NEW JERSEY

The Clean Air Act requires that all areas of the country be evaluated for attainment or nonattainment for each of the NAAQS. The 1990 amendments to the Clean Air Act required that areas be further classified based on the severity of nonattainment. The classifications range from “marginal” to “extreme” and are based on the design values that determine whether an area meets the standard.

The entire state of New Jersey is in nonattainment for the ozone NAAQS, and is classified as being “marginal.” A “marginal” area has a design value of 0.076 up to but not including 0.086 ppm. New Jersey’s classification with respect to the 8-hour standard is shown in Figure 9.

Figure 9
New Jersey 8-Hour Ozone Nonattainment Areas



Source: www3.epa.gov/airquality/greenbk/nj8_2008.html

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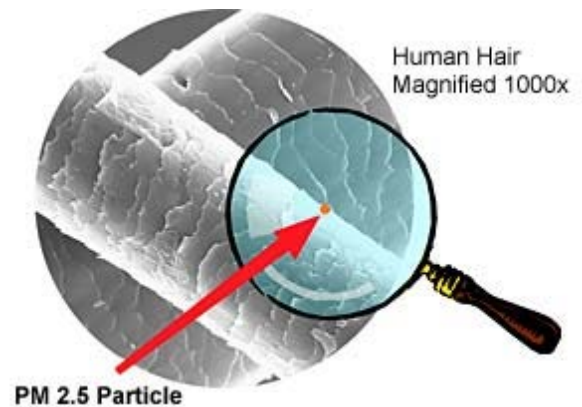
USEPA Greenbook, www.epa.gov/oar/oaqps/greenbk/nj8_2008.html



2014 Particulate Summary

New Jersey Department of Environmental Protection

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



NATURE AND SOURCES

Particulate air pollution is a complex mixture of organic and inorganic substances present in the atmosphere in the form of either liquids or solids. Particulates may be as large as 70 microns in diameter or smaller than 1 micron in diameter. Most particulates are small enough that individual particles are undetectable by the human eye. Particulates may travel hundreds of miles from their sources suspended in the atmosphere before reaching ground level.

Generally, particulate pollution is categorized by size. Particulates with diameters of 2.5 microns or less are considered “fine particulates,” often referred to as PM_{2.5} (Figure 1). Particulates with diameters of 10 microns or less are considered to be “inhalable particulates” and are referred to as PM₁₀. “Total suspended particulates” (TSP) refers to all suspended particulates, including the largest ones. Because particulates smaller than 10 microns are considered to be inhalable, they are a greater health risk, but particulates of all sizes have an impact on the environment.

Particulates can occur naturally or can be man-made. Examples of naturally-occurring particulates are windblown dust and sea salt. Man-made particulates, which come from sources such as fossil fuel combustion and industrial processes, can be divided into primary particulates and secondary particulates. Primary particulates are directly emitted from a source, while secondary particulates are created in the atmosphere through reactions of gaseous emissions.

Figure 2a



Figure 2b



ENVIRONMENTAL EFFECTS

Particulate matter is the major cause of reduced visibility in many parts of the United States. Figure 2a provides an example of reduced visibility due to particulate pollution, recorded by the New Jersey Department of Environmental Protection's (NJDEP) visibility camera in Newark, which shows the New York City skyline. Figure 2b is an example of a day with low particulate pollution and good visibility. Airborne particles can also impact vegetation and aquatic ecosystems, and can cause damage to paints and building materials. More information regarding NJDEP's visibility efforts can be found in the Regional Haze and Visibility Summary section of the 2014 Air Quality Report.

HEALTH EFFECTS

Inhalable particulates (PM_{10}) and especially fine particulates ($PM_{2.5}$) are health concerns because they are easily taken into the lungs. Various health problems are associated with both long- and short-term exposures. These particles can accumulate in the respiratory system, and are responsible for heart and lung conditions such as asthma, bronchitis, cardiac arrhythmias, and heart attacks, and can even contribute to premature death. People that appear to be at the greatest risk from particulates include children, the elderly, and individuals with heart and lung diseases.

AMBIENT AIR QUALITY STANDARDS

In 1971, the U.S. Environmental Protection Agency (USEPA) 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 set for annual and maximum 24-hour concentrations. 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 260 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and the annual geometric mean health standard was $75 \mu\text{g}/\text{m}^3$. The 24-hour secondary standard was set at $150 \mu\text{g}/\text{m}^3$. While USEPA did not establish a secondary annual standard for TSP, they did set a guideline of $60 \mu\text{g}/\text{m}^3$ to be used to ensure that the secondary 24-hour standard was being met throughout the year. Although New Jersey still maintains a state standard for TSP, the national standards have been replaced with standards for smaller particles, as described below. As a result, the monitoring effort for TSP has steadily diminished. NJDEP's last TSP sampler was discontinued in early 2008.

In 1987, USEPA replaced the TSP standards with standards that focused only on PM_{10} . The 24-hour PM_{10} primary and secondary standards were set at $150 \mu\text{g}/\text{m}^3$, and the annual primary and secondary standards were set at $50 \mu\text{g}/\text{m}^3$. The annual standard for PM_{10} is based on the arithmetic mean, as opposed to the geometric mean that was used for TSP.

In 1997 USEPA promulgated new standards for $PM_{2.5}$, while maintaining the existing standards for PM_{10} . The $PM_{2.5}$ annual primary and secondary standards were set at $15.0 \mu\text{g}/\text{m}^3$ and the 24-hour standard was set at $65 \mu\text{g}/\text{m}^3$. In October 2006 USEPA lowered the 24-hour standard to the current value of $35 \mu\text{g}/\text{m}^3$.

On December 14, 2012, USEPA promulgated a revised $PM_{2.5}$ annual standard of $12.0 \mu\text{g}/\text{m}^3$ that went into effect on March 18, 2013. The 24-hour standard was unchanged and remains at $35 \mu\text{g}/\text{m}^3$. 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 ($\mu\text{g}/\text{m}^3$)

Standard	Averaging Period	Type	New Jersey	National
Total Suspended Particulates (TSP)	12-Month [‡]	Primary	75 $\mu\text{g}/\text{m}^3$	---
	24-Hour	Primary	260 $\mu\text{g}/\text{m}^3$	---
	12-Month [†]	Secondary	60 $\mu\text{g}/\text{m}^3$	---
	24-Hour	Secondary	150 $\mu\text{g}/\text{m}^3$	---
Inhalable Particulates (PM ₁₀)	Annual [†]	Primary & Secondary	---	50 $\mu\text{g}/\text{m}^3$
	24-Hour Average	Primary & Secondary	---	150 $\mu\text{g}/\text{m}^3$
Fine Particulates (PM _{2.5})	Annual [†]	Primary & Secondary	----	12.0 $\mu\text{g}/\text{m}^3$ [@]
	24-Hour Average	Primary & Secondary	----	35 $\mu\text{g}/\text{m}^3$

[‡] Annual geometric mean

[†] Annual arithmetic mean

[@] Revision effective 2013.

PARTICULATE MONITORING NETWORK

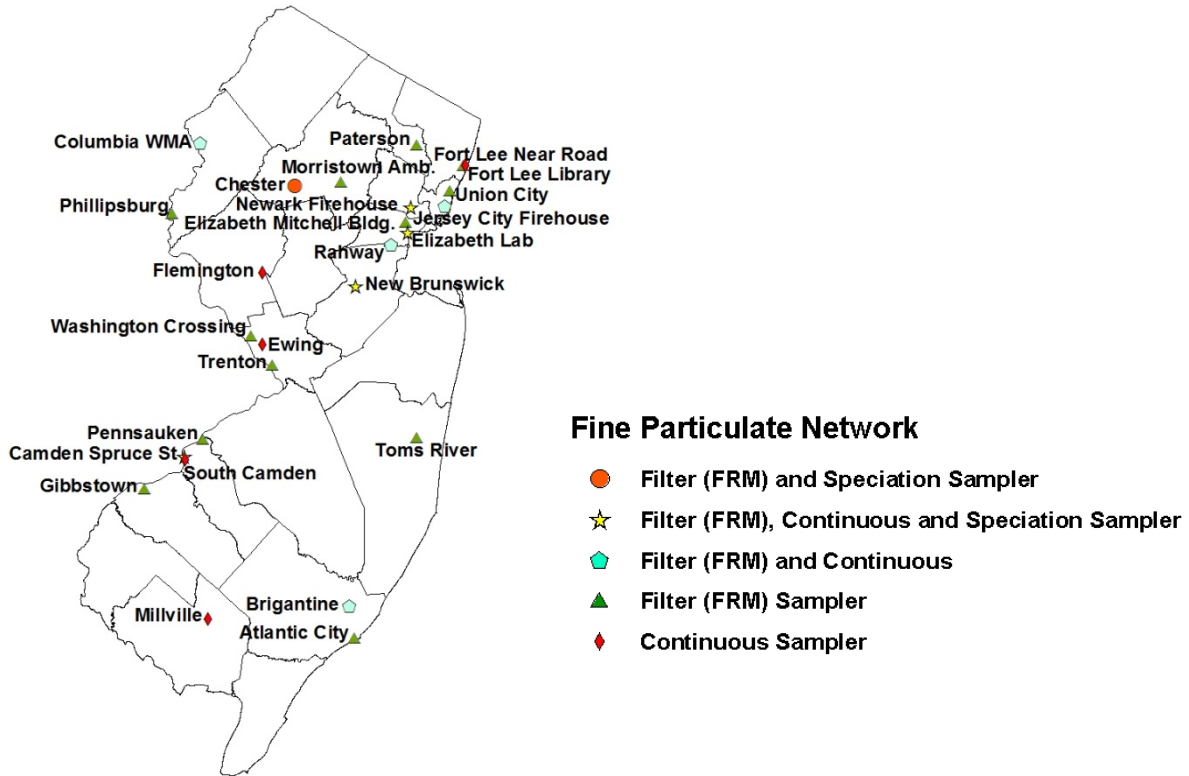
New Jersey's Particulate Monitoring Network consists of twenty-six PM_{2.5} monitoring sites, two PM₁₀ monitoring sites, and three sites where smoke shade is monitored.

NJDEP operates PM_{2.5} and PM₁₀ samplers that comply with strict USEPA requirements, and are designated as Federal Reference Method (FRM) samplers. These samplers pull a predetermined amount of air through PM_{2.5} or PM₁₀ size-selective inlets onto a filter for a 24-hour period. The filters are weighed before and after sampling under controlled environmental conditions to determine the concentration of the particles collected. The data is then used by NJDEP and USEPA to determine whether the state, or portions of the state, meet the NAAQS for particulate matter.

The FRM samplers are required to run for a 24-hour period and do not provide data in real time. In order to report current air quality to the public through the Air Quality Index (www.njaqinow.net), NJDEP uses additional monitors that continuously measure particulate concentrations. These include Beta Attenuation Monitors (BAM), Tapered Element Oscillating Microbalance (TEOM) analyzers, and smoke shade instruments. The TEOM analyzers collect a sample of PM_{2.5} on an oscillating filter and determine the concentration based on the change in the frequency at which the filter oscillates. The Beta Attenuation Monitors measure the loss of intensity (attenuation) of beta particles due to absorption by PM_{2.5} particles collected on a filter tape. Smoke shade instruments collect a sample of TSP on a paper tape for one hour, forming a spot. At the end of each hour the amount of light that will pass through the spot is measured, the tape is advanced, and the cycle is started over. The amount of light transmittance measured is used as an estimate of actual particulate concentrations.

Five monitoring stations make up a speciation network, employing a separate 24-hour filter-based sampler to determine the concentrations of the chemical analytes that constitute the sample. PM_{2.5} is collected on three types of filter media which are subsequently analyzed using ion chromatography (IC), X-ray fluorescence (XRF), and Thermal Optical Transmittance (TOT).

Figure 3
2014 PM_{2.5}
Monitoring Network



FINE PARTICLE (PM_{2.5}) SUMMARY

PM_{2.5} MONITORING SITES

The 21 monitoring sites in New Jersey with FRM samplers that collect 24-hour PM_{2.5} samples are shown on Figure 3. Also shown are thirteen sites that have continuous particulate monitors that measure the concentrations of fine particles every minute and transmit the data to the NJDEP website (www.njaginow.net).

PM_{2.5} CONCENTRATION SUMMARY

The annual mean concentrations of PM_{2.5} ranged from 7.1 $\mu\text{g}/\text{m}^3$ at Chester to 10.6 $\mu\text{g}/\text{m}^3$ at both the Camden Spruce St. and Union City monitoring locations. The highest 24-hour concentrations ranged from 19.1 $\mu\text{g}/\text{m}^3$ at Brigantine to 51.7 $\mu\text{g}/\text{m}^3$ at the Elizabeth Lab. Figures 4a and 4b depict the annual mean concentrations and the 98th percentile 24-hour concentrations for all the sites in 2014. Table 2 shows the 2014 annual mean, highest 24-hour and 98th percentile 24-hour concentrations, as well as the 2012-2014 annual and 24-hour design values. Design values are used to determine NAAQS attainment status. An annual design value for a given site is calculated by averaging the annual mean concentrations for the three most recent consecutive calendar years, in this case 2012-2014. Similarly, the 24-hour design value for a given site is calculated by averaging the 98th percentile 24-hour concentrations for each year for the same 3-year period. No sites were in violation of either the annual standard of 12.0 $\mu\text{g}/\text{m}^3$ or the 24-hour standard of 35 $\mu\text{g}/\text{m}^3$.

Figure 4a
2014 Fine Particulate (PM_{2.5}) Concentrations
Annual Average Concentration

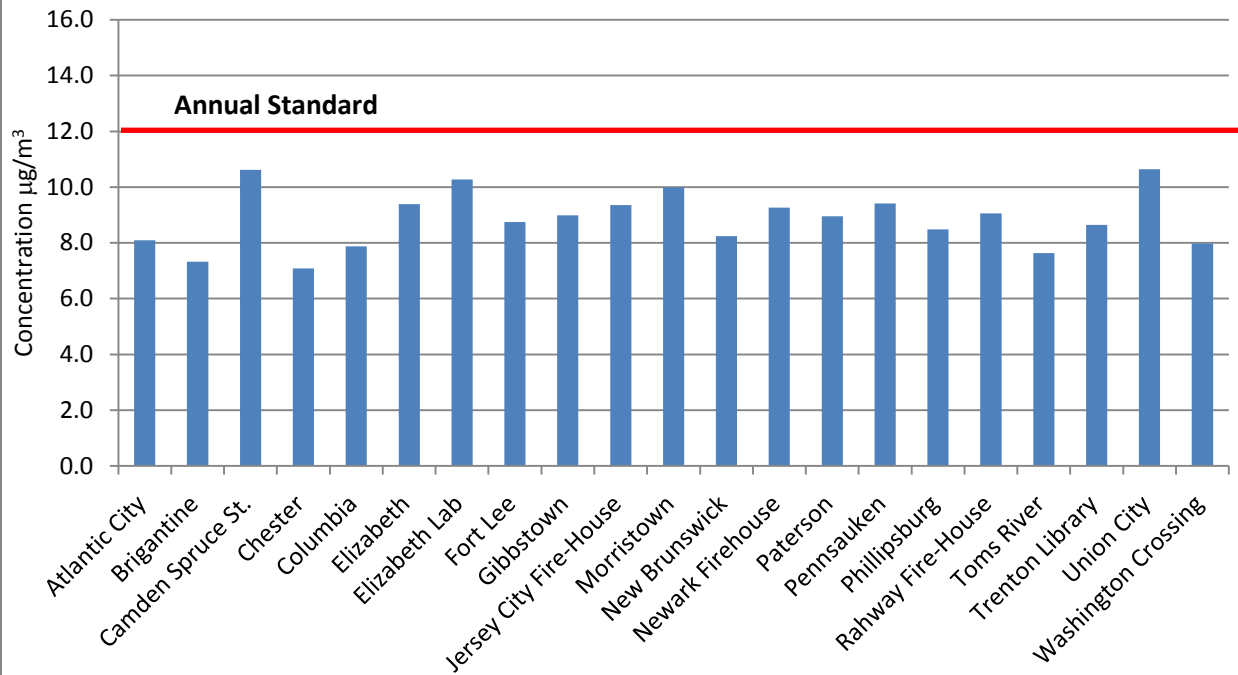


Figure 4b
2014 Fine Particulate (PM_{2.5}) Concentrations
98th Percentile 24-Hour Concentration

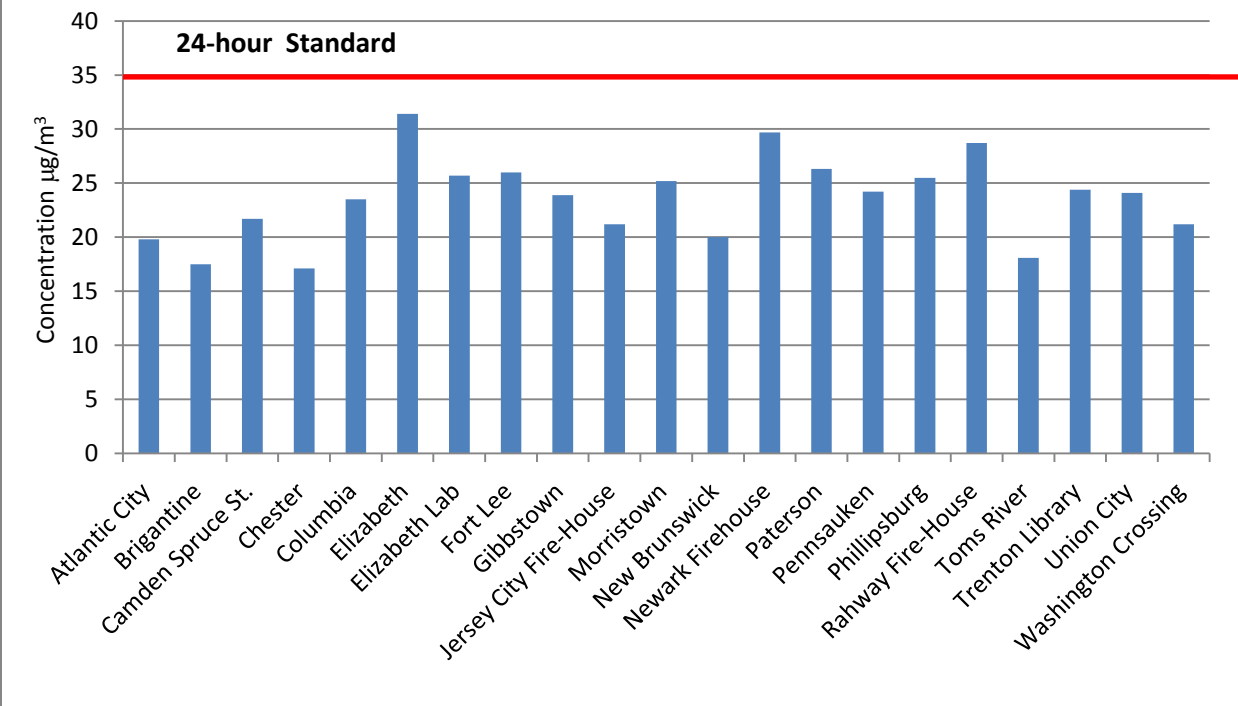


Table 2
2014 Summary of PM_{2.5} Sampler Data
Concentrations in Micrograms per Cubic Meter (µg/m³)

Monitoring Site	Number of Samples	Annual Mean Concentration	Highest 24-Hour Concentration	98 th -ile 24-Hour Concentration	2012-2014 24-Hour Design Value (98 th -ile)	2012-2014 Annual Design Value
Atlantic City *	116	8.1	20.5	19.8	--	--
Brigantine	112	7.3	19.1	17.5	19	7.4
Camden Spruce St.*	119	10.6	27.6	21.7	--	--
Chester	112	7.1	19.6	17.1	17	7.2
Columbia WMA*	119	7.9	27.2	23.5	23	8.1
Elizabeth Mitchell Bldg.	120	9.4	37.9	31.4	26	9.3
Elizabeth Lab	360	10.3	51.7	25.7	27	10.5
Fort Lee Library	116	8.7	28.4	26.0	24	8.8
Gibbstown	116	9.0	27.5	23.9	23	9.2
Jersey City Firehouse	345	9.4	32.8	21.2	26	9.6
Morristown Amb. Squad	121	10.0	32.4	25.2	22	8.7
New Brunswick *	114	8.2	32.5	20.0	--	--
Newark Firehouse	118	9.3	41.4	29.7	24	9.0
Paterson	119	9.0	33.5	26.3	24	8.9
Pennsauken	116	9.4	28.4	24.2	21	9.1
Phillipsburg	117	8.5	31.2	25.5	23	8.7
Rahway	117	9.1	40.0	28.7	25	9.3
Toms River	335	7.6	21.0	18.1	19	7.8
Trenton	350	8.6	30.9	24.4	23	8.8
Union City	116	10.6	35.5	24.1	26	10.6
Washington Crossing	118	8.0	25.3	21.2	21	8.1

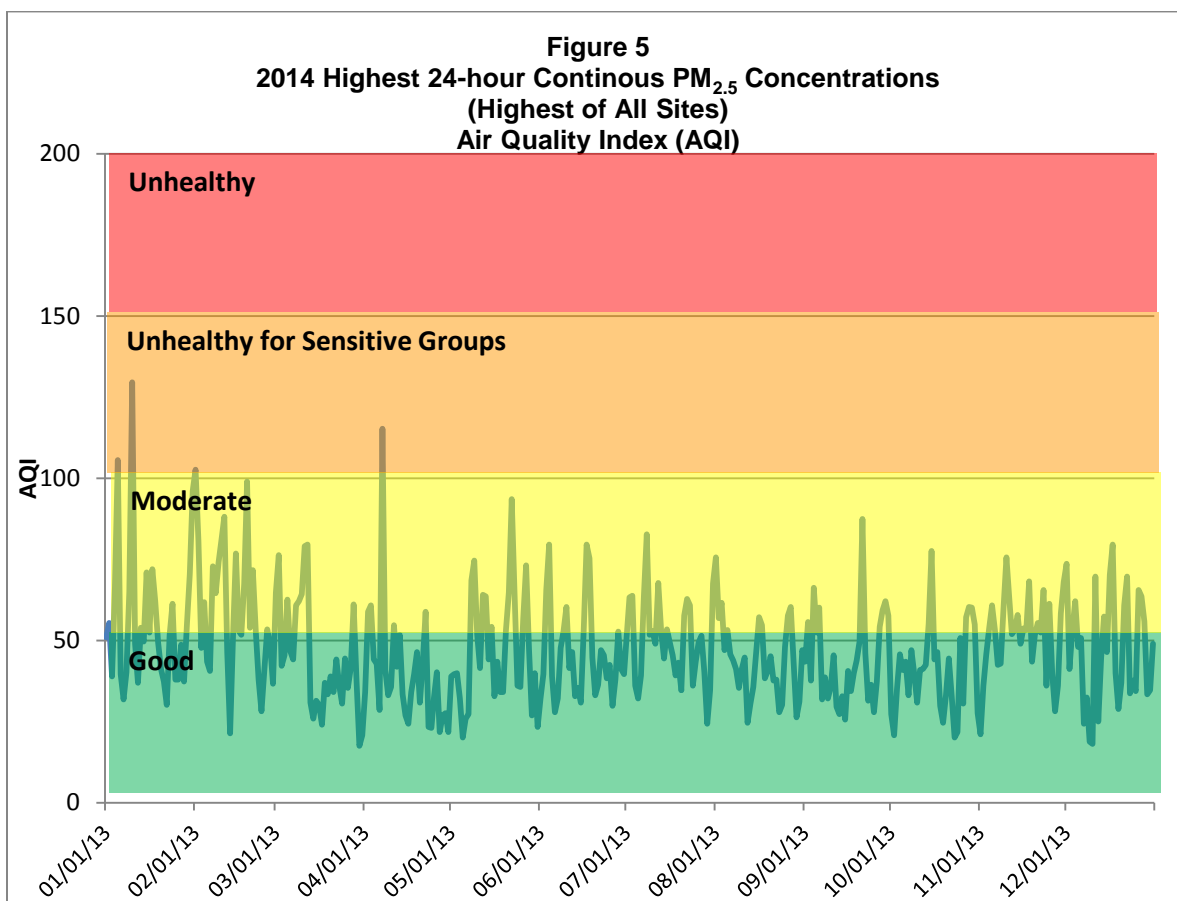
*Site does not have enough data to calculate 2012-2014 design values.

PM_{2.5} REAL-TIME MONITORING

New Jersey's continuous PM_{2.5} monitoring network includes thirteen sites: Brigantine, Camden Spruce Street, Columbia WMA, Elizabeth Lab, Ewing, Flemington, Fort Lee Near Road, Jersey City Firehouse, Millville, New Brunswick, Newark Firehouse, Rahway, and South Camden. The data is transmitted at least hourly to a central computer in Trenton, where it is averaged and automatically updated on the NJDEP website every hour. Table 3 provides a summary of the data from these sites. Figure 5 depicts the health level associated with the highest 24-hour fine particulate concentration recorded in the state each day for the entire year.

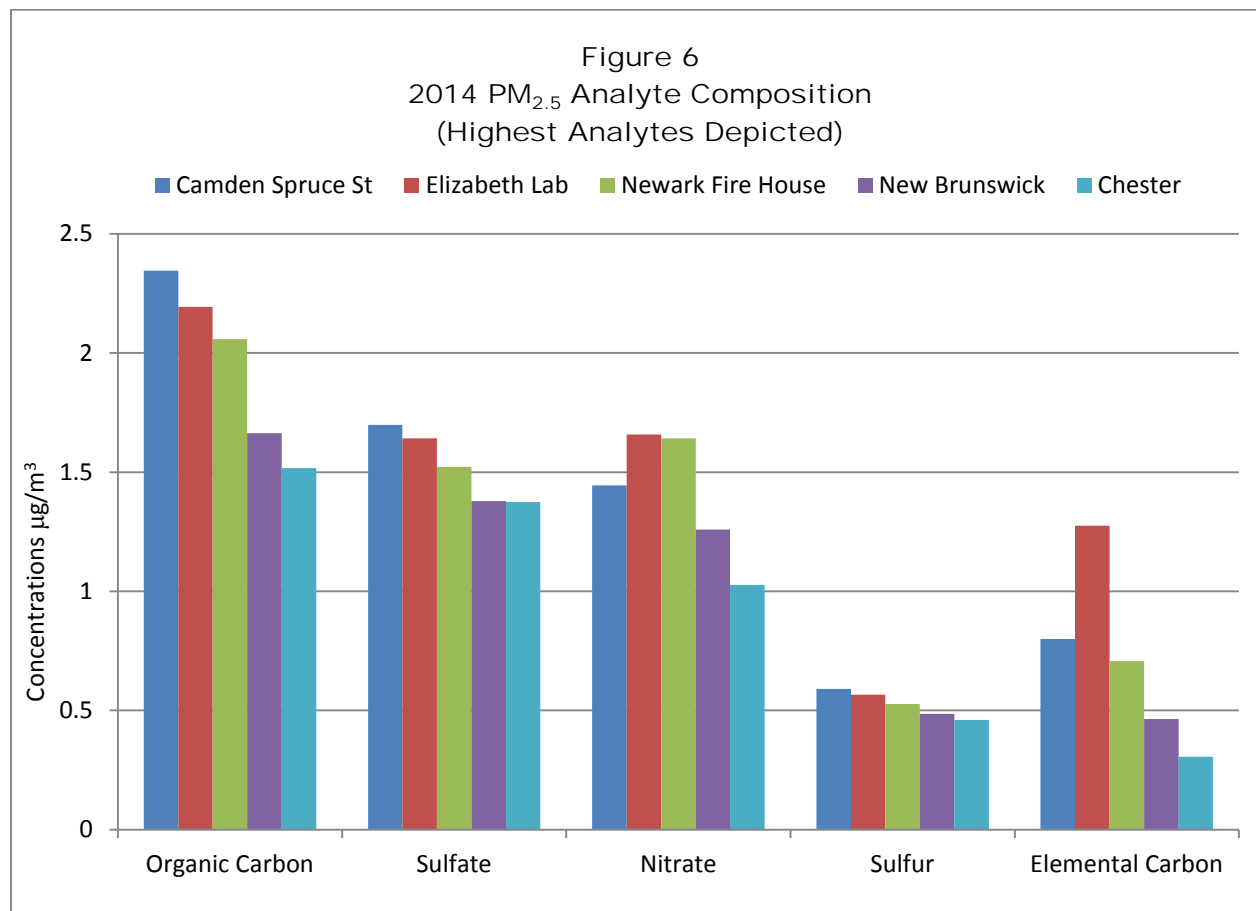
Table 3
 2014 Summary of Continuous PM_{2.5} Data
 Concentration in Micrograms Per Cubic Meter (µg/m³)

Monitoring Site	Annual Mean Concentration	Highest 24-Hour Concentration	Number of Unhealthy Air Quality Days
Brigantine	8.2	22.1	0
Camden Spruce St.	11.9	29.6	0
Columbia WMA	10.4	36.5	1
Elizabeth Lab	11.6	52.9	2
Ewing	8.1	21.0	0
Flemington	7.2	21.9	0
Fort Lee Near Road	11.0	32.8	0
Jersey City Firehouse	7.0	31.9	0
Millville	10.5	30.6	0
New Brunswick	10.3	44.2	2
Newark Firehouse	12.0	41.2	2
Rahway	9.6	28.5	0
South Camden	8.8	27.4	0



PM_{2.5} SPECIATION SUMMARY

New Jersey's PM_{2.5} speciation network is located at five monitoring sites: Camden Spruce St., Chester, Elizabeth Lab, Newark Firehouse, and New Brunswick. Samplers run every third or sixth day on a schedule concurrent with the Federal Reference Method sampling network. Of the 39 measured analytes, organic carbon, sulfate, nitrate, sulfur and elemental carbon are the most prevalent species; combined, they create the majority of the PM_{2.5} total mass concentration. Figure 6 presents the average concentrations of these five most prevalent species. High elemental carbon concentrations at Elizabeth Lab (located adjacent to the New Jersey Turnpike Exit 13 tollbooths) are due to the site's proximity to high traffic volume, as motor vehicles are a primary source of elemental carbon. More information about the speciated analytes, including average, highest, and 2nd highest 24-hour average concentrations, can be found in Appendix B - Fine Particulate Speciation Summary of the 2014 Air Quality Report.



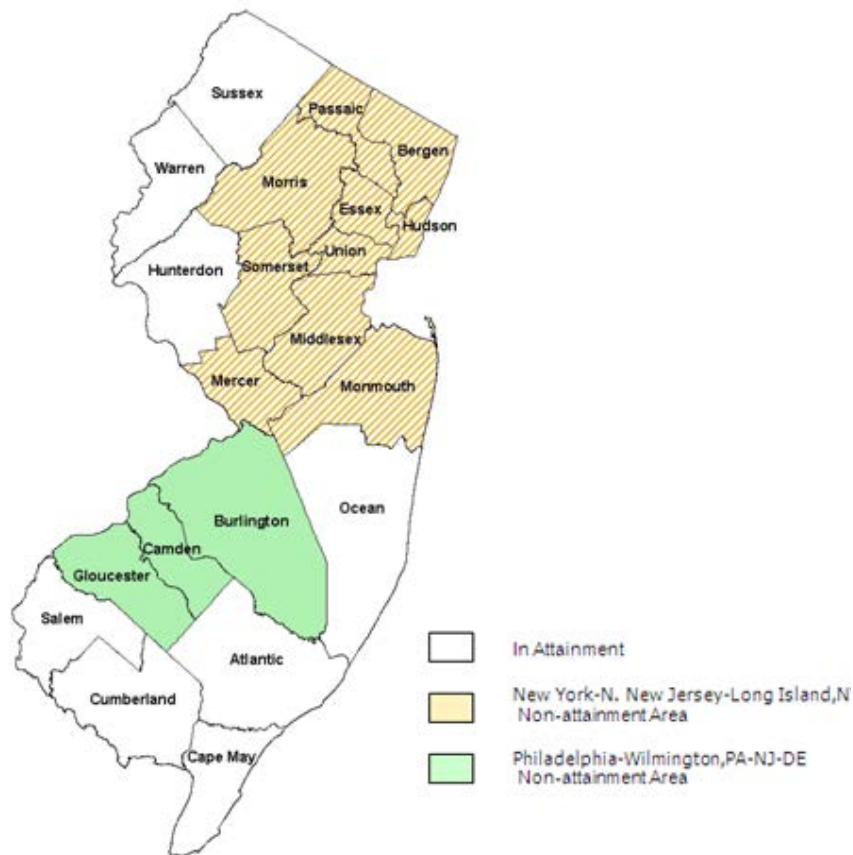
PM_{2.5} NON-ATTAINMENT AREAS

In order to determine if the PM_{2.5} annual and 24-hour NAAQS are met in New Jersey, twelve consecutive quarters of valid data within three calendar years are required. A non-attainment classification is given to an area that violates the air quality standard or contributes to the violation of that standard. The state proposes the classification of attainment or non-attainment areas for the PM_{2.5} NAAQS, but the final attainment or non-attainment designations are made by USEPA.

On April 5, 2005, thirteen New Jersey counties were designated by USEPA as non-attainment areas for PM_{2.5}. These counties are shown in Figure 7. While Elizabeth Lab was the only site to record a violation of the annual standard, 10 counties in the northeast and central region of the state were designated as non-attainment due to their potential PM_{2.5} contribution to the Elizabeth Lab monitor, and to additional sites in New York City that also recorded violations of the PM_{2.5} annual standard.

Similarly, three counties in the southwestern part of the state have been classified as non-attainment, due to their PM_{2.5} contribution to monitors in the city of Philadelphia that violated the PM_{2.5} NAAQS. NJDEP is currently devising a strategy to lower PM_{2.5} levels in these affected areas.

Figure 7
New Jersey Fine Particulate Matter (PM_{2.5})
Non-Attainment Areas

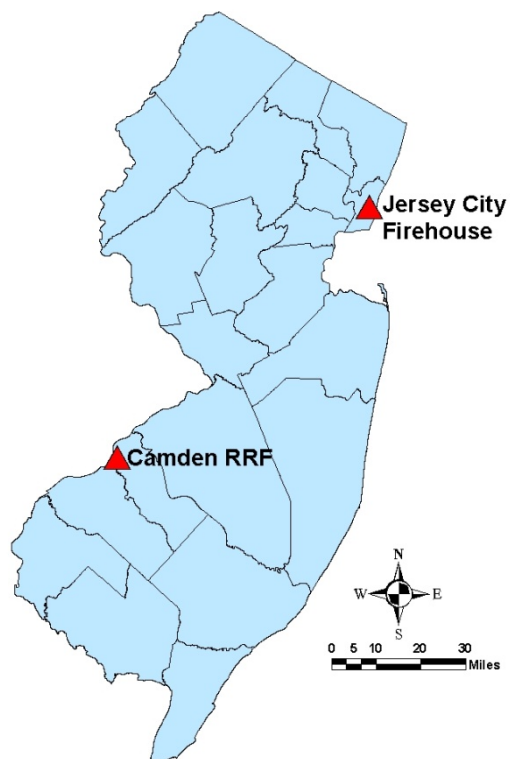


2014 INHALABLE PARTICULATE (PM₁₀) SUMMARY

PM₁₀ MONITORING SITES

At one time, NJDEP's PM₁₀ monitoring network consisted of more than 20 sampling sites. Due to many years of low concentrations and the shift in emphasis to fine particulate (PM_{2.5}) monitoring, the network has been reduced to only two sites, the Camden Resource Recovery Facility (RRF) and the Jersey City Firehouse. PM₁₀ samples, taken once every six days, are collected on a filter that is weighed before and after sampling to determine the concentration. Figure 8 depicts the PM₁₀ particulate monitoring network in New Jersey.

Figure 8
2014 PM_{2.5} Monitoring Network



PM₁₀ CONCENTRATION SUMMARY

In 2014, the annual mean concentrations measured at the Camden RRF and at the Jersey City Firehouse were 24 µg/m³ and 17 µg/m³, respectively. Table 4 and Figures 9a and 9b show the highest 24-hour and the annual mean PM₁₀ concentrations. All areas of the state are in attainment for the both the annual PM₁₀ standard of 50 µg/m³ and the 24-hour standard of 150 µg/m³.

Table 4
PM₁₀ Data - 2014
24-Hour and Annual Averages

Micrograms Per Cubic Meter (µg/m³)
24-hour Standard = 150 (µg/m³)
Annual Standard = 50 µg/m³

Monitoring Site	Number of Samples	Highest 24-Hour Concentration	Second Highest 24-Hour Concentration	Annual Mean
Camden RRF	52	97	57	24
Jersey City Firehouse	57	38	37	17

Figure 9a
Summary of 2014 New Jersey PM₁₀ Concentrations

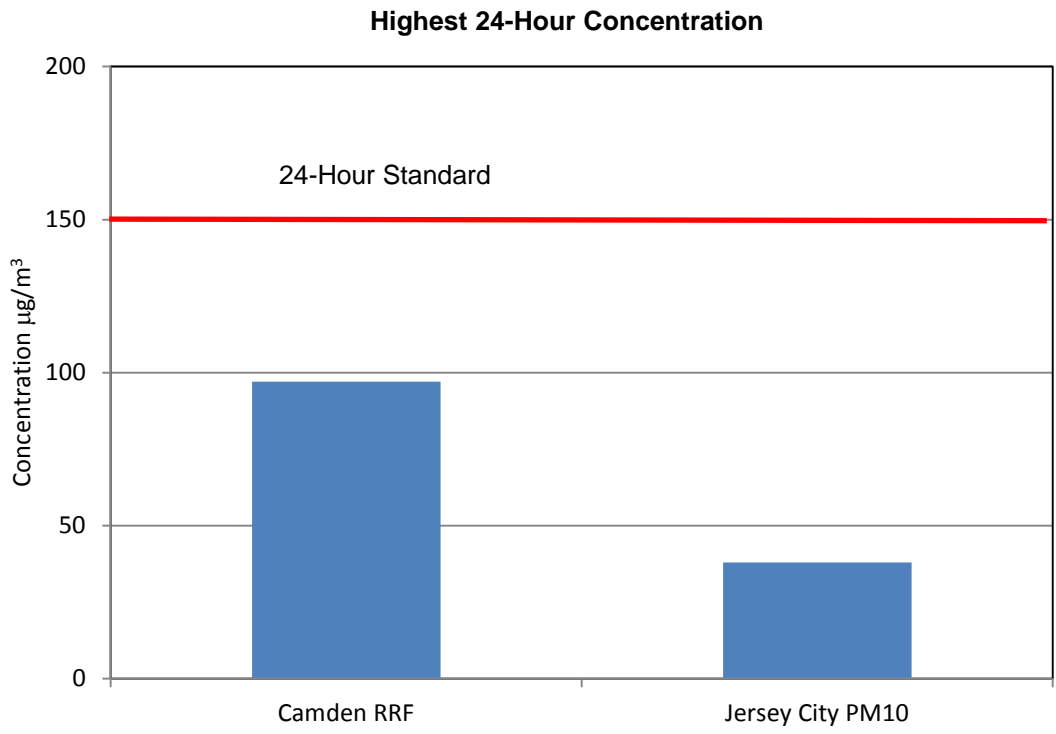
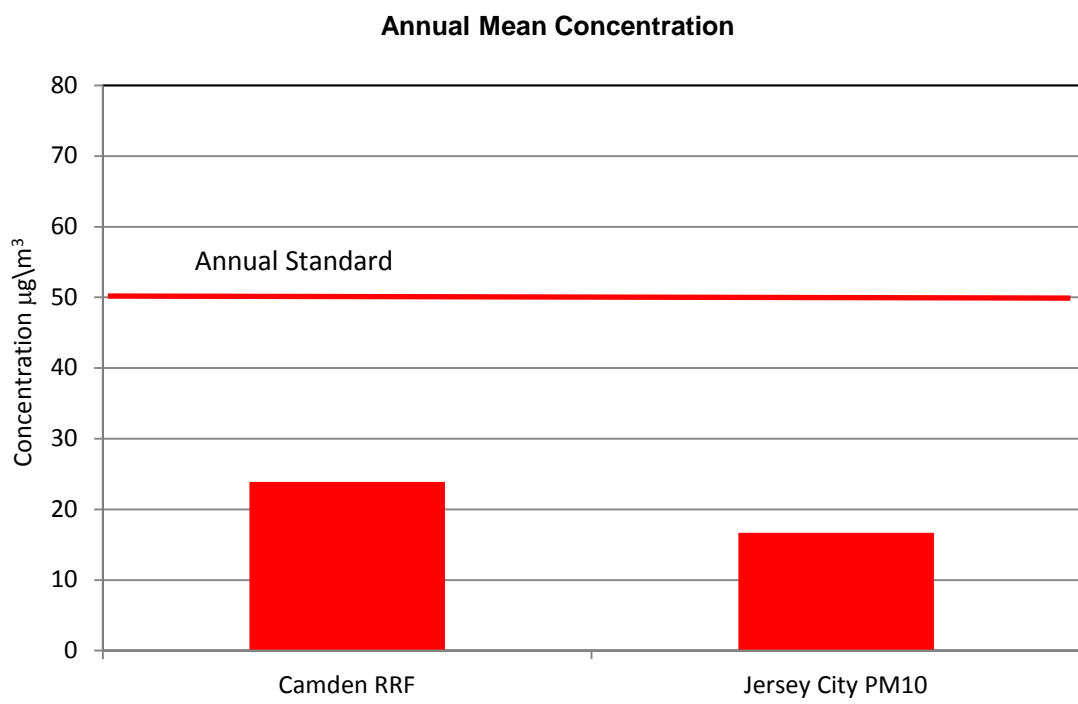


Figure 9b
Summary of 2014 New Jersey PM₁₀ Concentrations



SMOKE SHADE SUMMARY

SMOKE SHADE MONITORING SITES

In addition to PM_{2.5} and PM₁₀, smoke shade is also monitored at three stations around the state. Smoke shade, which is an indirect measurement of particles in the atmosphere, has been monitored in New Jersey for over 40 years. Smoke shade is primarily used for the daily reporting of particulate levels in the Air Quality Index. The sites which monitor smoke shade are shown in Figure 10.

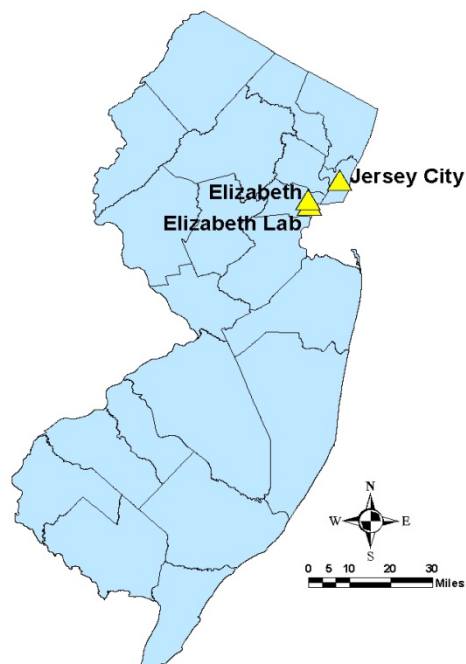
SMOKE SHADE CONCENTRATION SUMMARY

In 2014, the annual mean concentration of smoke shade ranged from 0.14 Coefficient of Haze units (COH) at the Elizabeth site, to 0.26 COH at both the Elizabeth Lab and Jersey City monitoring stations. COH are units of light transmittance; 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 highest and second highest 24-hour average, and annual mean smoke shade levels recorded at the monitoring sites in 2014.

Table 5
Smoke Shade - 2014
Coefficient of Haze (COHs)
No Standard

Site	Highest 24-Hour Average	2nd Highest 24-Hour Average	Annual Mean
Elizabeth	1.03	0.79	0.14
Elizabeth Lab	1.29	0.82	0.26
Jersey City	1.02	0.70	0.26

Figure 10
2014 Smoke Shade Network



TRENDS IN PARTICULATE CONCENTRATIONS

The longest continuously operating particulate 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 running for over forty years and still has three active sites. The trend graph for smoke shade in Figure 11 shows that particulate levels have steadily declined over the past 40 years. Smoke shade is not a direct measurement of particle mass, but can be related to TSP, PM₁₀, and PM_{2.5} health standards.

The PM_{2.5} monitoring network has been in place since 1999. Fifteen years of sampling has also shown a noticeable decline in fine particulate concentrations. Figure 12 shows the trend of the annual mean PM_{2.5} concentrations for all FRM sampler sites since the network began operating.

Figure 11
Long-Term Trend in Particulate Levels as Smoke Shade
New Jersey State Averages
1967-2014

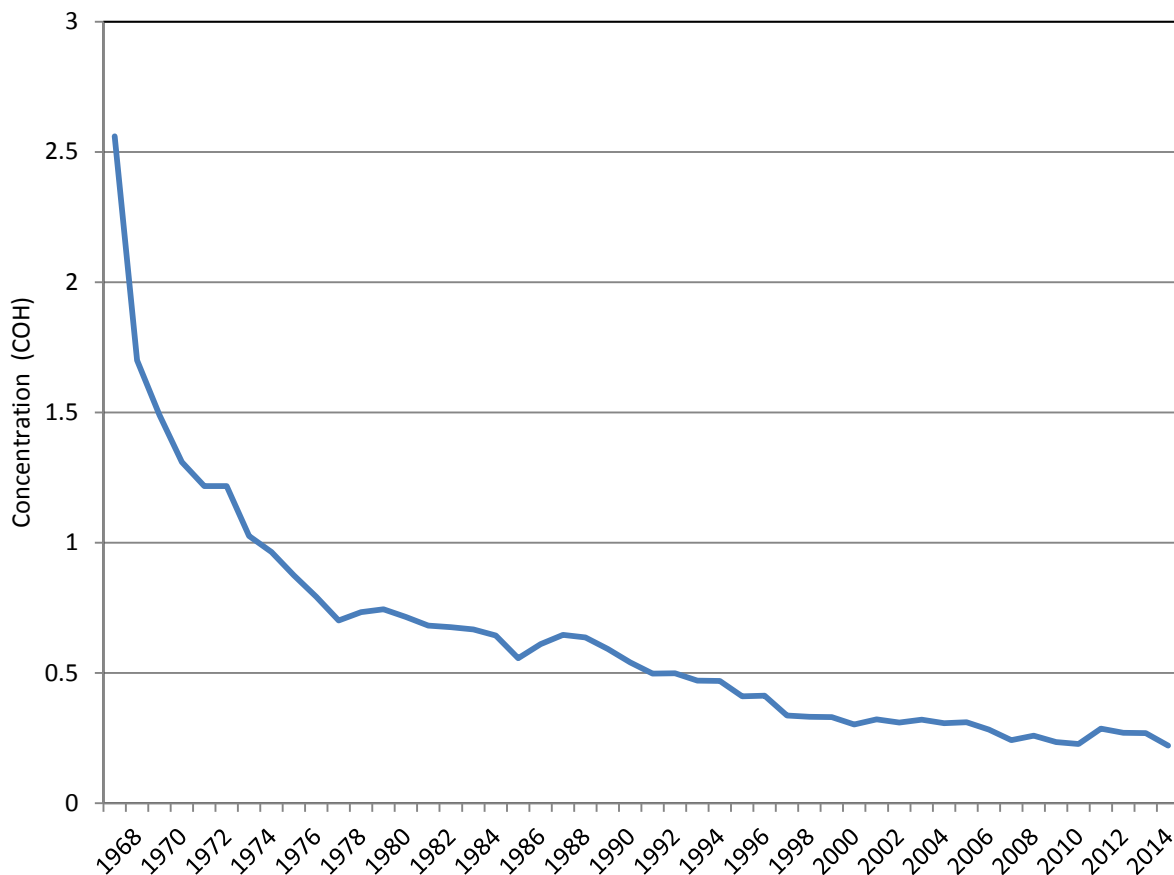
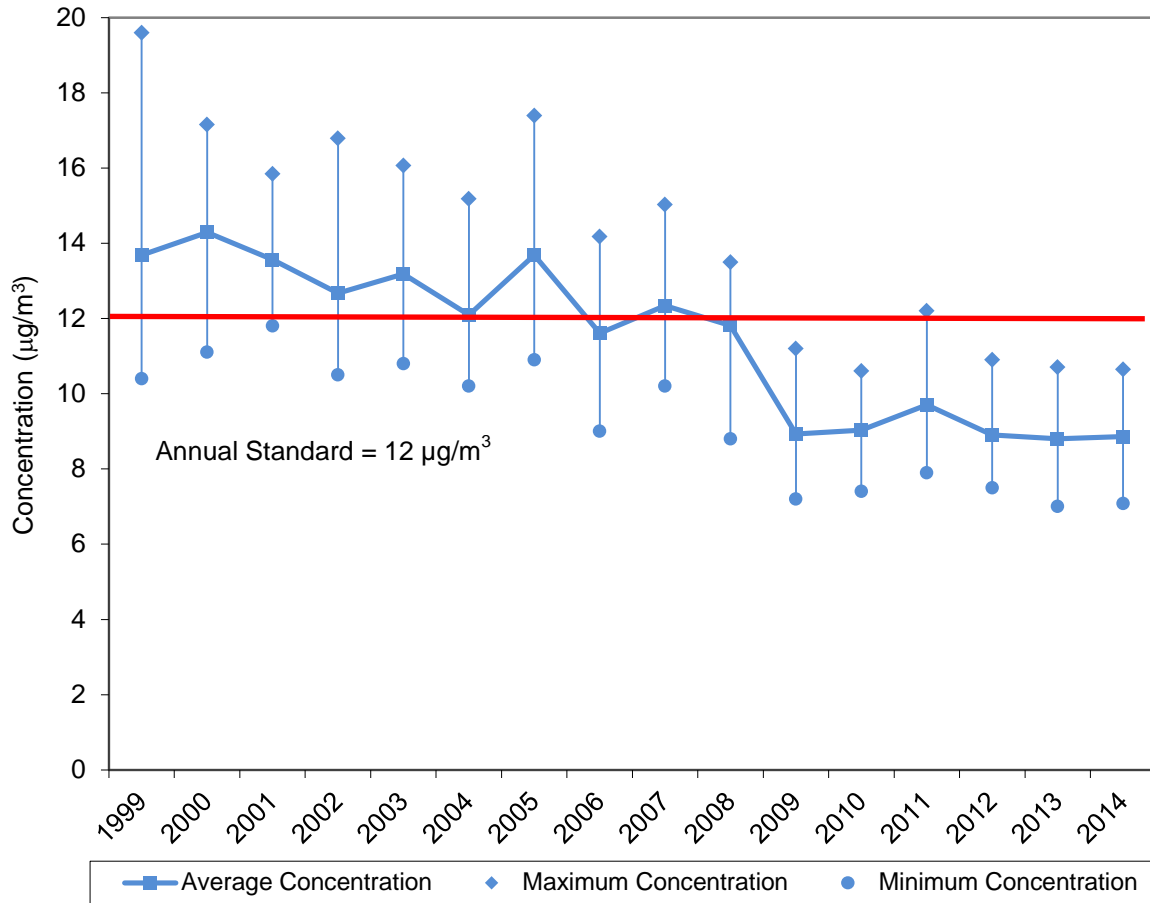


Figure 12
 Long-Term Trend in PM_{2.5} Annual Averages
 for All Sites in New Jersey
 1999-2014



Average Concentration = Average of all sites
 Maximum Concentration = Maximum annual average site
 Minimum Concentration = Minimum annual average site

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2014 Nitrogen Dioxide Summary

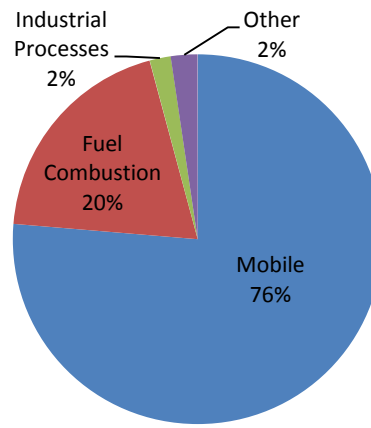
New Jersey Department of Environmental Protection

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). NO_2 is used by regulatory agencies as the indicator for the group of gases known as nitrogen oxides (NO_x). These gases are emitted from motor vehicle exhaust, combustion of coal, oil or natural gas, and 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. 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.

A pie chart summarizing the major sources of NO_x in New Jersey is shown in Figure 1. Because 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 Figure 2.

Figure 1
2011 New Jersey NO_x Emissions
by Source Category



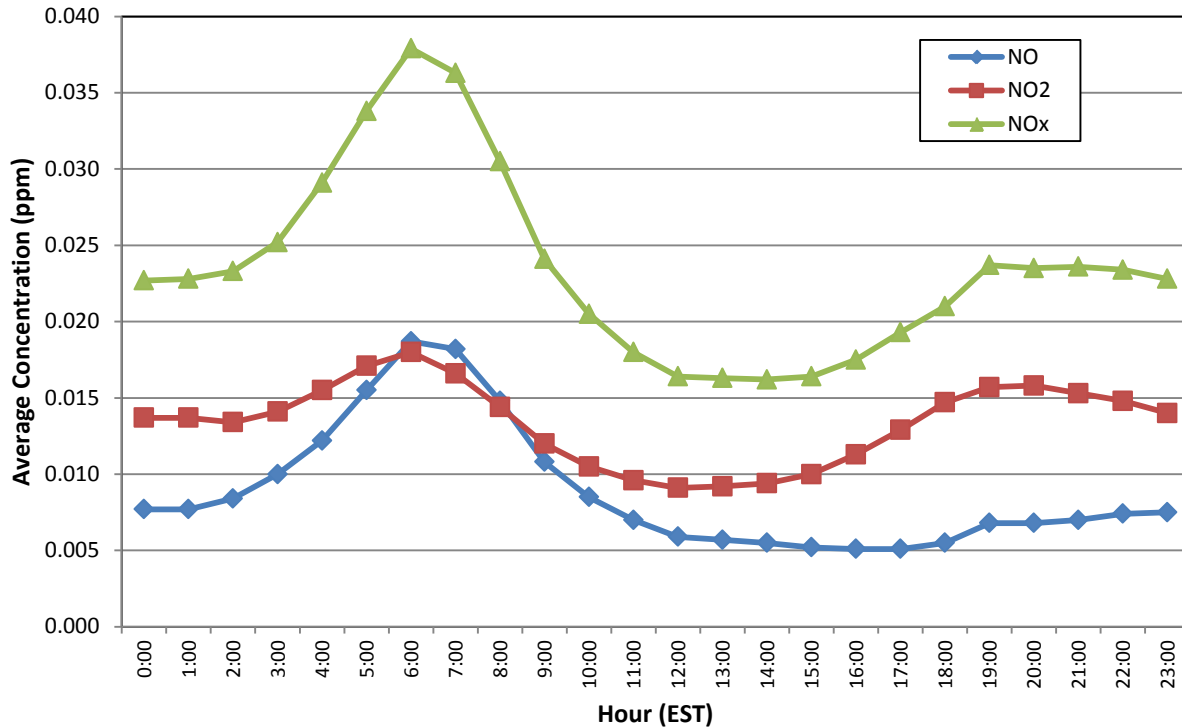
www3.epa.gov/air/emissions/index.htm

HEALTH AND ENVIRONMENTAL EFFECTS

Short-term exposures to low levels of nitrogen dioxide may aggravate pre-existing respiratory illnesses, and can actually 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. Studies show a connection between breathing elevated short-term NO_2 concentrations and increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma. Individuals who spend time on or near major roadways can experience high short-term NO_2 exposures.

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.

Figure 2
2014 Concentrations of Nitrogen Oxides in New Jersey
Hourly Variation



AMBIENT AIR QUALITY STANDARDS

The primary (health-based) and secondary (welfare-based) annual average National Ambient Air Quality Standards (NAAQS) for NO₂ are the same: 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 that micrograms per cubic meter (µg/m³) are the standard units and the averaging time is any 12-month period, not just the calendar year. In 2010, the U.S. Environmental Protection Agency (USEPA) strengthened the primary NAAQS by adding a 1-hour NO₂ standard of 0.100 ppm, based on the 98th percentile of the daily maximum 1-hour concentration. Table 1 provides a summary of the NO₂ standards.

Table 1
National and New Jersey Ambient Air Quality Standards for Nitrogen Dioxide (NO₂)
Parts Per Million (ppm) and Micrograms Per Cubic Meter (µg/m³)

Averaging Period	Type	New Jersey	National
12-month average	Primary	100 µg/m ³ (0.053 ppm)	
Annual average	Primary		0.053 ppm (100 µg/m ³)
12-month average	Secondary	100 µg/m ³ (0.053 ppm)	
Annual average	Secondary		0.053 ppm (100 µg/m ³)
1-hour average	Primary		0.100 ppm (190 µg/m ³)

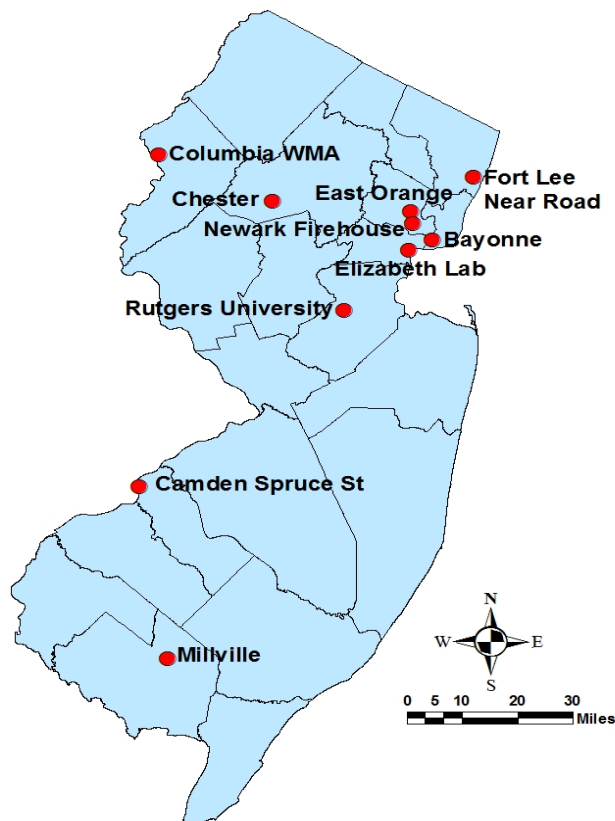
An area meets the new 1-hour NO₂ standard when the 3-year average of the 98th percentile of the daily maximum 1-hour NO₂ concentration is less than 0.100 ppm. This statistic, also known as the design value, is calculated by first obtaining the maximum 1-hour average NO₂ concentrations for each day at each monitor. Then the 98th percentile value of the daily maximum NO₂ concentrations must be determined for the current year, and for each of the previous two years. Finally, the average of these three 98th percentile values is the design value.

As part of the 2010 revision to the NAAQS, in addition to adopting a 1-hour NO₂ standard, USEPA required that in urban areas with populations of 1 million or more, an NO₂ near-road monitoring station be established and operational by January 1, 2014. A near-road station must be located no more than 50 meters (164 feet) from the nearest traffic lane of a major roadway. The New Jersey Department of Environmental Protection (NJDEP) established one near-road station for the New York-Northern New Jersey-Long Island Metropolitan area in Fort Lee along Interstate 95 and adjacent to the tollbooths for the George Washington Bridge.

MONITORING LOCATIONS

NJDEP monitored NO₂ levels at 10 locations in 2014. The Fort Lee Near Road monitoring station began operating in March 2014. These sites are shown in Figure 3.

Figure 3
2014 Nitrogen Dioxide Monitoring Network



NO₂ LEVELS IN 2014

Fort Lee Near Road was the only monitoring site in New Jersey that recorded any exceedances of either the National or New Jersey Air Quality Standards for NO₂ during 2014. The maximum 1-hour concentration at Fort Lee was 0.258 ppm, and the 2nd highest maximum 1-hour concentration was 0.130 ppm (see Table 2). While these values exceeded the NAAQS, it will not be known if this is a violation of the NAAQS until three years of data are collected at the Fort Lee site. The 98th percentile of the 1-hour daily maximum concentration for 2014 for each site is given in Table 2 and Figure 4. The 3-year average of the 98th percentile of the 1-hour daily maximum concentration (for 2012-2014) for each site is given in Table 2 and Figure 5. This is the design value that determines compliance with the 1-hour NO₂ NAAQS. The site with the highest design value for 2012-2014 was Elizabeth Trailer, with 0.066 ppm. In addition to Fort Lee Near Road, the three-year averages for the Bayonne and Millville stations could not be calculated because of incomplete data for certain years (see Table 2 notes).

The highest running-12-month and calendar-year average concentrations of NO₂ measured were 0.023 and 0.21 ppm respectively, at the Elizabeth Trailer site, located at Exit 13 of the New Jersey Turnpike (Table 2 and Figure 6).

Table 2
Nitrogen Dioxide (NO₂) and Nitric Oxide (NO) Data – 2014
1-Hour and 12-Month Averages
1-Hour NAAQS = 0.100 ppm
12-Month NAAQS = 0.053 ppm

Monitoring Site	Nitrogen Dioxide 1-Hour Average (ppm)				Nitrogen Dioxide 12-Month Average (ppm)	
	Daily Maximum	2nd Highest Daily Max.	2014 98th%-ile	2012-2014 98 th -ile 3-year Avg.	Maximum (Running 12- Month)	Calendar Year
Bayonne	0.075	0.071	0.061	a	0.018	0.017
Camden Spruce Street	0.064	0.060	0.050	0.046	0.013	0.013
Chester	0.051	0.049	0.040	0.036	0.005	0.004
Columbia WMA	0.058	0.056	0.049	0.045	0.013	0.012
East Orange	0.090	0.074	0.064	0.057	0.017	0.016
Elizabeth Trailer	0.085	0.083	0.070	0.066	0.023	0.021
Fort Lee Near Road	0.258	0.130	0.074	b	0.018	0.018
Millville	0.042	0.040	0.036	c	0.006	0.006
Newark Firehouse	0.083	0.083	0.070	0.063	0.019	0.018
Rutgers University	0.083	0.060	0.047	0.044	0.009	0.009

- a. Bayonne site temporarily shut down October 2012 through July 2013 due to damage from Superstorm Sandy.
- b. Fort Lee Near Road site began operating March 2014.
- c. Millville temporarily shut down for site renovations December 2012 to March 2013.

Figure 4
 2014 98th Percentile Daily Maximum 1-Hour
 Nitrogen Dioxide Concentrations in New Jersey

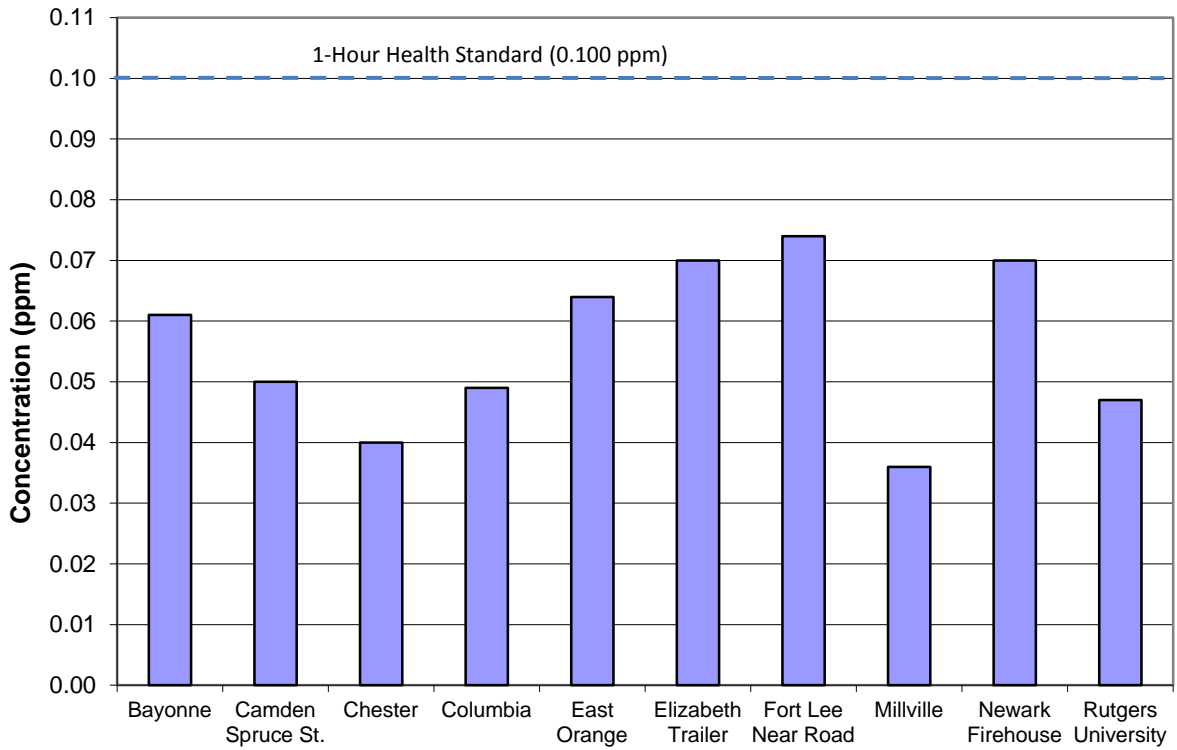


Figure 5
 3-Year Average of the 98th Percentile Daily Maximum 1-Hour Average
 Nitrogen Dioxide Concentrations in New Jersey (2012-2014)

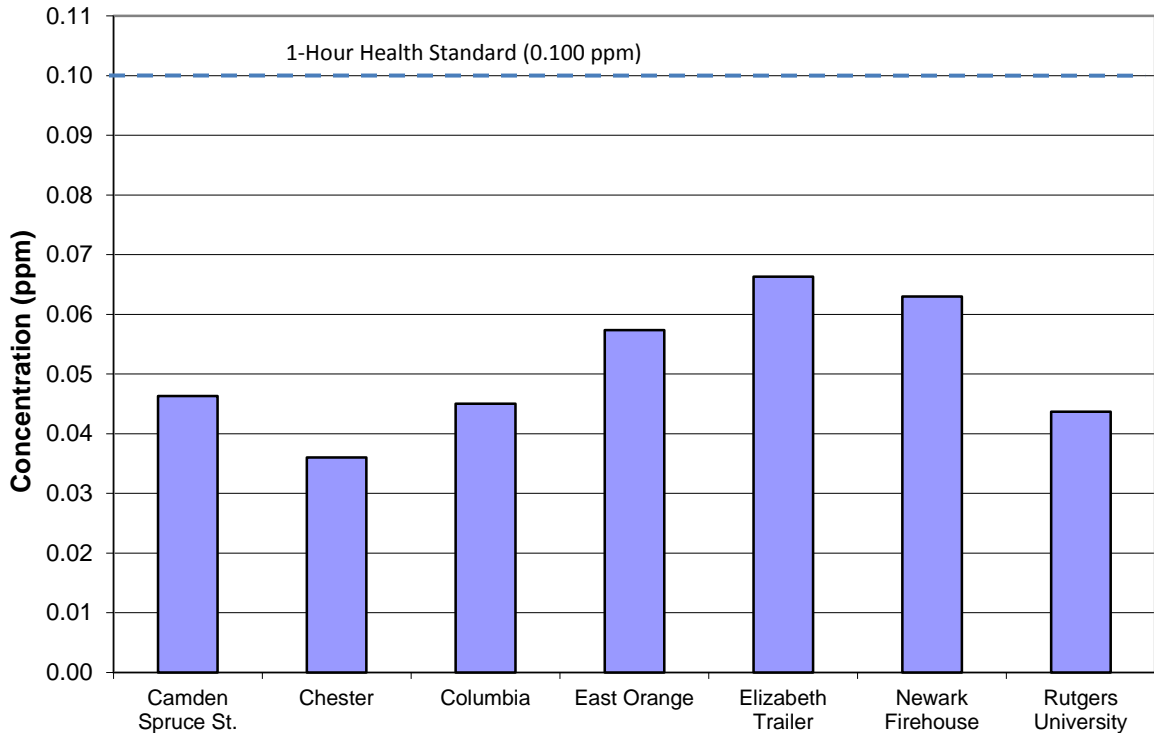
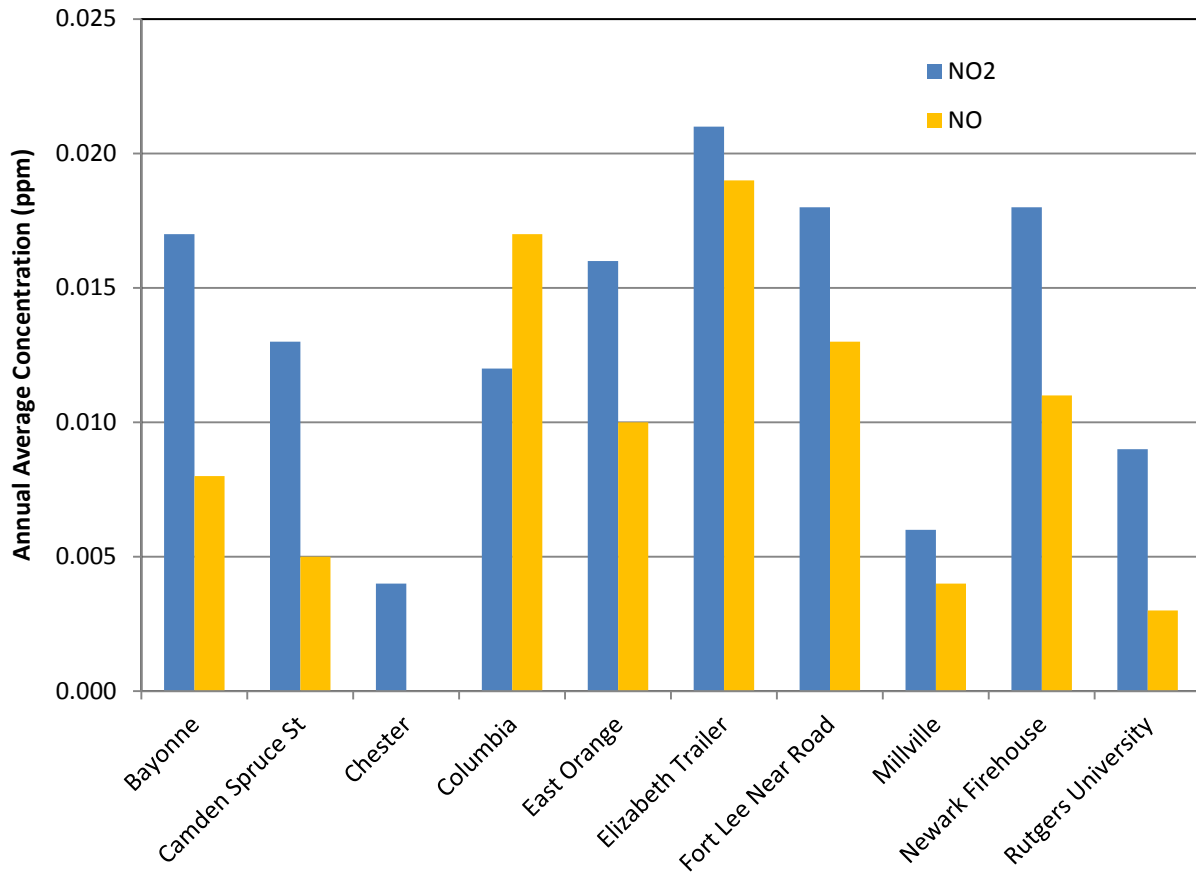


Figure 6
 Calendar Year Annual Average
 Nitrogen Dioxide & Nitric Oxide Concentrations
 in New Jersey – 2014



In addition to showing the calendar year annual average concentrations for nitrogen dioxide at each site, Figure 6 also includes values for nitric oxide. The New Jersey monitoring stations that measure NO₂ levels also measure NO and NO_x levels. NO_x levels are approximately the sum of the NO₂ and NO concentrations.

TRENDS

Figure 7 shows that NO_x concentrations tend to be higher in the winter than in the summer. This is due in part to building heating, and to poorer local dispersion conditions caused by light winds and other weather conditions that are more prevalent in the colder months of the year.

Routine monitoring for NO₂ in New Jersey began in 1966, and 1974 was the last year in which the annual mean NO₂ concentrations exceeded the NAAQS. The graph of NO₂ levels in Figure 8 shows the statewide average annual mean concentrations recorded from 1975 to 2014 in the form of a trend line. The graph also includes the levels at of the sites that measured the highest annual mean and lowest annual mean in each year, as points above and below this trend line. Although NO₂ concentrations are well within the NAAQS, there is still a great deal of concern about oxides of nitrogen because of their role in the formation of other pollutants, most notably ozone and fine particles. Both of these pollutants are of interest over much of the northeastern United States, and efforts to reduce levels of ozone and fine particles are likely to require continued reductions in NO_x emissions.

Figure 9 shows the highest, lowest, and average 98th percentile values of the daily maximum one-hour concentrations for the years 2000 to 2014 at each New Jersey monitoring site. The average values are well below the 1-hour NAAQS of 0.100 ppm.

Figure 7
2014 Concentrations of Nitrogen Oxides in New Jersey
Monthly Variation

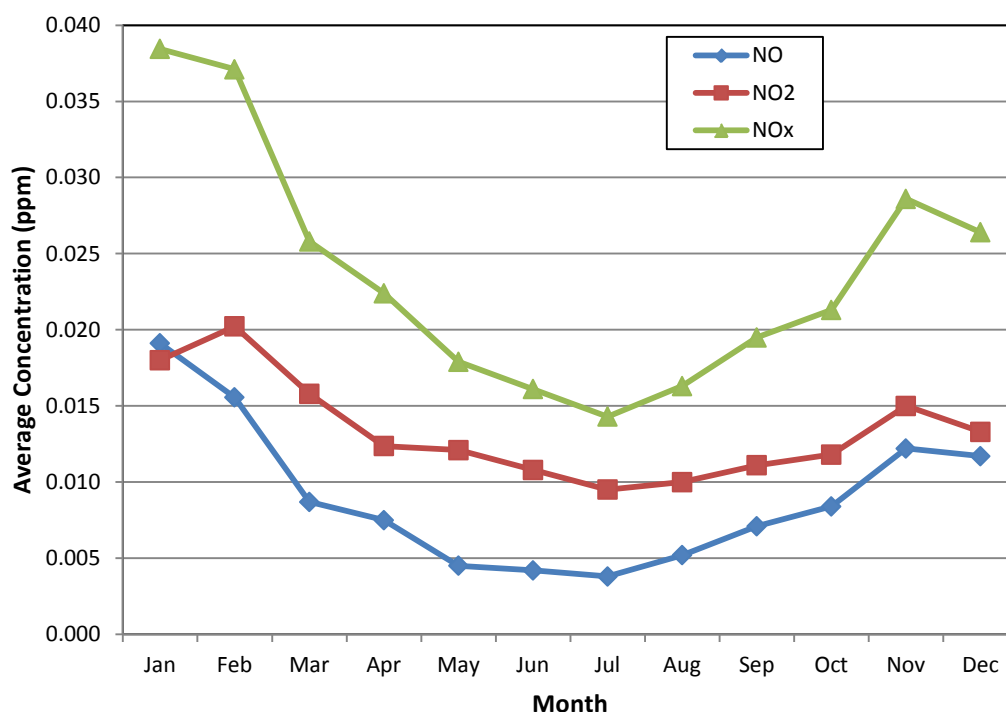


Figure 8
 Nitrogen Dioxide Concentrations in New Jersey, 1975-2014
 12-Month (Calendar Year) Average

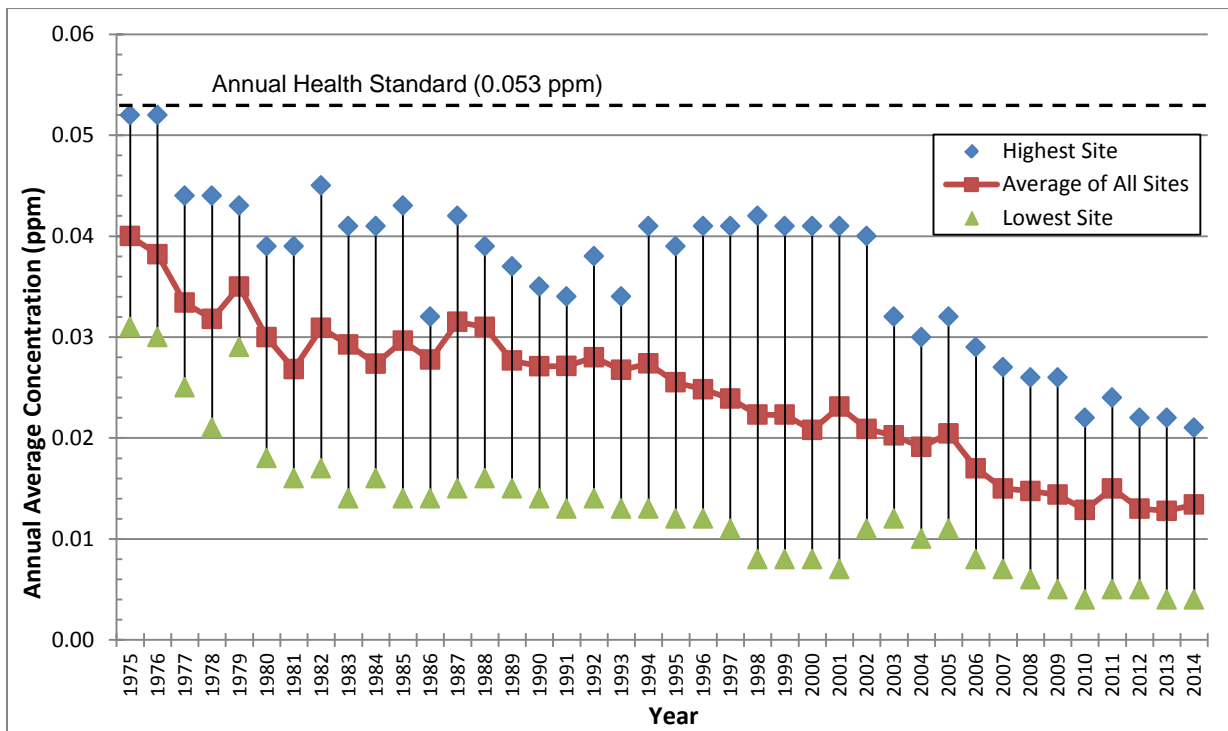
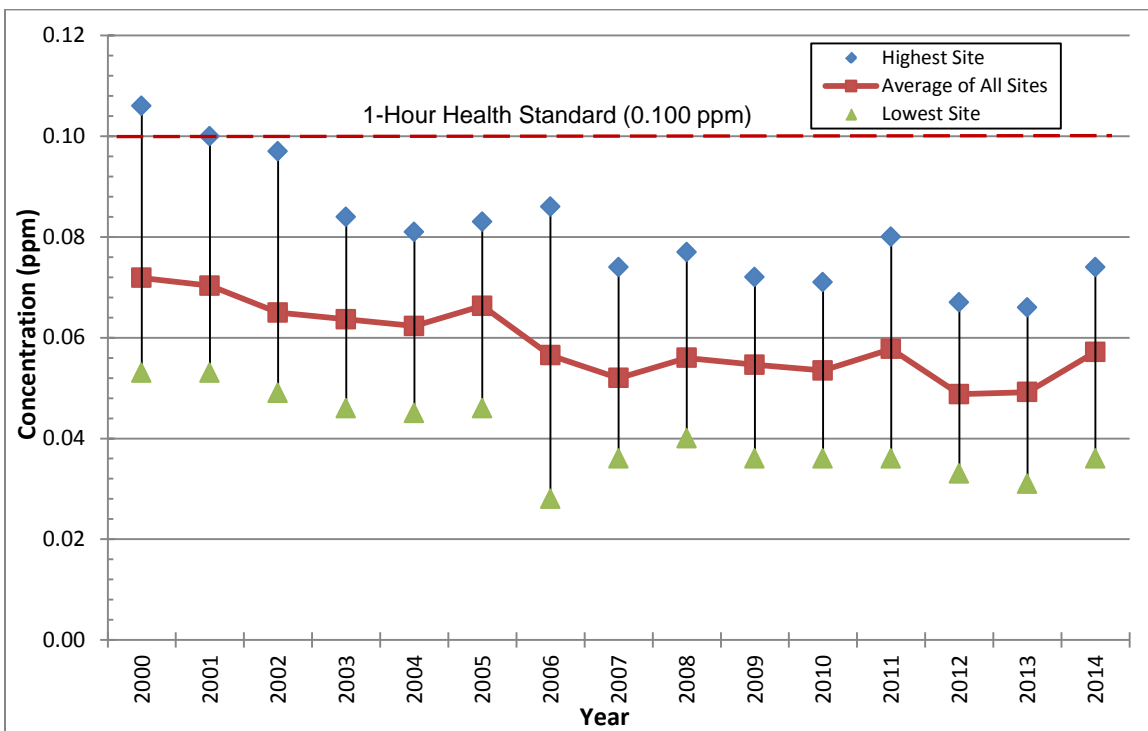


Figure 9
 Nitrogen Dioxide Concentrations in New Jersey, 2000-2014
 98th Percentile of Daily Maximum 1-Hour Concentrations



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2014 Sulfur Dioxide Summary

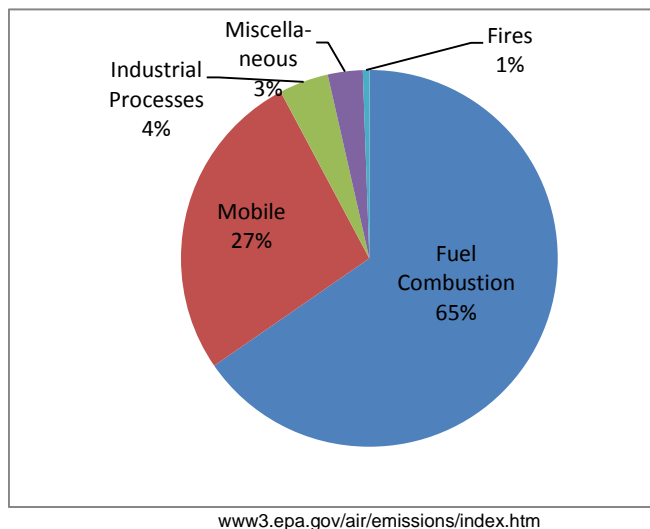
New Jersey Department of Environmental Protection

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 combustion in electric utilities, especially those that burn coal with high sulfur content. Sulfur is found in raw materials such as crude oil, coal, and ores that contain metals, including 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 in New Jersey is shown in Figure 1.

Figure 2 shows that SO₂ concentrations in New Jersey are generally higher in the winter than in the summer because of higher emissions from heating buildings and other sources, but peak SO₂ daily levels can occur anytime during the year. As shown in Figure 3. SO₂ levels tend to peak in mid- to late morning as emissions accumulate prior to being dispersed, when wind speeds and atmospheric mixing increase later in the day.

Figure 1
2011 New Jersey SO₂ Emissions
by Source Category



HEALTH AND ENVIRONMENTAL EFFECTS

Sulfur dioxide causes irritation of the mucous membranes. This is probably the result of sulfurous acid forming 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.

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 that fall to the earth in rain and snow. Better known as acid rain, this acidic precipitation can damage forests and crops, can make lakes and streams too acidic for fish, and can speed up the decay of building materials and paints.

Figure 2
Sulfur Dioxide Concentrations in New Jersey
2014 Monthly Variation

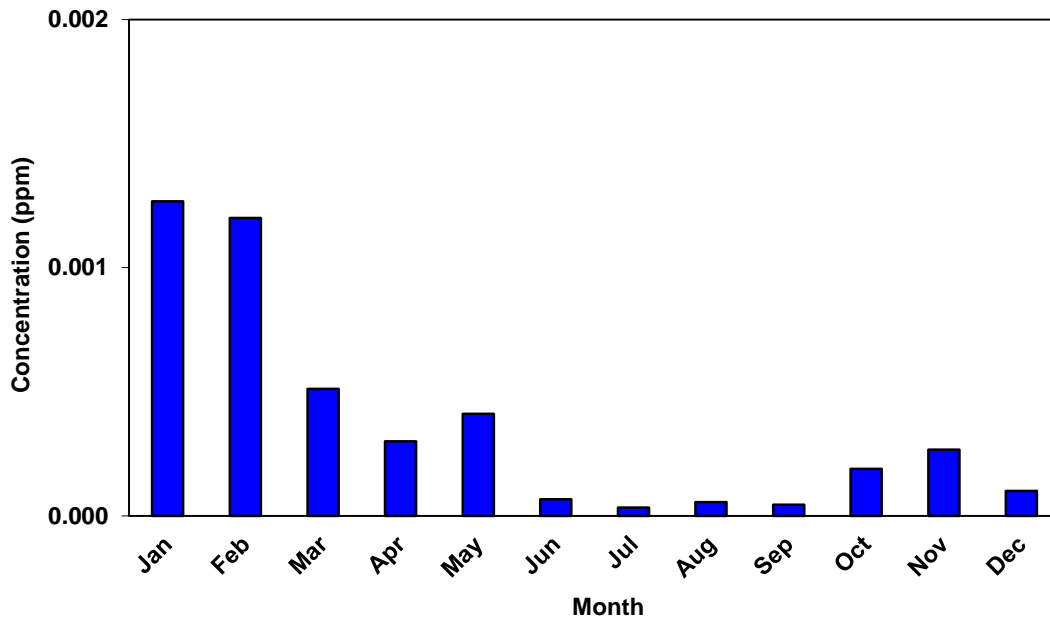
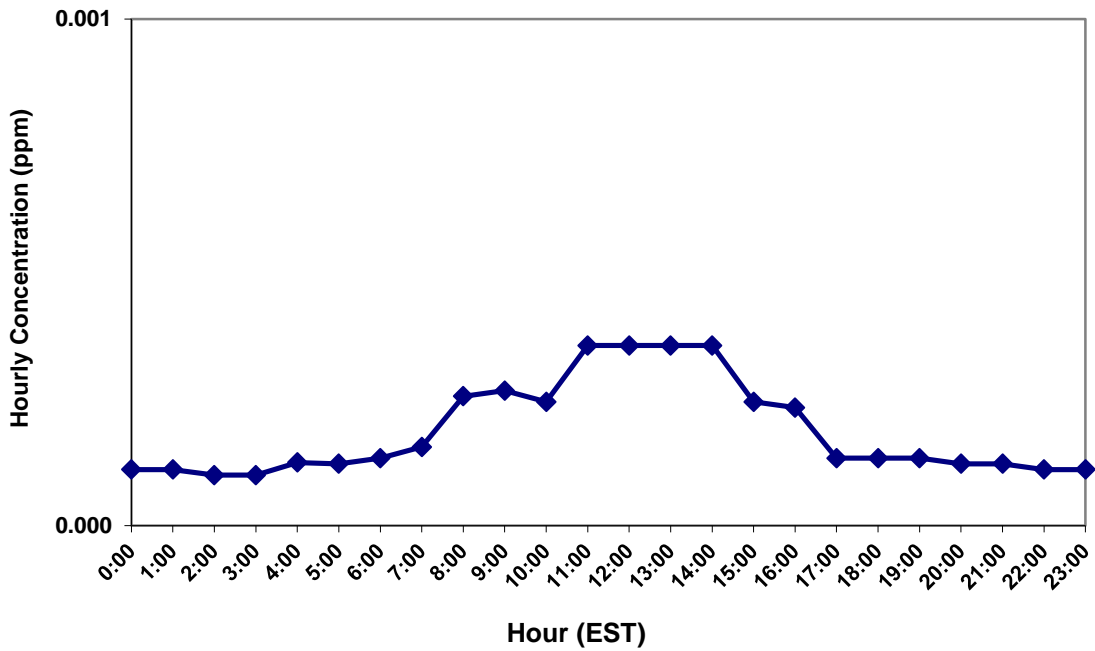


Figure 3
Sulfur Dioxide Concentrations in New Jersey
2014 Hourly Variation



AMBIENT AIR QUALITY STANDARDS

From 1971 through June 2010, the National Ambient Air Quality Standards (NAAQS) for SO₂ were revised three times. In June 2010, based on its review of the air quality standard for oxides of sulfur (as measured by SO₂), the United States Environmental Protection Agency (USEPA) established a new 1-hour NAAQS for SO₂ at a level of 75 parts per billion (ppb), and the old 24-hour and annual average NAAQS were revoked. USEPA did not revoke the existing 3-hour secondary NAAQS. The new 1-hour standard is based on the 3-year average of the 99th percentile of 1-hour daily maximum concentrations. However, the 1971 SO₂ standards remain in effect until one year after an area is designated as either in or out of attainment for the 2010 standard. In areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. The 1971 NAAQS include an annual average health standard of 0.03 parts per million (ppm), 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) 3-hour-average standard of 0.5 ppm that is also not to be exceeded more than once per year.

The New Jersey Ambient Air Quality Standards (NJAAQS) for SO₂ are similar to the federal standards, but are expressed in micrograms per cubic meter (µg/m³) instead of ppm, and are based on rolling averages rather than block averages. This means the state's primary 12-month standard is based on any twelve-month average recorded during two consecutive years, while the federal standard is based solely on the calendar year (block) average. New Jersey also has secondary 12-month, 24-hour, and 3-hour average standards. Table 1 summarizes the NAAQS and the NJAAQS for SO₂.

Table 1
National and New Jersey Ambient Air Quality Standards for Sulfur Dioxide
Parts per Million (ppm), Parts per Billion (ppb)
Micrograms per Cubic Meter (µg/m³)

Averaging Period	Type	New Jersey	National ^a
12-month average	Primary	80 µg/m ³ (0.03 ppm)	--
12-month average	Secondary	60 µg/m ³ (0.02 ppm)	---
24-hour average	Primary	365 µg/m ³ (0.14 ppm)	--
24-hour average	Secondary	260 µg/m ³ (0.10 ppm)	---
3-hour average	Secondary	1300 µg/m ³ (0.5 ppm)	0.5 ppm
1-hour average ^b	Primary	---	75 ppb

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

^b To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

MONITORING LOCATIONS

The state monitored SO₂ levels at nine locations in 2014. These sites are shown in Figure 4. The newest SO₂ monitoring site is at Camden Spruce Street, which became operational in April 2012. In September 2010, a monitoring station was established at the Columbia Wildlife Management Area (WMA) in Warren County. This was in support of a petition submitted to USEPA by the New Jersey Department of Environmental Protection (NJDEP) under Section 126 of the Clean Air Act that showed emissions from the Portland Generating Station, located in Pennsylvania, significantly contribute to nonattainment or interfere with maintenance of the 1-hour SO₂ NAAQS in New Jersey.

SO₂ LEVELS IN 2014

In 2014, five exceedances of the 1-hour standard were recorded, all at the Columbia WMA site. The highest 99th percentile of the 1-hour daily maximum concentration for 2014 was 78 ppb. The highest 3-year average of the 99th percentile of the 1-hour daily maximum SO₂ concentrations was 75 ppb, also measured at the Columbia WMA station. The Camden Spruce Street and Bayonne sites did not have sufficient data from 2012-2014 to determine if these sites met the 1-hour SO₂ standard. (The Bayonne site did not operate between October 2012 and July 2013 because of damage from Superstorm Sandy. The Camden site started operating in April 2012.)

No other monitoring sites recorded exceedances of the primary or secondary SO₂ standards during 2014. The maximum 12-month average concentration recorded was 0.001 ppm, at Bayonne, Chester, Columbia, Elizabeth, Elizabeth Lab, and Jersey City sites. The maximum 24-hour average level recorded was 0.018 ppm at the Columbia WMA site. The highest 3-hour average recorded was 0.090 ppm at the Columbia WMA site. Summaries of the 2014 data are provided in Tables 2, 3, and 4, and Figures 5 and 6.

Figure 4
2014 Sulfur Dioxide
Monitoring Network

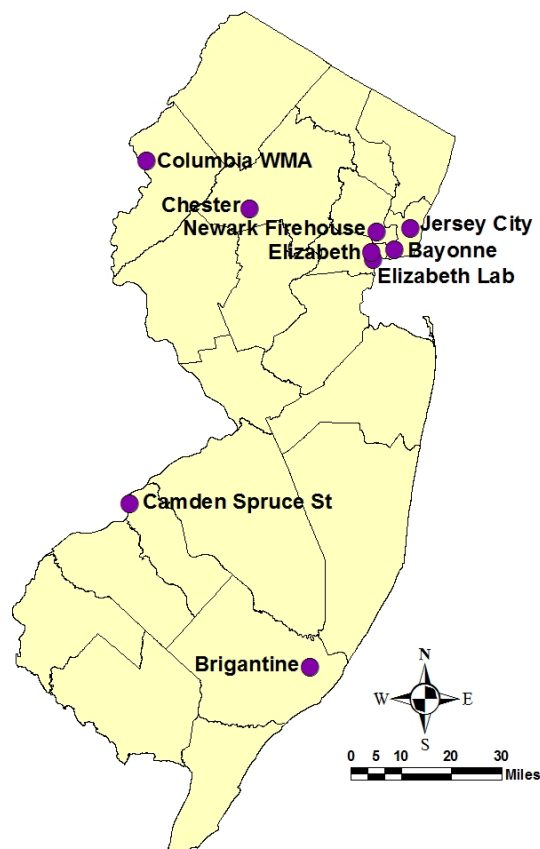


Table 2
 2014 Sulfur Dioxide Concentrations in New Jersey
 3-Year Average of the 99th Percentile
 of Daily Maximum 1-Hour Averages
 Parts per Billion (ppb)

Location	1-Hour Average (ppb)			3-Year Average 2012-2014
	Highest 1-Hr. Daily Maximum	2nd Highest 1-Hr. Daily Maximum	99th %-ile 1-Hr. Daily Maximum	99 th %-ile 1-Hr. Daily Maximum
Bayonne ^a	11	10	10	--
Brigantine	10.1	8.7	7.2	6.2
Camden Spruce St. ^b	10	10	10	--
Chester	20	17	12	10
Columbia WMA	124	104	78	75
Elizabeth	10	9	7	7
Elizabeth Lab	11	16	13	20
Jersey City	11	10	9	9
Newark Firehouse	13.0	10.5	8.9	9.9

a Bayonne site temporarily shut down October 2012 due to Superstorm Sandy, and restarted July 2013.

b Camden Spruce St. site started operating in April 2012.

Table 3
 2014 Sulfur Dioxide Concentrations in New Jersey
 3-Hour and Annual Averages
 Parts per Million (ppm)

Monitoring Sites	3-Hour Maximum Average	3-Hour 2 nd Highest ^a Average	12-Month Maximum Average	Calendar Year Average
Bayonne	0.009	0.008	0.001	0.001
Brigantine	0.0096	0.0070	0.0005	0.0004
Camden Spruce St.	0.009	0.009	0.000	0.000
Chester	0.014	0.011	0.001	0.001
Columbia WMA	0.090	0.084	0.001	0.001
Elizabeth	0.008	0.007	0.001	0.001
Elizabeth Lab	0.037	0.011	0.001	0.001
Jersey City	0.010	0.009	0.001	0.001
Newark Firehouse	0.0094	0.0090	0.0010	0.0008

a Based on non-overlapping 3-hour moving averages.

Table 4
 2014 Sulfur Dioxide Concentrations in New Jersey
 24-Hour and Daily Averages
 Parts per Million (ppm)

Monitoring Sites	24-Hour Maximum Average	24-Hour 2 nd Highest Average ^a	Daily Maximum Average	Daily 2 nd Highest Average
Bayonne	0.005	0.005	0.005	0.004
Brigantine	0.0044	0.0042	0.0035	0.0033
Camden Spruce St.	0.007	0.005	0.005	0.005
Chester	0.006	0.005	0.005	0.005
Columbia WMA	0.018	0.016	0.016	0.015
Elizabeth	0.005	0.004	0.004	0.004
Elizabeth Lab	0.007	0.005	0.006	0.005
Jersey City	0.007	0.006	0.006	0.005
Newark Firehouse	0.0062	0.0054	0.0060	0.0052

a Based on non-overlapping 24-hour moving averages.

Figure 5
 2014 Sulfur Dioxide Concentrations in New Jersey
 99th Percentile of the 1-Hour Daily Maximum Concentrations
 3-Year Design Value (2012-2014)
 Parts per Billion (ppb)

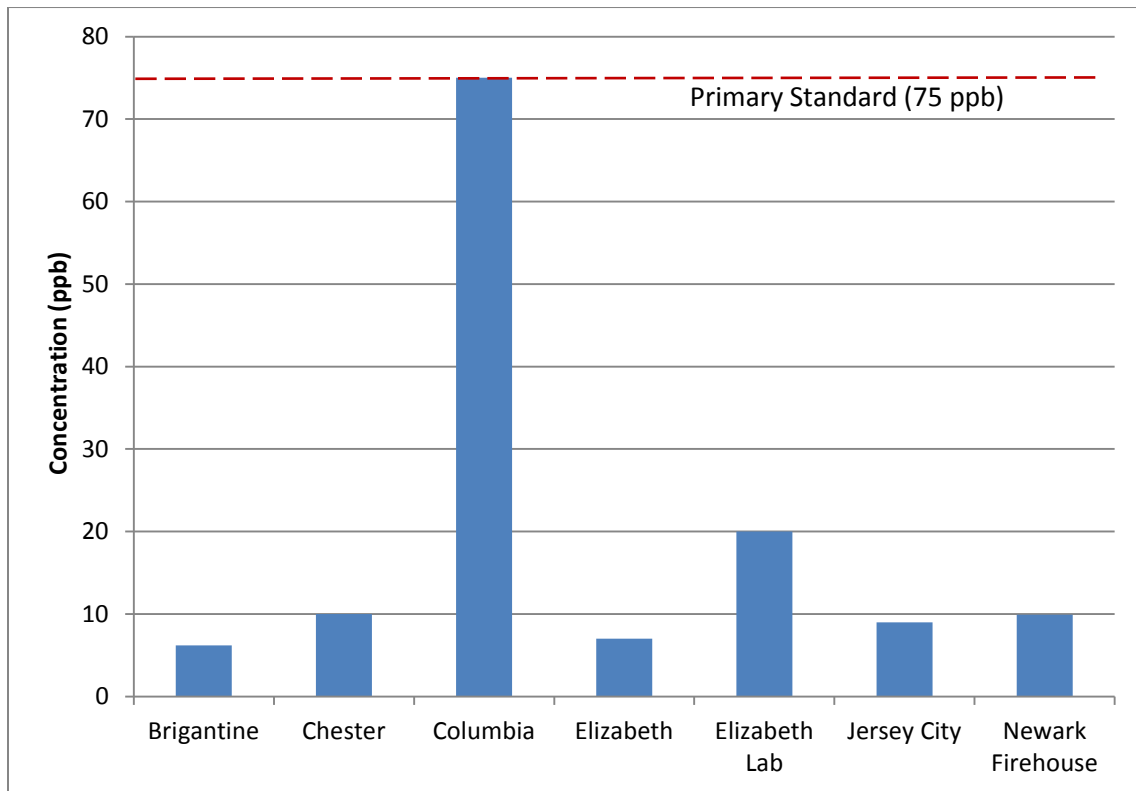
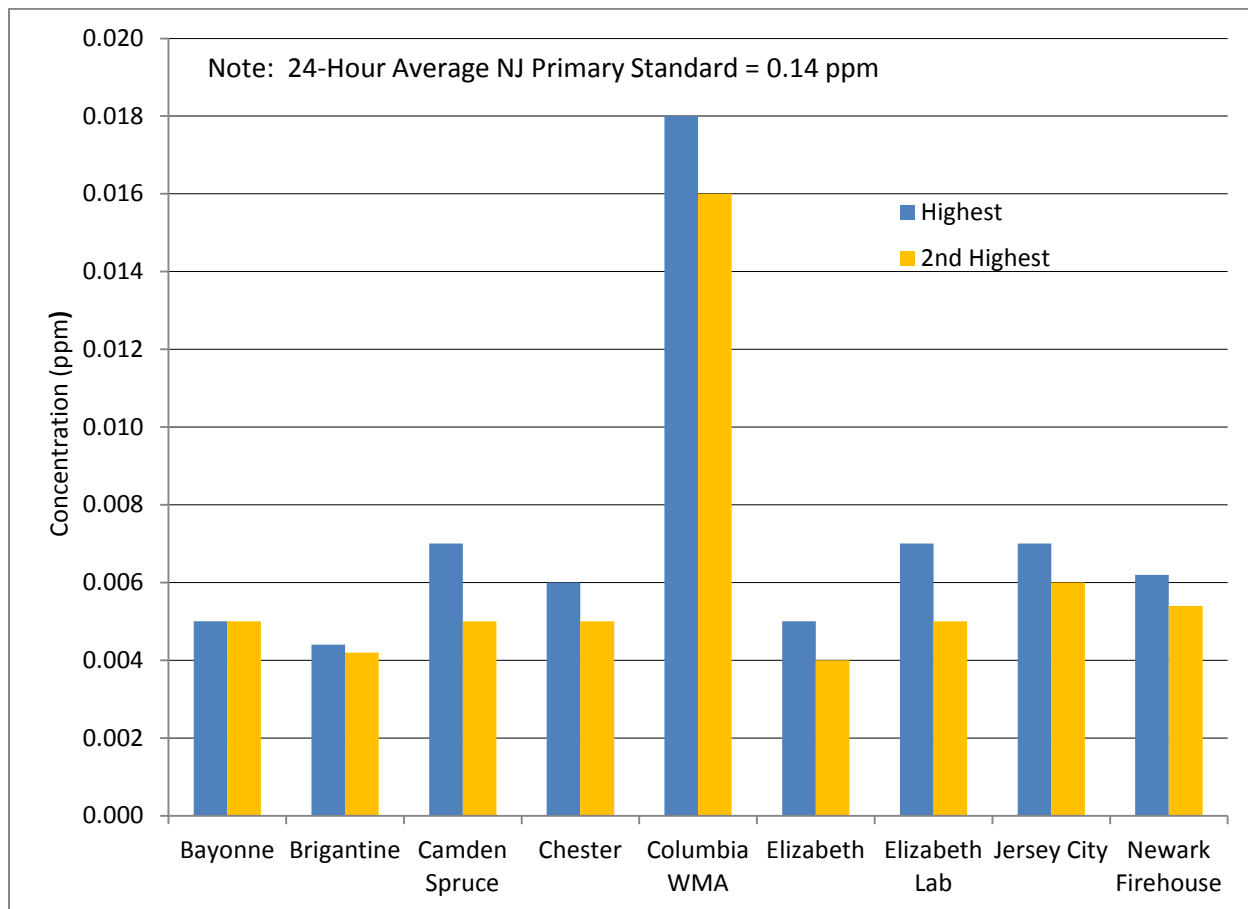


Figure 6
 2014 Sulfur Dioxide Concentrations in New Jersey
 Highest and 2nd-Highest 24-Hour Averages
 Parts per Million (ppm)



SO₂ TRENDS

Since the implementation of federal regulations requiring the nationwide use of lower sulfur fuels, SO₂ concentrations have improved significantly. The last time an exceedance of the 3-hour, 24-hour, or 12-month national and New Jersey AAQS for SO₂ was recorded was in 1980. A trend graph of SO₂ levels showing the daily average concentrations recorded in each year since 1975 for the highest site, average of all sites, and lowest site is provided in Figure 7. The graph uses the second-highest daily average.

Figure 8 shows the trend in one-hour concentrations of SO₂ since 2000. The graph uses the 99th percentile of the 1-hour daily maximum concentrations. The increase in maximum values that begins in 2010 is attributable to the start-up of the Columbia WMA site, which is impacted by the Portland Power Plant across the Delaware River in Pennsylvania.

Figure 7
Sulfur Dioxide Concentrations in New Jersey, 1975-2014
Second-Highest Daily Average
Parts per Million (ppm)

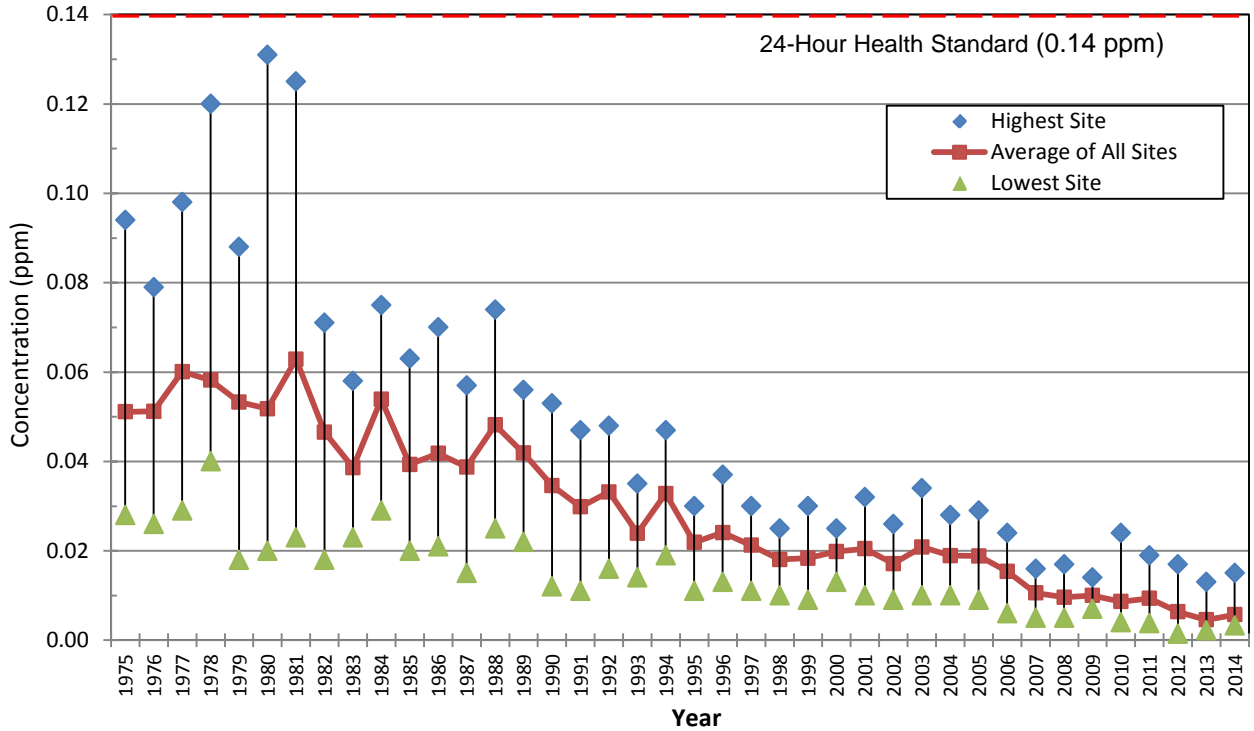
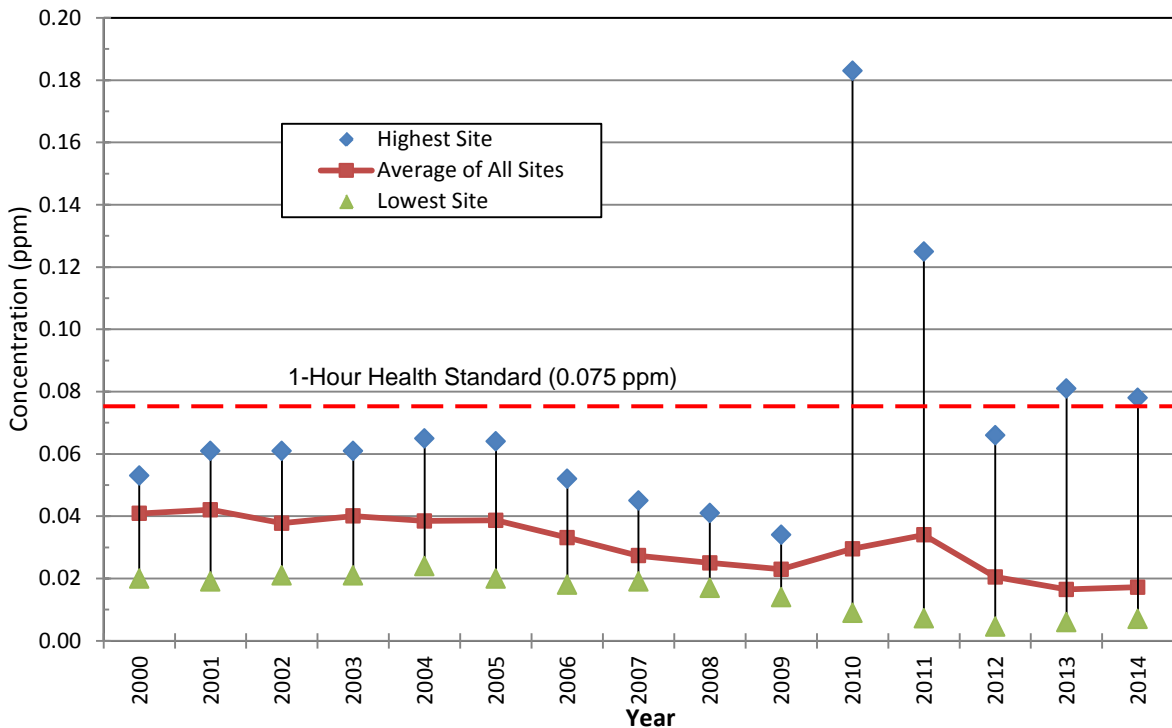


Figure 8
Sulfur Dioxide Concentrations in New Jersey, 1975-2014
99th Percentile of the 1-Hour Daily Maximum Concentration
Parts per Million (ppm)

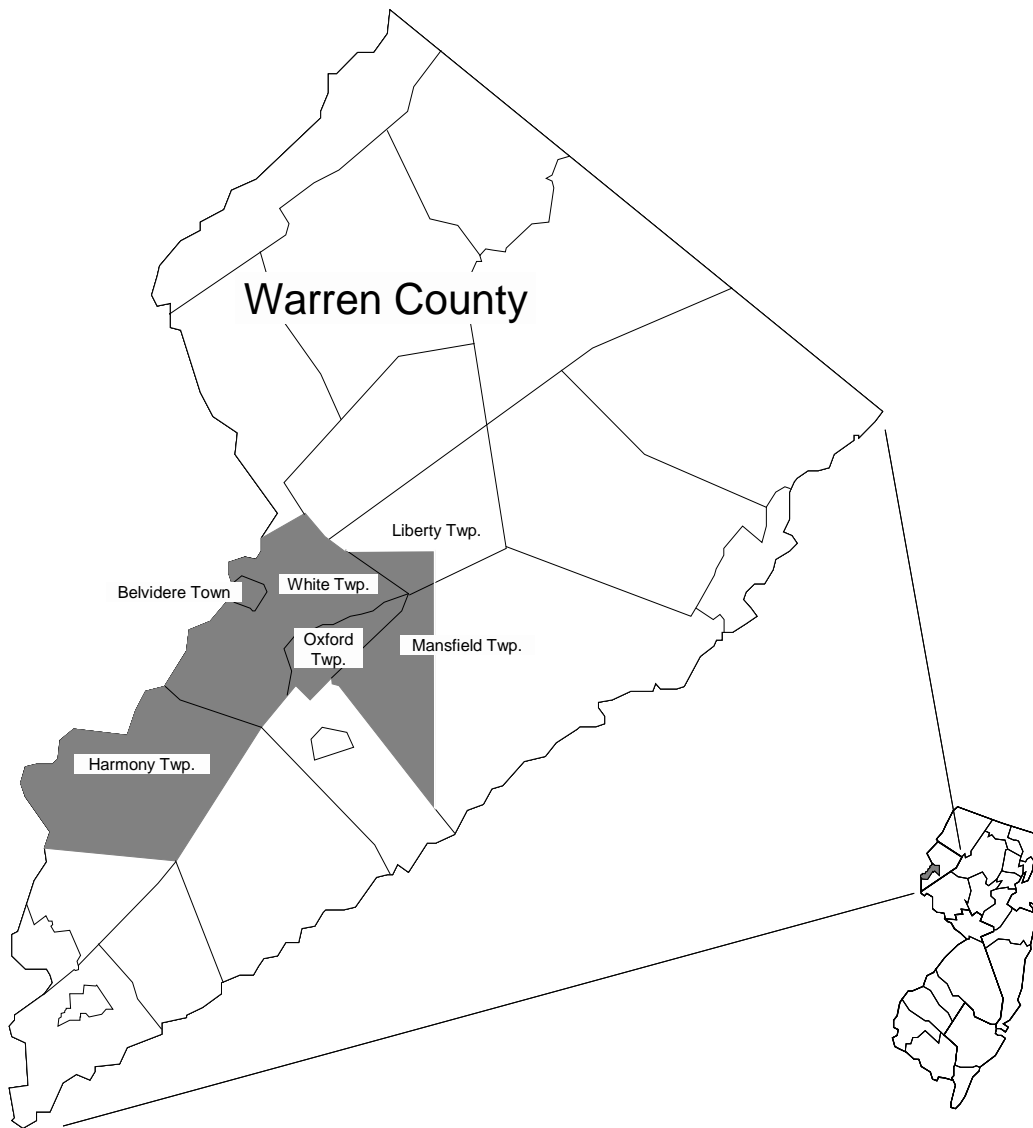


COMPLIANCE WITH THE SO₂ STANDARDS IN NEW JERSEY

There is still a small portion of New Jersey that is classified as a non-attainment area for SO₂, based on the 1971 12-month and 24-hour average primary NAAQS. This area is shown in Figure 8. The non-attainment designation is the result of air quality modeling studies done by NJDEP that predicted nonattainment of these standards within an area of Warren County, due to emissions of SO₂ from the Portland Power Plant across the Delaware River in Pennsylvania. In September 2010, New Jersey petitioned the USEPA under Section 126 of the Clean Air Act to take action against the Portland Power Plant. All of Warren County and portions of Sussex, Morris, and Hunterdon Counties were being impacted by SO₂ emissions from the plant, likely causing violations of the new (2010) 1-hour NAAQS. A detailed map of the affected area can be found at www.state.nj.us/dep/baqp/docs/SO2%20package.pdf.

In support of the Section 126 petition, NJDEP established an SO₂ monitoring station in the Columbia Wildlife Management Area (WMA) in Knowlton Township, Warren County, in September 2010. In October 2011, the USEPA finalized a rule to grant New Jersey's petition. This final rule required the Portland Power Plant to reduce its SO₂ emissions such that the plant's contribution to predicted air quality standard violations would be lowered within one year, and completely eliminated within 3 years. The power plant has since been shut down. It is expected that Warren County and its vicinity will be able to attain the new SO₂ standard. The state is working with USEPA to have the area re-designated as being in attainment.

Figure 8
Sulfur Dioxide Nonattainment 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

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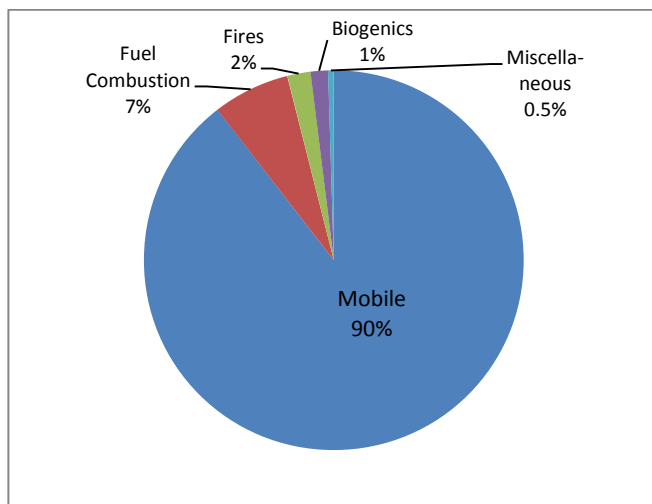
2014 Carbon Monoxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Carbon monoxide (CO) is a colorless, odorless gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes over 51 percent of all CO emissions nationwide, and 90% in New Jersey. Non-road vehicles and engines, such as construction equipment and boats, are other significant sources of CO. CO is also emitted from fuel combustion in boilers and incinerators, natural sources such as forest fires, and various industrial processes. Figure 1 shows the average contributions of these sources in New Jersey for 2011 (the most recent year available).

Figure 1
2011 New Jersey CO Emissions
by Source Category



Source: www.epa.gov/air/emissions/index.htm

Atmospheric inversions occur when cooler air is trapped beneath a layer of warmer air, which usually occurs overnight. The inversion acts like a lid, preventing pollution from mixing in the atmosphere and effectively trapping it close to the ground (see Figure 2). This can allow CO to accumulate at ground-level. Figure 3 shows that CO concentrations are slightly higher in the winter, probably because inversions are more frequent during the winter months. Also, high CO levels often coincide with morning and afternoon rush hours; this diurnal variation is displayed in Figure 4.

Figure 2
Effect of Atmospheric Inversion of Pollution
www.sciencelearn.org.nz

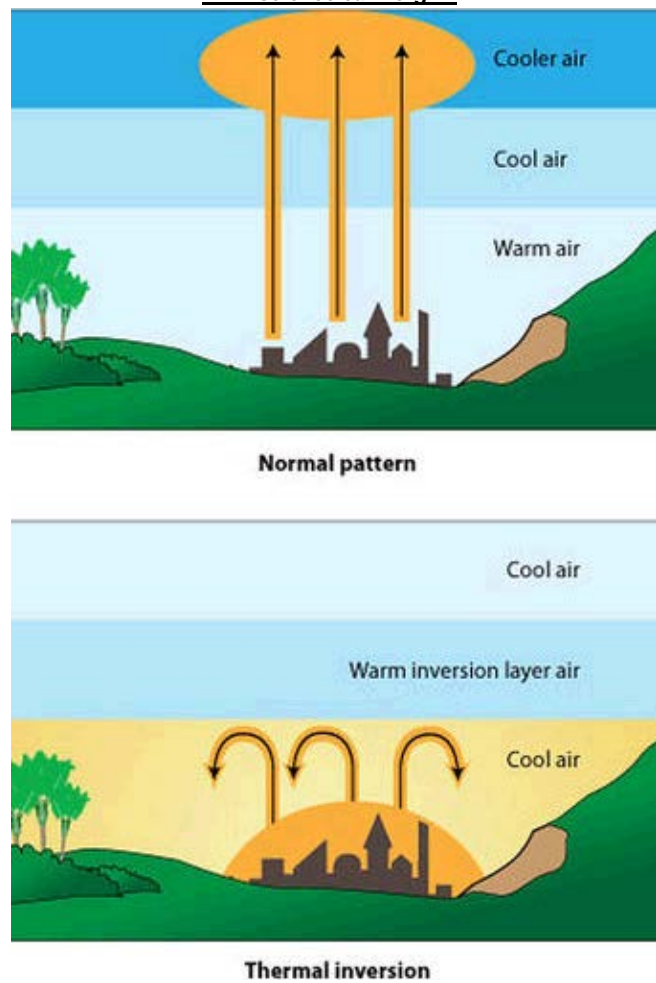


Figure 3
 2014 Carbon Monoxide Average Concentrations in New Jersey
 Monthly Variation

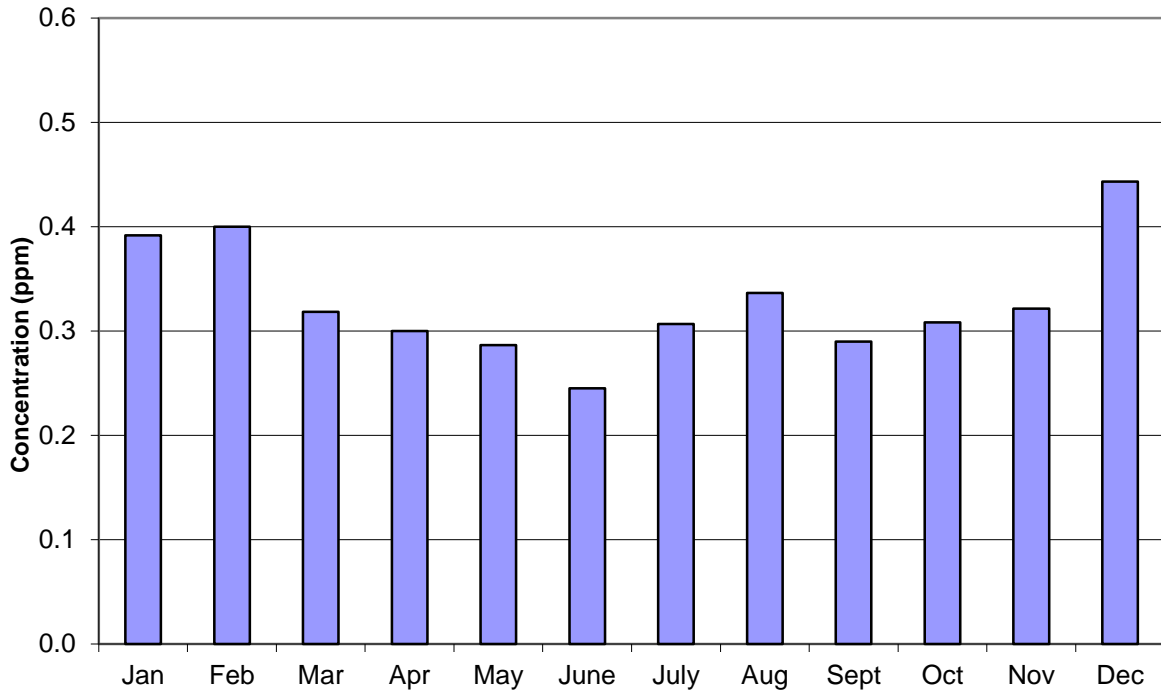
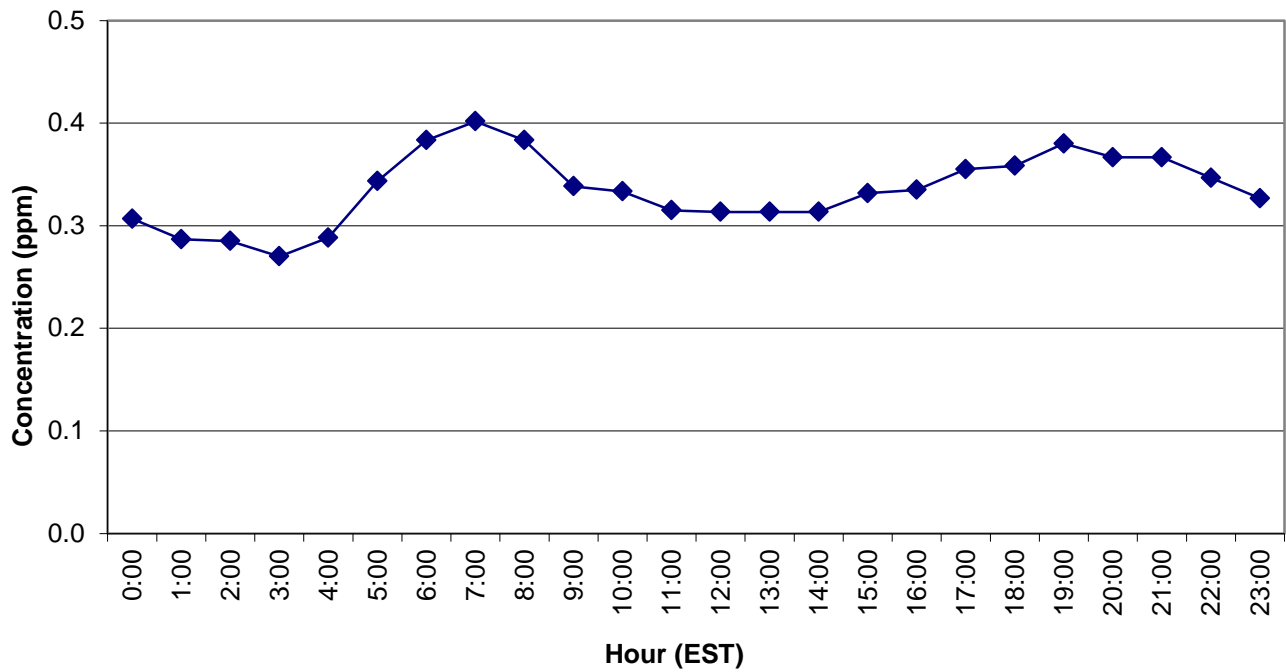


Figure 4
 2014 Carbon Monoxide Average Concentrations in New Jersey
 Hourly Variation



HEALTH EFFECTS

Carbon monoxide reduces the oxygen-carrying capacity of blood, therefore reducing the distribution of 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 may 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. At extremely high levels, CO can cause death.

AMBIENT AIR QUALITY STANDARDS

There are currently two national primary, or health-based, standards for carbon monoxide in ambient air. They are a 1-hour average 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, or welfare-based, standards for CO at this time. The national standards are commonly known as National Ambient Air Quality Standards (NAAQS). New Jersey also has standards for CO, and they are based on different units (milligrams per cubic meter as opposed to parts per million). The state standards are not to be exceeded more than once in any 12-month period. The state has set secondary standards for CO at the same level as the primary standards. The standards are summarized in Table 1.

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)	----

MONITORING LOCATIONS

The New Jersey Department of Environmental Protection (NJDEP) operated seven CO monitoring stations in 2014. These sites are shown in the map in Figure 5. The Newark Firehouse station is part of the U.S. Environmental Protection Agency's (USEPA) National Core Multipollutant Monitoring Network (NCore). It measures and reports CO concentrations at trace levels, down to a hundredth of a ppm. The NJDEP also established a new CO monitoring location in Fort Lee in March 2014. Identified as the Fort Lee Near Road monitoring site, it meets the USEPA's new siting requirements for near-road monitors. USEPA regulations required the establishment of a near-road site in New Jersey by January 1, 2015.

CO LEVELS IN 2014

None of the New Jersey monitoring sites recorded exceedances of any CO standards during 2014. The maximum 1-hour average CO concentration recorded in 2014 was 3.3 ppm at the Jersey City station. The highest 8-hour average CO concentration recorded was 2.6 ppm at the East Orange station. Summaries of the 2014 data are provided in Table 2, Figure 6 and Figure 7.

Figure 5
2014 Carbon Monoxide
Monitoring Network

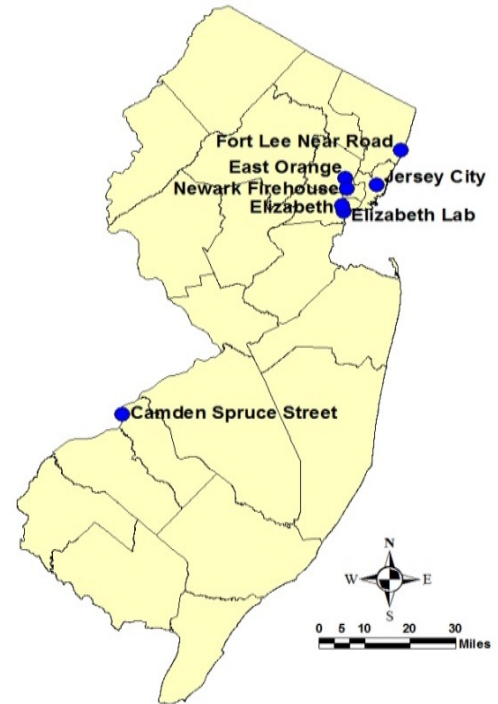


Table 2
2014 Carbon Monoxide Concentrations in New Jersey
1-Hour and 8-Hour Averages
Parts per Million (ppm)

Monitoring Site	Maximum 1-Hour Average Concentration	2 nd Highest 1-Hour Average Concentration	Maximum 8-Hour Average Concentration	2 nd Highest 8-Hour Average Concentration
Camden Spruce St.	1.8	1.7	1.5	1.2
East Orange	3.0	2.8	2.6	2.4
Elizabeth	2.8	2.7	2.5	2.2
Elizabeth Lab	2.2	2.2	2.0	1.8
Fort Lee Near Road	1.9	1.9	0.8	0.8
Jersey City	3.3	2.5	2.3	1.8
Newark Firehouse	3.13	3.12	2.49	2.47

Figure 6
2014 Carbon Monoxide Concentrations in New Jersey
1-Hour Averages

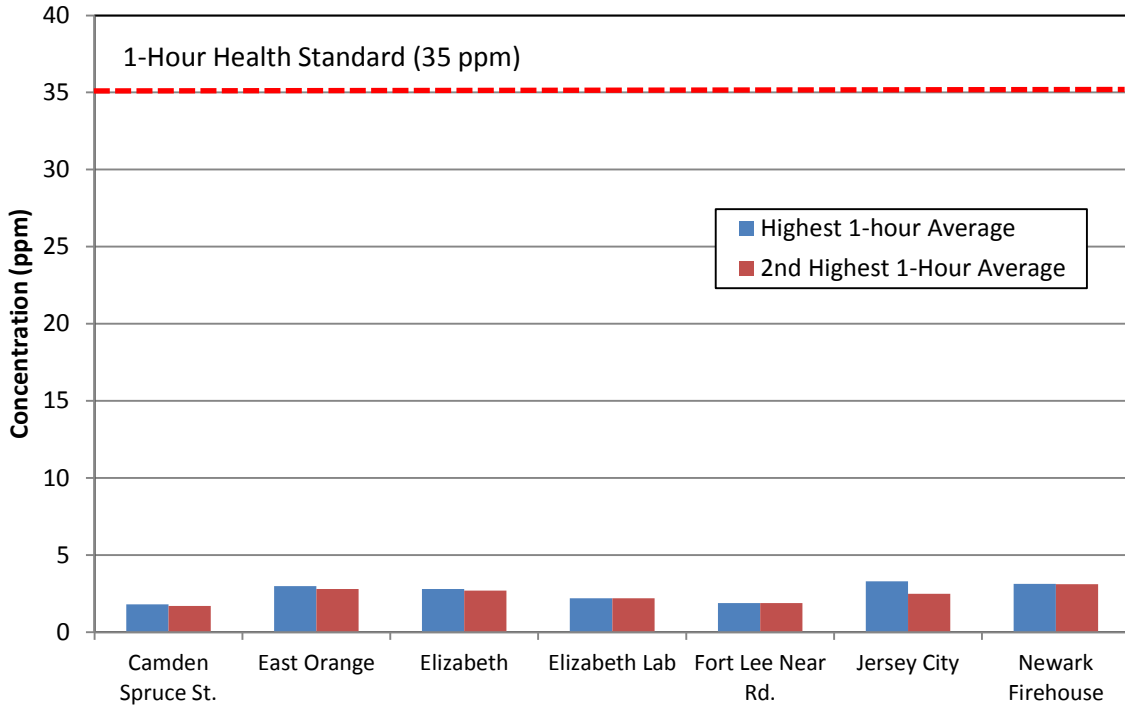
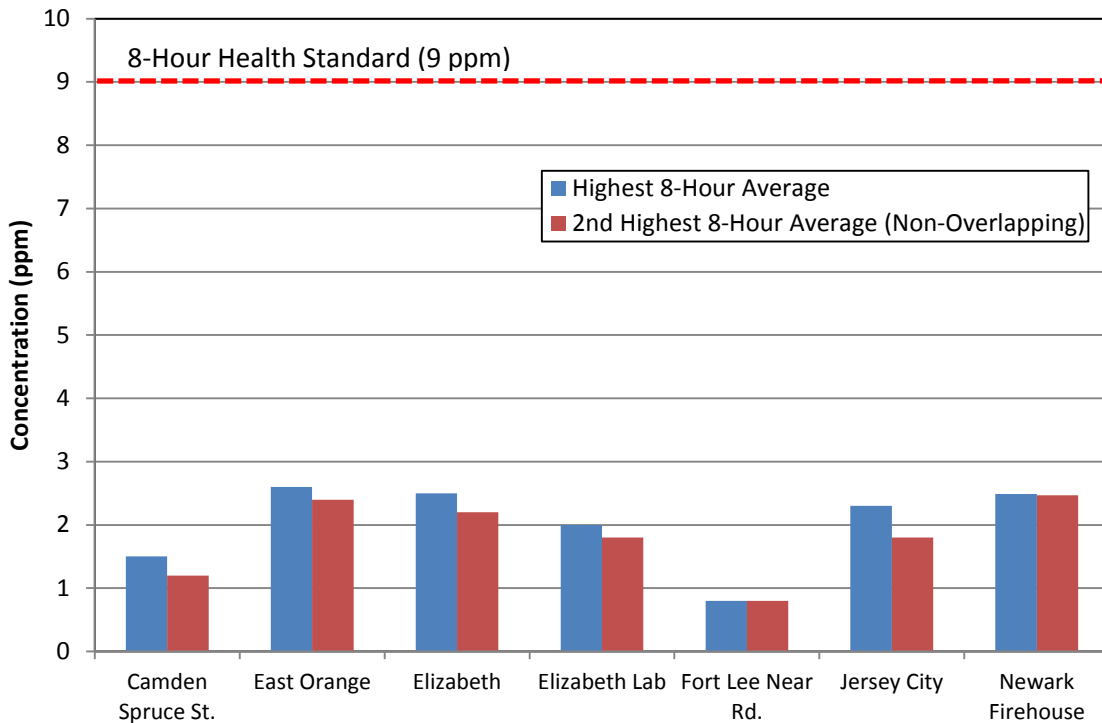


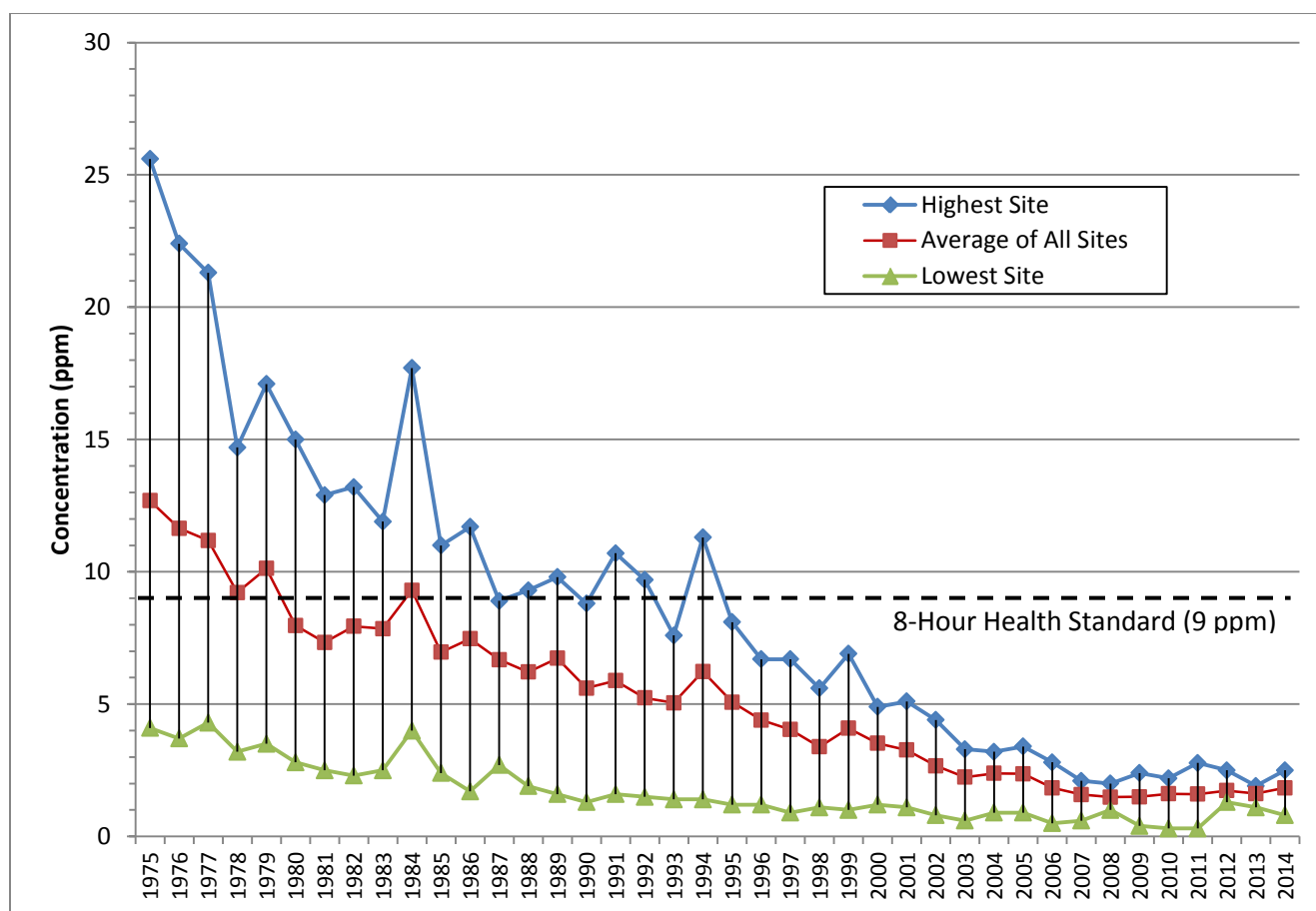
Figure 7
2014 Carbon Monoxide Concentrations in New Jersey
8-Hour Averages



TRENDS

Carbon monoxide levels have improved dramatically over the past thirty-nine years. Figure 8 presents the trend in CO levels since 1975, showing the concentrations recorded each year of the highest site, average of all sites, and lowest site. The graph actually shows the second highest 8-hour value recorded, because this is the design value that determines if the NAAQS are being met (one exceedance per site is allowed each year). The last time the CO standard was exceeded in New Jersey was in January 1995. The entire state was officially declared to have attained the CO standard as of August 23, 2002. At one time, unhealthy levels of CO were recorded on a regular basis. The reduction in CO levels is due primarily to cleaner-running cars, which are by far the largest source of this pollutant.

Figure 8
Carbon Monoxide Air Concentrations in New Jersey
2nd Highest 8-hour Average, 1975-2014
Parts per Million (ppm)



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2014 Photochemical Assessment Monitoring Station (PAMS) Summary

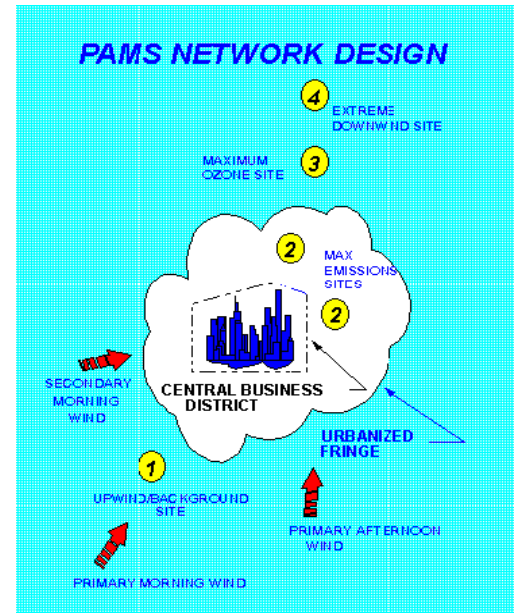
New Jersey Department of Environmental Protection

PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

Most ground-level ozone (O_3) is formed from oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) reacting in the presence of sunlight. Therefore, to effectively evaluate strategies for reducing ozone levels, it is necessary to measure these ozone-forming pollutants, also known as precursor pollutants. The Photochemical Assessment Monitoring Stations (PAMS) network was established by the U.S. Environmental Protection Agency (USEPA) for this purpose. Data from the PAMS network is used to better characterize the nature and extent of the O_3 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, NO_x , nitric oxide (NO), nitrogen dioxide (NO_2), as well as specific VOCs, including several carbonyls that are important in ozone formation. In addition, the measurement of specific weather parameters (wind speed, wind 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 peak ozone season, from June 1st to August 31st each year.

The PAMS network is designed around metropolitan areas where ozone is a significant problem. Each site in the network has a specific purpose, as shown in Figure 1. New Jersey is part of both the Philadelphia and New York Metropolitan areas and has historically operated a total of three PAMS sites. A Type 3 maximum ozone site for the Philadelphia area was located at Rider University in Mercer County. A secondary Type 2 (or Type 2A) maximum emissions site was located downwind of the Philadelphia Metropolitan urban area in Camden. The 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.

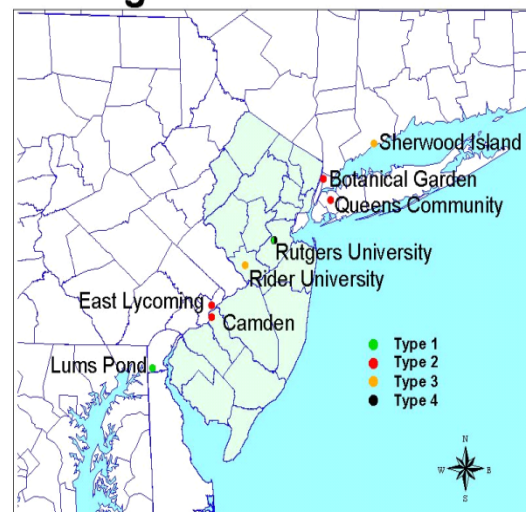
Figure 1



⁵ USEPA, PAMS General Information

Figure 2

Regional PAMS Sites

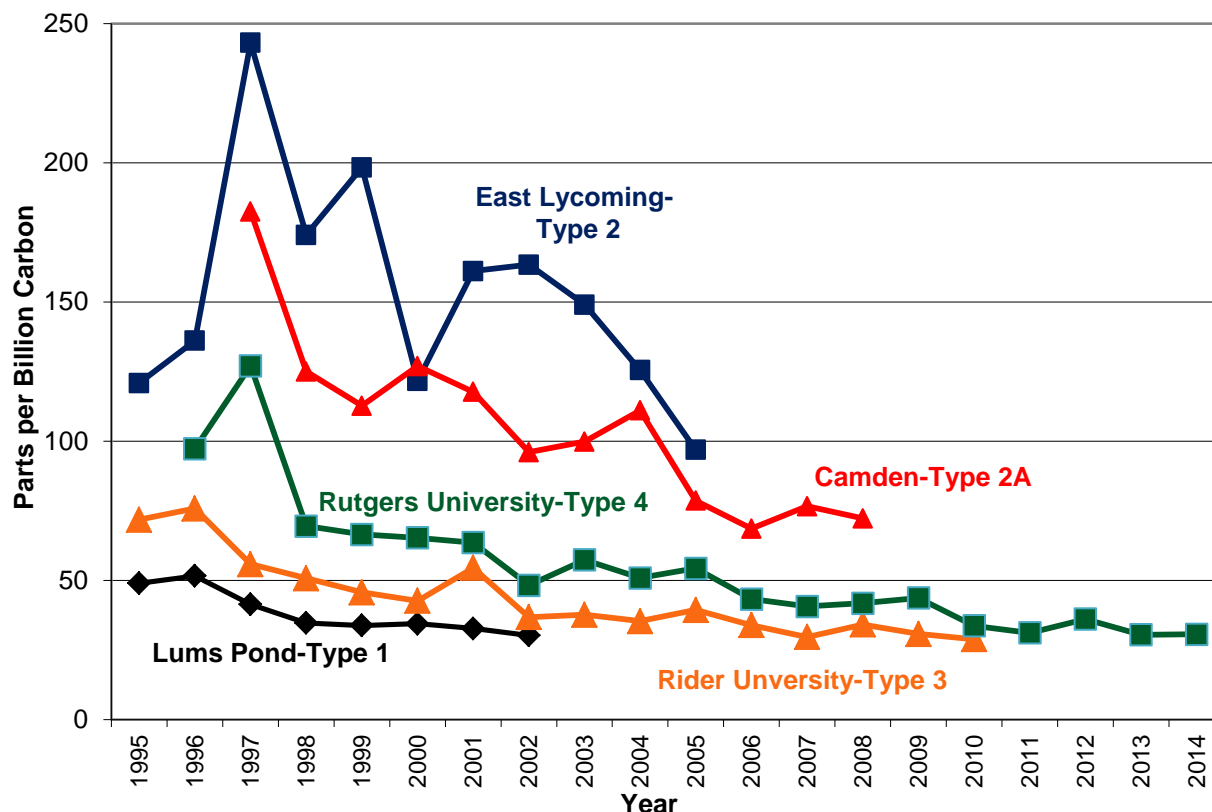


Note: Rutgers University PAMS site is both Type 4 for Philadelphia and Type 1 for New York City.

PHILADELPHIA REGION

Figure 3 shows VOC trends for the PAMS sites for the Philadelphia Metropolitan area. In general, at the 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 the other sites are mostly impacted by transportation sources.

Figure 3
Philadelphia Region
Total Non-Methane Organic Carbon (TNMOC)
Seasonal Average 1995-2014



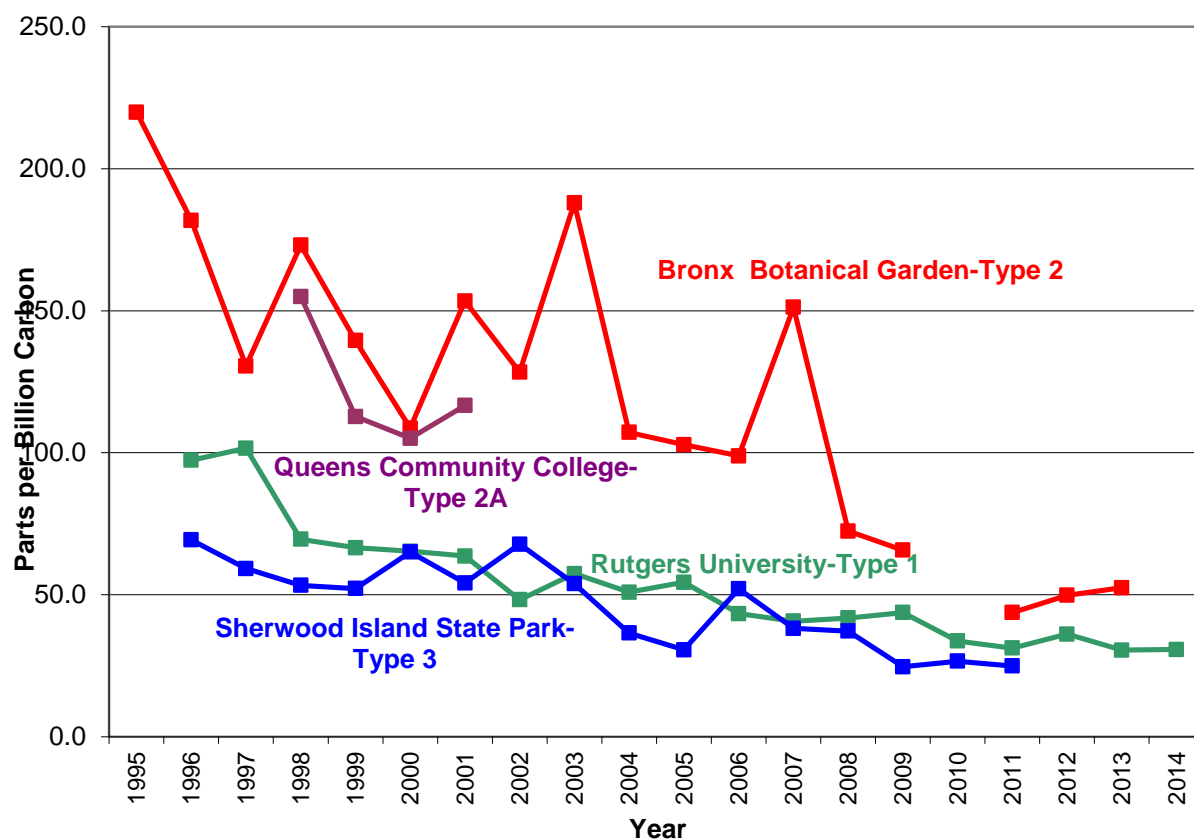
NOTE: Delaware's Department of Natural Resources and Environmental Control (DNREC) discontinued operation of the Lums Pond site after the 2002 season. Philadelphia's Air Management Services Laboratory still operates the PAMS site at their East Lycoming lab, but as of 2006 they no longer report Total Non-Methane Organic Carbon (TNMOC). Our Camden site was shut down in 2008 when we lost access to the site. The Rider University site was removed from the PAMS network following the 2010 season. An evaluation of the site showed this data was not significantly different from the Rutgers University site and it was discontinued as part of an overall restructuring of the monitoring network.

NEW YORK REGION

Figure 4 shows VOC trends for the PAMS sites in the New York City metropolitan area. In general, observations in the NYC area 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.

NOTE: Operation of the Queens Community College site was discontinued after the 2001 season. No data was reported for the Bronx Botanical Garden site for 2010 due to equipment problems. The Sherwood Island site began using new equipment in 2012 which doesn't allow for a measure of TNMOC.

Figure 4
New York City Region
Total Non-Methane Organic Carbon (TNMOC)
Seasonal Average 1995-2014



SUMMARY

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

Results for all of the VOCs measured at the New Jersey PAMS sites can be found in Table 1.

Table 1
Summary of Photochemical Assessment Monitoring (PAMS) Data
June, July and August 2014

Parts per Billion (Volume) – ppbv
Parts per Billion (Carbon) – ppbC

	Rutgers University			
	ppbv		ppbC	
	Average	Maximum	Average	Maximum
Acetylene	0.11	5.57	0.23	11.14
Benzene	0.05	0.63	0.33	3.80
n-Butane	0.44	8.06	1.74	32.23
1-Butene	0.02	0.32	0.08	1.26
cis-2-Butene	0.01	0.72	0.05	2.87
trans-2-Butene	0.02	0.46	0.07	1.83
Cyclohexane	0.03	0.53	0.16	3.16
Cyclopentane	0.02	0.50	0.10	2.48
n-Decane	0.01	0.27	0.11	2.66
m-Diethylbenzene	0.01	0.09	0.12	0.94
p-Diethylbenzene	0.01	0.26	0.11	2.62
2,2-Dimethylbutane	0.01	0.20	0.07	1.19
2,3-Dimethylbutane	0.03	0.70	0.17	4.19
2,3-Dimethylpentane	0.02	0.29	0.14	2.06
2,4-Dimethylpentane	0.03	0.98	0.18	6.85
Ethane	1.99	10.39	3.97	20.77
Ethylbenzene	0.02	0.29	0.13	2.33
Ethylene (Ethene)	0.20	5.29	0.39	10.57
m-Ethyltoluene	0.01	0.25	0.09	2.28
o-Ethyltoluene	0.01	0.12	0.05	1.08
p-Ethyltoluene	0.02	0.46	0.17	4.13

Table 1 (Continued)
 Summary of Photochemical Assessment Monitoring (PAMS) Data
 June, July and August 2014

Parts per Billion (Volume) – ppbv
 Parts per Billion (Carbon) – ppbC

	Rutgers University			
	ppbv		ppbC	
	Average	Maximum	Average	Maximum
n-Heptane	0.09	1.05	0.63	7.37
Hexane	0.06	1.30	0.33	7.78
1-Hexene	0.01	0.30	0.08	1.82
Isobutane	0.16	1.80	0.65	7.19
Isopentane	0.38	14.90	1.90	74.50
Isoprene	0.16	2.89	0.79	14.45
Isopropylbenzene	0.01	0.08	0.06	0.73
Methylcyclohexane	0.03	0.43	0.18	3.03
Methylcyclopentane	0.03	0.45	0.19	2.67
2-Methylheptane	0.01	0.21	0.07	1.23
3-Methylheptane	0.01	0.23	0.07	1.37
2-Methylhexane	0.02	0.35	0.17	2.77
3-Methylhexane	0.03	0.39	0.21	3.13
2-Methylpentane	0.06	1.80	0.45	12.63
3-Methylpentane	0.04	1.04	0.29	7.28
n-Nonane	0.01	0.25	0.11	2.26
n-Octane	0.01	0.34	0.12	2.74
n-Pentane	0.22	6.85	1.09	34.23
1-Pentene	0.01	1.00	0.06	5.02
cis-2-Pentene	0.01	0.94	0.04	4.68
trans-2-Pentene	0.01	1.85	0.07	9.25
Propane	0.93	18.83	2.79	56.50
n-Propylbenzene	0.01	0.07	0.05	0.61
Propylene (Propene)	0.15	1.86	0.44	5.58
Styrene	0.01	0.09	0.09	0.73
Toluene	0.15	1.60	1.07	11.23
1,2,3-Trimethylbenzene	0.03	0.99	0.28	8.92
1,2,4-Trimethylbenzene	0.03	0.45	0.25	4.01
1,3,5-Trimethylbenzene	0.01	0.19	0.06	1.73
2,2,4-Trimethylpentane	0.03	0.46	0.23	3.65
2,3,4-Trimethylpentane	0.02	0.30	0.19	2.41
n-Undecane	0.01	0.25	0.09	2.70
m/p-Xylene	0.05	1.17	0.41	9.35
o-Xylene	0.02	0.43	0.18	3.43

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2014 Air Toxics Summary

New Jersey Department of Environmental Protection

INTRODUCTION

Air pollutants can be divided into two categories: 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 since the 1970s. 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 New Jersey Department of Environmental Protection (NJDEP) 2014 Air Quality Report.

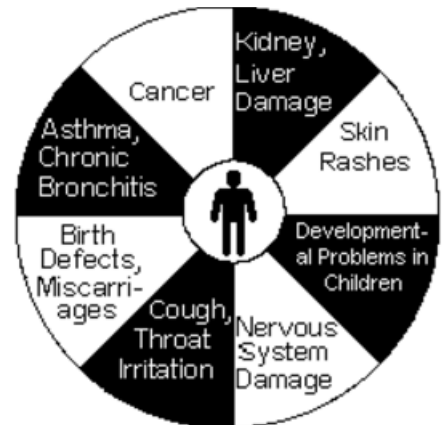
Air toxics are basically all the other chemicals released into the air that have the potential to cause adverse health effects in humans. These effects cover a wide range of conditions, from lung irritation to birth defects to cancer (see Figure 1). There are no NAAQS for these pollutants, but in 1990 the U.S. Congress directed the USEPA to begin addressing 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.nj.gov/dep/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 noncancer 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 soil or surface water. 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 based on toxicity values developed by the USEPA and other agencies, using chemical-specific health studies. For carcinogens (chemicals suspected of causing cancer) the health benchmark is 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 a noncarcinogen is the air concentration at which no adverse health effect is expected to occur, even if a person is exposed to that concentration on a daily basis for a lifetime (this is also known as a reference concentration). Not all air toxics have health benchmarks, because of a lack of toxicity studies. Available health benchmarks for the air toxics monitored in New Jersey are listed in Tables 6 through 9. If ambient air concentrations exceed the health benchmarks, then some action, such as a reduction in emissions, should be considered.

Figure 1
Potential Effects of Air Toxics



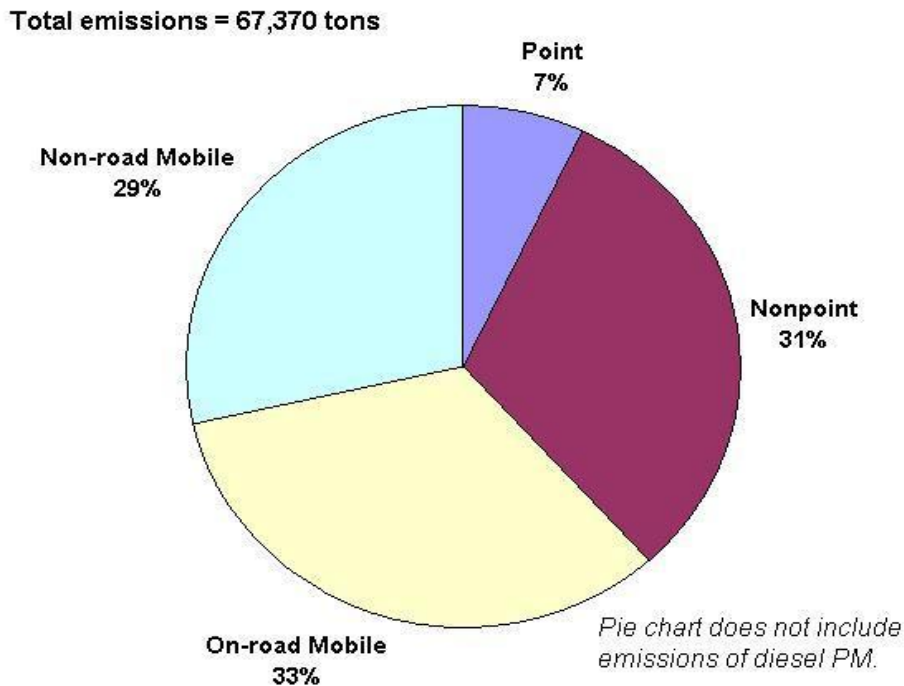
Source: www3.epa.gov/ttn/atw/3_90_024.html

SOURCES OF AIR TOXICS

A number of years ago, USEPA began the National-Scale Air Toxics Assessment (NATA). Starting with the year 1996, they set out on a three-year cycle to determine people's exposure to air toxics around the country. To do this, USEPA first prepares a comprehensive inventory of air toxics emissions from all man-made sources. The emissions inventory is reviewed and updated by each state. Although there are likely to be some errors in the details of such a massive undertaking, the emissions inventory still gives us a reasonable indication of the most important sources of air toxic emissions in our state. The pie chart in Figure 1, based on the most recent NATA emissions estimates, shows that mobile sources are the largest contributors of air toxics emissions in New Jersey. (The most recent NATA, released in 2011, was for 2005. A 2011 update is expected to be released in late 2015.)

On-road mobile sources (cars and trucks) account for 33% of the air toxics emissions, and non-road mobile sources (airplanes, trains, construction equipment, lawnmowers, boats, dirt bikes, etc.) contribute an additional 20%. Nonpoint sources (residential, commercial, and small industrial sources) represent 31% of the inventory, and point sources (such as factories and power plants) account for the remaining 7%.

Figure 2
2005 Air Toxics Emissions Source
Estimates for New Jersey

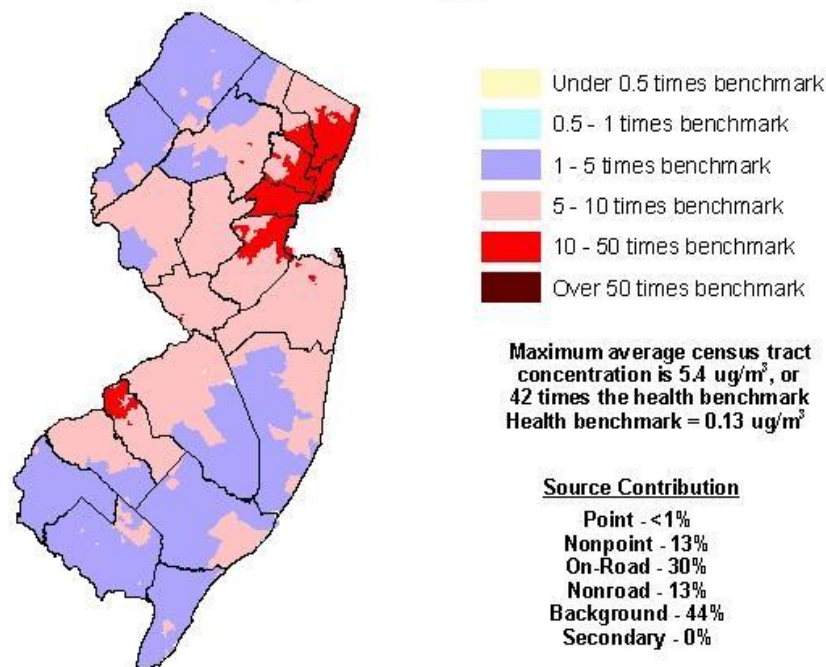


ESTIMATING AIR TOXICS EXPOSURE

There are a limited number of air toxics monitors located throughout the country, because of costs and logistics. In order to estimate air toxics concentrations in areas across the U.S., especially those areas with no monitors, USEPA's NATA project uses its emissions inventory in an air dispersion model that predicts ambient annual average concentrations. (A comparison of NATA estimates with monitoring data is presented in Figure 19).

The map in Figure 3 shows the NATA-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 or airborne transport, but in general, higher population densities result in greater emissions of, and exposure to, air toxics. Maps for other air toxics can be found at www.nj.gov/dep/airtoxics/nataest05.htm.

Figure 3
BENZENE - 2005 NATA Predicted
Concentrations for New Jersey



Analysis of the NATA state and county average air toxics concentrations indicates that twenty-three chemicals were predicted to exceed their health benchmarks, or level of concern, in one or more counties in 2005. Twenty-two of these chemicals were evaluated based on their cancer potency, and one (acrolein) was based on non-cancer effects. Estimated air concentrations of these 23 pollutants vary around the state, depending on the types of sources that emit them. This is summarized in Table 1.

Table 1
Air Toxics of Greatest Concern in New Jersey
Based on 2005 National-Scale Air Toxics Assessment

Pollutant of Concern	Number of Counties Above Health Benchmark	Primary Source of Emissions
Acetaldehyde	Statewide	Background, secondary
Acrolein	Statewide	Background, nonpoint
Acrylonitrile	2 (Bergen & Essex)	Point, nonpoint
Arsenic Compounds	19	Background, secondary
Benzene	Statewide	Background, mobile
1,3-Butadiene	Statewide	Background, mobile
Cadmium Compounds	1 (Warren)	Nonpoint, background
Carbon Tetrachloride	Statewide	Background
Chloroform	Statewide	Nonpoint, background
Chromium (hexavalent)	20	Background, point
Cobalt Compounds	7	Point
1,4-Dichlorobenzene	8	Nonpoint, background
1,3-Dichloropropene	1 (Hudson)	Nonpoint
Diesel Particulate Matter	Statewide	Mobile
Ethylbenzene	6	Mobile, nonpoint
Ethylene Oxide	6	Background, nonpoint
Formaldehyde	Statewide	Background, secondary
Methyl Chloride	Statewide	Background
Naphthalene	20	Nonpoint, mobile
Nickel compounds	1 (Hudson)	Nonpoint, point
PAH/POM	18	Nonpoint
Tetrachloroethylene	8	Nonpoint, background
1,1,2-Trichloroethane	1 (Salem)	Nonpoint

NEW JERSEY AIR TOXICS MONITORING PROGRAM RESULTS FOR 2014

NJDEP has four air toxics monitoring sites for volatile organic compounds (VOCs) around the state (located in Camden, Chester, Elizabeth, and New Brunswick), and five for toxic metals (Camden, Chester, Elizabeth, New Brunswick, and Newark).

The Chester monitoring site is in rural Morris County, away from known sources, and serves as kind of a “background” monitor. The New Brunswick monitoring station is in a suburban setting, and the Elizabeth monitor is located next to the Exit 13 tollbooths on the New Jersey Turnpike. The Camden monitor is located in an

industrial urban setting, while the Newark monitoring site is in an urban residential area. More information about the air monitoring sites can be found in the annual Air Quality Report at www.njaqinow.net/.

A previous monitoring site in Camden (officially called the Camden Lab site) was shut down on September 29, 2008, because NJDEP lost access to the location. The Camden Lab site had been measuring several toxics since 1989. The new monitoring site in Camden (formally called the Camden Spruce Street site) became operational in 2013. The Elizabeth air toxics site (formally called the Elizabeth Lab site) began measuring VOCs in 2000, and the New Brunswick and Chester sites started in July 2001. Analysis of toxic metals at these sites also began in 2001, with the Newark Firehouse site added in 2010. Data for some of the toxic metals will be discussed below.

New Jersey's VOC monitors are part of the Urban Air Toxics Monitoring Program (UATMP), sponsored by the U.S. Environmental Protection Agency. A 24-hour integrated air sample is collected in a canister every six days, and then sent to the EPA contract laboratory (ERG, located in North Carolina) to be analyzed for VOCs and carbonyls (a subset of VOCs that includes formaldehyde and acetaldehyde).

2014 air toxic monitoring results for VOCs are shown in Table 2. This table contains the annual average concentration for each air toxic measured at the four New Jersey monitoring sites. All values are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). More detail can be found in Tables 6 through 9, including additional statistics, detection limit information, health benchmarks used by NJDEP, risk ratios, and concentrations in parts per billion by volume (ppbv). The ppbv units are more common in air monitoring, while $\mu\text{g}/\text{m}^3$ units are generally used in air dispersion modeling and health studies. Many of the compounds that were analyzed were below the detection limit of the method used. These are listed separately in Table 10.

Reported averages for chemicals with less than 50% of the samples above the detection limit should be viewed with caution. Median values (the value of the middle sample value when the results are ranked) are reported in Tables 6 through 9 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 (the basis for the air toxics health benchmarks).

The Chester site had the lowest concentrations for the bulk of the prevalent air toxics. The highest concentrations for many compounds were found in Camden.

USEPA has recently determined that the methods used to collect and analyze acrolein in ambient air are not producing reliable results. More information is available at <http://archive.epa.gov/schoolair/web/html/acrolein.html>. Although we are including the 2014 New Jersey acrolein data in this report, the concentrations are highly uncertain and should be viewed as such.

This report includes results for toxic metals from the particulate speciation monitors in Camden, Chester, Elizabeth, New Brunswick, and Newark. The data is collected every three days. Monitoring data for other speciated particulate can be found in Appendix B (Fine Particulate Speciation Summary) of the annual Air Quality Report (www.njaqinow.net/). Table 3 presents the annual average concentrations for the toxic metals which have a health benchmark, along with estimated risk ratios. (For more information see the section on "Estimating Health Risk" below.) Chromium and nickel have health benchmarks that are based on carcinogenicity of specific compounds. Since the monitoring method only measures total chromium or nickel and cannot distinguish between different types of compounds, cancer risk ratios are not calculated with those benchmarks. However, risk ratios are calculated for nickel based on noncancer effects.

Table 2
2014 Summary of Toxic Volatile Organic Compounds Monitored in New Jersey

Annual Average Concentration
micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Synonym	HAP	CAS No.	Camden	Chester	Elizabeth	New Brunswick
Acetaldehyde		*	75-07-0	2.488	1.249	2.771	2.865
Acetone			67-64-1	2.904	2.149	2.796	2.736
Acetonitrile		*	75-05-8	0.501	0.666	0.489	1.680
Acetylene			74-86-2	0.856	0.479	0.971	0.677
Acrolein ^a		*	107-02-8	1.077	1.145	0.990	1.056
Acrylonitrile		*	107-13-1	<i>0.019</i>	<i>0.081</i>	0.650	0.221
tert-Amyl Methyl Ether			994-05-8	ND	<i>0.0003</i>	ND	<i>0.001</i>
Benzaldehyde			100-52-7	0.251	0.059	0.112	0.200
Benzene		*	71-43-2	0.754	0.469	0.782	0.535
Bromochloromethane			74-97-5	ND	ND	ND	ND
Bromodichloromethane			75-27-4	<i>0.003</i>	<i>0.002</i>	<i>0.005</i>	<i>0.008</i>
Bromoform		*	75-25-2	<i>0.004</i>	<i>0.009</i>	<i>0.012</i>	<i>0.012</i>
Bromomethane	Methyl bromide	*	74-83-9	3.493	0.062	0.050	0.056
1,3-Butadiene		*	106-99-0	0.094	0.059	0.119	0.065
Butyraldehyde			123-72-8	0.409	0.157	0.356	0.608
Carbon Disulfide		*	75-15-0	1.254	2.420	16.744	5.069
Carbon Tetrachloride		*	56-23-5	0.606	0.604	0.618	0.630
Chlorobenzene		*	108-90-7	<i>0.001</i>	<i>0.004</i>	<i>0.004</i>	<i>0.003</i>
Chloroethane	Ethyl chloride	*	75-00-3	<i>0.023</i>	<i>0.039</i>	<i>0.023</i>	<i>0.047</i>
Chloroform		*	67-66-3	0.131	0.115	0.152	0.464
Chloromethane	Methyl chloride	*	74-87-3	1.317	1.420	1.195	1.166
Chloroprene	2-Chloro-1,3-butadiene	*	126-99-8	ND	ND	<i>0.002</i>	ND
Crotonaldehyde			123-73-9	0.272	0.250	0.257	0.324
Dibromochloromethane			594-18-3	0.028	0.032	0.036	0.035
1,2-Dibromoethane	Ethylene dibromide	*	106-93-4	ND	<i>0.003</i>	<i>0.002</i>	<i>0.004</i>
m-Dichlorobenzene	1,3-Dichlorobenzene		541-73-1	<i>0.015</i>	<i>0.024</i>	<i>0.002</i>	<i>0.006</i>
o-Dichlorobenzene	1,2-Dichlorobenzene		95-50-1	<i>0.003</i>	<i>0.004</i>	<i>0.005</i>	<i>0.008</i>
p-Dichlorobenzene	1,4-Dichlorobenzene	*	106-46-7	<i>0.035</i>	<i>0.015</i>	<i>0.041</i>	<i>0.028</i>
Dichlorodifluoromethane			75-71-8	2.564	2.482	2.510	2.498
1,1-Dichloroethane	Ethylidene dichloride	*	75-34-3	ND	<i>0.001</i>	<i>0.001</i>	<i>0.001</i>
1,2-Dichloroethane	Ethylene dichloride	*	107-06-2	0.081	0.076	0.086	0.079
1,1-Dichloroethylene	Vinylidene chloride	*	75-35-4	ND	<i>0.001</i>	<i>0.002</i>	<i>0.001</i>
cis-1,2-Dichloroethylene	cis-1,2-Dichloroethene		156-59-2	ND	ND	<i>0.004</i>	ND
trans-1,2-Dichloroethylene	trans-1,2-Dichloroethene		156-60-5	<i>0.002</i>	ND	ND	ND
Dichloromethane	Methylene chloride	*	75-09-2	0.537	0.496	0.644	0.552

- Values in **italics** indicate averages based on less than 50% of samples above the detection limit.
- **ND** indicates that all samples were below the detection limit.
- HAP = Hazardous air pollutant as listed in the Clean Air Act.

^a Acrolein concentrations are highly uncertain because of problems with collection and analysis methods.

Table 2 (continued)
2014 Summary of Toxic Volatile Organic Compounds Monitored in New Jersey

Annual Average Concentration
micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Synonym	HAP	CAS No.	Camden	Chester	Elizabeth	New Brunswick
1,2-Dichloropropane	Propylene dichloride	*	78-87-5	0.001	ND	ND	ND
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene	*	542-75-6	ND	0.001	0.0007	ND
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene	*	542-75-6	ND	ND	ND	ND
Dichlorotetrafluoroethane	Freon 114		76-14-2	0.121	0.123	0.125	0.125
2,5-Dimethylbenzaldehyde			5799-94-2	ND	ND	ND	ND
Ethyl Acrylate		*	140-88-5	ND	ND	ND	ND
Ethyl tert-Butyl Ether	tert-Butyl ethyl ether		637-92-3	0.015	0.034	0.196	0.071
Ethylbenzene		*	100-41-4	0.324	0.108	0.362	0.245
Formaldehyde		*	50-00-0	4.466	2.059	4.431	11.044
Hexachloro-1,3-butadiene	Hexachlorobutadiene	*	87-68-3	0.015	0.023	0.024	0.023
Hexaldehyde	Hexanaldehyde		66-25-1	0.232	0.046	0.130	0.471
Isovaleraldehyde			590-86-3	ND	ND	ND	ND
Methyl Ethyl Ketone	MEK		78-93-3	0.516	0.315	0.475	0.575
Methyl Isobutyl Ketone	MIBK	*	108-10-1	0.403	0.117	0.175	0.142
Methyl Methacrylate		*	80-62-6	0.010	0.003	0.022	0.004
Methyl tert-Butyl Ether	MTBE	*	1634-04-4	0.157	0.178	0.077	0.038
n-Octane			111-65-9	0.234	0.183	0.278	0.136
Propionaldehyde		*	123-38-6	0.423	0.198	0.414	0.521
Propylene			115-07-1	1.019	0.563	2.876	0.614
Styrene		*	100-42-5	1.137	0.057	0.102	0.199
1,1,1,2-Tetrachloroethane		*	79-34-5	0.008	0.011	0.137	0.043
Tetrachloroethylene	Perchloroethylene	*	127-18-4	0.116	0.069	0.156	0.093
Tolualdehydes				0.128	0.057	0.119	0.267
Toluene		*	108-88-3	2.508	0.615	1.662	0.805
1,2,4-Trichlorobenzene		*	102-82-1	0.001	0.004	0.003	0.008
1,1,1-Trichloroethane	Methyl chloroform	*	71-55-6	0.036	0.032	0.040	0.038
1,1,2-Trichloroethane		*	79-00-5	ND	ND	ND	ND
Trichloroethylene		*	79-01-6	0.041	0.003	0.028	0.016
Trichlorofluoromethane			75-69-4	1.845	1.304	1.348	1.325
Trichlorotrifluoroethane	1,1,2-Trichloro-1,2,2-trifluoroethane		76-13-1	0.603	0.619	0.619	0.617
1,2,4-Trimethylbenzene			95-63-6	0.389	0.111	0.297	0.196
1,3,5-Trimethylbenzene			108-67-8	0.136	0.060	0.113	0.090
Valeraldehyde			110-62-3	0.193	0.047	0.144	0.372
Vinyl chloride		*	75-01-4	0.009	0.001	0.003	0.003
m,p-Xylene		*	1330-20-7	0.932	0.220	0.913	0.416
o-Xylene		*	95-47-6	0.406	0.103	0.381	0.191

- Values in **italics** indicate averages based on less than 50% of samples above the detection limit.
- **ND** indicates that all samples were non-detectable, that is, below the detection limit.
- HAP = Hazardous air pollutant as listed in the Clean Air Act.

Table 3
2014 New Jersey Toxic Metals Summary & Risk Ratios

Pollutant	HAP ^a	Annual average concentration (µg/m ³)					Health Benchmark (µg/m ³) ^b	Risk Ratio ^c				
		Camden	Chester	Elizabeth	New Brunswick	Newark		Camden	Chester	Elizabeth	New Brunswick	Newark
Antimony	*	0.019	0.017	0.016	0.018	0.018	0.2	0.1	0.1	0.1	0.1	0.1
Arsenic	*	0.0009	0.0004	0.0004	0.0005	0.001	2.30E-04	4	2	2	2	4
Cadmium	*	0.002	0.001	0.002	0.002	0.002	2.40E-04	8	4	8	8	8
Chlorine	*	0.178	0.006	0.038	0.014	0.027	0.2	0.9	0.03	0.2	0.1	0.1
Chromium ^e	*	0.006	0.004	0.003	0.003	0.004	8.30E-05	See "d" below				
Cobalt	*	0.001	0.001	0.001	0.001	0.001	1.10E-04	9	9	9	9	9
Lead	*	0.005	0.001	0.001	0.001	0.001	0.15	0.03	0.01	0.01	0.01	0.01
Manganese	*	0.003	0.001	0.002	0.001	0.001	0.05	0.06	0.02	0.04	0.02	0.02
Nickel	*	0.003	0.001	0.002	0.001	0.002	0.05	0.06	0.02	0.04	0.02	0.04
Nickel ^f	*	0.003	0.001	0.002	0.001	0.002	2.10E-03	See "e" below				
Phosphorus	*	0.005	0.005	0.005	0.005	0.005	0.07	0.1	0.1	0.1	0.1	0.1
Selenium	*	0.001	0.001	0.001	0.001	0.001	20	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon		0.067	0.037	0.070	0.049	0.056	3	0.02	0.01	0.02	0.02	0.02
Vanadium		0.002	0.001	0.002	0.001	0.002	0.1	0.02	0.01	0.02	0.01	0.02

^a HAP = Hazardous air pollutant listed in the Clean Air Act.

^b The health benchmark is defined as the chemical-specific air concentration above which there may be human health concerns. Toxicity values are not available for all chemicals. For more information, go to www.nj.gov/dep/agpp/risk.html.

Health benchmarks in italics have a cancer endpoint.

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.

^c The risk ratio for a chemical is a comparison of the annual mean air concentration to the health benchmark. A risk ratio greater than one may be of concern.

^d Chromium - The health benchmark is based on carcinogenicity of hexavalent chromium (Cr⁺⁶). It is not known how much of the chromium measured by the monitor is hexavalent.

^e Nickel - The cancer-based health benchmark for nickel is based on specific nickel compounds. It is not known how much of the nickel measured by the monitor is in that form.

More information on speciated fine particulate matter measured in New Jersey can be found in the NJDEP's 2014 Air Quality Report, Appendix B - Fine Particulate Speciation Summary, at www.njaqinow.net/.

ESTIMATING HEALTH RISK

A simplified way to determine whether the ambient concentration of an air toxic could pose a potential human health risk is to compare the air concentration to a health benchmark. The number that we get when we divide the concentration by the benchmark is called a **risk ratio**. If the risk ratio is less than one, the air concentration should not pose a health risk. If it is greater than one, it may be of concern. The risk ratio also indicates how much higher or lower the estimated air concentration is compared to the health benchmark.

The pollutants with risk ratios greater than one for at least one monitoring site are summarized in Table 4. In addition to the toxic VOCs and carbonyls, speciated metals were also evaluated for risk. Elizabeth, and New Brunswick had fourteen pollutants with annual average concentrations that exceeded their health benchmarks, Chester had thirteen, and Camden had twelve. The toxic VOCs with risk ratios greater than one at all sites are acetaldehyde, acrylonitrile, benzene, 1,3-butadiene, carbon tetrachloride, chloroform, chloromethane (methyl chloride), 1,2-dichloroethane, and formaldehyde. Toxic metals that had risk ratios greater than one at the five monitoring sites were arsenic, cadmium, and cobalt.

Although the mean concentrations of acrolein exceeded the health benchmark at all sites (see Tables 6 through 9), they are not included here because of problems with the sampling method. Formaldehyde contributed the highest risks, but note that the risks varied substantially from site to site. Risk ratios for 1,1,2,2-tetrachloroethane were of concern only at Elizabeth and New Brunswick, but these are based on detection levels of 51% and 20%, respectively. Details for each site, including health benchmarks used to calculate risk ratios, can be found in Tables 6 through 9.

Table 4 can be compared with the risk results predicted by NATA in Table 5. Chromium and nickel cancer risk cannot be estimated from monitoring data because the sampling method measures total chromium and total nickel concentrations; the amounts that are in the carcinogenic form cannot be determined. 1,3-Dichloropropene and 1,1,2-trichloroethane samples were mostly below the detection limits, so no annual average concentration could be calculated. Ethylene oxide and naphthalene are not sampled at the New Jersey sites. PAH/POM are polycyclic aromatic hydrocarbons/polycyclic organic matter, a broad class of compounds that are not measured in New Jersey because of a lack of a practical sampling method. On the other hand, acrylonitrile is measured in New Jersey at levels higher than estimated by NATA.

NATA estimates show concentrations of diesel particulate matter (DPM) in New Jersey that are at levels that potentially pose a higher cancer risk than the other air toxics combined. However, actually measuring diesel in the ambient air is problematic. It is difficult to distinguish particulate matter emitted by diesel engines from other types of particulate matter. Diesel emissions consist of agglomerated and condensed fine particles and gases, onto which are adsorbed potentially hundreds of compounds formed by incomplete combustion, such as polycyclic aromatic hydrocarbons (PAHs) and nitrated PAHs. Some of these very specific compounds have been suggested as indicators for DPM, but sampling technologies and costs continue to be obstacles. Elemental carbon is sometimes assumed to be an indicator for diesel emissions. See Figure 3 for a comparison of DPM concentrations from NATA with monitored concentrations of elemental carbon. For more information about diesel, see www.nj.gov/dep/airtoxics/diesemis.htm.

Table 4
 Monitored Toxic Air Pollutants with Risk Ratios Greater Than One in NJ for 2014

POLLUTANT		Risk Ratio				
		Camden	Chester	Elizabeth	New Brunswick	Newark
1	Acetaldehyde	6	3	6	6	
2	Acrylonitrile	<i>1.3</i>	5	43	15	
3	Arsenic	4	2	2	2	4
4	Benzene	6	4	6	4	
5	1,3-Butadiene	3	1.8	4	2	
6	Cadmium	8	4	8	8	8
7	Carbon Tetrachloride	9	9	9	9	
8	Chloroform	3	3	4	11	
9	Chloromethane	2	3	2	2	
10	Cobalt	9	9	9	9	9
11	1,2-Dibromoethane		<i>1.7</i>	<i>1.3</i>	2	
12	1,2-Dichloroethane	2	2	2	2	
13	Formaldehyde	58	27	58	143	
14	1,1,2,2-Tetrachloroethane			8	3	

Values in italics are based on less than 50% of samples above the detection limit.

Figure 4. Comparison of Elemental Carbon Monitoring Data with NATA 2005 Predicted Concentrations for Diesel PM

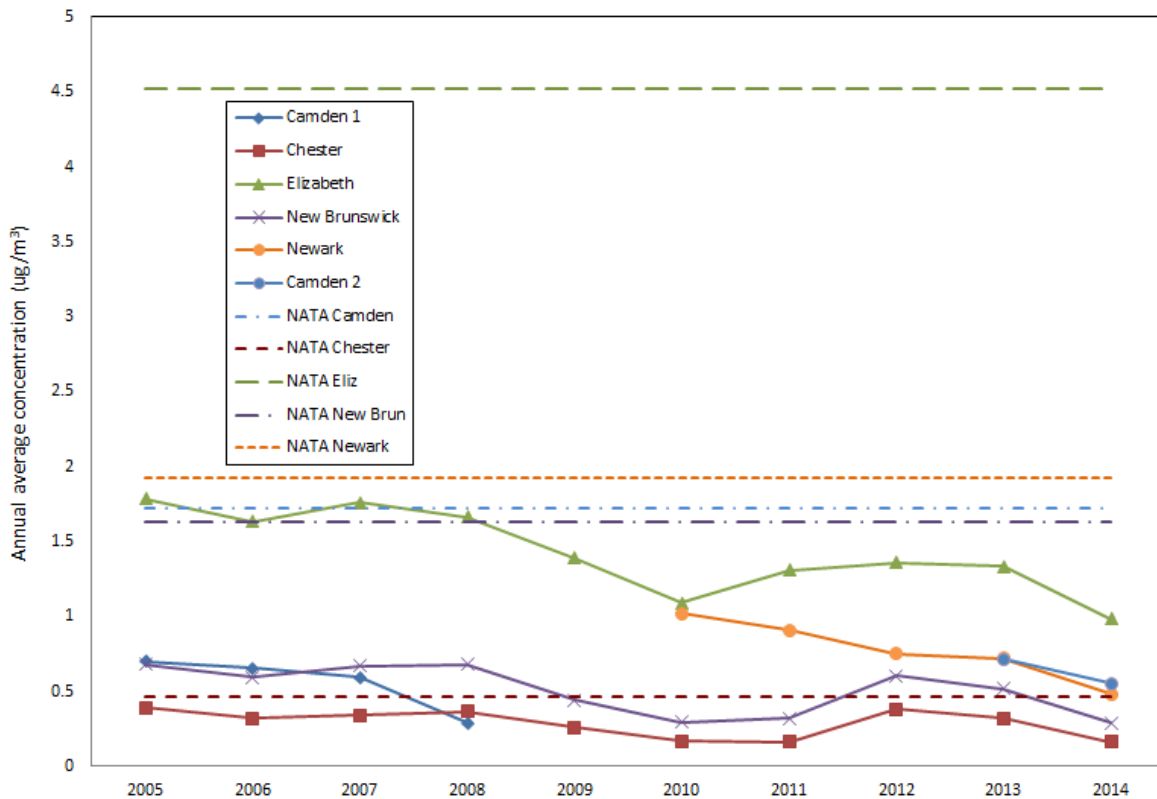


Table 5
2005 NATA Modeled Air Concentrations Compared to Health Benchmarks
New Jersey Statewide Averages

Pollutant	Modeled Air Concentration ($\mu\text{g}/\text{m}^3$)	Health Benchmark ($\mu\text{g}/\text{m}^3$)	Risk Ratio	% Contribution from				
				Major Sources	Area Sources	On-Road Mobile Sources	Nonroad Mobile Sources	Background & Secondary Formation
Acetaldehyde	1.9	0.45	4.3	<1%	4%	6%	3%	87%*
Acrolein	0.062	0.020	3.1	<1%	22%	14%	9%	55%*
Arsenic compounds	0.00053	0.00023	2.3	3%	13%	5%	5%	74%
Benzene	1.3	0.13	10	<1%	13%	30%	13%	44%
1,3-Butadiene	0.095	0.033	2.9	<1%	<1%	40%	17%	43%
Cadmium compounds	0.00011	0.00024	0.5	12%	44%	0%	1%	43%
Carbon tetrachloride	0.61	0.17	3.6	0%	<1%	0%	0%	100%
Chloroform	0.13	0.043	3.1	<1%	54%	0%	0%	46%
Chromium (hexavalent form)	0.00024	0.000083	2.9	29%	10%	4%	1%	56%
Cobalt Compounds	0.000093	0.00011	0.8	93%	7%	0%	0%	0%
1,4-Dichlorobenzene	0.12	0.091	1.3	<1%	58%	0%	0%	42%
1,3-Dichloropropene	0.14	0.25	0.5	0%	100%	0%	0%	0%
Diesel particulate matter	1.1	0.0033	327	0%	0%	47%	53%	0%
Ethylbenzene	0.34	0.40	0.9	1%	30%	45%	24%	0%
Ethylene oxide	0.011	0.011	1.0	12%	18%	0%	0%	70%
Formaldehyde	2.2	0.077	28	<1%	3%	9%	6%	82%*
Methyl chloride	1.2	0.56	2.2	<1%	1%	0%	0%	99%
Naphthalene	0.13	0.029	4.6	1%	48%	26%	4%	21%
Nickel Compounds	0.0012	0.0021	0.6	36%	37%	2%	10%	15%
PAH/POM**	0.012	0.0072*	1.6	1%	79%	8%	12%	0%
Tetrachloroethylene	0.25	0.17	1.4	<1%	61%	0%	0%	39%
1,1,2-Trichloroethane	0.0066	0.063	0.1	<1%	100%	0%	0%	0%

- For information on risk ratios see section on “Estimating Health Risk” above.
- Chemicals with risk ratios greater than or equal to 1 are in bold.
- Risk ratios based on noncarcinogenic effects are in *italics*.
- For diesel particulate matter, onroad and nonroad concentrations include a model-estimated background concentration.
- *Acetaldehyde, acrolein and formaldehyde concentration estimates include secondary formation, which is the process by which chemicals in the air are transformed into other chemicals.
- **PAH/POM is "polycyclic aromatic hydrocarbons/polycyclic organic matter." These define a broad class of compounds. The chemicals making up this class were broken up into 8 groups based on toxicity, and each group was assigned a cancer-weighted toxicity estimate. 0.0072 $\mu\text{g}/\text{m}^3$ is the health benchmark average across the 8 groups.

TRENDS AND COMPARISONS

Monitoring of air toxics in New Jersey has been going on for over a decade, although it continues to evolve, with improvements in the ability to detect given chemicals at lower concentrations. Figures 5 through 15 present data for some of the VOCs that have been sampled over the past decade. As mentioned previously, the first toxics monitoring site in Camden (Camden Lab) was shut down in 2008. It is identified in Figures 5 through 15 as “Camden 1.” The new Camden site, located about two miles from the old site, is designated “Camden 2.”

According to USEPA's National Air Toxics Assessment (NATA), **acetaldehyde** concentrations in New Jersey (Figure 4) are primarily influenced by secondary formation, a process in which chemicals in the air are transformed into other chemicals by chemical reactions. Mobile sources also contribute to ambient levels. In 2003, no data was collected in Camden after September, which could have had an influence on the low annual average for that year. In 2004 in both Camden and New Brunswick, high levels of acetaldehyde were measured over a number of weeks. Note the similarity with the formaldehyde graph (Figure 14).

Acrylonitrile concentrations (Figure 6) are impacted by nonpoint sources and background. Elizabeth and New Brunswick samples were consistently higher than Camden and Chester (which were mostly below the detection limit) in 2013 and 2014, although the average values dropped in 2014. The high concentration in 2008 in Elizabeth is the result of a number of high sample values that year. Data for New Brunswick for 2012 were invalidated because of problems with the sampler.

Figure 7 shows a gradual decrease in **benzene** concentrations over the past decade. Most benzene now comes from mobile and area sources, and is also transported from other regions (background). Sources of **1,3-butadiene** (Figure 8) are similar to those of benzene.

Carbon tetrachloride (Figure 9) was once used extensively as a degreaser, household cleaner, propellant, refrigerant, and fumigant. It has been phased out of most production and use because of its toxicity and its ability to deplete stratospheric ozone. However, about 100 tons are still emitted annually by industry in the U.S, although no emissions have been reported in New Jersey for a number of years. It degrades slowly in the environment, so levels in the air remain relatively steady.

Some of the increase in **chloroform** concentrations shown in Figure 10 is believed to be from improvements in the detection limit. Nonpoint sources and background are the major contributors to ambient chloroform levels. The high annual average concentration for New Brunswick in 2014 is attributable to a period of high values in May and June.

Chloromethane (also known as methyl chloride) levels are influenced primarily by background. Figure 11 shows that concentrations have remained relatively stable from year to year, and that all the sites show similar levels.

1,4-Dichlorobenzene (Figure 12) is emitted primarily from nonpoint sources. It is used in products such as pesticides, disinfectant, mothballs and toilet deodorizer blocks. There is also a significant background level. The high annual average for New Brunswick in 2005 is attributable to an exceptionally high reading on July 27th that may be a lab error.

Ethylbenzene is associated with mobile sources, which is probably why it is higher at the Elizabeth monitoring site and lower at Chester (Figure 13). 2001 data for Chester and New Brunswick have been omitted from the graph because of technical problems encountered when sampling was begun that May.

Formaldehyde (Figure 14) is a ubiquitous pollutant that is often found at higher concentrations indoors rather than outdoors because of its use in many consumer goods. It is used in the production of fertilizer, paper, plywood, urea-formaldehyde resins, and many other products. In New Jersey the primary emitters of formaldehyde are on-road mobile sources, although secondary formation and transport contribute significantly to high outdoor concentrations. In 2014, concentrations at the New Brunswick site were consistently higher than at the other monitors.

Tetrachloroethylene (also known as perchloroethylene) (Figure 15) is used as an industrial solvent and in dry cleaning. It is a common contaminant of hazardous waste sites because of a tendency in the 20th century to dispose of it improperly. Production and demand for it by industry has been declining.

Figure 5
ACETALDEHYDE - New Jersey Monitored Concentrations

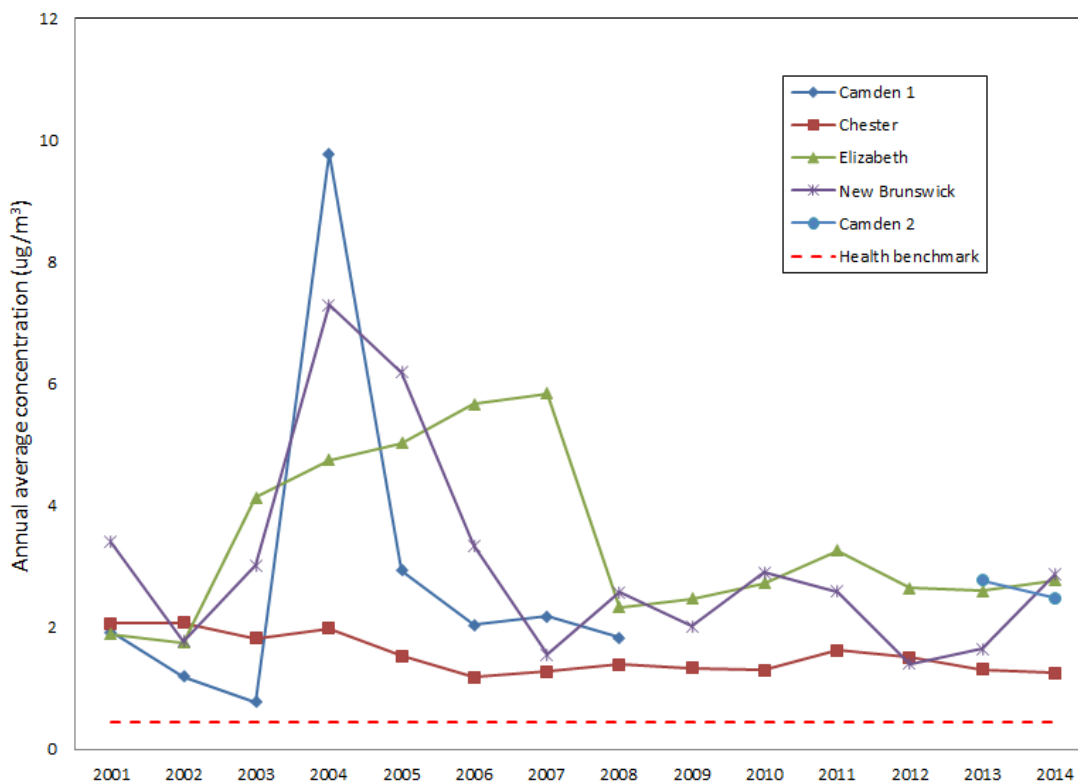


Figure 6
 ACRYLONITRILE – New Jersey Monitored Concentrations

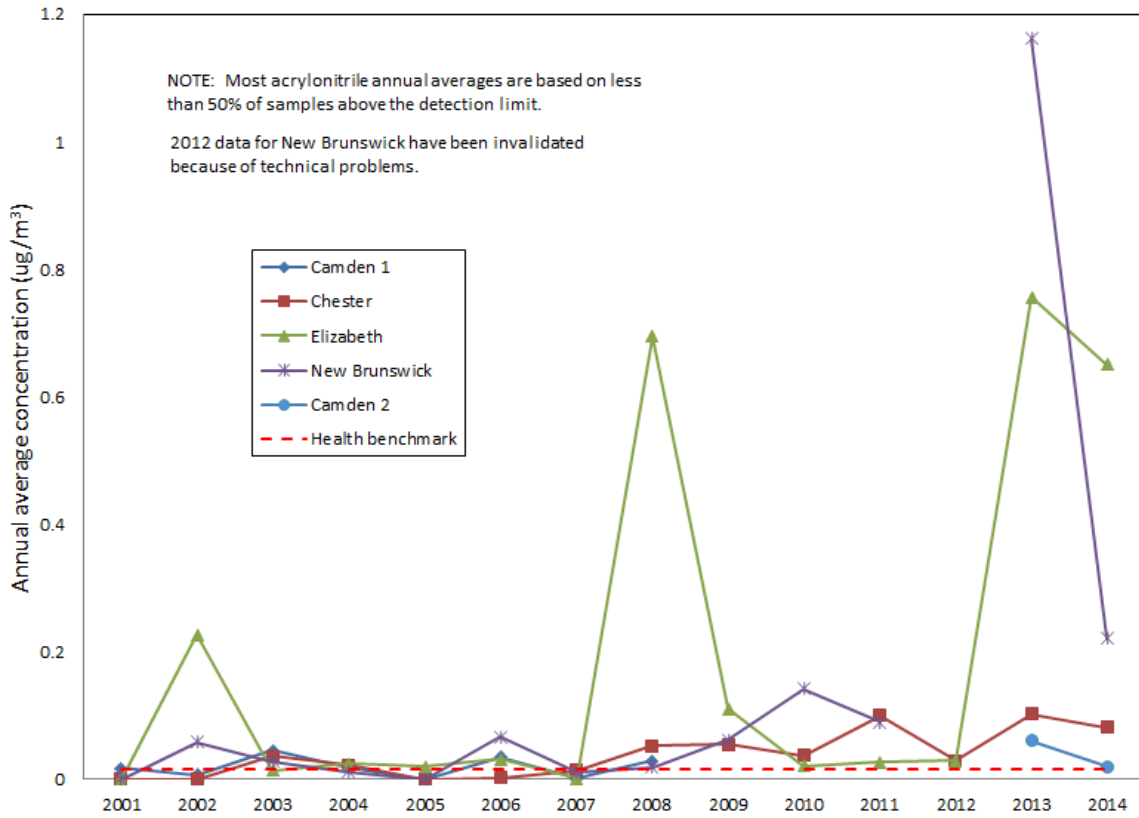


Figure 7
 BENZENE – New Jersey Monitored Concentrations

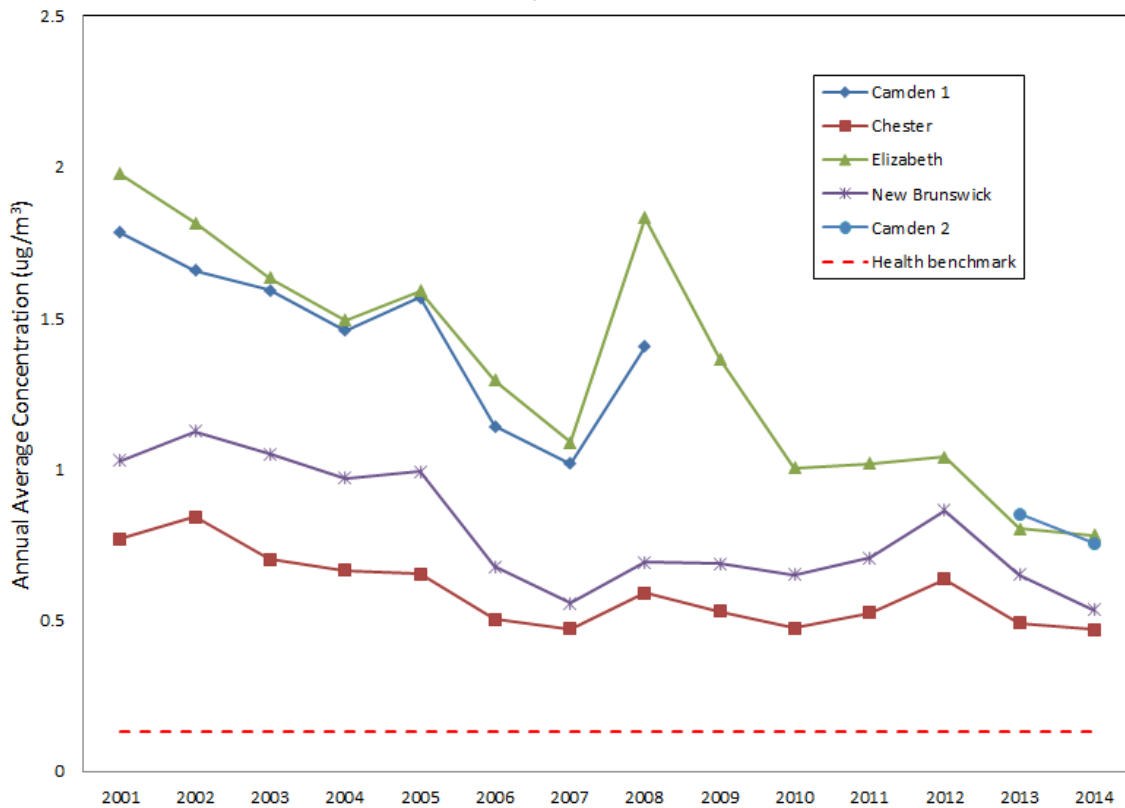


Figure 8
1,3-BUTADIENE - New Jersey Monitored Concentrations

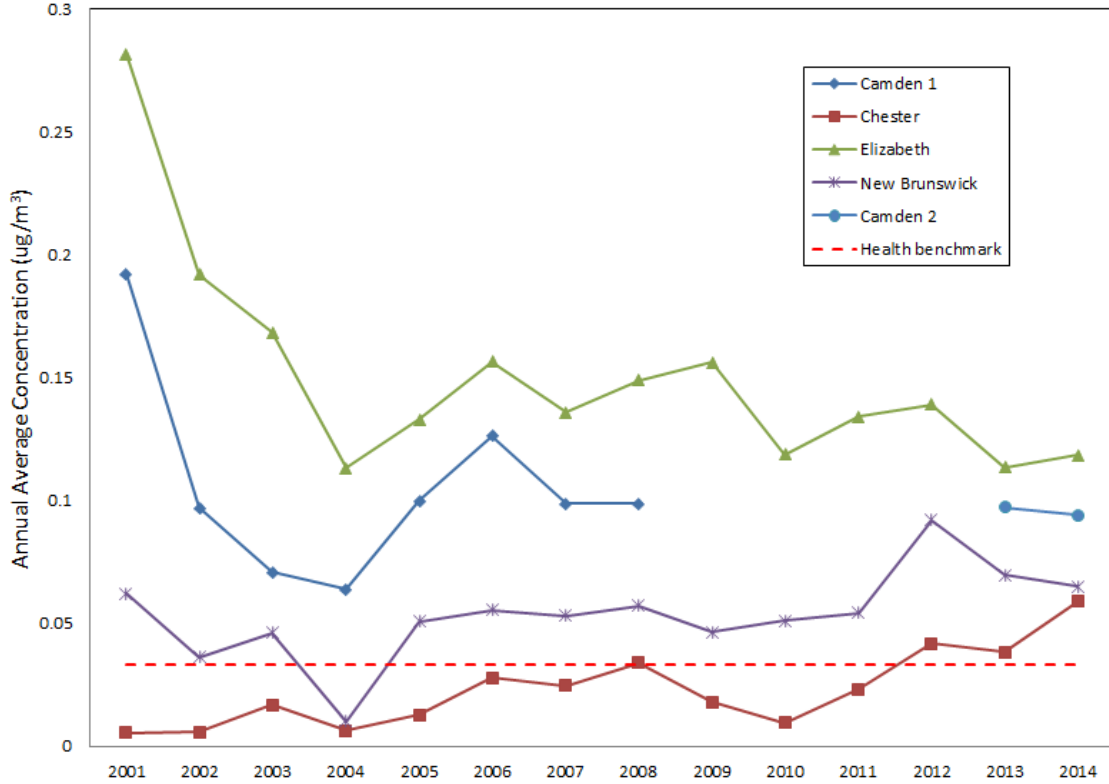


Figure 9
CARBON TETRACHLORIDE - New Jersey Monitored Concentrations

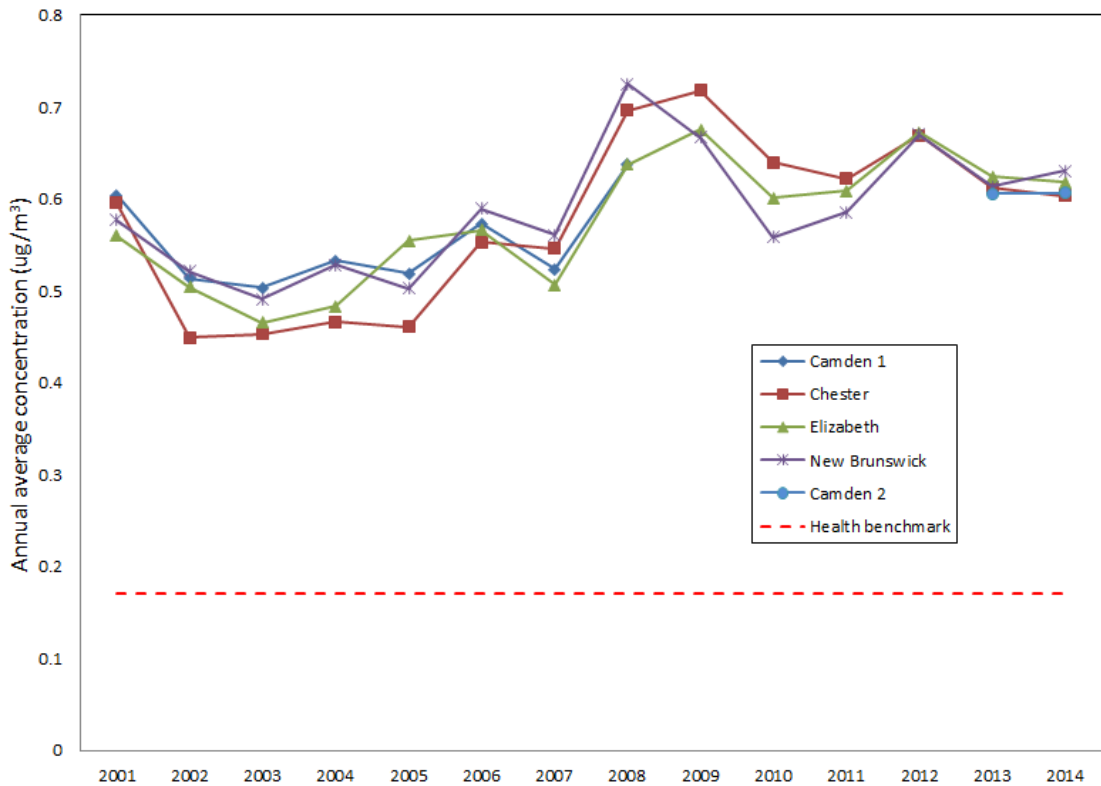


Figure 10
 CHLOROFORM – New Jersey Monitored Concentrations

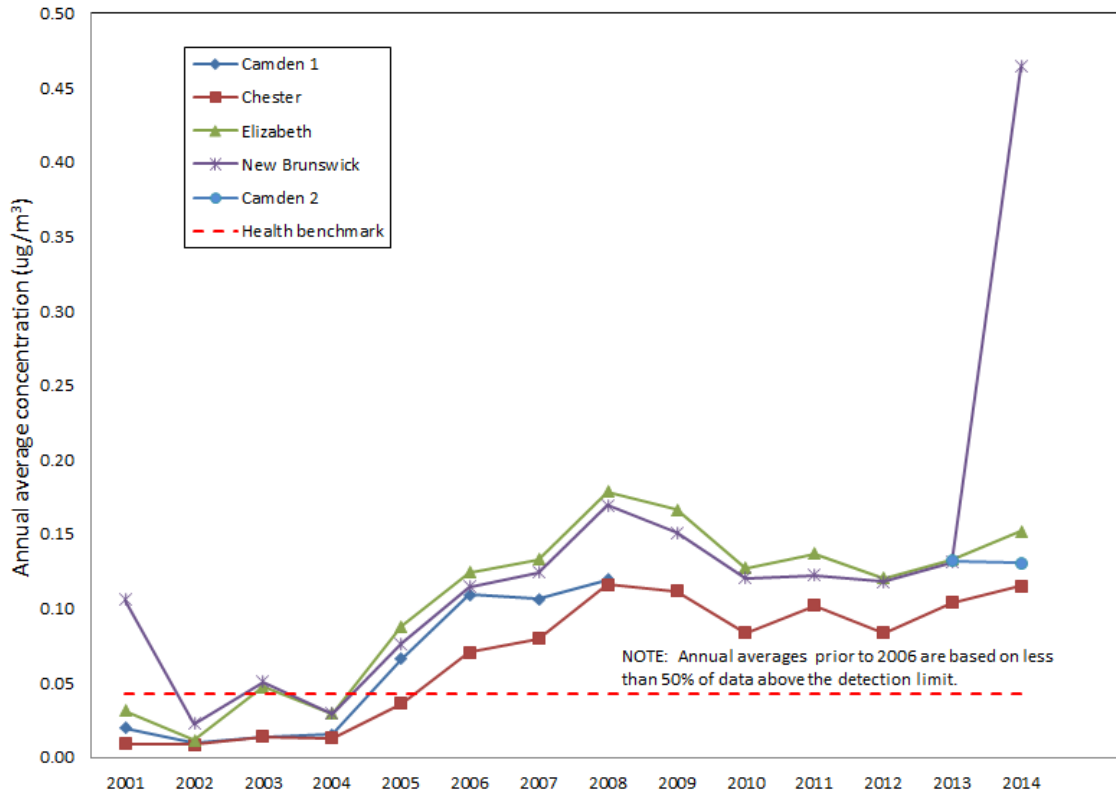


Figure 11
 CHLOROMETHANE (Methyl chloride) – New Jersey Monitored Concentrations

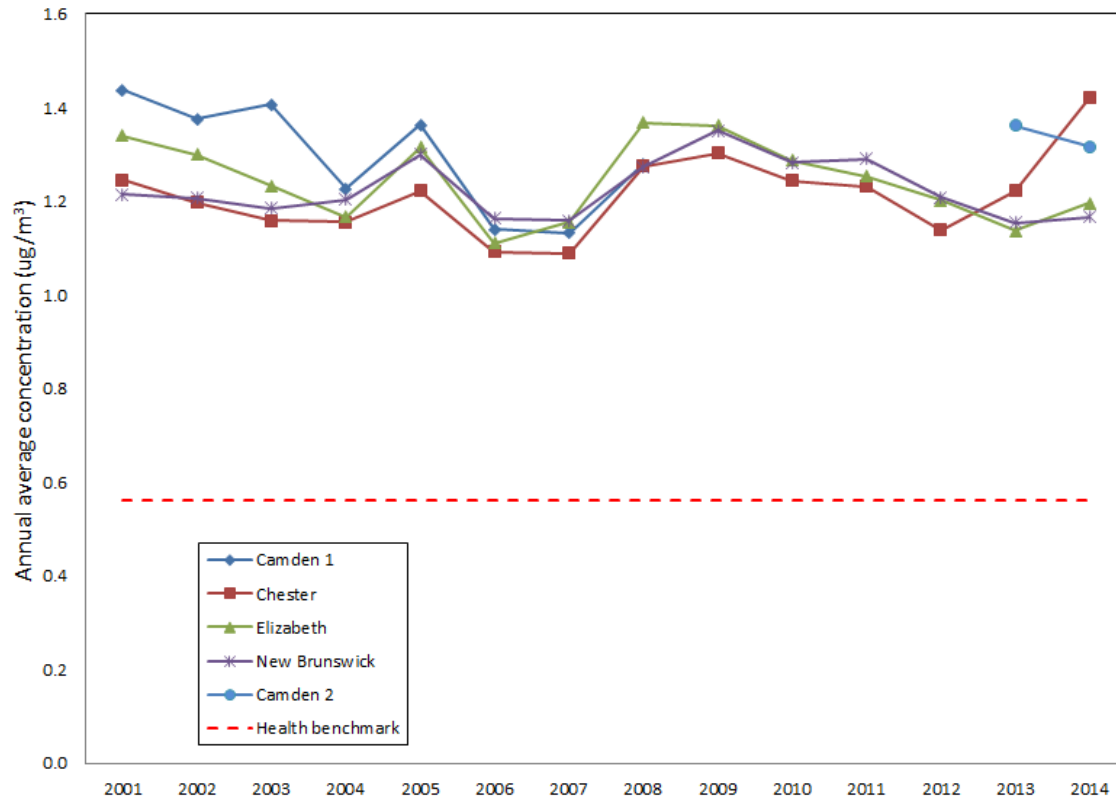


Figure 12
1,4-DICHLOROBENZENE – New Jersey Monitored Concentrations

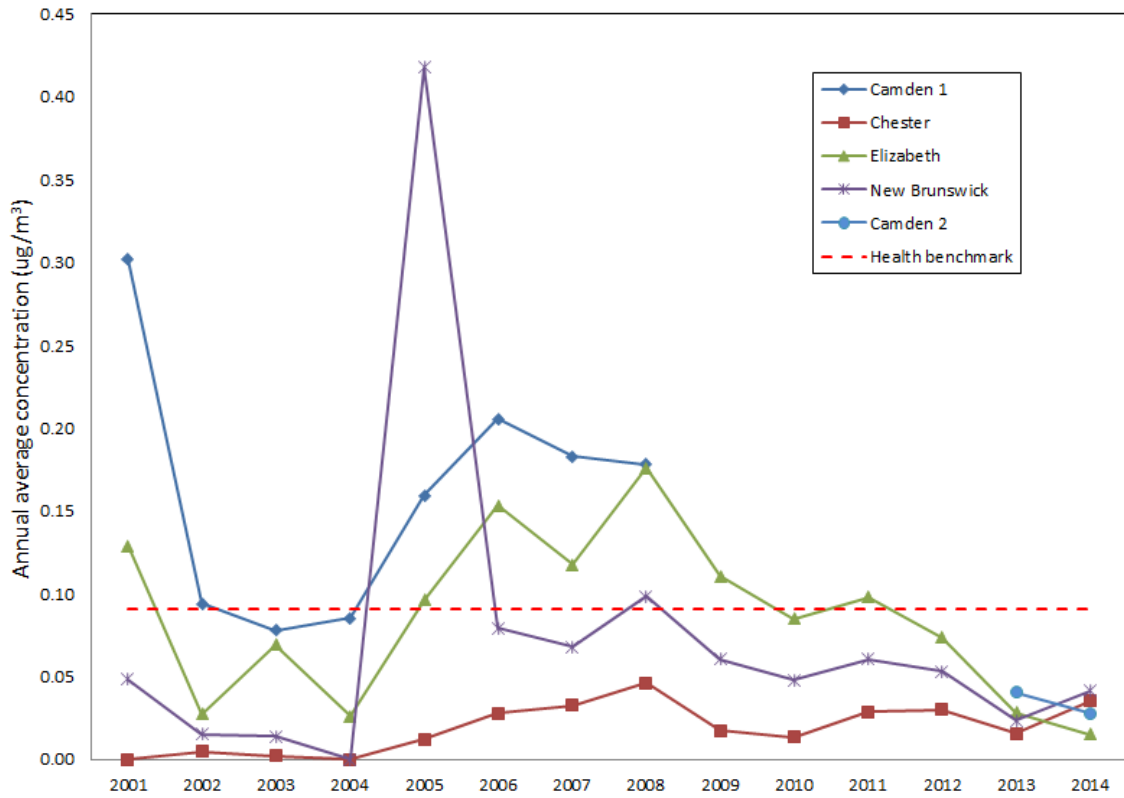


Figure 13
ETHYLBENZENE – New Jersey Monitored Concentrations

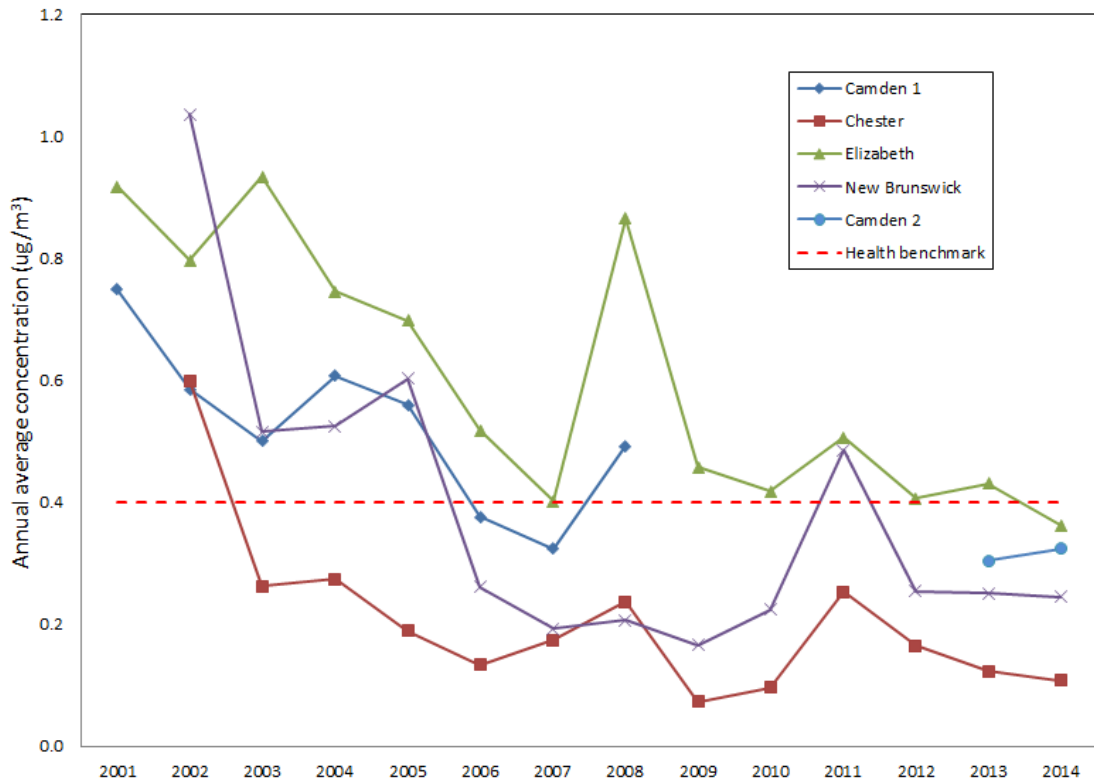


Figure 14
 FORMALDEHYDE - New Jersey Monitored Concentrations

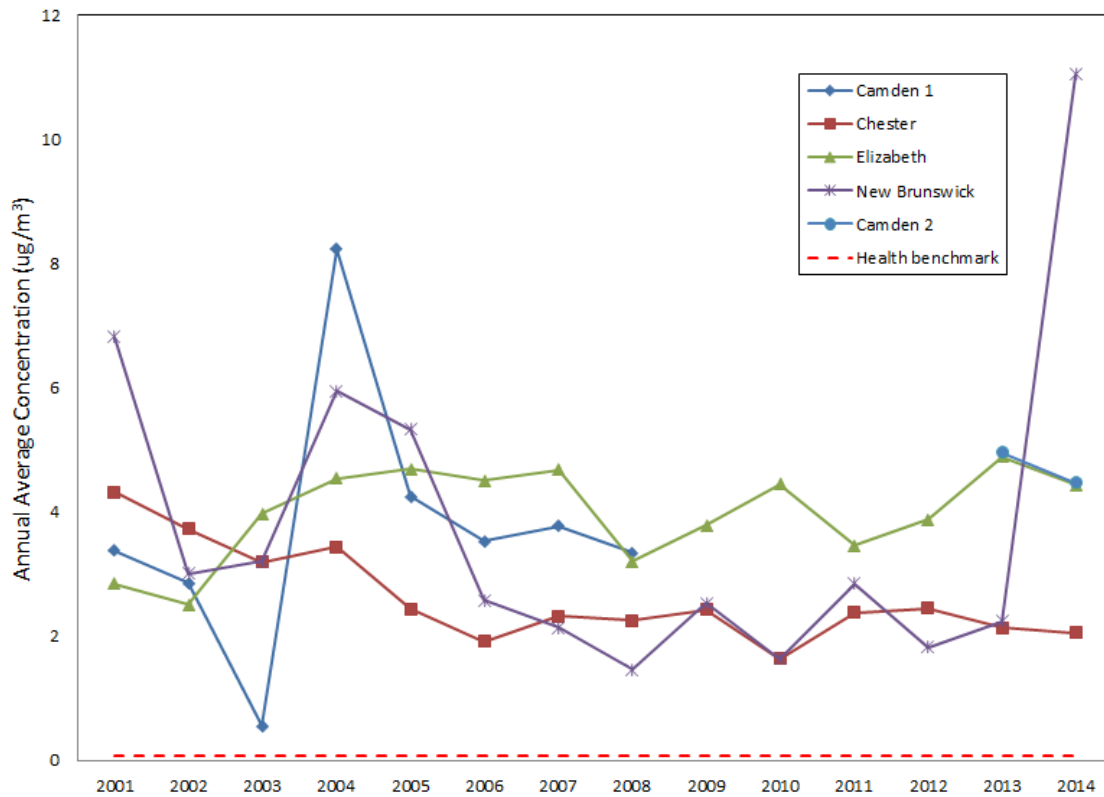
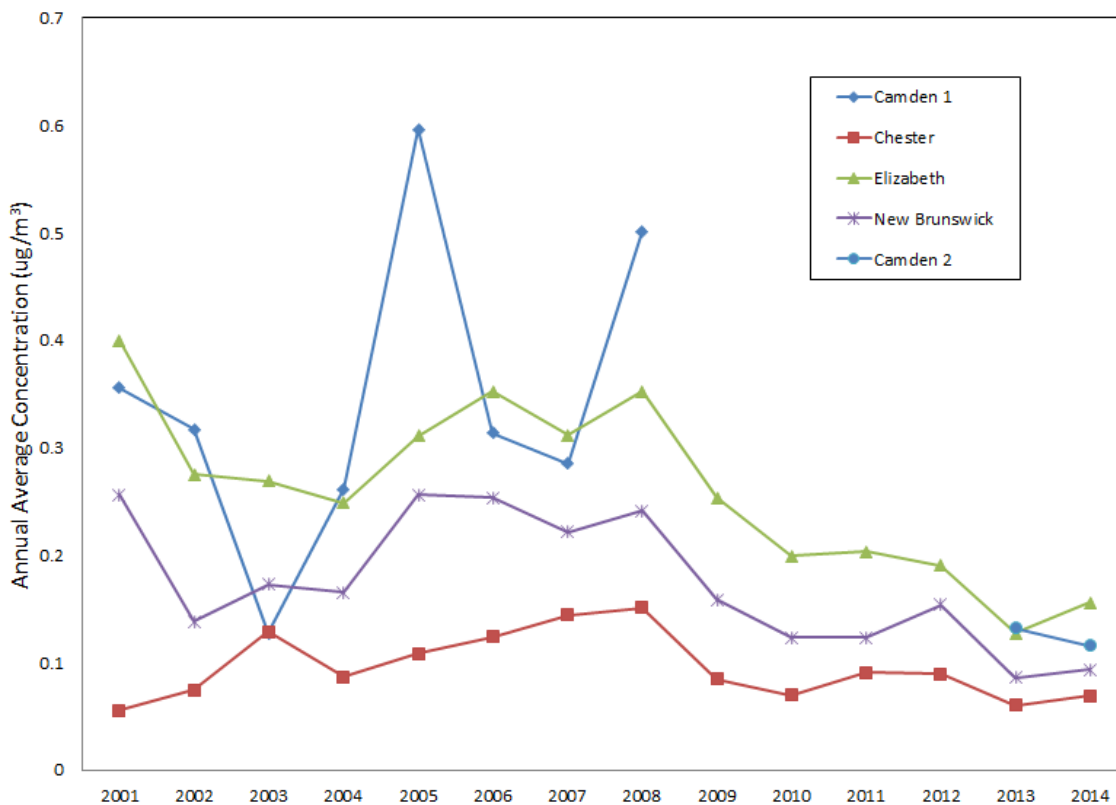


Figure 15
 TETRACHLOROETHYLENE - New Jersey Monitored Concentrations



Toxic metals data from the PM_{2.5} speciation monitors in Camden, Chester, Elizabeth, New Brunswick and Newark are presented in Figures 16 through 20. The Newark site became operational in 2010, and a new Camden site was established in 2013. The original Camden site was shut down in 2008.

Chromium and nickel are shown here because NATA 2005 indicated that there are levels of their carcinogenic forms in the air above the one-in-a-million cancer risk level. The data in Figures 18 and 20 are for total chromium and total nickel. The specific carcinogenic compounds cannot be measured with available monitoring methods.

Arsenic, cadmium, and cobalt concentrations are all influenced by combustion, industrial processes, and transport.

Note that in a few of the graphs some of the years are marked with an asterisk, indicating that less than 50% of the samples used to calculate the annual average were above the detection limit. Values below the detection limit are considered to be zero.

Figure 16
ARSENIC - New Jersey Monitored Concentrations

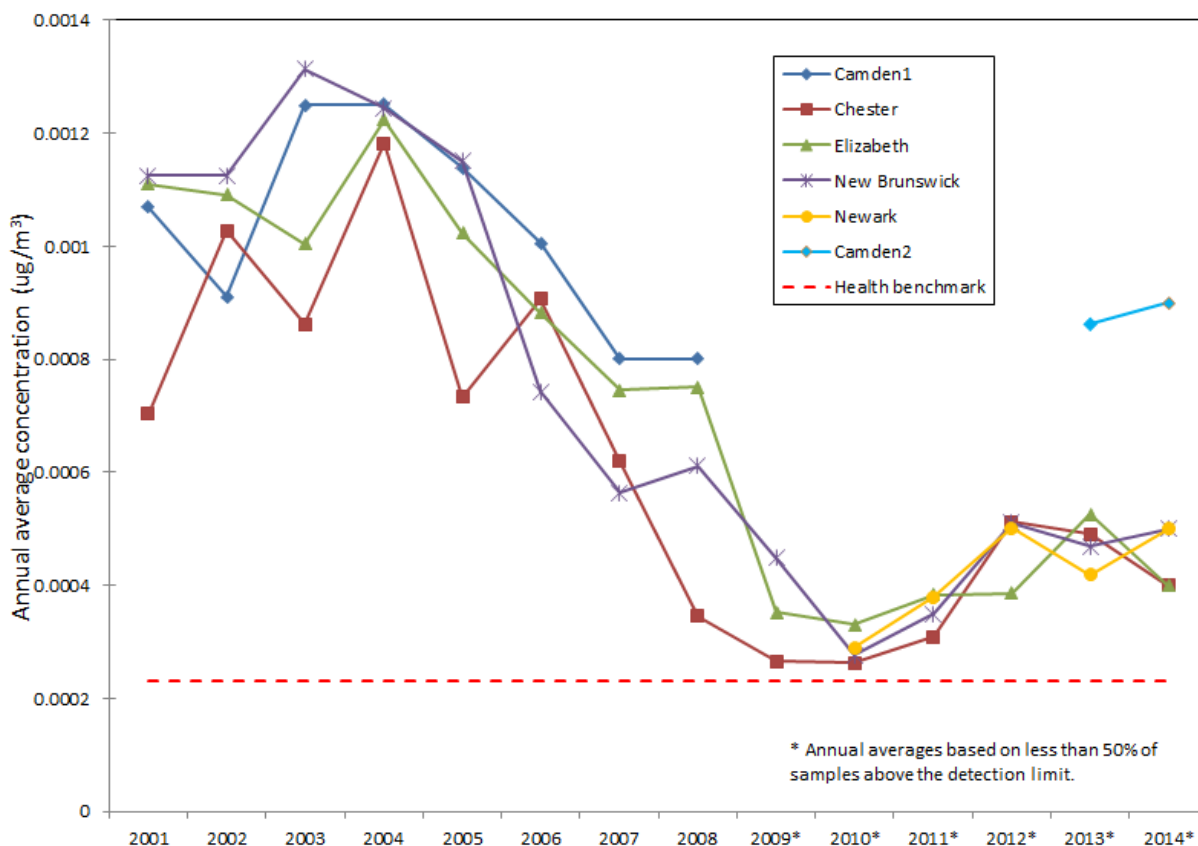


Figure 17
 CADMIUM – New Jersey Monitored Concentrations

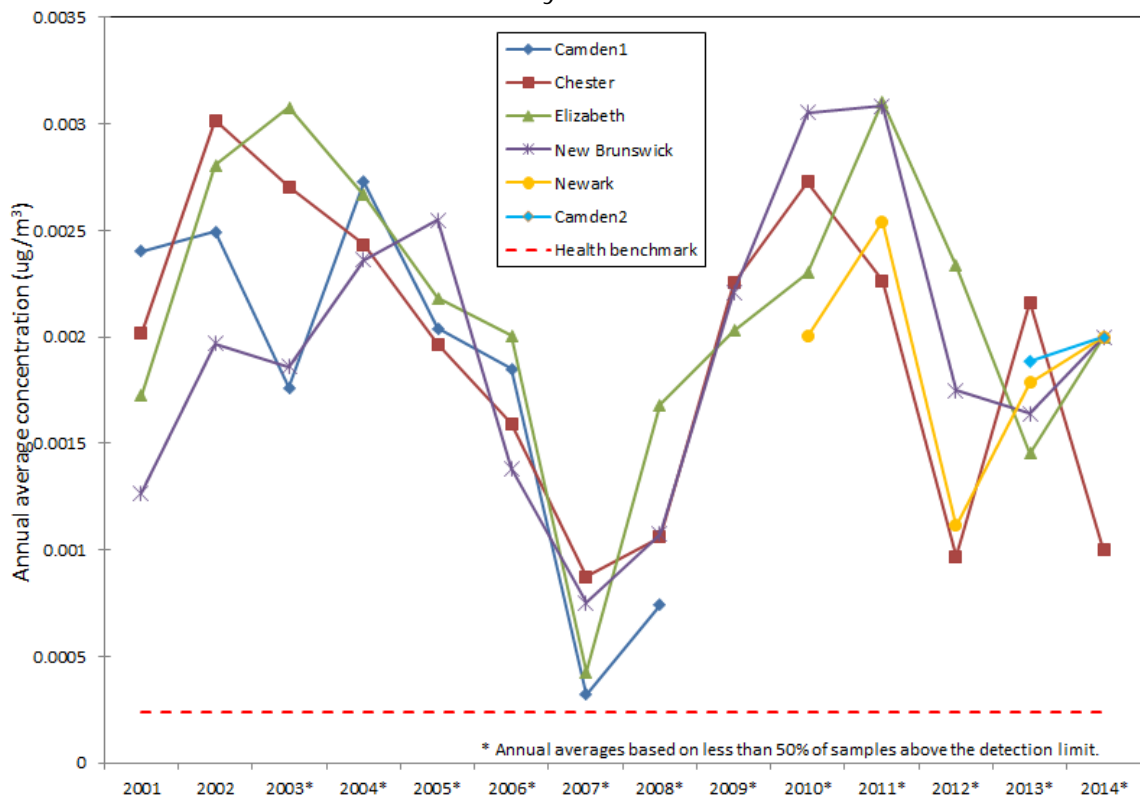


Figure 18
 CHROMIUM – New Jersey Monitored Concentrations

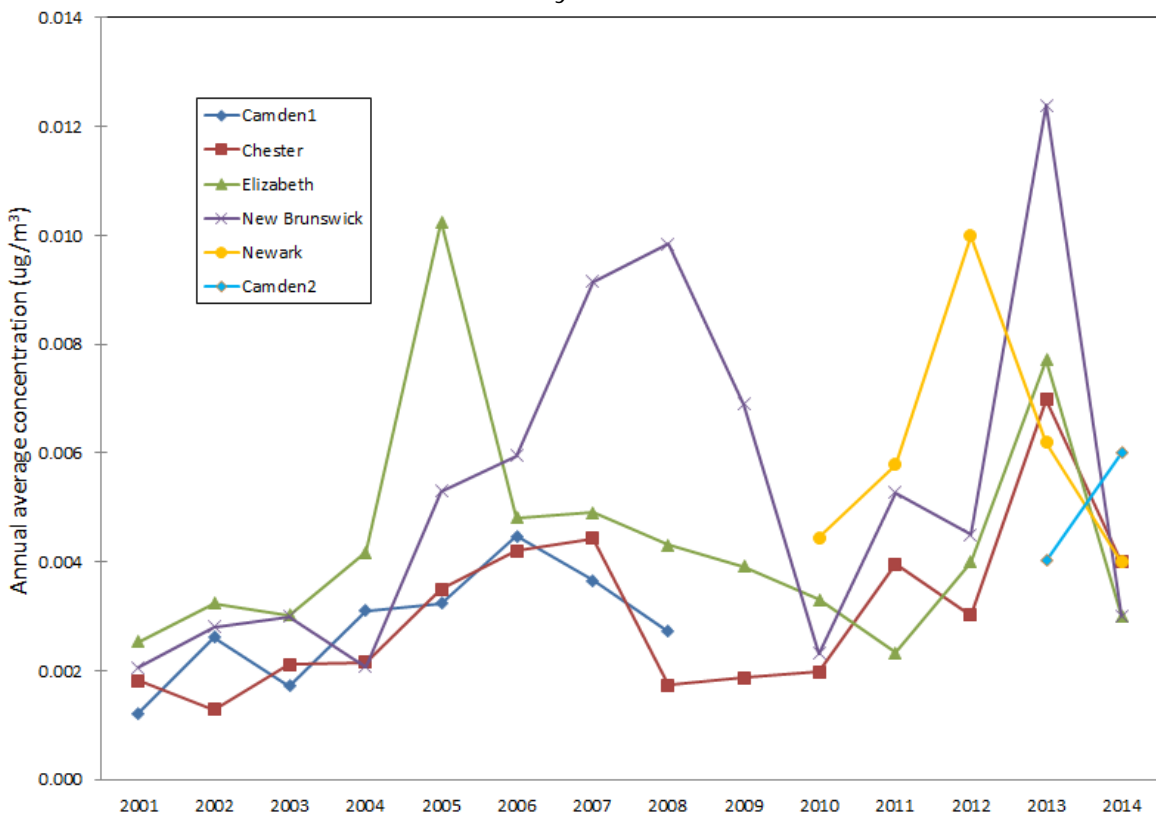


Figure 19
COBALT - New Jersey Monitored Concentrations

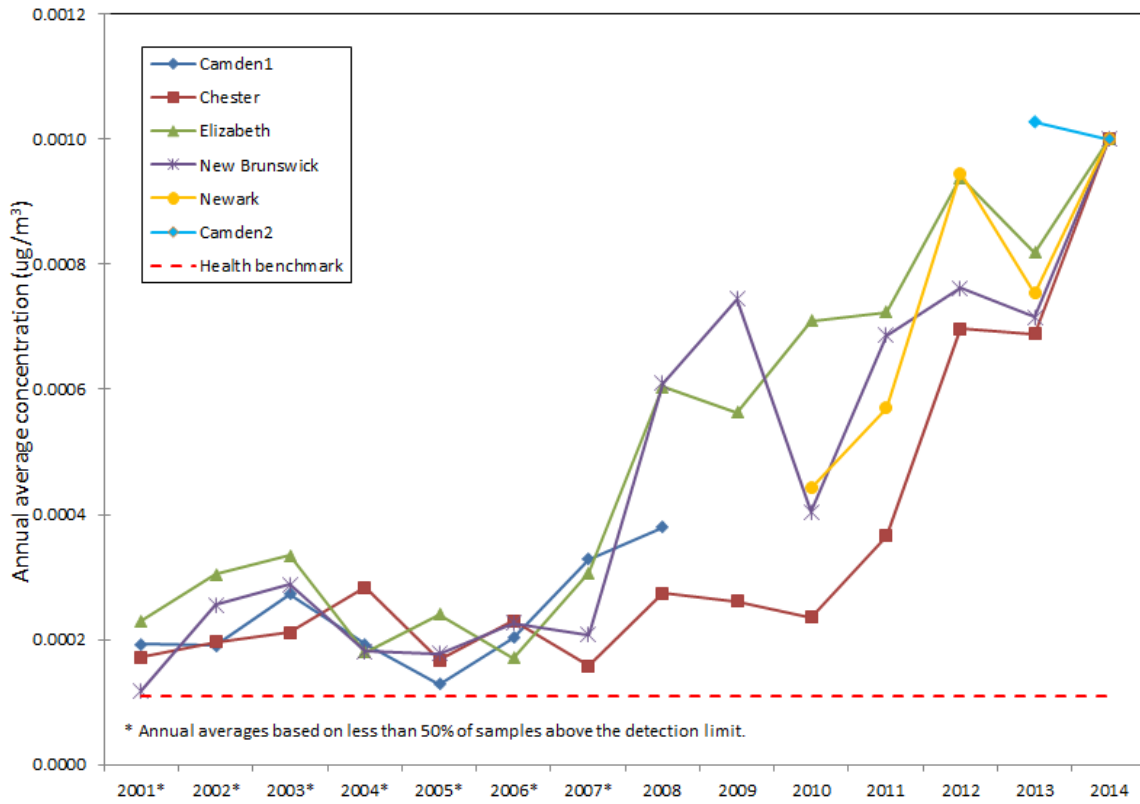


Figure 20
NICKEL - New Jersey Monitored Concentrations

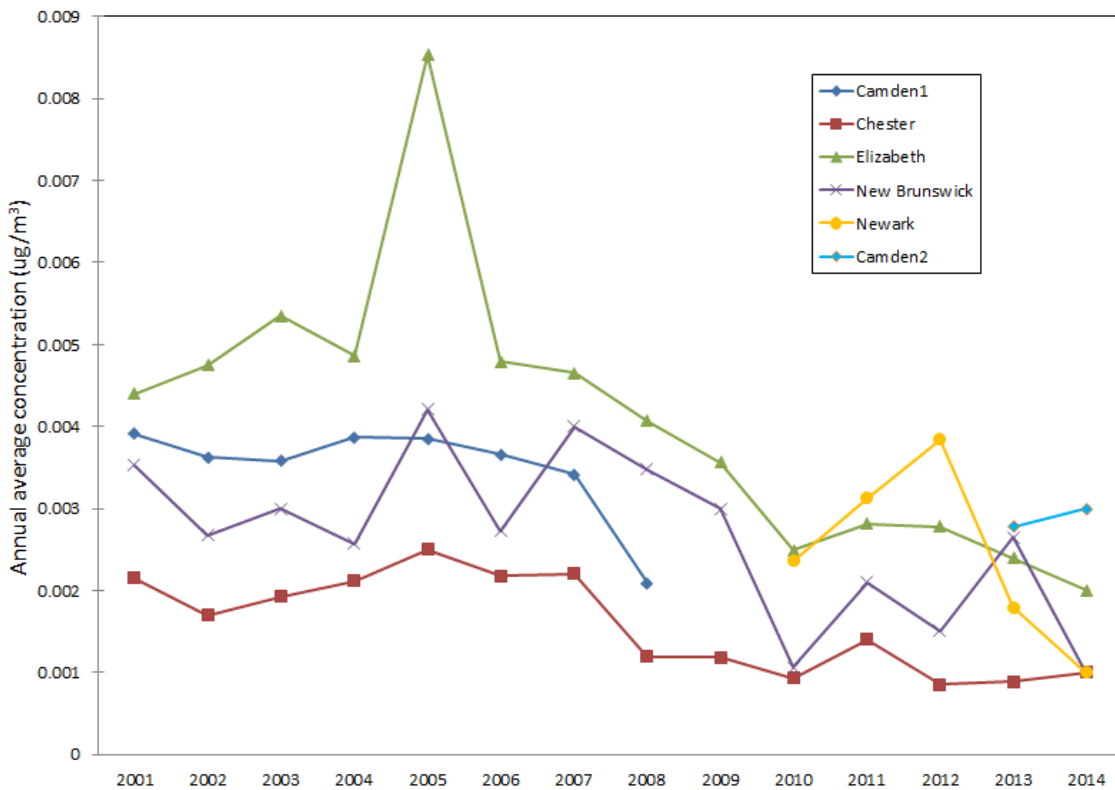
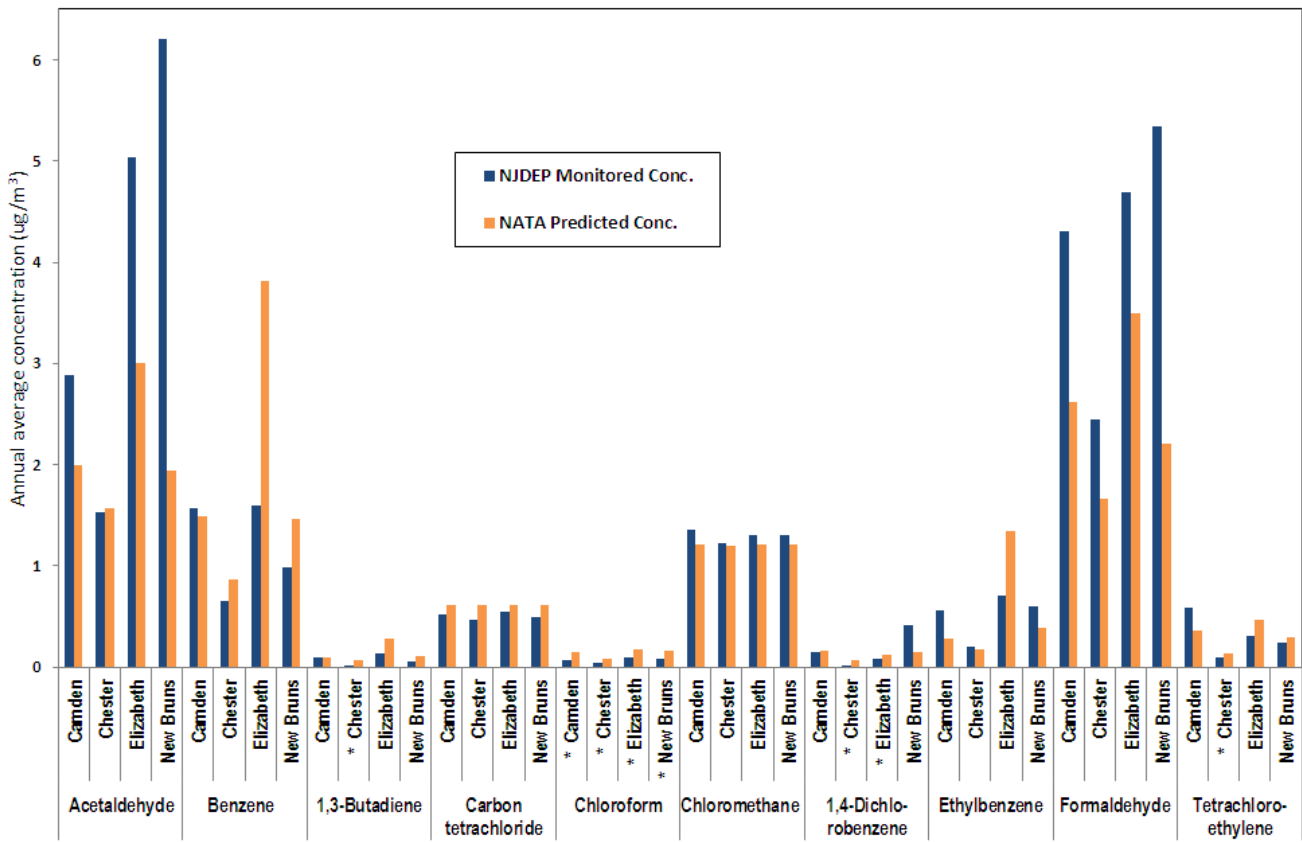


Figure 21 below shows a comparison of annual average concentrations measured at New Jersey's four air toxics monitoring sites in 2005 with annual average concentrations predicted by USEPA's 2005 NATA (at the monitoring site census tract). Most of the pollutants show agreement within a factor of 2 or less, although acetaldehyde and formaldehyde appear to be underestimated by NATA.

Figure 21
2005 New Jersey Monitored Concentrations Compared to 2005 NATA Predicted Concentrations



* Monitoring data average is based on less than 50% of samples above the detection limit.

Table 6
CAMDEN NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^d	24-Hour Max. (ppbv)	Annual Mean (µg/m ³) ^{c,d}	Annual Median (µg/m ³) ^d	24-Hour Max. (µg/m ³)	Health Benchmark (µg/m ³) ^e	Annual Risk Ratio ^f	Detection Limit (µg/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	1.381	1.300	3.490	2.488	2.342	6.288	0.45	6	0.007	100
Acetone	67-64-1	1.222	1.165	2.740	2.904	2.767	6.509	31000	0.0001	0.014	100
Acetonitrile	75-05-8	0.298	0.231	2.220	0.501	0.388	3.727	60	0.01	0.012	100
Acetylene	74-86-2	0.804	0.664	2.900	0.856	0.707	3.086			0.078	100
Acrolein ^g	107-02-8	0.470	0.444	0.900	1.077	1.018	2.064	0.02	54 ^g	0.165	100
Acrylonitrile	107-13-1	0.009	0	0.120	0.019	0	0.260	0.015	1.3	0.130	13
tert-Amyl Methyl Ether	994-05-8	0	0	0	0	0	0			0.067	0
Benzaldehyde	100-52-7	0.058	0.035	1.300	0.251	0.152	5.643			0.087	100
Benzene	71-43-2	0.236	0.197	0.662	0.754	0.629	2.115	0.13	6	0.010	100
Bromochloromethane	74-97-5	0	0	0	0	0	0			0.323	0
Bromodichloromethane	75-27-4	0.0005	0	0.015	0.003	0	0.101			0.094	5
Bromoform	75-25-2	0.0003	0	0.014	0.004	0	0.145	0.91	0.004	0.217	3
Bromomethane	74-83-9	0.899	0.014	47.700	3.493	0.054	185.240	5	0.7	0.078	87
1,3-Butadiene	106-99-0	0.043	0.038	0.109	0.094	0.084	0.241	0.033	3	0.024	100
Butyraldehyde	123-72-8	0.139	0.128	0.250	0.409	0.377	0.737			0.035	100
Carbon Disulfide	75-15-0	0.403	0.408	0.959	1.254	1.271	2.986	700	0.002	0.009	100
Carbon Tetrachloride	56-23-5	0.096	0.099	0.123	0.606	0.623	0.774	0.067	9	0.088	100
Chlorobenzene	108-90-7	0.0001	0	0.009	0.001	0	0.041	1000	0.000001	0.110	2
Chloroethane	75-00-3	0.009	0	0.054	0.023	0	0.142	10000	0.000002	0.066	33
Chloroform	67-66-3	0.027	0.026	0.044	0.131	0.127	0.215	0.043	3	0.083	100
Chloromethane	74-87-3	0.638	0.603	1.460	1.317	1.245	3.015	0.56	2	0.029	100
Chloroprene	126-99-8	0	0	0	0	0	0	7		0.119	0
Crotonaldehyde	123-73-9	0.095	0.047	0.431	0.272	0.135	1.236			0.043	100
Dibromochloromethane	124-48-1	0.003	0.003	0.011	0.028	0.030	0.109			0.030	52
1,2-Dibromoethane	106-93-4	0	0	0	0	0	0	0.0017		0.131	0
m-Dichlorobenzene	541-73-1	0.003	0	0.015	0.015	0	0.090			0.222	28
o-Dichlorobenzene	95-50-1	0.0005	0	0.012	0.003	0	0.072	200	0.00001	0.126	7
p-Dichlorobenzene	106-46-7	0.006	0	0.022	0.035	0	0.132	0.091	0.4	0.114	49
Dichlorodifluoromethane	75-71-8	0.518	0.514	0.672	2.564	2.542	3.323	200	0.01	0.089	100
1,1-Dichloroethane	75-34-3	0	0	0	0	0	0	0.63		0.061	0
1,2-Dichloroethane	107-06-2	0.020	0.020	0.038	0.081	0.081	0.154	0.038	2	0.065	97
1,1-Dichloroethylene	75-35-4	0	0	0	0	0	0	200		0.056	0
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0			0.048	0
trans-1,2-Dichloroethylene	156-60-5	0.0004	0	0.027	0.002	0	0.107			0.048	2
Dichloromethane	75-09-2	0.154	0.135	0.387	0.537	0.469	1.344	2.1	0.3	0.080	100

^a See page 31 for footnotes.

Table 6 (continued)
CAMDEN NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^d	24-Hour Max. (ppbv)	Annual Mean (µg/m ³) ^{c,d}	Annual Median (µg/m ³) ^d	24-Hour Max. (µg/m ³)	Health Benchmark (µg/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (µg/m ³)	% Above Minimum Detection Limit
1,2-Dichloropropane	78-87-5	0.0002	0	0.014	0.001	0	0.065	0.1	0.01	0.088	2
cis-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.082	0
trans-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.073	0
Dichlorotetrafluoroethane	76-14-2	0.017	0.017	0.023	0.121	0.119	0.161			0.161	100
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0			0.016	0
Ethyl Acrylate	140-88-5	0	0	0	0	0	0	2		0.049	0
Ethyl tert-Butyl Ether	637-92-3	0.004	0	0.025	0.015	0	0.104			0.059	21
Ethylbenzene	100-41-4	0.075	0.054	0.771	0.324	0.234	3.348	0.40	0.8	0.048	100
Formaldehyde	50-00-0	3.637	3.18	9.700	4.466	3.905	11.912	0.077	58	0.028	100
Hexachloro-1,3-butadiene	87-68-3	0.001	0	0.011	0.015	0	0.117	0.045	0.3	0.085	20
Hexaldehyde	66-25-1	0.057	0.045	0.560	0.232	0.182	2.294			0.090	100
Isovaleraldehyde	590-86-3	0	0	0	0	0	0			0.007	0
Methyl Ethyl Ketone	78-93-3	0.175	0.146	0.610	0.516	0.428	1.796	5000	0.0001	0.071	100
Methyl Isobutyl Ketone	108-10-1	0.098	0.039	3.370	0.403	0.160	13.805	3000	0.0001	0.061	97
Methyl Methacrylate	80-62-6	0.003	0	0.065	0.010	0	0.229	700	0.00001	0.088	15
Methyl tert-Butyl Ether	1634-04-4	0.044	0.038	0.115	0.157	0.137	0.415	3.8	0.04	0.040	98
n-Octane	111-65-9	0.050	0.042	0.143	0.234	0.196	0.668			0.093	100
Propionaldehyde	123-38-6	0.178	0.17	0.404	0.423	0.404	0.960	8	0.1	0.007	100
Propylene	115-07-1	0.592	0.448	3.280	1.019	0.771	5.645	3000	0.0003	0.057	100
Styrene	100-42-5	0.267	0.116	2.060	1.137	0.494	8.774	1.8	0.6	0.102	100
1,1,2,2-Tetrachloroethane	79-34-5	0.001	0	0.012	0.008	0	0.082	0.017	0.4	0.124	13
Tetrachloroethylene	127-18-4	0.017	0.015	0.049	0.116	0.102	0.332	0.17	0.7	0.136	95
Tolualdehydes		0.026	0.023	0.059	0.128	0.113	0.290			0.025	100
Toluene	108-88-3	0.666	0.522	3.090	2.508	1.967	11.643	5000	0.001	0.170	100
1,2,4-Trichlorobenzene	102-82-1	0.0001	0	0.008	0.001	0	0.059	4	0.0002	0.163	2
1,1,1-Trichloroethane	71-55-6	0.007	0.007	0.027	0.036	0.038	0.147	1000	0.00004	0.109	70
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0.063		0.115	0
Trichloroethylene	79-01-6	0.008	0	0.150	0.041	0	0.806	0.5	0.1	0.118	33
Trichlorofluoromethane	75-69-4	0.328	0.256	1.070	1.845	1.438	6.012	700	0.003	0.084	100
Trichlorotrifluoroethane	76-13-1	0.079	0.080	0.089	0.603	0.613	0.682	30000	0.00002	0.130	98
1,2,4-Trimethylbenzene	95-63-6	0.079	0.067	0.226	0.389	0.329	1.111			0.123	100
1,3,5-Trimethylbenzene	108-67-8	0.028	0.024	0.071	0.136	0.118	0.349			0.108	100
Valeraldehyde	110-62-3	0.055	0.051	0.169	0.193	0.180	0.595			0.011	100
Vinyl chloride	75-01-4	0.004	0	0.100	0.009	0	0.256	0.11	0.1	0.028	13
m,p-Xylene	1330-20-7	0.215	0.124	3.210	0.932	0.538	13.938	100	0.01	0.009	100
o-Xylene	95-47-6	0.093	0.060	1.160	0.406	0.261	5.037	100	0.004	0.087	100

^a See page 31 for footnotes.

Table 7
CHESTER NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	0.693	0.669	1.800	1.249	1.205	3.243	0.45	3	0.007	100
Acetone	67-64-1	0.905	0.832	2.790	2.149	1.975	6.628	31000	0.0001	0.014	100
Acetonitrile	75-05-8	0.397	0.369	0.896	0.666	0.620	1.504	60	0.01	0.012	100
Acetylene	74-86-2	0.450	0.360	1.580	0.479	0.383	1.681			0.078	100
Acrolein ^g	107-02-8	0.499	0.469	0.902	1.145	1.075	2.068	0.02	57 ^g	0.165	100
Acrylonitrile	107-13-1	0.037	0	0.134	0.081	0	0.291	0.015	5	0.130	48
tert-Amyl Methyl Ether	994-05-8	0.0001	0	0.005	0.0003	0	0.021			0.067	2
Benzaldehyde	100-52-7	0.014	0.012	0.064	0.059	0.052	0.278			0.087	100
Benzene	71-43-2	0.147	0.128	0.412	0.469	0.409	1.316	0.13	4	0.010	100
Bromochloromethane	74-97-5	0	0	0	0	0	0			0.323	0
Bromodichloromethane	75-27-4	0.0003	0	0.010	0.002	0	0.067			0.094	3
Bromoform	75-25-2	0.0009	0	0.016	0.009	0	0.165	0.91	0.01	0.217	10
Bromomethane	74-83-9	0.0159	0.015	0.069	0.062	0.058	0.268	5	0.01	0.078	97
1,3-Butadiene	106-99-0	0.0266	0.026	0.079	0.059	0.058	0.175	0.033	1.8	0.024	93
Butyraldehyde	123-72-8	0.0532	0.049	0.176	0.157	0.145	0.519			0.035	100
Carbon Disulfide	75-15-0	0.7773	0.794	1.810	2.420	2.473	5.637	700	0.003	0.009	100
Carbon Tetrachloride	56-23-5	0.0959	0.098	0.124	0.604	0.617	0.780	0.067	9	0.088	100
Chlorobenzene	108-90-7	0.0008	0	0.013	0.004	0	0.060	1000	0.000004	0.110	7
Chloroethane	75-00-3	0.0147	0	0.060	0.039	0	0.158	10000	0.000004	0.066	49
Chloroform	67-66-3	0.0236	0.022	0.040	0.115	0.107	0.195	0.043	3	0.083	100
Chloromethane	74-87-3	0.6877	0.612	2.530	1.420	1.264	5.225	0.56	3	0.029	100
Chloroprene	126-99-8	0	0	0	0	0	0	7		0.119	0
Crotonaldehyde	123-73-9	0.087	0.0225	0.478	0.250	0.065	1.370			0.043	100
Dibromochloromethane	124-48-1	0.003	0.003	0.011	0.032	0.030	0.109			0.030	52
1,2-Dibromoethane	106-93-4	0.0004	0	0.013	0.003	0	0.100	0.0017	1.7	0.131	3
m-Dichlorobenzene	541-73-1	0.004	0	0.014	0.024	0	0.084			0.222	43
o-Dichlorobenzene	95-50-1	0.001	0	0.009	0.004	0	0.054	200	0.00002	0.126	8
p-Dichlorobenzene	106-46-7	0.003	0	0.017	0.015	0	0.102	0.091	0.2	0.114	26
Dichlorodifluoromethane	75-71-8	0.502	0.508	0.551	2.482	2.512	2.725	200	0.01	0.089	100
1,1-Dichloroethane	75-34-3	0.0004	0	0.012	0.001	0	0.049	0.63	0.002	0.061	3
1,2-Dichloroethane	107-06-2	0.019	0.019	0.029	0.076	0.077	0.117	0.038	2	0.065	97
1,1-Dichloroethylene	75-35-4	0.0001	0	0.009	0.001	0	0.036	200	0.000003	0.056	2
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0			0.048	0
trans-1,2-Dichloroethylene	156-60-5	0	0	0	0	0	0			0.048	0
Dichloromethane	75-09-2	0.14285	0.1135	0.401	0.496	0.394	1.393	2.1	0.2	0.080	100

^a See page 31 for footnotes.

Table 7 (continued)
 CHESTER NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^d	24-Hour Max. (ppbv)	Annual Mean (µg/m ³) ^{c,d}	Annual Median (µg/m ³) ^d	24-Hour Max. (µg/m ³)	Health Benchmark (µg/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (µg/m ³)	% Above Minimum Detection Limit
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0.1		0.088	0
cis-1,3-Dichloropropene	542-75-6	0.0002	0	0.010	0.001	0	0.045			0.082	2
trans-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.073	0
Dichlorotetrafluoroethane	76-14-2	0.018	0.017	0.024	0.123	0.119	0.168			0.161	100
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0			0.016	0
Ethyl Acrylate	140-88-5	0	0	0	0	0	0	2		0.049	0
Ethyl tert-Butyl Ether	637-92-3	0.008	0	0.176	0.034	0	0.736			0.059	28
Ethylbenzene	100-41-4	0.025	0.019	0.093	0.108	0.082	0.404	0.40	0.3	0.048	100
Formaldehyde	50-00-0	1.677	1.395	4.930	2.059	1.713	6.054	0.077	27	0.028	100
Hexachloro-1,3-butadiene	87-68-3	0.002	0	0.012	0.023	0	0.128	0.045	0.5	0.085	26
Hexaldehyde	66-25-1	0.011	0.009	0.032	0.046	0.037	0.131			0.090	100
Isovaleraldehyde	590-86-3	0	0	0	0	0	0			0.007	0
Methyl Ethyl Ketone	78-93-3	0.107	0.095	0.434	0.315	0.278	1.278	5000	0.0001	0.071	100
Methyl Isobutyl Ketone	108-10-1	0.029	0.024	0.095	0.117	0.098	0.389	3000	0.00004	0.061	100
Methyl Methacrylate	80-62-6	0.001	0	0.010	0.003	0	0.035	700	0.000004	0.088	8
Methyl tert-Butyl Ether	1634-04-4	0.049	0.047	0.142	0.178	0.169	0.512	3.8	0.05	0.040	97
n-Octane	111-65-9	0.039	0.038	0.073	0.183	0.178	0.341			0.093	100
Propionaldehyde	123-38-6	0.083	0.072	0.211	0.198	0.171	0.501	8	0.02	0.007	100
Propylene	115-07-1	0.327	0.295	0.714	0.563	0.508	1.229	3000	0.0002	0.057	100
Styrene	100-42-5	0.013	0.013	0.031	0.057	0.055	0.132	1.8	0.03	0.102	79
1,1,2,2-Tetrachloroethane	79-34-5	0.002	0	0.012	0.011	0	0.082	0.017	0.7	0.124	18
Tetrachloroethylene	127-18-4	0.010	0.010	0.042	0.069	0.068	0.285	0.17	0.4	0.136	77
Tolualdehydes		0.012	0.010	0.053	0.057	0.049	0.260			0.025	85
Toluene	108-88-3	0.163	0.143	0.520	0.615	0.539	1.959	5000	0.0001	0.170	100
1,2,4-Trichlorobenzene	102-82-1	0.001	0	0.021	0.004	0	0.156	4	0.001	0.163	5
1,1,1-Trichloroethane	71-55-6	0.006	0.007	0.016	0.032	0.038	0.087	1000	0.00003	0.109	69
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0.063		0.115	0
Trichloroethylene	79-01-6	0.001	0	0.012	0.003	0	0.064	0.5	0.01	0.118	5
Trichlorofluoromethane	75-69-4	0.232	0.233	0.260	1.304	1.309	1.461	700	0.002	0.084	100
Trichlorotrifluoroethane	76-13-1	0.081	0.081	0.090	0.619	0.621	0.690	30000	0.00002	0.130	100
1,2,4-Trimethylbenzene	95-63-6	0.022	0.018	0.067	0.111	0.088	0.329			0.123	98
1,3,5-Trimethylbenzene	108-67-8	0.012	0.010	0.031	0.060	0.049	0.152			0.108	87
Valeraldehyde	110-62-3	0.013	0.011	0.043	0.047	0.039	0.151			0.011	100
Vinyl chloride	75-01-4	0.0004	0	0.011	0.001	0	0.028	0.11	0.01	0.028	5
m,p-Xylene	1330-20-7	0.051	0.040	0.278	0.220	0.174	1.207	100	0.002	0.009	100
o-Xylene	95-47-6	0.024	0.019	0.104	0.103	0.082	0.452	100	0.001	0.087	100

^a See page 31 for footnotes.

Table 8

ELIZABETH NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	1.538	1.430	2.880	2.771	2.577	5.189	0.45	6	0.007	100
Acetone	67-64-1	1.177	1.060	4.580	2.796	2.518	10.880	31000	0.0001	0.014	100
Acetonitrile	75-05-8	0.291	0.240	1.590	0.489	0.403	2.670	60	0.01	0.012	100
Acetylene	74-86-2	0.912	0.723	2.930	0.971	0.769	3.118			0.078	100
Acrolein ^g	107-02-8	0.432	0.384	0.853	0.990	0.880	1.956	0.02	49 ^g	0.165	100
Acrylonitrile	107-13-1	0.300	0.312	0.652	0.650	0.677	1.415	0.015	43	0.130	92
tert-Amyl Methyl Ether	994-05-8	0	0	0	0	0	0			0.067	0
Benzaldehyde	100-52-7	0.026	0.022	0.085	0.112	0.095	0.369			0.087	100
Benzene	71-43-2	0.245	0.211	0.803	0.782	0.674	2.565	0.13	6	0.010	100
Bromochloromethane	74-97-5	0	0	0	0	0	0			0.323	0
Bromodichloromethane	75-27-4	0.001	0	0.012	0.005	0	0.080			0.094	7
Bromoform	75-25-2	0.001	0	0.014	0.012	0	0.145	0.91	0.01	0.217	14
Bromomethane	74-83-9	0.013	0.013	0.054	0.050	0.050	0.210	5	0.01	0.078	85
1,3-Butadiene	106-99-0	0.054	0.051	0.130	0.119	0.113	0.288	0.033	4	0.024	100
Butyraldehyde	123-72-8	0.121	0.113	0.229	0.356	0.333	0.675			0.035	100
Carbon Disulfide	75-15-0	5.377	5.5	12.100	16.744	17.128	37.681	700	0.024	0.009	100
Carbon Tetrachloride	56-23-5	0.098	0.1	0.134	0.618	0.629	0.843	0.067	9	0.088	100
Chlorobenzene	108-90-7	0.001	0	0.053	0.004	0	0.244	1000	0.000004	0.110	2
Chloroethane	75-00-3	0.009	0	0.054	0.023	0	0.142	10000	0.000002	0.066	34
Chloroform	67-66-3	0.031	0.028	0.056	0.152	0.137	0.273	0.043	4	0.083	98
Chloromethane	74-87-3	0.579	0.566	0.741	1.195	1.169	1.530	0.56	2	0.029	100
Chloroprene	126-99-8	0.001	0	0.040	0.002	0	0.145	7	0.0004	0.119	2
Crotonaldehyde	123-73-9	0.090	0.038	0.522	0.257	0.109	1.496			0.043	100
Dibromochloromethane	124-48-1	0.004	0.004	0.010	0.036	0.040	0.099			0.030	61
1,2-Dibromoethane	106-93-4	0.0003	0	0.010	0.002	0	0.077	0.0017	1.3	0.131	3
m-Dichlorobenzene	541-73-1	0.0003	0	0.009	0.002	0	0.054			0.222	3
o-Dichlorobenzene	95-50-1	0.001	0	0.010	0.005	0	0.060	200	0.00002	0.126	10
p-Dichlorobenzene	106-46-7	0.007	0.005	0.026	0.041	0.030	0.156	0.091	0.5	0.114	51
Dichlorodifluoromethane	75-71-8	0.508	0.506	0.582	2.510	2.502	2.878	200	0.01	0.089	100
1,1-Dichloroethane	75-34-3	0.0002	0	0.010	0.001	0	0.040	0.63	0.001	0.061	2
1,2-Dichloroethane	107-06-2	0.021	0.022	0.035	0.086	0.089	0.142	0.038	2	0.065	97
1,1-Dichloroethylene	75-35-4	0.0004	0	0.008	0.002	0	0.032	200	0.00001	0.056	5
cis-1,2-Dichloroethylene	156-59-2	0.001	0	0.058	0.004	0	0.230			0.048	2
trans-1,2-Dichloroethylene	156-60-5	0	0	0	0	0	0			0.048	0
Dichloromethane	75-09-2	0.185	0.143	1.540	0.644	0.497	5.350	2.1	0.3	0.080	100

^a See page 31 for footnotes.

Table 8 (continued)
ELIZABETH NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^d	24-Hour Max. (ppbv)	Annual Mean (µg/m ³) ^{c,d}	Annual Median (µg/m ³) ^d	24-Hour Max. (µg/m ³)	Health Benchmark (µg/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (µg/m ³)	% Above Minimum Detection Limit
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0.1		0.088	0
cis-1,3-Dichloropropene	542-75-6	0.0002	0	0.009	0.001	0	0.041			0.082	2
trans-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.073	0
Dichlorotetrafluoroethane	76-14-2	0.018	0.018	0.023	0.125	0.126	0.161			0.161	100
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0			0.016	0
Ethyl Acrylate	140-88-5	0	0	0	0	0	0	2		0.049	0
Ethyl tert-Butyl Ether	637-92-3	0.047	0.048	0.101	0.196	0.201	0.422			0.059	100
Ethylbenzene	100-41-4	0.083	0.078	0.214	0.362	0.339	0.929	0.40	0.9	0.048	100
Formaldehyde	50-00-0	3.608	3.210	9.420	4.431	3.942	11.568	0.077	58	0.028	100
Hexachloro-1,3-butadiene	87-68-3	0.002	0	0.01	0.024	0	0.107	0.045	0.5	0.085	31
Hexaldehyde	66-25-1	0.032	0.028	0.083	0.130	0.115	0.340			0.090	100
Isovaleraldehyde	590-86-3	0	0	0	0	0	0			0.007	0
Methyl Ethyl Ketone	78-93-3	0.161	0.137	0.455	0.475	0.403	1.340	5000	0.0001	0.071	100
Methyl Isobutyl Ketone	108-10-1	0.043	0.040	0.083	0.175	0.164	0.340	3000	0.0001	0.061	97
Methyl Methacrylate	80-62-6	0.006	0	0.068	0.022	0	0.239	700	0.00003	0.088	22
Methyl tert-Butyl Ether	1634-04-4	0.021	0.022	0.046	0.077	0.079	0.166	3.8	0.02	0.040	88
n-Octane	111-65-9	0.059	0.044	0.300	0.278	0.206	1.401			0.093	100
Propionaldehyde	123-38-6	0.174	0.151	0.448	0.414	0.359	1.064	8	0.05	0.007	100
Propylene	115-07-1	1.671	0.624	16.100	2.876	1.074	27.709	3000	0.001	0.057	100
Styrene	100-42-5	0.024	0.023	0.059	0.102	0.098	0.251	1.8	0.06	0.102	92
1,1,2,2-Tetrachloroethane	79-34-5	0.020	0.007	0.082	0.137	0.048	0.563	0.017	8	0.124	51
Tetrachloroethylene	127-18-4	0.023	0.017	0.138	0.156	0.115	0.936	0.17	0.9	0.136	92
Tolualdehydes		0.024	0.020	0.061	0.119	0.098	0.300			0.025	98
Toluene	108-88-3	0.441	0.357	1.780	1.662	1.345	6.707	5000	0.0003	0.170	100
1,2,4-Trichlorobenzene	102-82-1	0.0004	0	0.009	0.003	0	0.067	4	0.001	0.163	5
1,1,1-Trichloroethane	71-55-6	0.007	0.009	0.014	0.040	0.049	0.076	1000	0.00004	0.109	76
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0.063		0.115	0
Trichloroethylene	79-01-6	0.005	0	0.035	0.028	0	0.188	0.5	0.06	0.118	36
Trichlorofluoromethane	75-69-4	0.240	0.235	0.332	1.348	1.320	1.865	700	0.002	0.084	100
Trichlorotrifluoroethane	76-13-1	0.081	0.081	0.092	0.619	0.621	0.705	30000	0.00002	0.130	100
1,2,4-Trimethylbenzene	95-63-6	0.060	0.054	0.203	0.297	0.265	0.998			0.123	100
1,3,5-Trimethylbenzene	108-67-8	0.023	0.022	0.063	0.113	0.108	0.310			0.108	98
Valeraldehyde	110-62-3	0.041	0.038	0.091	0.144	0.134	0.321			0.011	100
Vinyl chloride	75-01-4	0.001	0	0.017	0.003	0	0.043	0.11	0.03	0.028	12
m,p-Xylene	1330-20-7	0.210	0.188	0.715	0.913	0.816	3.104	100	0.009	0.009	100
o-Xylene	95-47-6	0.088	0.079	0.267	0.381	0.343	1.159	100	0.004	0.087	100

^a See page 31 for footnotes.

Table 9

NEW BRUNSWICK NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^{c,d}	24-Hour Max. (ppbv)	Annual Mean (ug/m ³) ^{c,d}	Annual Median (ug/m ³) ^{c,d}	24-Hour Max. (ug/m ³)	Health Benchmark (ug/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (ug/m ³)	% Above Minimum Detection Limit
Acetaldehyde	75-07-0	1.590	1.350	5.150	2.865	2.432	9.279	0.45	6	0.007	100
Acetone	67-64-1	1.152	1.090	2.450	2.736	2.589	5.820	31000	0.0001	0.014	100
Acetonitrile	75-05-8	1.001	0.322	7.730	1.680	0.540	12.978	60	0.03	0.012	100
Acetylene	74-86-2	0.637	0.467	3.480	0.677	0.496	3.703			0.078	100
Acrolein ^g	107-02-8	0.460	0.394	0.936	1.056	0.903	2.146	0.02	53 ^g	0.165	100
Acrylonitrile	107-13-1	0.102	0.055	0.396	0.221	0.118	0.859	0.015	15	0.130	55
tert-Amyl Methyl Ether	994-05-8	0.0002	0	0.011	0.001	0	0.046			0.067	2
Benzaldehyde	100-52-7	0.046	0.03	0.175	0.200	0.130	0.760			0.087	100
Benzene	71-43-2	0.167	0.138	0.450	0.535	0.441	1.438	0.13	4	0.010	100
Bromochloromethane	74-97-5	0	0	0	0	0	0			0.323	0
Bromodichloromethane	75-27-4	0.001	0	0.012	0.008	0	0.080			0.094	13
Bromoform	75-25-2	0.001	0	0.014	0.012	0	0.145	0.91	0.01	0.217	13
Bromomethane	74-83-9	0.014	0.013	0.129	0.056	0.049	0.501	5	0.01	0.078	82
1,3-Butadiene	106-99-0	0.029	0.026	0.126	0.065	0.058	0.279	0.033	2	0.024	95
Butyraldehyde	123-72-8	0.206	0.151	0.746	0.608	0.445	2.200			0.035	100
Carbon Disulfide	75-15-0	1.628	0.119	6.750	5.069	0.369	21.020	700	0.007	0.009	100
Carbon Tetrachloride	56-23-5	0.100	0.103	0.126	0.630	0.645	0.793	0.067	9	0.088	100
Chlorobenzene	108-90-7	0.001	0	0.015	0.003	0	0.069	1000	0.000003	0.110	5
Chloroethane	75-00-3	0.018	0	0.377	0.047	0	0.995	10000	0.000005	0.066	33
Chloroform	67-66-3	0.095	0.029	1.650	0.464	0.139	8.057	0.043	11	0.083	100
Chloromethane	74-87-3	0.565	0.559	0.675	1.166	1.154	1.394	0.56	2	0.029	100
Chloroprene	126-99-8	0	0	0	0	0	0	7		0.119	0
Crotonaldehyde	123-73-9	0.113	0.069	0.431	0.324	0.198	1.236			0.043	100
Dibromochloromethane	124-48-1	0.004	0.004	0.012	0.035	0.040	0.119			0.030	62
1,2-Dibromoethane	106-93-4	0.0005	0	0.011	0.004	0	0.085	0.0017	2	0.131	5
m-Dichlorobenzene	541-73-1	0.001	0	0.011	0.006	0	0.066			0.222	12
o-Dichlorobenzene	95-50-1	0.001	0	0.009	0.008	0	0.054	200	0.00004	0.126	18
p-Dichlorobenzene	106-46-7	0.005	0	0.018	0.028	0	0.108	0.091	0.3	0.114	42
Dichlorodifluoromethane	75-71-8	0.505	0.5105	0.583	2.498	2.525	2.883	200	0.01	0.089	100
1,1-Dichloroethane	75-34-3	0.0004	0	0.014	0.001	0	0.057	0.63	0.002	0.061	3
1,2-Dichloroethane	107-06-2	0.020	0.02	0.031	0.079	0.081	0.125	0.038	2	0.065	95
1,1-Dichloroethylene	75-35-4	0.0003	0	0.008	0.001	0	0.032	200	0.00001	0.056	3
cis-1,2-Dichloroethylene	156-59-2	0	0	0	0	0	0			0.048	0
trans-1,2-Dichloroethylene	156-60-5	0	0	0	0	0	0			0.048	0
Dichloromethane	75-09-2	0.159	0.131	0.570	0.552	0.455	1.980	2.1	0.3	0.080	100

^a See page 31 for footnotes.

Table 9 (continued)
NEW BRUNSWICK NJ 2014 Toxic VOCs Monitoring Data^a

Analyte ^b	CAS No.	Annual Mean (ppbv) ^{c,d}	Annual Median (ppbv) ^d	24-Hour Max. (ppbv)	Annual Mean (µg/m ³) ^{c,d}	Annual Median (µg/m ³) ^d	24-Hour Max. (µg/m ³)	Health Benchmark (µg/m ³) ^e	Annual Mean Risk Ratio ^f	Detection Limit (µg/m ³)	% Above Minimum Detection Limit
1,2-Dichloropropane	78-87-5	0	0	0	0	0	0	0.1		0.088	0
cis-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.082	0
trans-1,3-Dichloropropene	542-75-6	0	0	0	0	0	0			0.073	0
Dichlorotetrafluoroethane	76-14-2	0.018	0.018	0.024	0.125	0.126	0.168			0.161	100
2,5-Dimethylbenzaldehyde	5799-94-2	0	0	0	0	0	0			0.016	0
Ethyl Acrylate	140-88-5	0	0	0	0	0	0	2		0.049	0
Ethyl tert-Butyl Ether	637-92-3	0.017	0.021	0.037	0.071	0.088	0.155			0.059	72
Ethylbenzene	100-41-4	0.056	0.040	0.272	0.245	0.174	1.181	0.40	0.6	0.048	100
Formaldehyde	50-00-0	8.993	7.350	37.200	11.044	9.026	45.684	0.077	143	0.028	100
Hexachloro-1,3-butadiene	87-68-3	0.002	0	0.012	0.023	0	0.128	0.045	0.5	0.085	28
Hexaldehyde	66-25-1	0.115	0.078	0.415	0.471	0.320	1.700			0.090	100
Isovaleraldehyde	590-86-3	0	0	0	0	0	0			0.007	0
Methyl Ethyl Ketone	78-93-3	0.195	0.191	0.423	0.575	0.562	1.246	5000	0.0001	0.071	100
Methyl Isobutyl Ketone	108-10-1	0.035	0.032	0.074	0.142	0.129	0.303	3000	0.00005	0.061	100
Methyl Methacrylate	80-62-6	0.001	0	0.018	0.004	0	0.063	700	0.00001	0.088	10
Methyl tert-Butyl Ether	1634-04-4	0.011	0.013	0.035	0.038	0.045	0.126	3.8	0.01	0.040	65
n-Octane	111-65-9	0.029	0.027	0.087	0.136	0.126	0.406			0.093	97
Propionaldehyde	123-38-6	0.219	0.193	0.660	0.521	0.458	1.568	8	0.07	0.007	100
Propylene	115-07-1	0.357	0.304	1.740	0.614	0.522	2.995	3000		0.057	100
Styrene	100-42-5	0.047	0.026	0.318	0.199	0.109	1.354	1.8	0.1	0.102	87
1,1,2,2-Tetrachloroethane	79-34-5	0.006	0	0.091	0.043	0.000	0.625	0.017	3	0.124	20
Tetrachloroethylene	127-18-4	0.014	0.012	0.055	0.093	0.081	0.373	0.17	0.5	0.136	85
Tolualdehydes		0.054	0.040	0.166	0.267	0.197	0.816			0.025	96
Toluene	108-88-3	0.214	0.170	0.859	0.805	0.641	3.237	5000	0.0002	0.170	100
1,2,4-Trichlorobenzene	102-82-1	0.001	0	0.017	0.008	0	0.126	4	0.002	0.163	10
1,1,1-Trichloroethane	71-55-6	0.007	0.008	0.015	0.038	0.044	0.082	1000	0.00004	0.109	77
1,1,2-Trichloroethane	79-00-5	0	0	0	0	0	0	0.063		0.115	0
Trichloroethylene	79-01-6	0.003	0	0.018	0.016	0	0.097	0.5	0.03	0.118	25
Trichlorofluoromethane	75-69-4	0.236	0.237	0.284	1.325	1.332	1.596	700	0.002	0.084	100
Trichlorotrifluoroethane	76-13-1	0.080	0.081	0.093	0.617	0.621	0.713	30000	0.00002	0.130	100
1,2,4-Trimethylbenzene	95-63-6	0.040	0.030	0.431	0.196	0.145	2.119			0.123	97
1,3,5-Trimethylbenzene	108-67-8	0.018	0.014	0.224	0.090	0.069	1.101			0.108	85
Valeraldehyde	110-62-3	0.106	0.067	0.380	0.372	0.236	1.339			0.011	100
Vinyl chloride	75-01-4	0.001	0	0.024	0.003	0	0.061	0.11	0.02	0.028	7
m,p-Xylene	1330-20-7	0.096	0.078	0.462	0.416	0.336	2.006	100	0.004	0.009	100
o-Xylene	95-47-6	0.044	0.034	0.206	0.191	0.148	0.894	100	0.002	0.087	100

^a See page 31 for footnotes.

Footnotes for Tables 6 through 9

^b Analytes in bold text had annual means above the long-term health benchmark.

^c Numbers in italics are arithmetic means (or averages) based on less than 50% of the samples above the detection limit.

^d 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.

^e The health 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. These toxicity values are not available for all chemicals. For more information, go to www.nj.gov/dep/aqpp/risk.html.

^f The risk ratio for a chemical is a comparison of the annual mean air concentration to the long-term health benchmark. If the annual mean is 0, then the annual mean risk ratio is not calculated.

^g Acrolein concentrations are highly uncertain because of problems with collection and analysis methods.

Table 10
Analytes with 100% Non-Detects in 2014

	Analyte	CAS No.	Camden	Chester	Elizabeth	New Brunswick
1	tert-Amyl Methyl Ether	994-05-8	X		X	
2	Bromochloromethane	74-97-5	X	X	X	X
3	Chloroprene	126-99-8	X	X		X
4	1,2-Dibromoethane	106-93-4	X			
5	1,1-Dichloroethane	75-34-3	X			
6	1,1-Dichloroethylene	75-35-4	X			
7	cis-1,2-Dichloroethylene	156-59-2	X	X		X
8	trans-1,2-Dichloroethylene	156-60-5		X	X	X
9	1,2-Dichloropropane	78-87-5		X	X	X
10	cis-1,3-Dichloropropene	542-75-6	X			X
11	trans-1,3-Dichloropropene	542-75-6	X	X	X	X
12	2,5-Dimethylbenzaldehyde	5799-94-2	X	X	X	X
13	Ethyl Acrylate	140-88-5	X	X	X	X
14	Isovaleraldehyde	590-86-3	X	X	X	X
15	1,1,2-Trichloroethane	79-00-5	X	X	X	X

In 2014, collected samples of these chemicals were never above the detection limits at the specific monitoring locations. However, they may be present in the air below the detection limit level. Chemical-specific detection limits can be found in Tables 6 through 9.

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NJDEP, Toxicity Values for Inhalation Exposure, DAQ, August 2011, www.nj.gov/dep/aqpp/permitguide/ToxAll_2011.pdf

USEPA, 2005 National-Scale Air Toxics Assessment, Office of Air and Radiation, www3.epa.gov/ttn/atw/nata2005.

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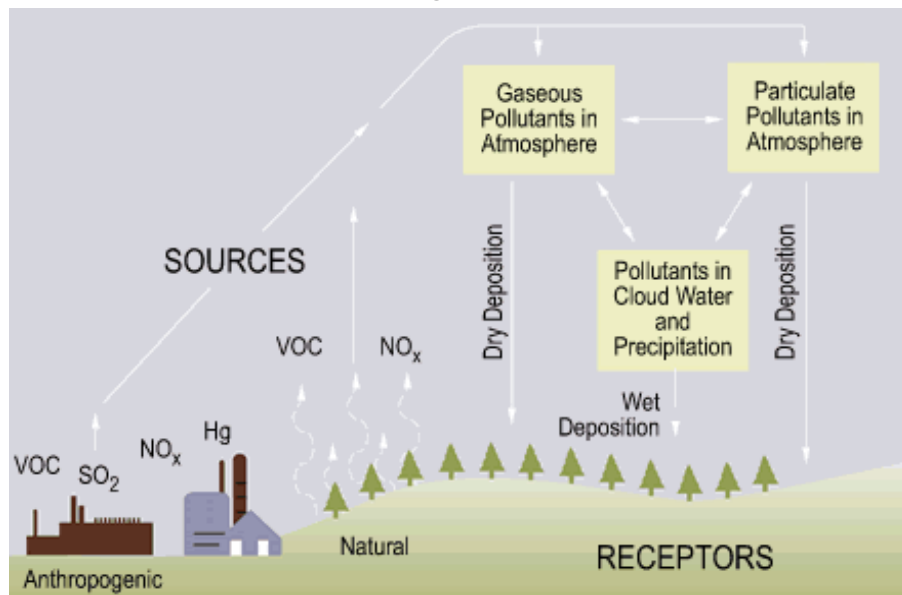
2014 Atmospheric Deposition Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Atmospheric deposition is a process in which pollutants are deposited on land or water from the air. It occurs when pollutants are removed from the atmosphere and deposited by precipitation (wet deposition), or by the settling out of particulates (dry deposition). Dry deposition also occurs when gaseous pollutants are absorbed by land or water bodies. Figure 1 shows the basic mechanisms of deposition and the major pollutants of concern. These include sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and mercury. SO_2 is a major contributor to acid deposition, which can acidify water bodies and reduce their ability 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. VOCs are a large and diverse group of compounds, some of which are toxic or carcinogenic. Mercury will accumulate in fish by a process known as bio-magnification. Small amounts of mercury in water are absorbed by small organisms. These small organisms are in turn consumed by larger ones. As the mercury moves up the food chain, it becomes more concentrated. Fish in mercury-contaminated water can become contaminated to the point where they are no longer safe for people to eat. For more information on mercury 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.

Figure 1



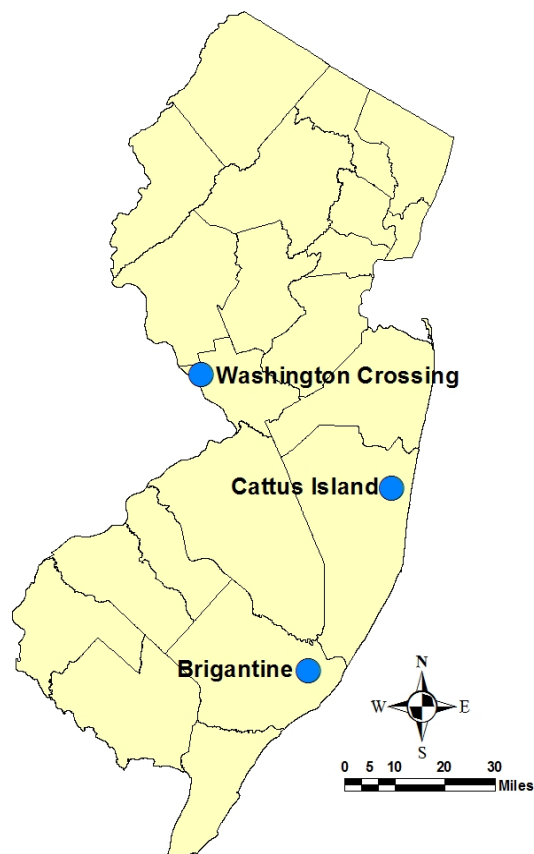
Source: www.epa.gov/acidrain/what/index.html

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

MONITORING LOCATIONS

Figure 2 shows the three active deposition monitoring sites in New Jersey for 2014: Washington Crossing State Park, Cattus Island, and the Edwin B. Forsythe National Wildlife Refuge (NWR), also known as Brigantine. Each of the sites has a sampler for collecting wet deposition (rain and snow) and a rain gauge for determining precipitation amounts. They are part of the National Atmospheric Deposition Program's (NADP) National Trends Network (NTN). A sample is collected every week from each site. The New Jersey Department of Environmental Protection (NJDEP) collects all samples from Washington Crossing and Cattus Island. The United States Fish and Wildlife Service, Air Quality Branch (USFWS-AQB), is responsible for sample collection at the Edwin B. Forsythe NWR. All collected samples are shipped to the Central Analytical Laboratory (CAL) at the Illinois State Water Survey (ISWS) for analysis. CAL analyzes each sample with the goal of providing data on amounts, trends, and geographic distributions of acids, nutrients, and base cations in precipitation. The resulting data is then used by the U.S. Environmental Protection Agency (USEPA) to assess national deposition patterns and trends.

Figure 2
Acid Precipitation Monitoring Network - 2014



SUMMARY OF 2014 DATA

A summary of the 2014 wet deposition data is provided in Table 1. Raw data was obtained from the NADP website. The table shows total deposition, pH, conductivity, and concentrations of several important ions (calcium, magnesium, potassium, sodium, ammonium, nitrate, chloride, and sulfate).

When acidity is reported on the pH scale, 7 is considered neutral, 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 values recorded at the Washington Crossing State Park and Cattus Island weekly samplers was 5.09 and 5.04 respectively. The Edwin B. Forsythe NWR sampler recorded a mean pH of 5.08.

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.

Certain ions can affect the chemistry of lakes, streams and other water bodies. Concentrations of these specific ions are reported in Table 1 for each site, for each season of the year, along with annual averages.

Table 1
 Acid Precipitation Monitoring Network - 2014
 Annual and Seasonal Averages
 Weighted by Precipitation (Precip.) Amount

Ca ²⁺ - Calcium	Cond. - Specific conductance
Mg ²⁺ - Magnesium	cm - Centimeter
K ⁺ - Potassium	uS/cm - MicroSiemens per centimeter
Na ⁺ - Sodium	mg/L - Milligrams per liter
NH ₄ ⁺ - Ammonium	Winter - December-February
NO ₃ ⁻ - Nitrate	Spring - March-May
Cl ⁻ - Chloride	Summer - June-August
SO ₄ ²⁻ - Sulfate	Fall - September-November

Edwin B. Forsythe National Wildlife Refuge

	Precip. (cm)	pH	Cond. (uS/cm)	Ca ²⁺ (mg/L)	Mg ²⁺ (mg/L)	K ⁺ (mg/L)	Na ⁺ (mg/L)	NH ₄ ⁺ (mg/L)	NO ₃ ⁻ (mg/L)	Cl ⁻ (mg/L)	SO ₄ ²⁻ (mg/L)
Winter	35.10	4.92	13.41	0.067	0.108	0.043	0.918	0.122	0.569	1.602	0.693
Spring	28.07	5.07	9.97	0.069	0.076	0.043	0.600	0.164	0.514	1.072	0.504
Summer	39.57	5.21	7.99	0.065	0.059	0.103	0.435	0.165	0.460	0.811	0.456
Fall	33.66	5.09	11.95	0.066	0.109	0.072	0.948	0.125	0.446	1.723	0.583
Annual	133.20	5.08	10.97	0.069	0.094	0.073	0.773	0.141	0.487	1.389	0.565

Washington Crossing State Park

	Precip. (cm)	pH	Cond. (uS/cm)	Ca ²⁺ (mg/L)	Mg ²⁺ (mg/L)	K ⁺ (mg/L)	Na ⁺ (mg/L)	NH ₄ ⁺ (mg/L)	NO ₃ ⁻ (mg/L)	Cl ⁻ (mg/L)	SO ₄ ²⁻ (mg/L)
Winter	30.15	4.93	8.44	0.037	0.014	0.012	0.106	0.142	0.728	0.188	0.490
Spring	34.61	5.26	7.07	0.090	0.040	0.037	0.262	0.231	0.631	0.457	0.544
Summer	28.13	5.14	7.32	0.100	0.026	0.149	0.063	0.299	0.859	0.121	0.584
Fall	22.42	5.06	6.84	0.042	0.027	0.018	0.201	0.136	0.541	0.371	0.416
Annual	114.11	5.09	7.50	0.073	0.030	0.058	0.176	0.214	0.704	0.315	0.525

Cattus Island

	Precip. (cm)	pH	Cond. (uS/cm)	Ca ²⁺ (mg/L)	Mg ²⁺ (mg/L)	K ⁺ (mg/L)	Na ⁺ (mg/L)	NH ₄ ⁺ (mg/L)	NO ₃ ⁻ (mg/L)	Cl ⁻ (mg/L)	SO ₄ ²⁻ (mg/L)
Winter	27.76	4.96	12.16	0.044	0.094	0.032	0.780	0.108	0.528	1.408	0.607
Spring	32.57	4.85	15.07	0.152	0.091	0.053	0.663	0.364	1.264	1.143	1.148
Summer	31.17	5.21	8.09	0.053	0.061	0.033	0.537	0.154	0.408	0.986	0.423
Fall	31.37	5.07	14.80	0.086	0.158	0.058	1.328	0.128	0.535	2.433	0.700
Annual	123.88	5.04	12.54	0.075	0.112	0.046	0.937	0.153	0.579	1.704	0.651

WET DEPOSITION

Acid deposition is primarily the result of deposition of sulfuric and nitric acids and ammonium that are formed from atmospheric emissions of sulfur dioxide, nitrogen oxides, and ammonia. Excessive deposition of these materials can have significant environmental impacts on both terrestrial and freshwater ecosystems through acidification of soil and water bodies, reducing the diversity of aquatic organisms and stressing native vegetation (Driscoll et al. 2003).

Sulfate, for example, can alter soil and water chemistry, and a deposition level of 20 kilograms per hectare per year has been generally accepted as the limit above which damage to sensitive natural resources is likely to occur (i.e., Aquatic Effect Level). Deposition in rain and snow is often expressed as mass per unit land area over time.

Figures 3, 4 and 5 show the change in the amount of sulfate ion deposited over the last several years at the Washington Crossing State Park, Edwin B. Forsythe NWR, and Cattus Island sites, respectively. Figures 6, 7 and 8 show the amount of ammonium ion deposited at these sites, and Figures 9, 10 and 11 show the amount of nitrate ion deposited. All figures below show “wet deposition” only. They do not include dry particulate deposited when no precipitation was occurring. Therefore, the actual total deposition is higher than what is shown here.

The year-to-year variations in the charts below are a function of both the concentrations of sulfate, nitrate, and ammonium in air and in cloud droplets, and the total amount of precipitation that occurs each 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 data is in the form of annual totals, it is also sensitive to the loss of samples due to contamination or other factors.

According to the New Jersey Comparative Risk Project (NJCRP) Ecological Technical Work Group, streams and lakes with significant buffering capacity are somewhat protected from the effects of acid deposition. It is for this reason that actual risk assessments are primarily based on the direct observation of pH in streams and lakes, and on actual observed effects on aquatic species, rather than on deposition measurements alone (NJCRP 2003).

To convert the values shown in Figures 3 through 11 to pounds per acre per year, multiply by 0.89 (since one kilogram equals 2.21 pounds and one hectare equals 2.47 acres).

Figures 3 through 11 Data Legend	
•	Met Criteria
▲	Did Not Meet Criteria
All raw data for Figures 3 through 8 were obtained from the NADP website. NADP criteria requirements can also be found at http://nadp.isws.illinois.edu/ .	

Figure 3
 Sulfate (SO₄²⁻) NADP/NTN Site NJ99 (Washington Crossing State Park)
 Annual Wet Deposition 1981-2014
 Kilograms per Hectare (kg/ha)

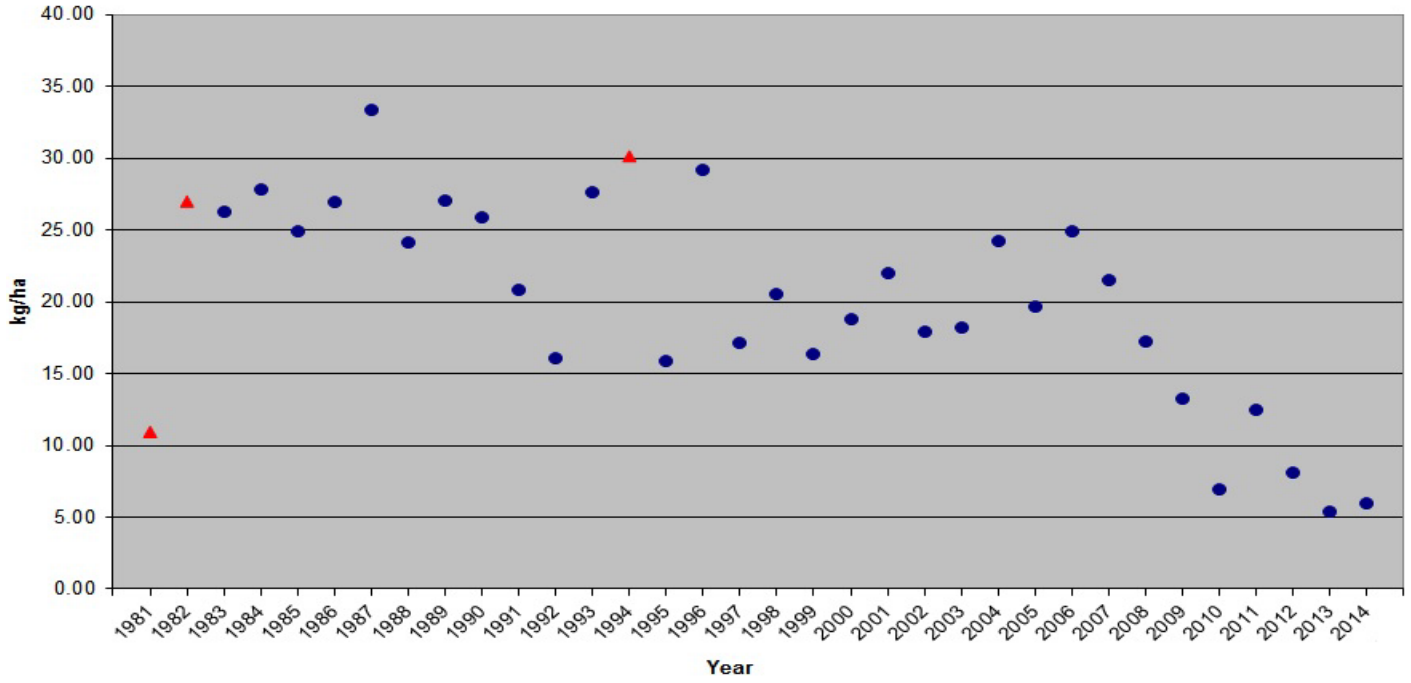


Figure 4
 Sulfate (SO₄²⁻) NADP/NTN Site NJ00 (Edwin B. Forsythe National Wildlife Refuge)
 Annual Wet Deposition 1998-2014
 Kilograms per Hectare (kg/ha)

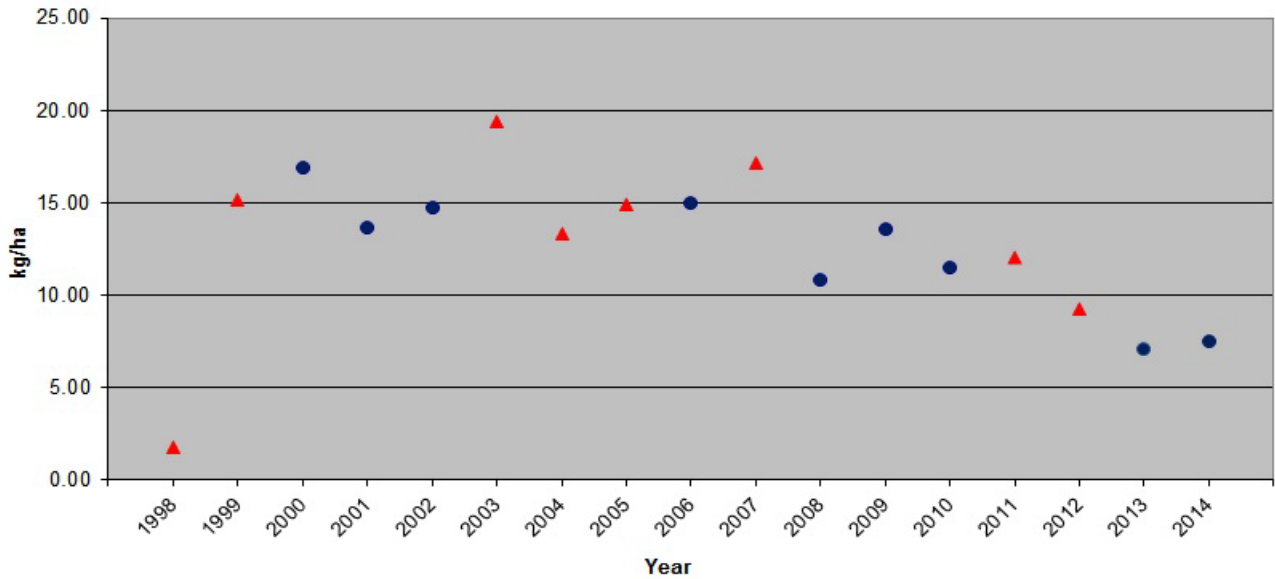


Figure 5
 Sulfate (SO_4^{2-}) NADP/NTN Site NJ39 (Cattus Island)
 Annual Wet Deposition 2012-2014
 Kilograms per Hectare (kg/ha)

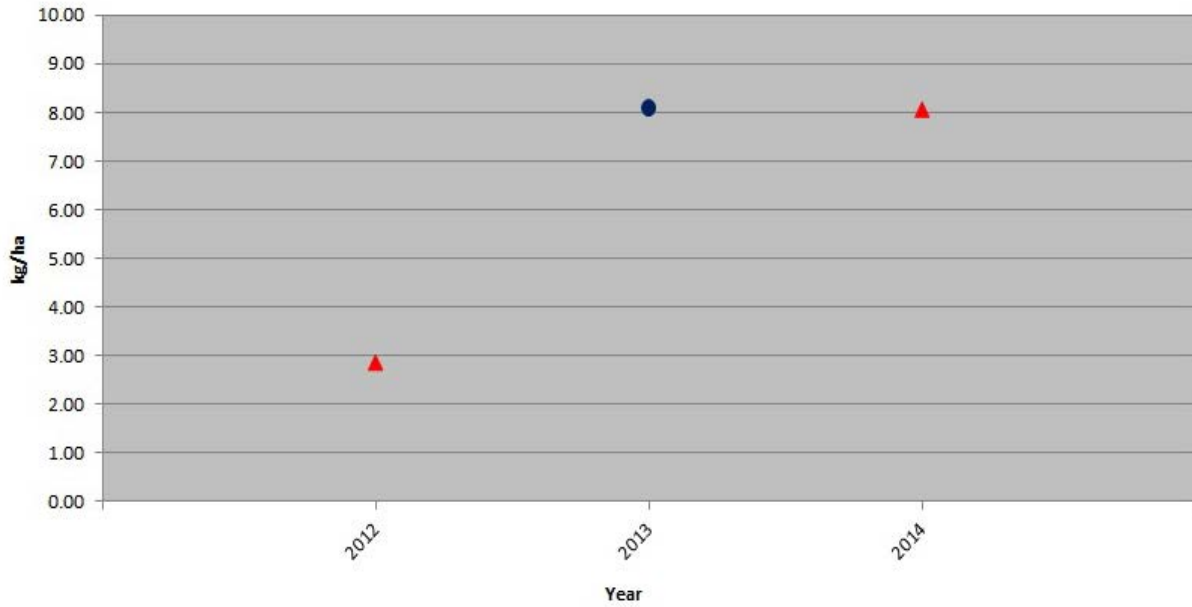


Figure 6
 Ammonium (NH_4^+) NADP/NTN Site NJ99 (Washington Crossing State Park)
 Annual Wet Deposition 1981-2014
 Kilograms per Hectare (kg/ha)

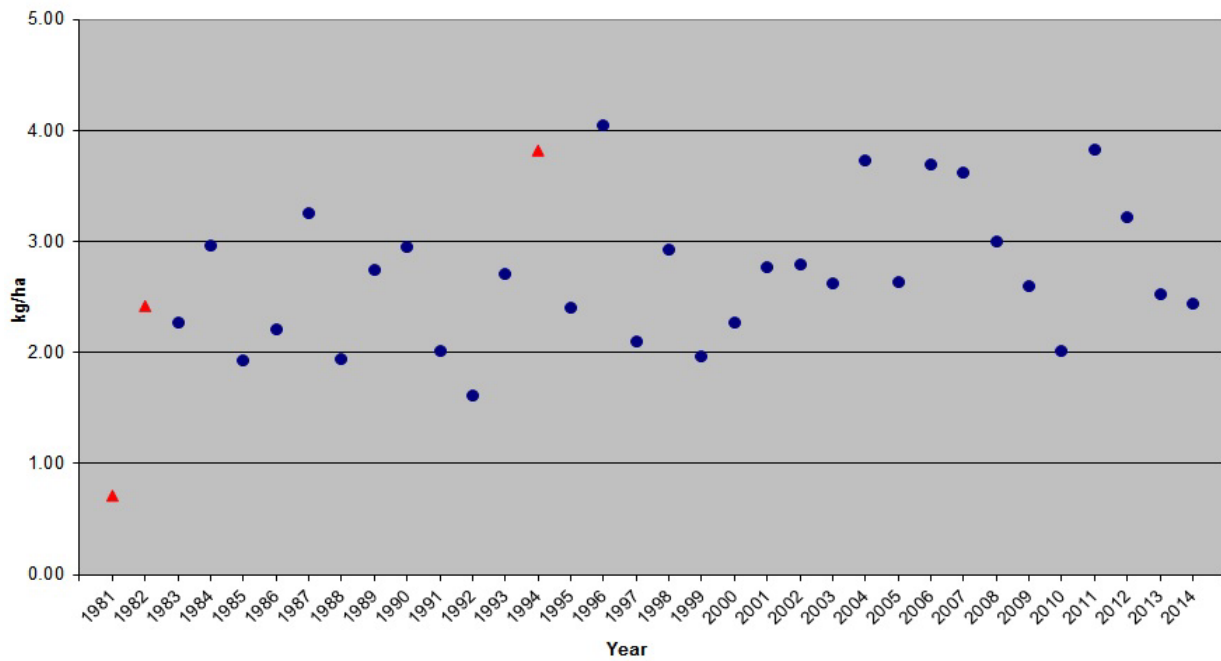


Figure 7
 Ammonium (NH₄⁺) NADP/NTN Site NJ00 (Edwin B. Forsythe National Wildlife Refuge)
 Annual Wet Deposition 1998-2014
 Kilograms per Hectare (kg/ha)

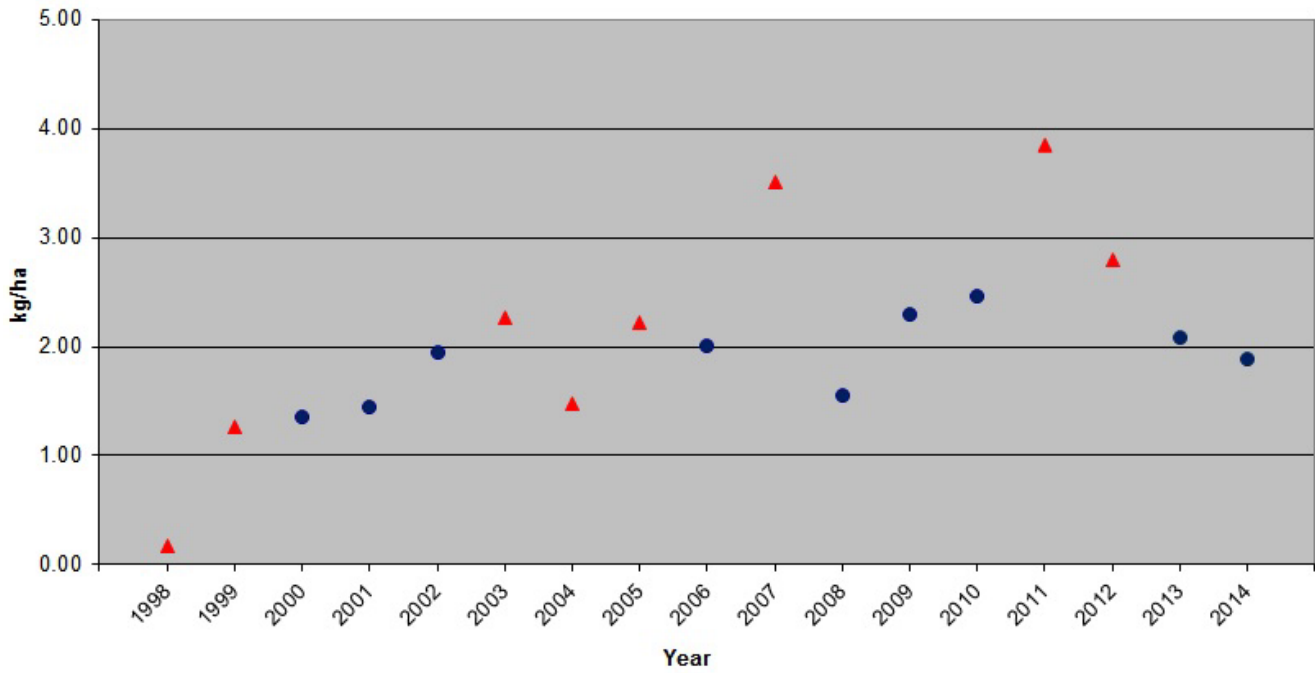


Figure 8
 Ammonium (NH₄⁺) NADP/NTN Site NJ39 (Cattus Island)
 Annual Wet Deposition 2012-2014
 Kilograms per Hectare (kg/ha)

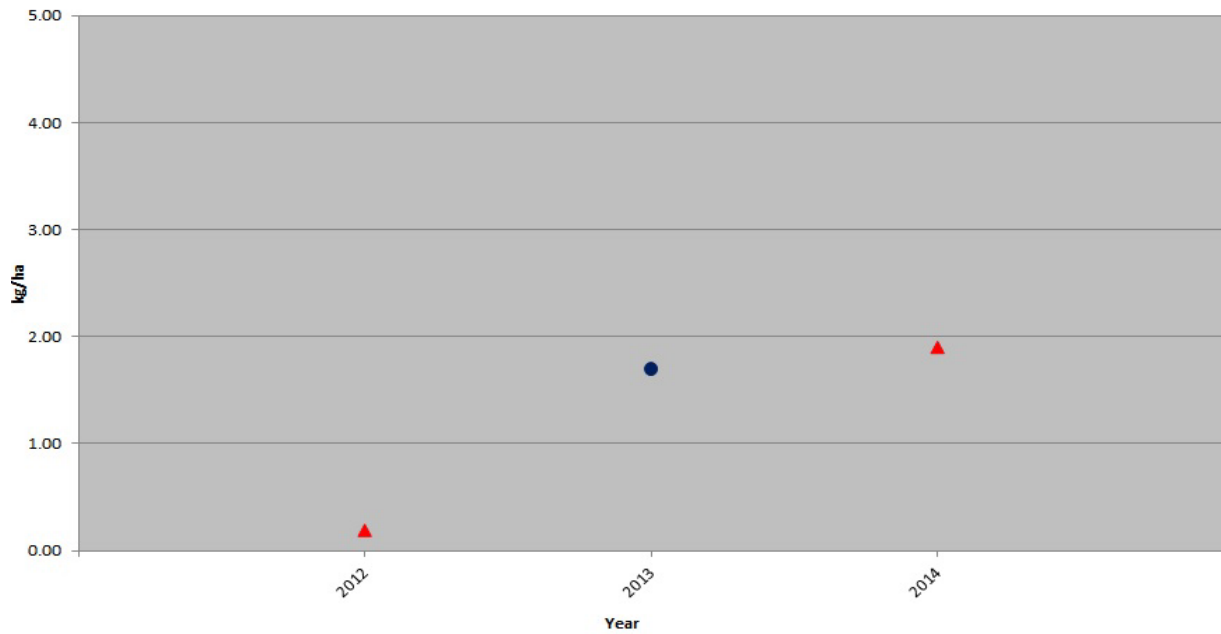


Figure 9
 Nitrate (NO_3^-) NADP/NTN Site NJ99 (Washington Crossing State Park)
 Annual Wet Deposition 1981-2014
 Kilograms per Hectare (kg/ha)

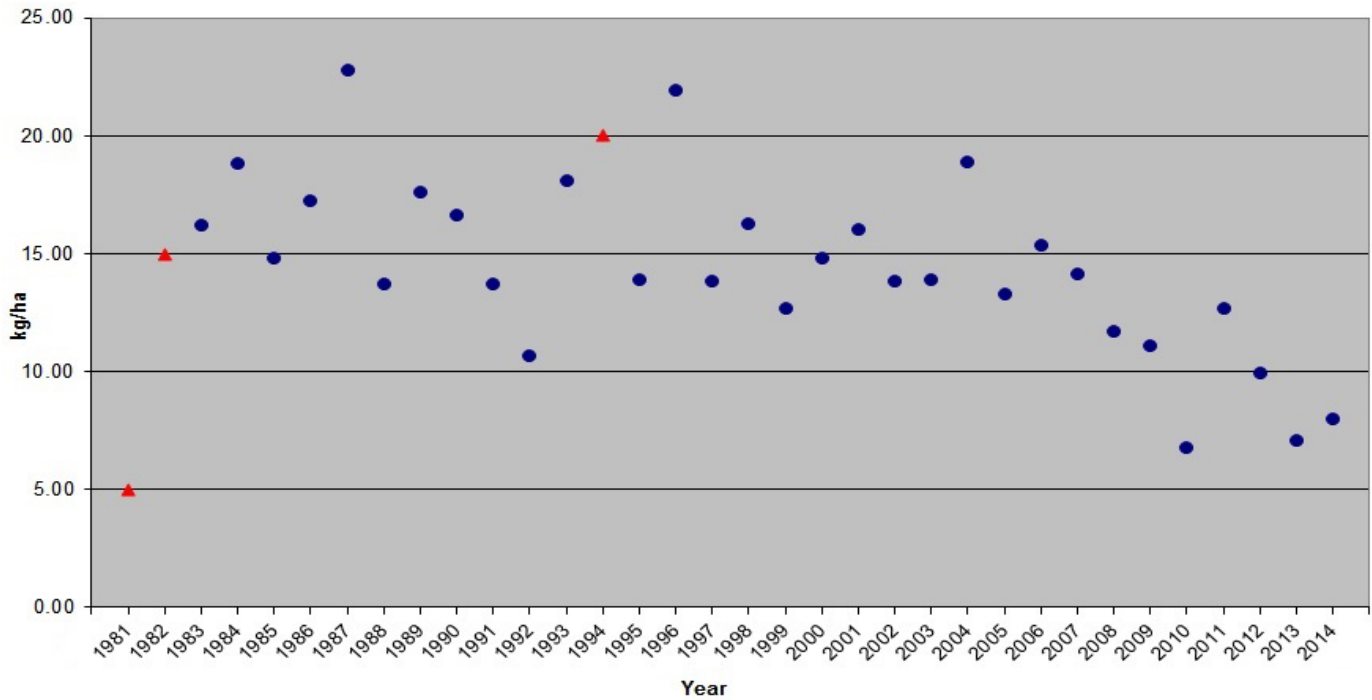


Figure 10
 Nitrate (NO_3^-) NADP/NTN Site NJ00 (Edwin B. Forsythe National Wildlife Refuge)
 Annual Wet Deposition 1998-2014
 Kilograms per Hectare (kg/ha)

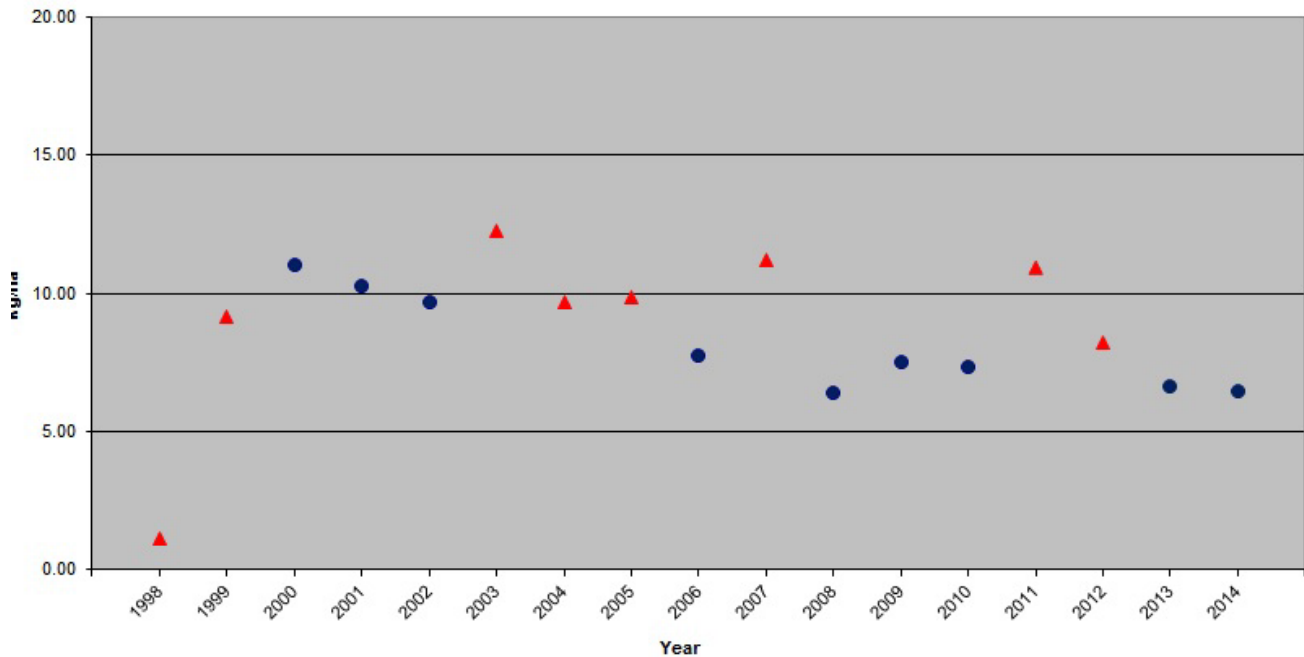
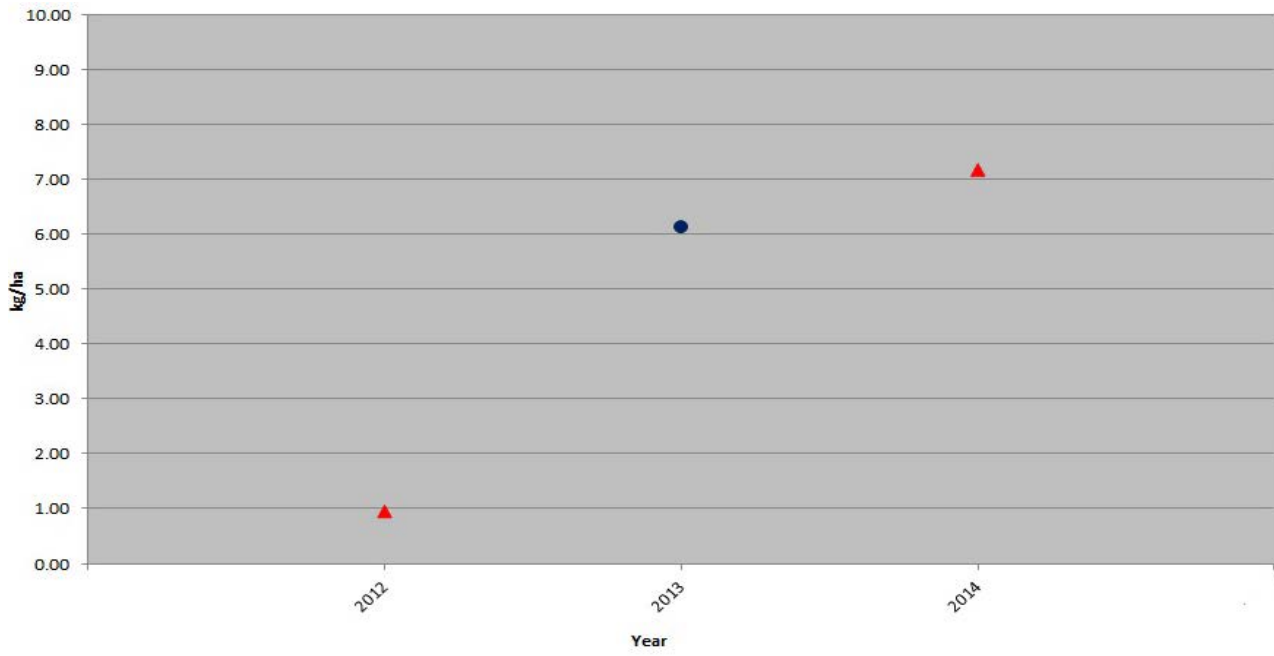


Figure 11
Nitrate (NO_3^-) NADP/NTN Site NJ39 (Cattus Island)
Annual Wet Deposition 2012-2014
Kilograms per Hectare (kg/ha)



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2014 Meteorology Summary

New Jersey Department of Environmental Protection

AIR POLLUTION AND METEOROLOGY

Meteorology plays an important role in the distribution of pollution throughout the troposphere, the layer of the atmosphere closest to the earth's surface. Atmospheric processes such as wind speed and wind direction affect the transport and dispersion of air pollution. Precipitation, solar radiation, and other weather phenomena influence chemical reactions and atmospheric transformations. By studying meteorological and air pollution data together, scientists and mathematicians have developed reasonably accurate models for predicting the fate of pollutants as they go through the stages of transport, dispersion, transformation, and removal.

Scientists, engineers, and policy makers can use air pollution models as a screening tool, for comparing predicted pollutant concentrations to National Ambient Air Quality Standards (NAAQS), to determine the impacts of new and existing air pollution sources, and to design ambient air monitoring networks. The meteorological data collected by the New Jersey Department of Environmental Protection (NJDEP) can assist planners in preparing State Implementation Plans (SIPs) to reduce pollutant emissions, engineers in designing or evaluating air pollution permit applications, and scientists in siting air monitoring stations.

Figure 1
New Jersey Climate Zones

CLIMATOLOGY IN NEW JERSEY

New Jersey is located about halfway between the Equator and the North Pole, on the eastern coast of the United States. Its geographic location results in the state being influenced by different air streams at different times (wet, dry, hot, cold), making for daily weather that is highly variable.

Although New Jersey is one of the smallest states in the Union, with a land area of 7,836 square miles, it has five distinct climate zones, which are classified as the Northern, Central, Pine Barrens, Southwest, and Coastal Zones. The topography of the different zones, their distance from the Atlantic Ocean, and the prevailing atmospheric flow patterns affecting them produce distinct variations in the daily weather. These climate zones are shown in Figure 1.



Source: Office of the New Jersey State Climatologist

MONITORING LOCATIONS

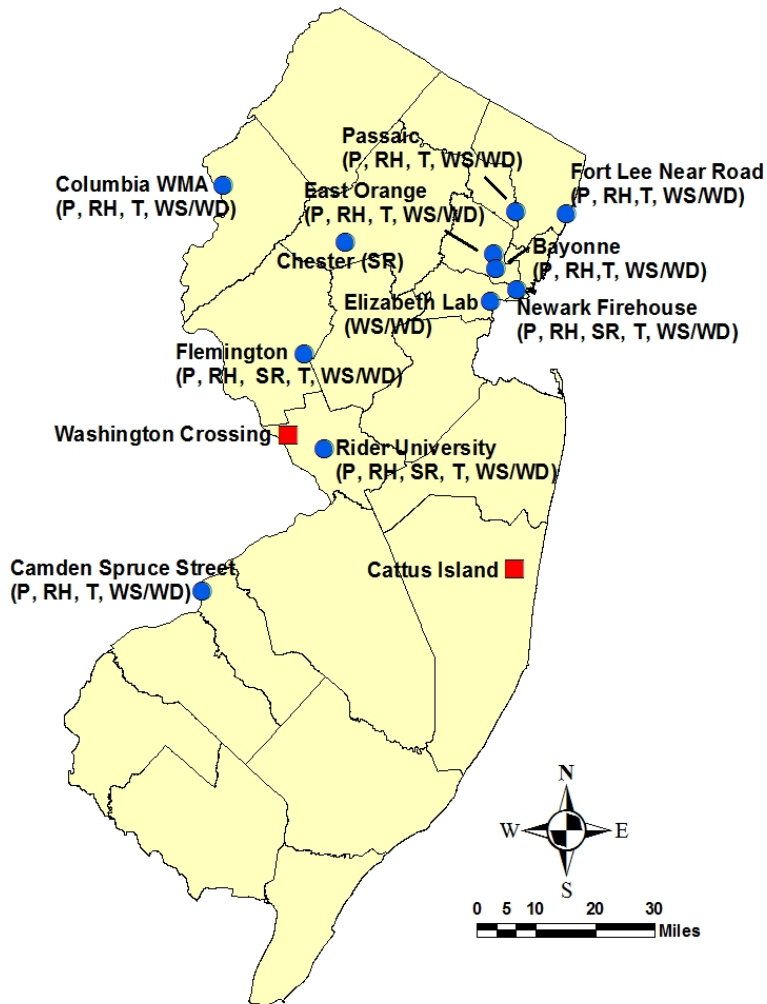
NJDEP maintains a network of eleven meteorological monitoring locations. In addition, total weekly precipitation is measured in Washington Crossing State Park and Cattus Island County Park. Not all meteorological parameters are measured at each site. Table 1 lists the meteorological parameters measured at each site, and Figure 2 shows the 2014 Meteorological Monitoring Network. In Table 2, the 2014 meteorological data is summarized alphabetically by site. Figure 3 shows the average monthly temperatures of the Northern Region monitoring stations (Bayonne, Columbia, East Orange, Fort Lee Near Road, and Newark Firehouse) versus the 30-year average monthly temperatures measured by the Northern Office of the State Climatologist. Figure 4 shows the average monthly temperatures of the Southern Region monitoring stations (Camden Spruce Street, Flemington, and Rider University) versus the 30-year average monthly temperatures measured by the Southern Office of the State Climatologist.

Figures 5 through 14 depict annual wind roses for Bayonne, Camden Spruce Street, Columbia WMA, East Orange, Elizabeth Trailer, Flemington, Fort Lee Near Road, Newark Firehouse, Passaic and Rider University, respectively. Presented in a circular format, a wind rose shows the frequency of winds blowing *from* particular directions over a specified period. The length of each "spoke" around the circle is related to the frequency that the wind blows from a particular direction per unit time. Each concentric circle represents a different frequency, starting with zero at the center and increasing frequencies at the outer circles. Each spoke is broken down into color-coded bands that show wind speed ranges.

Table 1
2014 New Jersey Meteorological Monitoring Network
Parameter Summary

Site Name	Temperature	Relative Humidity	Wind Speed	Wind Direction	Barometric Pressure	Solar Radiation	Precipitation
Bayonne	X	X	X	X	X		X
Camden Spruce Street	X	X	X	X	X		
Cattus Island							X
Chester						X	
Columbia WMA	X	X	X	X	X		
East Orange	X	X	X	X	X		
Elizabeth Lab			X	X			
Flemington	X	X	X	X	X	X	
Fort Lee Near Road	X	X	X	X	X		X
Newark Firehouse	X	X	X	X	X	X	
Passaic	X	X	X	X	X		
Rider University	X	X	X	X	X		
Washington Crossing							X

Figure 2
2014 Meteorological Monitoring Network



Legend

●	Meteorological Site
P	Barometric Pressure
RH	Relative Humidity
SR	Solar Radiation
T	Temperature
WS/WD	Wind Speed/Wind Direction
■	Deposition Site

Table 2
Summary of Meteorological Monitoring Data - 2014

MONITORING SITES		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
Bayonne														
Temperature (°F)	Mean	No Data ⁴	No Data ⁴	38	50	63	71	74	72	67	57	43	38	57
	Mean ¹	--	--	39	50	60	69	76	72	65	53	44	34	52
	Min	No Data ⁴	No Data ⁴	32	42	57	64	68	66	61	51	37	34	32
	Max	No Data ⁴	No Data ⁴	45	57	69	78	82	79	75	64	49	43	82
Relative Humidity (%)	Mean	No Data ⁴	No Data ⁴	52.9	58.1	64.5	63.1	63.0	61.3	64.9	64.8	58.3	66.5	61.7
	Min	No Data ⁴	No Data ⁴	38.0	38.0	49.9	46.2	45.1	44.7	46.0	48.7	43.5	56.0	38.0
	Max	No Data ⁴	No Data ⁴	67.3	76.1	78.3	79.1	79.7	77.5	80.0	78.9	73.3	78.0	80.0
Barometric Pressure (in of Hg)	Mean	No Data ⁴	No Data ⁴	29.93	30.01	30.02	29.95	29.95	29.98	30.07	29.89	30.02	30.09	29.99
	Min	No Data ⁴	No Data ⁴	29.76	29.85	29.97	29.87	29.87	29.92	30.00	29.80	29.89	29.97	29.76
	Max	No Data ⁴	No Data ⁴	30.07	30.14	30.08	30.03	30.01	30.04	30.15	29.98	30.13	30.20	30.20
Precipitation (inches)	Historical ²	3.49	2.90	4.12	4.31	4.37	4.51	4.78	4.13	4.49	4.36	3.90	4.00	49.37
	Observed	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	2.27	2.38	1.15	2.88	2.65	2.83	No Data ³
Camden Spruce Street														
Temperature (°F)	Mean	29	31	39	53	65	74/	76	74	69	59	44	40	54
	Mean ⁵	33	35	42	52	62	71	76	74	67	56	47	37	54
	Min	20	25	30	44	57	65	69	66	62	52	38	35	20
	Max	37	39	46	62	73	82	85	82	78	66	51	46	85
Relative Humidity (%)	Mean	58.7	57.9	50.9	53.2	56.5	59.7	59.1	59.1	63.1	61.4	54.8	62.4	58.0
	Min	40.8	40.7	35.1	34.9	39.9	39.7	40.6	40.9	43.1	42.0	36.6	49.7	34.9
	Max	76.2	78.4	70.4	75.8	77.2	80.0	78.3	79.0	81.3	78.1	73.8	77.1	81.3
Barometric Pressure (in of Hg)	Mean	30.03	30.04	29.99	30.01	30.01	29.96	29.96	29.99	30.07	29.91	30.05	30.10	30.01
	Min	29.82	29.88	29.83	29.85	29.92	29.87	29.87	29.93	29.99	29.80	29.88	29.98	29.80
	Max	30.20	30.20	30.14	30.15	30.07	30.04	30.02	30.05	30.15	30.00	30.16	30.23	30.23
Precipitation (inches)	Historical ⁶	3.47	2.85	4.35	3.95	3.82	3.79	4.39	4.30	3.87	3.70	3.50	3.88	45.85
	Observed	No Data ⁷	No Data ⁷	No Data ⁷	6.597	2.59	4.15	3.68	1.39	3.30	3.01	3.05	1.39	No Data ⁷

1) Office of the New Jersey State Climatologist 30-year mean Northern NJ temperature data.
2) Office of the New Jersey State Climatologist 30-year Northern NJ mean precipitation data.
3) Commenced data collection July 2014.
4) Commenced data collection March 2014.
5) Office of the New Jersey State Climatologist 30-year mean Southern NJ temperature data.
6) Office of the New Jersey State Climatologist 30-year Southern NJ mean precipitation data.
7) Commenced data collection, April 2014.

Table 2, Continued
Summary of Meteorological Monitoring Data – 2014

MONITORING SITES		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
Chester														
Solar Radiation (Langleys)	Mean	0.085	0.123	0.216	0.266	0.320	0.367	0.360	0.313	0.235	0.155	0.100	0.064	0.217
	Max	0.458	0.573	0.886	1.003	1.104	1.216	1.243	1.145	1.044	0.746	0.523	0.339	1.243
Columbia WMA														
Temperature (°F)	Mean	22	25	33	49	61	69	70	68	62	53	38	34	48
	Mean ¹	29	32	39	50	60	69	74	72	65	53	44	34	52
	Min	12	14	23	37	50	57	60	57	52	44	29	29	12
	Max	30	34	41	59	71	79	82	79	76	63	47	41	82
Relative Humidity (%)	Mean	63.1	61.4	51.8	57.6	63.4	69.9	72.7	72.0	73.2	69.8	61.6	67.6	65.3
	Min	46.6	40.9	34.1	34.4	39.5	45.0	44.8	44.9	44.9	46.9	42.6	53.8	34.1
	Max	78.0	79.6	71.3	81.9	86.6	90.3	91.1	90.3	90.6	88.4	80.3	81.1	91.1
Barometric Pressure (in of Hg)	Mean	29.48	29.51	29.47	29.49	29.50	29.47	29.47	29.50	29.59	29.40	29.51	29.58	29.49
	Min	29.29	29.34	29.31	29.36	29.42	29.39	29.38	29.45	29.52	29.30	29.38	29.45	29.29
	Max	29.64	29.66	29.61	29.64	29.56	29.55	29.53	29.57	29.67	29.49	29.63	29.70	29.60
Precipitation (inches)	Historical ²	3.49	2.90	4.12	4.31	4.37	4.51	4.78	4.13	4.49	4.36	3.90	4.00	49.37
	Observed	No Data ³	No Data ³	No Data ³	5.759	1.529	4.117	4.39	1.63	1.13	2.50	0.99	1.97	No Data ³
East Orange														
Temperature (°F)	Mean	26	28	36	50	62	71	74	72	67	56	42	37	51
	Mean ¹	29	32	39	50	60	69	74	72	65	53	44	34	52
	Min	20	23	28	41	55	63	66	64	59	50	35	33	20
	Max	32	35	43	59	70	79	82	79	75	64	49	43	82
Relative Humidity (%)	Mean	59.2	58.0	47.0	53.7	54.6	59.7	60.4	58.1	62.3	63.0	54.1	63.1	57.7
	Min	44.4	42.0	31.8	33.9	39.3	40.7	41.9	40.6	43.2	44.8	38.1	50.4	31.8
	Max	72.7	74.3	62.3	73.4	74.8	76.6	78.4	76.4	79.9	79.0	70.8	76.0	79.9
Barometric Pressure (in of Hg)	Mean	29.80	29.85	29.81	29.84	29.82	29.79	29.78	29.82	29.91	29.73	29.85	29.92	29.82
	Min	29.68	29.73	29.64	29.69	29.76	29.72	29.70	29.77	29.84	29.64	29.73	29.81	29.64
	Max	29.97	29.99	29.95	29.97	29.87	29.87	29.84	29.88	29.99	29.82	29.96	30.03	30.03

1) Office of the New Jersey State Climatologist 30-year mean Northern NJ temperature data.

2) Office of the New Jersey State Climatologist 30-year Northern NJ mean precipitation data.

3) Commenced data collection April 2014.

Table 2, Continued
Summary of Meteorological Monitoring Data - 2014

MONITORING SITES		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
Flemington														
Temperature (°F)	Mean	24	27	35	49	60	69	71	69	63	54	39	36	49
	Mean ⁴	33	35	42	52	62	71	76	74	67	56	47	37	54
	Min	15	17	26	37	50	59	62	58	52	45	30	30	15
	Max	31	34	42	59	69	79	81	79	75	63	48	43	81
Relative Humidity (%)	Mean	63.70	64.00	52.40	58.40	63.50	67.10	68.90	68.40	70.30	68.30	61.10	67.10	64.40
	Min	47.90	42.30	36.60	37.90	46.00	45.90	45.40	44.90	44.60	45.70	41.20	52.00	36.60
	Max	79.60	82.30	73.60	81.70	85.20	89.40	89.90	89.60	89.60	87.40	80.80	82.00	89.90
Solar Radiation (Langleys)	Mean	0.112	0.169	0.229	0.301	0.287	0.359	0.359	0.309	0.250	0.166	0.122	0.077	0.228
	Max	0.512	0.720	0.891	1.021	0.970	1.154	1.161	1.049	0.957	0.717	0.534	0.386	1.161
Barometric Pressure (in of Hg)	Mean	29.84	29.85	29.81	29.84	29.83	29.79	29.79	29.82	29.91	29.73	29.86	29.92	29.83
	Min	29.69	29.74	29.64	29.68	29.76	29.72	29.72	29.77	29.84	29.65	29.73	29.80	29.64
	Max	30.00	30.00	29.96	29.97	29.88	29.87	29.85	29.88	29.99	29.82	29.97	30.04	30.04
Fort Lee Near Road														
Temperature (°F)	Mean	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	74	72	67	57	42	37	58
	Mean ¹	--	--	--	--	--	--	74	72	65	53	44	34	52
	Min	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	68	65	60	51	36	33	33
	Max	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	81	80	75	63	48	42	81
Relative Humidity (%)	Mean	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	60.3	60.3	63.8	64.0	55.9	66.7	61.8
	Min	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	33.8	39.9	45.6	47.0	39.6	53.7	33.8
	Max	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	68.5	79.9	81.6	80.3	73.3	80.0	81.6
Barometric Pressure (in of Hg)	Mean	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	29.78	29.68	29.77	29.58	29.71	29.76	29.71
	Min	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	29.74	29.63	29.69	29.48	29.56	29.64	29.48
	Max	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	29.77	29.74	29.85	29.67	29.82	29.88	29.88
Precipitation (inches)	Historical ²	3.49	2.90	4.12	4.31	4.37	4.51	4.78	4.13	4.49	4.36	3.90	4.00	49.37
	Observed	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	0.10	2.52	0.79	4.29	2.76	4.97	No Data ³

- 1) Office of the New Jersey State Climatologist 30-year mean Northern NJ temperature data.
- 2) Office of the New Jersey State Climatologist 30-year Northern NJ mean precipitation data.
- 3) Commenced data collection July 2014.
- 4) Office of the New Jersey State Climatologist 30-year mean Southern NJ temperature data.

Table 2, Continued
Summary of Meteorological Monitoring Data - 2014

MONITORING SITES		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
Newark Firehouse														
Temperature (°F)	Mean	27	29	37	52	63	73	75	74	68	58	43	38	53
	Mean ¹	29	32	39	50	60	69	74	72	65	53	44	34	52
	Min	20	24	29	43	56	65	68	66	61	51	35	34	20
	Max	33	36	44	60	71	80	83	81	76	65	50	44	83
Relative Humidity (%)	Mean	57.3	56.9	45.0	52.6	55.7	57.7	58.8	56.2	60.4	61.5	53.0	62.4	56.4
	Min	41.0	39.5	28.4	32.3	39.3	38.7	39.3	38.4	40.7	42.2	35.1	49.7	28.4
	Max	71.4	74.6	61.9	73.5	75.6	75.7	77.0	74.8	77.4	78.4	71.2	76.5	78.4
Solar Radiation (Langleys)	Mean	0.090	0.155	0.205	0.291	0.301	0.353	0.335	0.304	0.228	0.148	0.101	0.066	0.214
	Max	0.457	0.646	0.812	1.024	1.036	1.153	1.164	1.078	0.914	0.664	0.483	0.357	1.164
Barometric Pressure (in of Hg)	Mean	29.89	29.91	29.87	29.90	29.89	29.85	29.84	29.88	29.97	29.80	29.91	29.98	29.89
	Min	29.76	29.76	29.71	29.76	29.82	29.77	29.78	29.83	29.90	29.71	29.79	29.86	29.71
	Max	30.05	30.06	30.01	30.04	29.95	29.93	29.91	29.94	30.06	29.89	30.03	30.09	30.09
Passaic														
Temperature (°F)	Mean	26	29	36	51	63	72	75	73	67	57	43	37	52
	Mean ¹	29	32	39	50	60	69	74	72	65	53	44	34	52
	Min	20	22	27	37	54	64	67	64	59	50	35	33	20
	Max	32	36	43	70	71	80	83	81	76	64	49	43	83
Relative Humidity (%)	Mean	58.9	59.1	47.1	48.0	55.3	58.6	59.2	57.5	61.0	62.5	53.8	62.9	57.4
	Min	42.8	41.3	31.4	15.8	37.4	41.1	39.1	38.6	41.7	43.8	35.5	51.0	31.4
	Max	72.8	75.7	62.7	89.4	75.2	75.2	77.0	77.0	78.3	79.1	70.6	76.0	79.1
Barometric Pressure (in of Hg)	Mean	29.94	29.96	29.91	30.15	29.93	29.89	29.87	29.92	30.01	29.83	29.95	30.03	29.93
	Min	29.79	29.82	29.74	29.55	29.86	29.82	29.81	29.87	29.93	29.73	29.83	29.91	29.73
	Max	30.09	30.11	30.06	30.59	29.99	29.97	29.94	29.98	30.09	29.92	30.07	30.14	30.14
Precipitation (inches)	Historical ²	3.49	2.90	4.12	4.31	4.37	4.51	4.78	4.13	4.49	4.36	3.90	4.00	49.37
	Observed	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	No Data ³	0.43	2.25	0.85	3.76	2.56	2.51	No Data ³

1) Office of the New Jersey State Climatologist 30-year mean Northern NJ temperature data.
2) Office of the New Jersey State Climatologist 30-year Northern NJ mean precipitation data.
3) Commenced data collection July 2014.

Table 2, Continued
Summary of Meteorological Monitoring Data - 2014

MONITORING
SITES

JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC YEAR

Rider University														
Temperature (F°)	Mean	26	27	36	51	62	70	73	70	65	55	41	37	51
	Mean ¹	33	35	42	52	62	71	76	74	67	56	47	37	54
	Min	16	19	27	39	52	61	64	60	56	46	32	31	16
	Max	34	35	44	60	71	80	82	79	76	64	49	44	82
Relative Humidity (%)	Mean	66.1	67.7	54.5	60.2	66.3	70.0	70.1	72.3	75.5	74.2	65.3	71.7	67.8
	Min	45.6	43.1	36.4	36.0	44.1	45.5	45.2	45.7	46.7	48.3	41.1	56.5	36.0
	Max	84.9	90.3	77.1	86.7	89.0	94.8	92.8	95.2	95.3	94.6	86.4	88.9	95.3
Solar Radiation (Langleys)	Mean	0.099	0.149	0.195	0.281	0.289	0.347	0.339	0.295	0.232	0.149	0.101	0.067	0.211
	Max	0.460	0.630	0.750	0.945	0.985	1.114	1.115	1.016	0.913	0.651	0.462	0.333	1.115
Barometric Pressure (in of Hg)	Mean	30.25	30.28	30.23	30.26	30.25	30.20	30.20	30.23	30.32	30.14	30.29	30.34	30.24
	Min	30.11	30.14	30.05	30.12	30.18	30.12	30.13	30.18	30.25	30.04	30.15	30.22	30.04
	Max	30.42	30.43	30.38	30.40	30.31	30.29	30.27	30.30	30.40	30.23	30.39	30.46	30.46

1) Office of the New Jersey State Climatologist 30-year mean Southern NJ temperature data.

Figure 3
2014 Northern Region Average Monthly
Temperatures vs. North Jersey Office of the
Climatologist 30-Year Mean

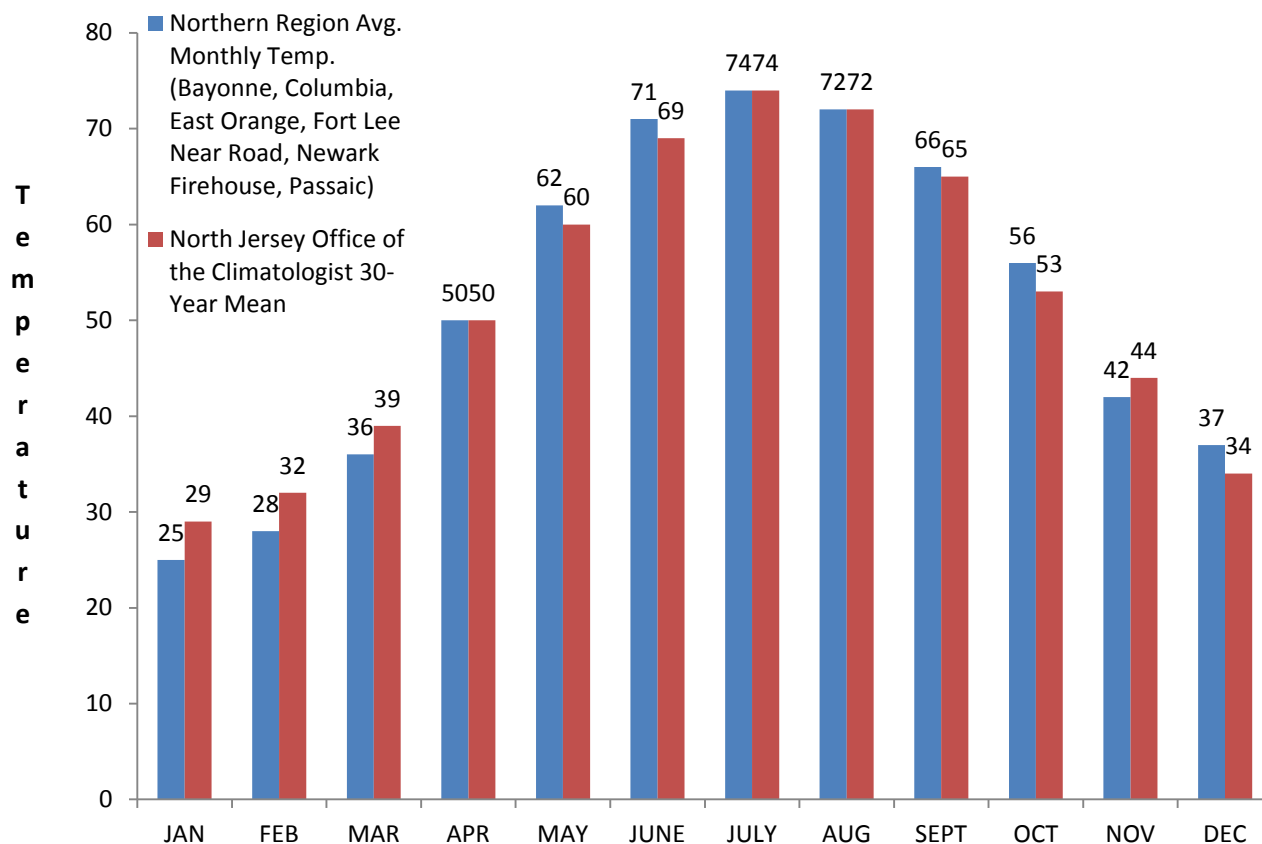


Figure 4
2014 Southern Region Average Monthly
Temperatures vs. South Jersey Office of the
Climatologist 30-Year Mean

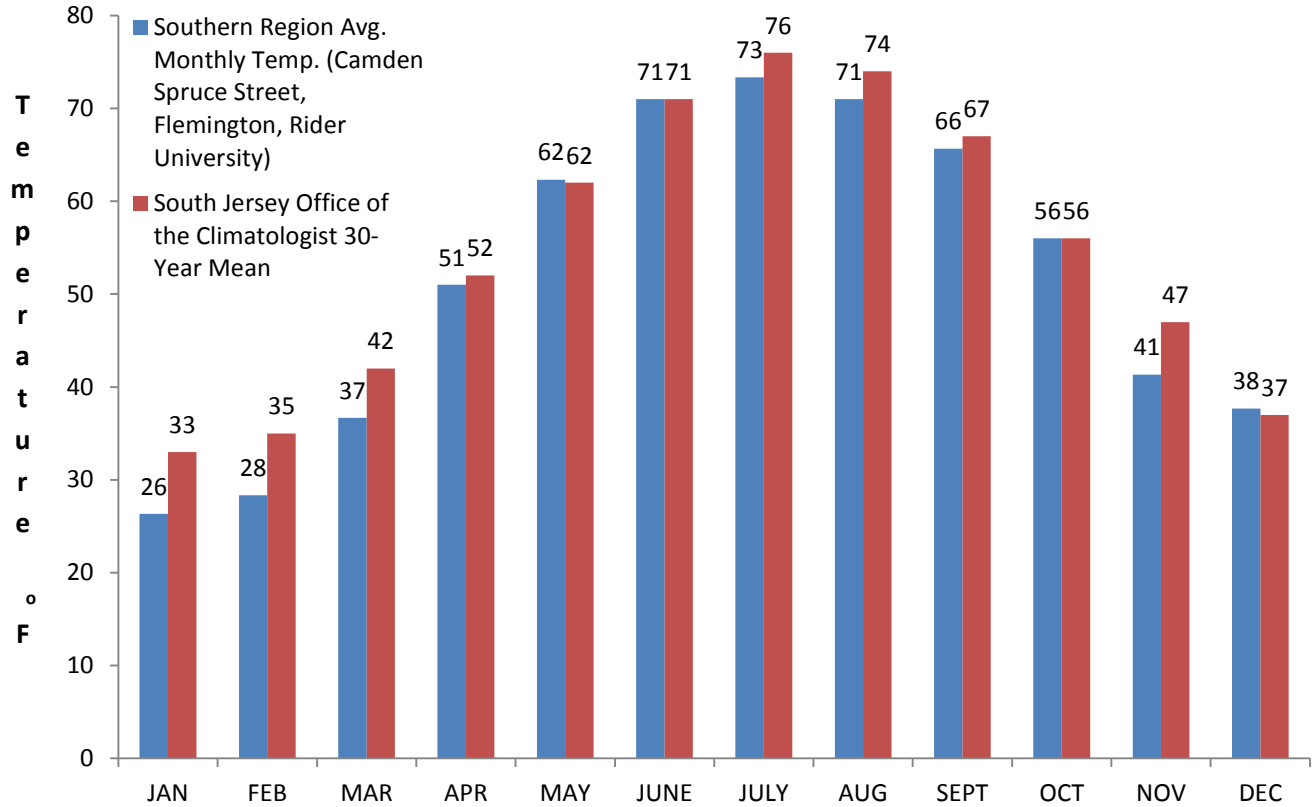


Figure 5
 2014 Wind Rose for Bayonne
 Displaying Distribution of Wind Speed & Wind Direction

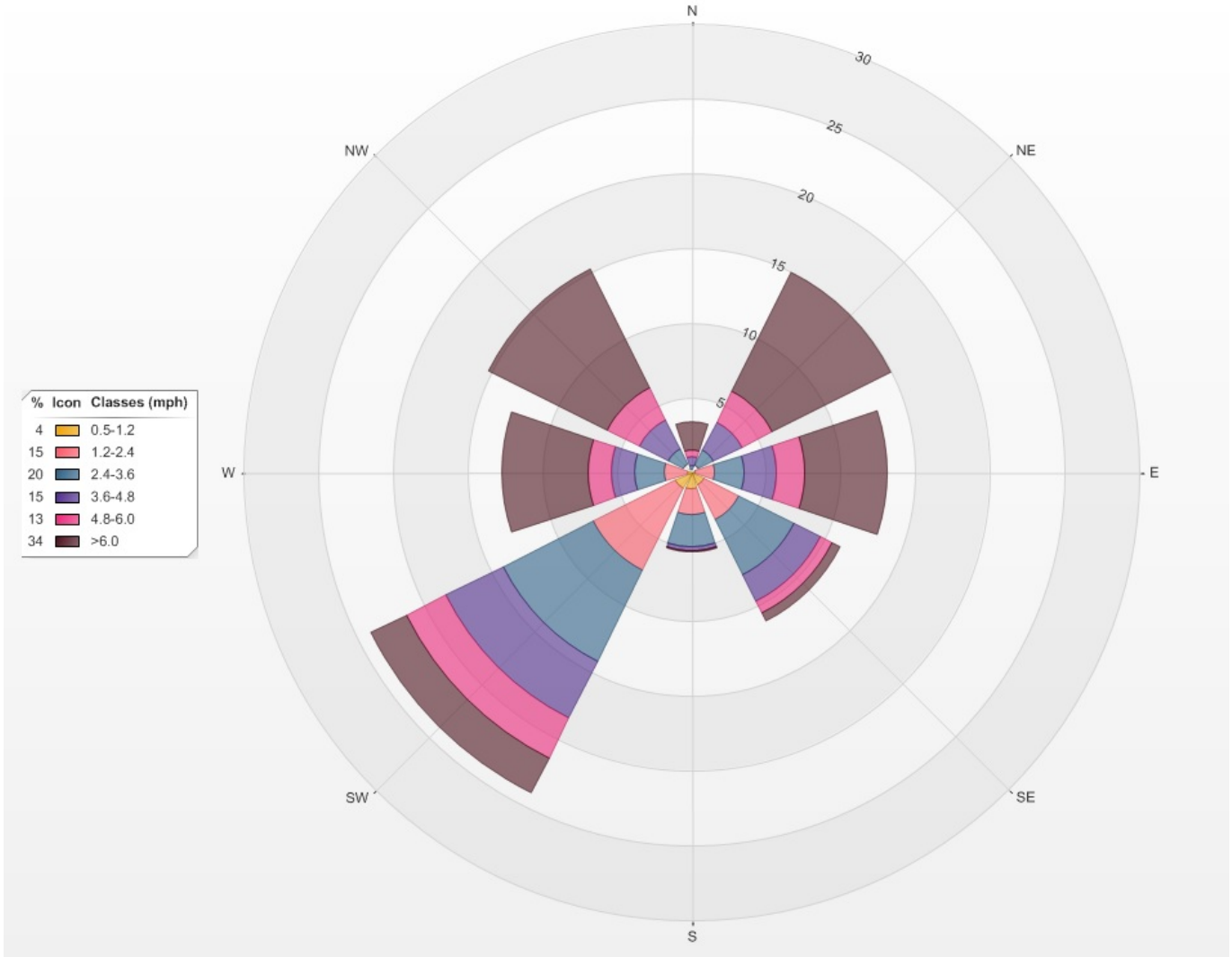


Figure 6
 2014 Wind Rose for Camden Spruce Street
 Displaying Distribution of Wind Speed & Wind Direction

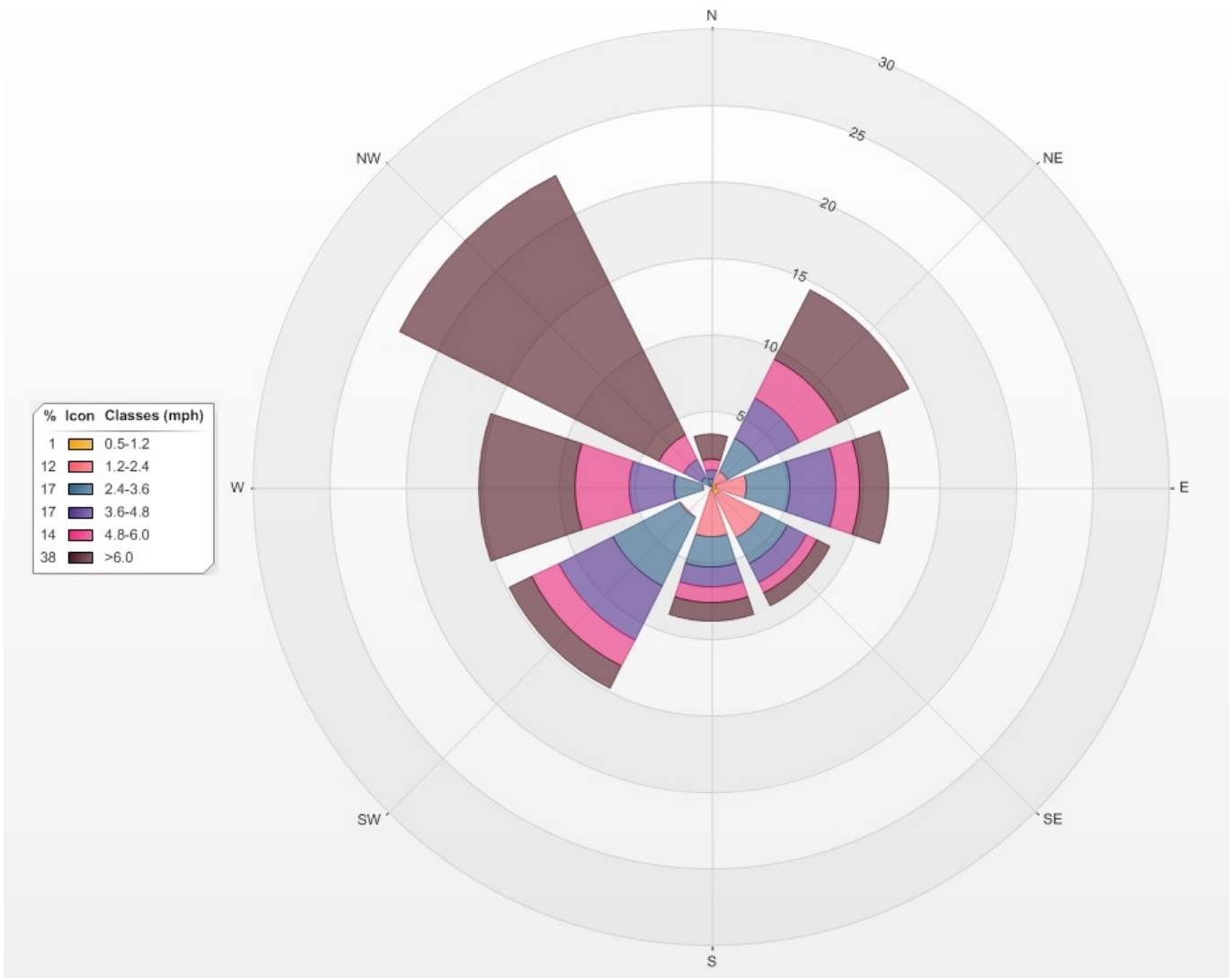


Figure 7
 2014 Wind Rose for Columbia WMA
 Displaying Distribution of Wind Speed & Wind Direction

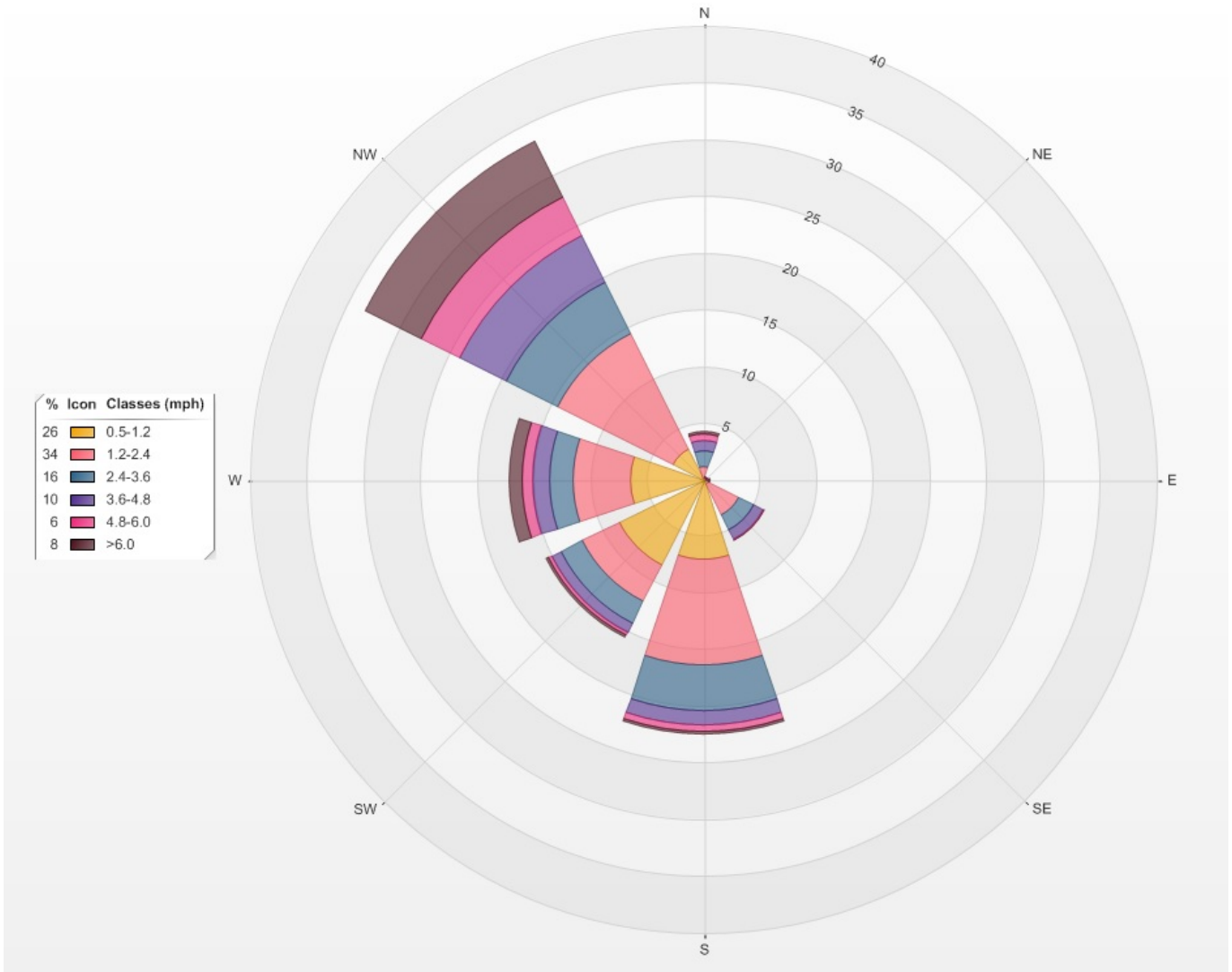


Figure 8
 2014 Wind Rose for East Orange
 Displaying Distribution of Wind Speed & Wind Direction

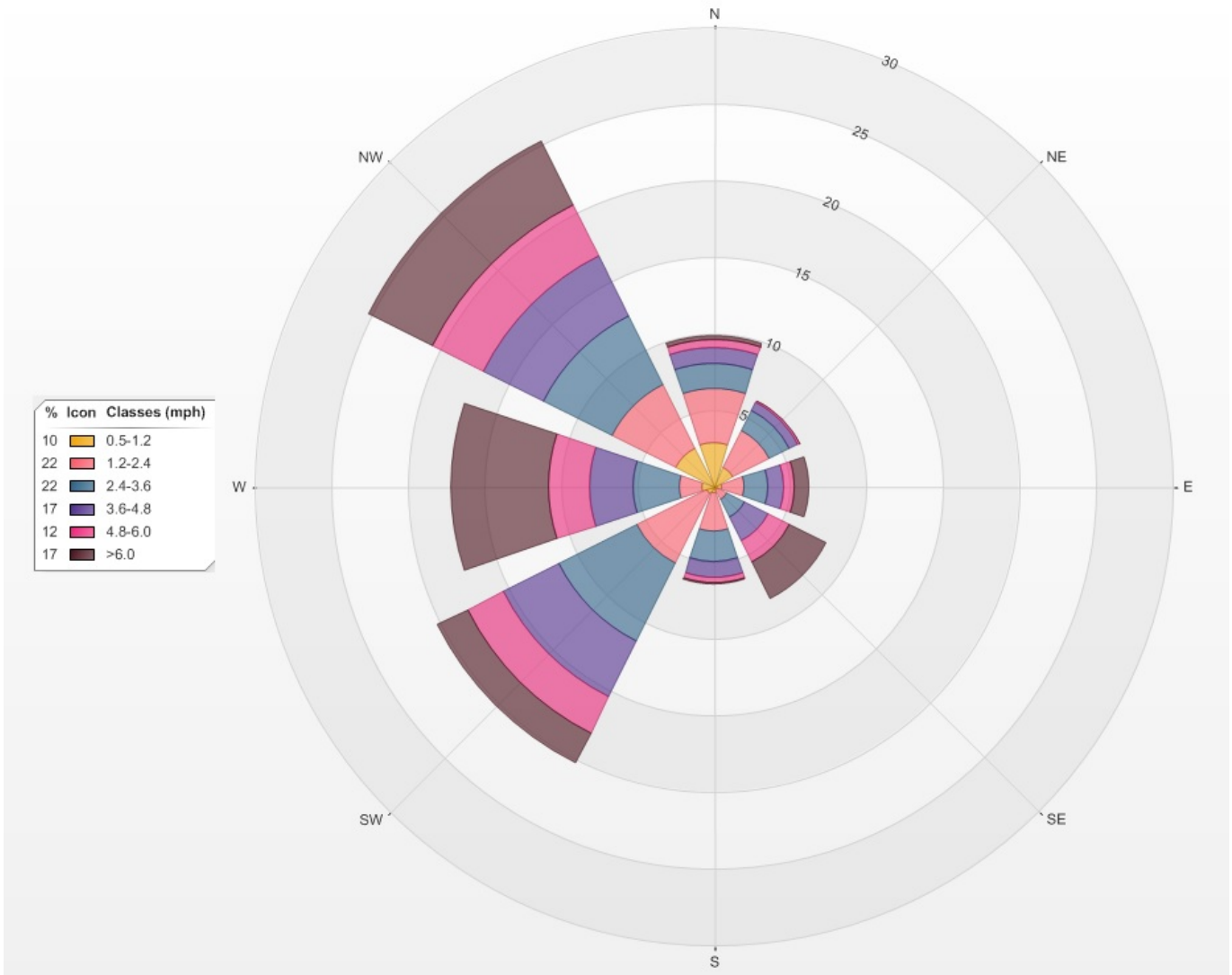


Figure 9
 2014 Wind Rose for Elizabeth Lab
 Displaying Distribution of Wind Speed & Wind Direction

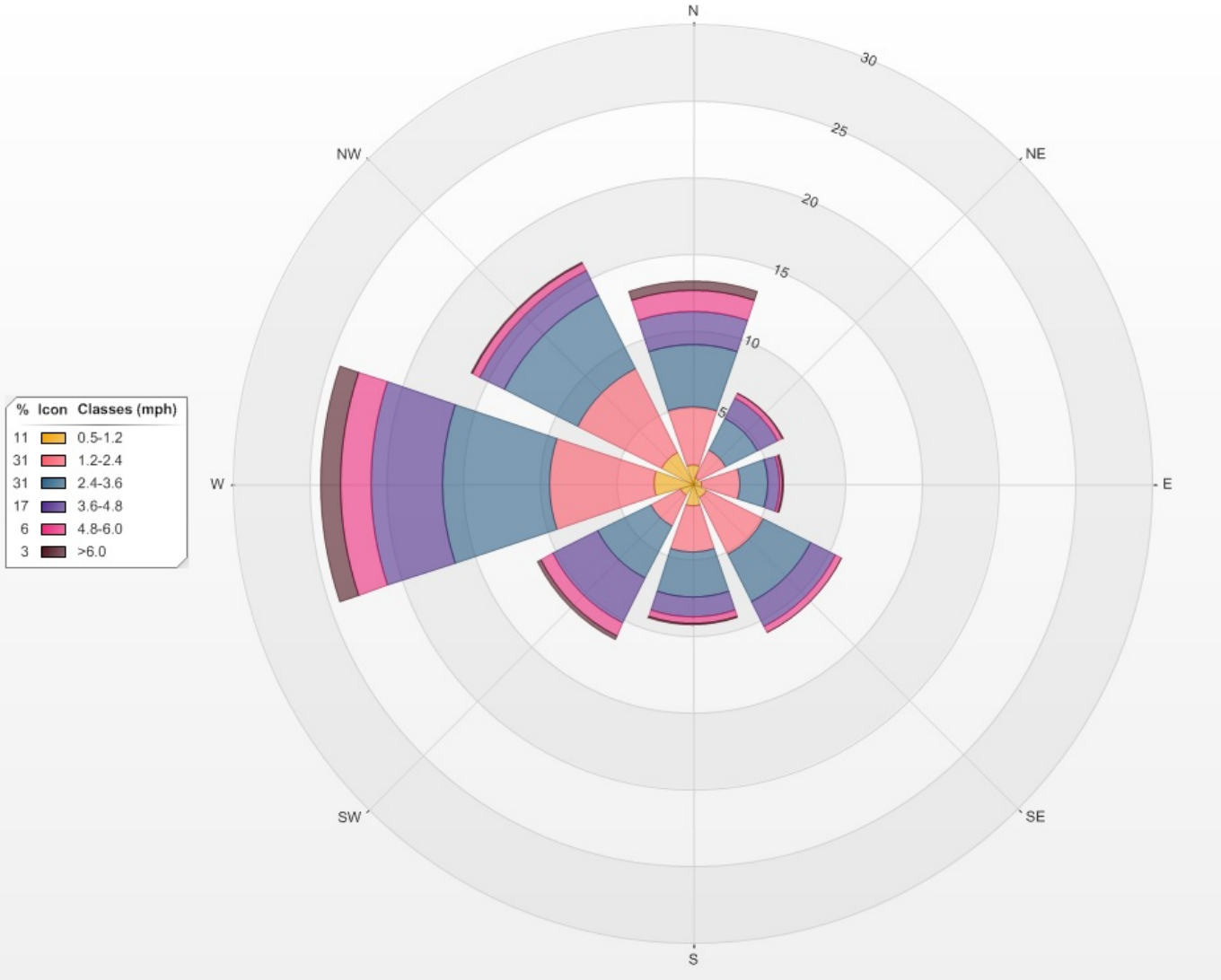


Figure 10
 2014 Wind Rose for Flemington
 Displaying Distribution of Wind Speed & Wind Direction

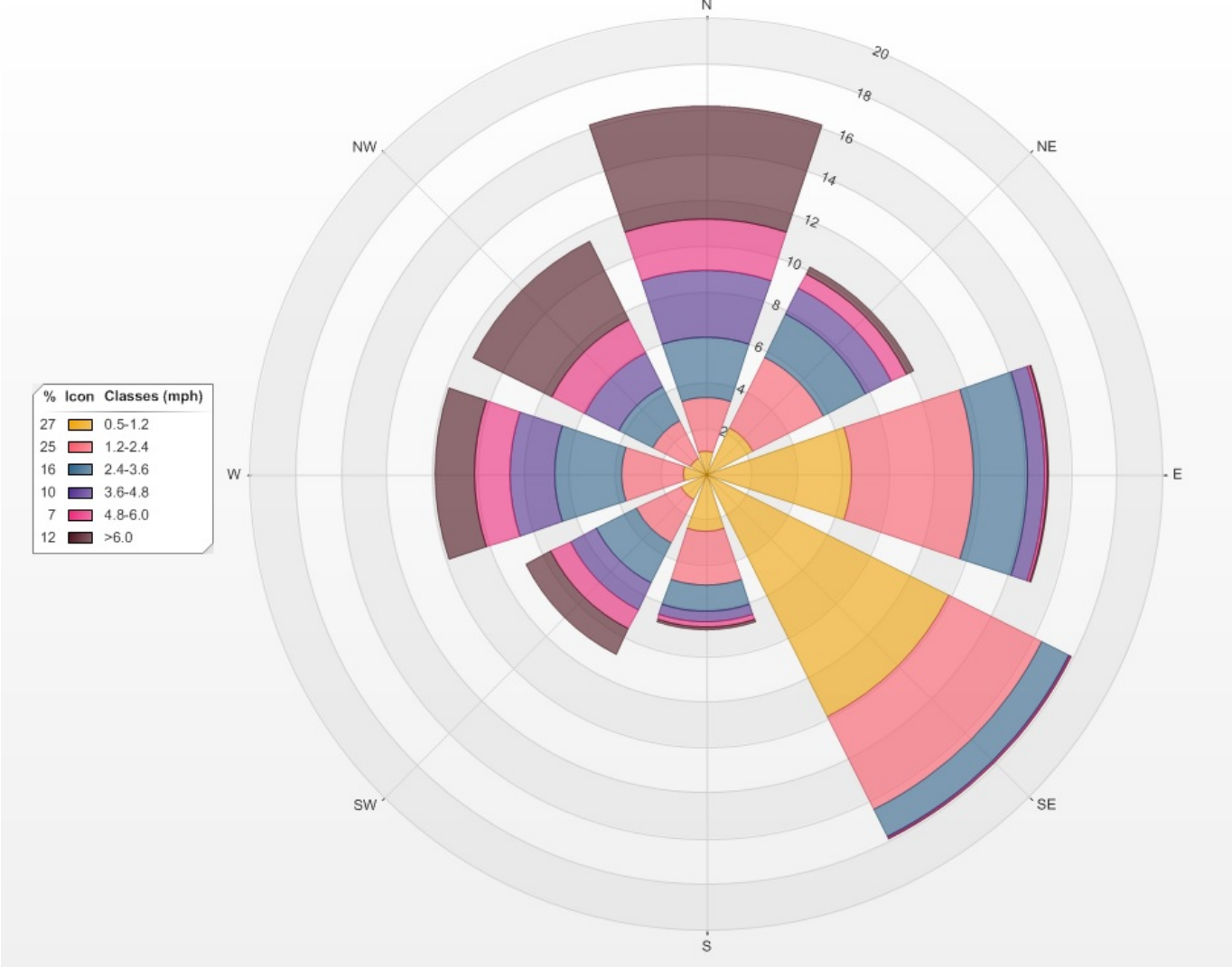


Figure 11
 2014 Wind Rose for Fort Lee Near Road
 Displaying Distribution of Wind Speed & Wind Direction

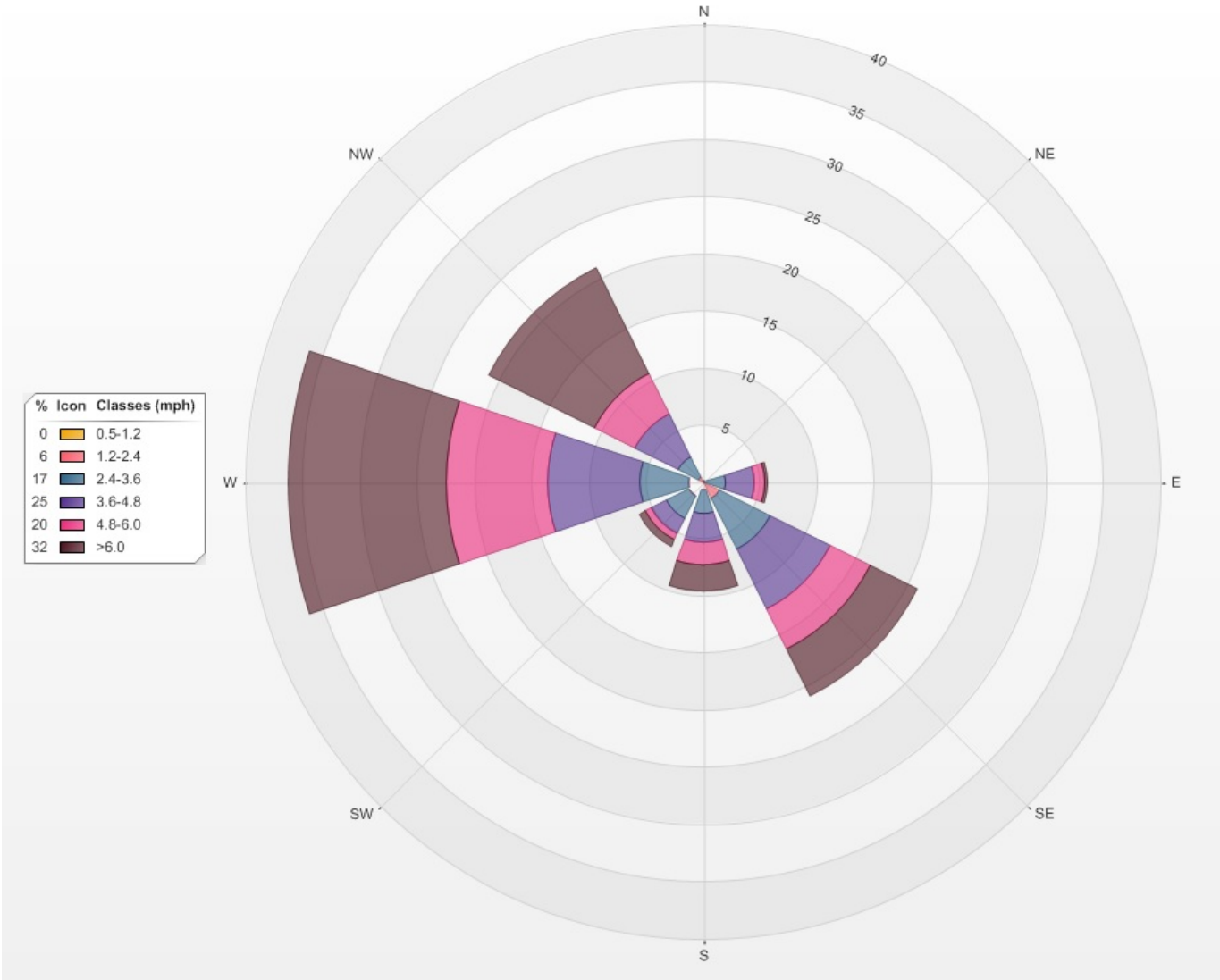


Figure 12
 2014 Wind Rose for Newark Firehouse
 Displaying Distribution of Wind Speed & Wind Direction

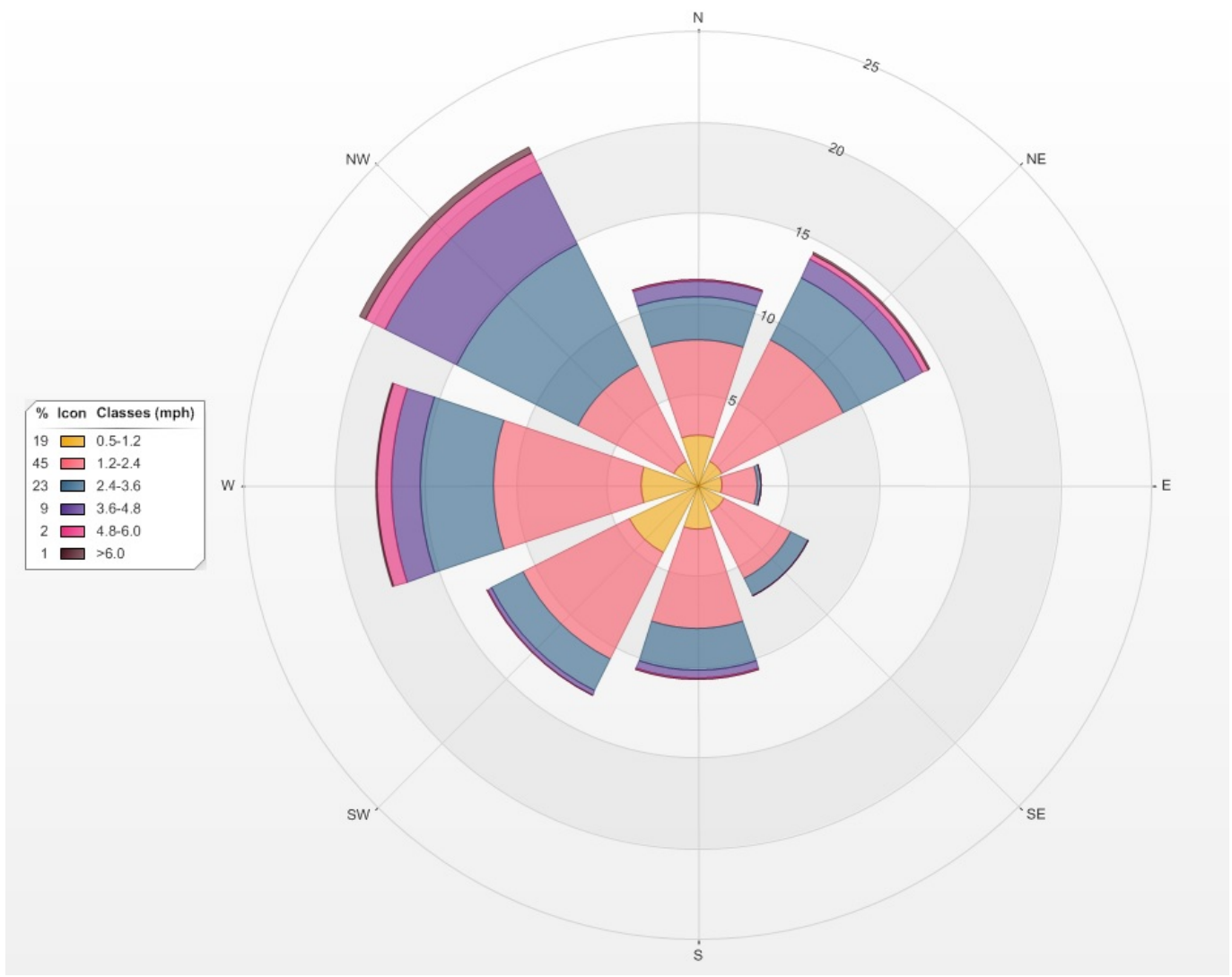


Figure 13
 2014 Wind Rose for Passaic
 Displaying Distribution of Wind Speed & Wind Direction

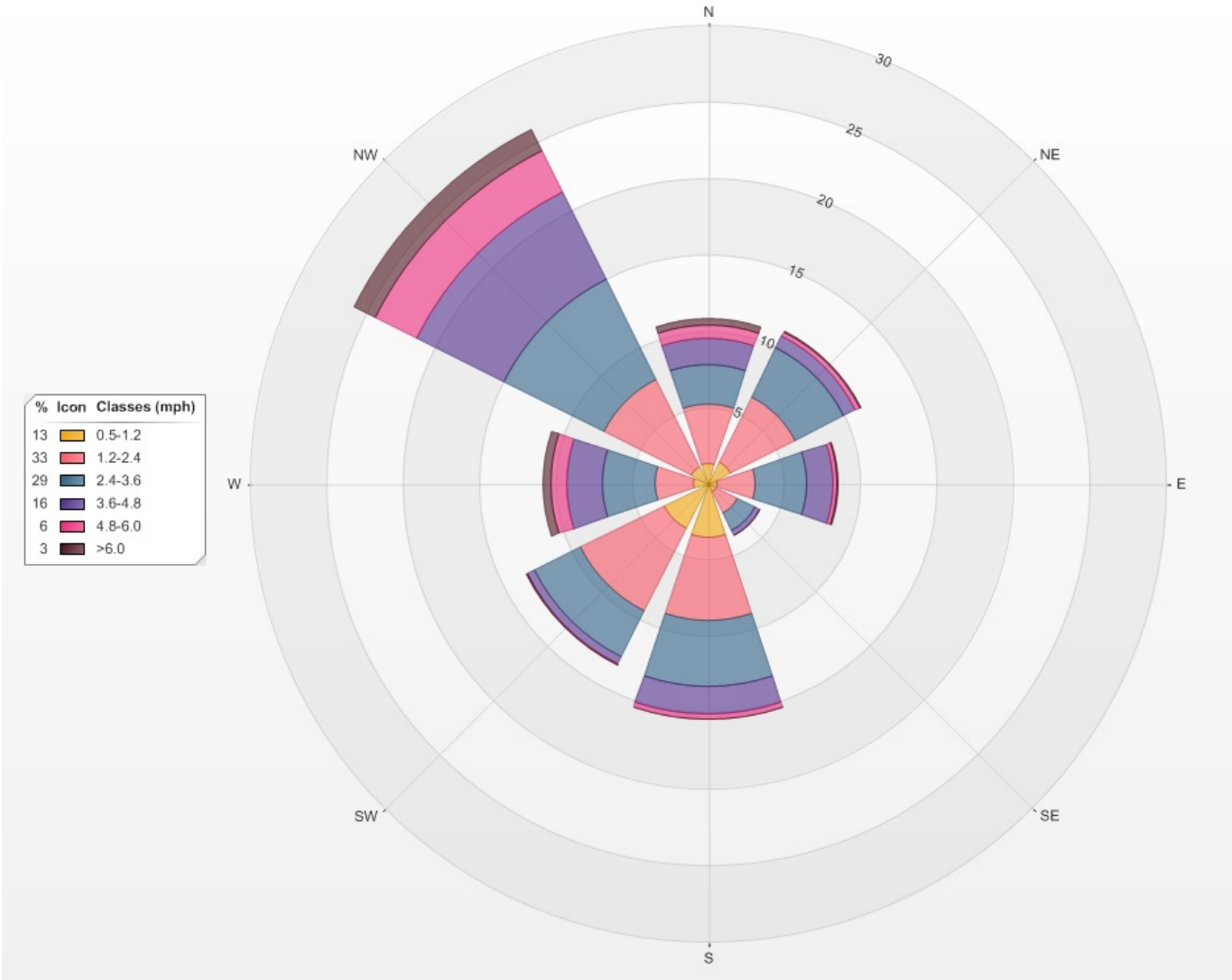
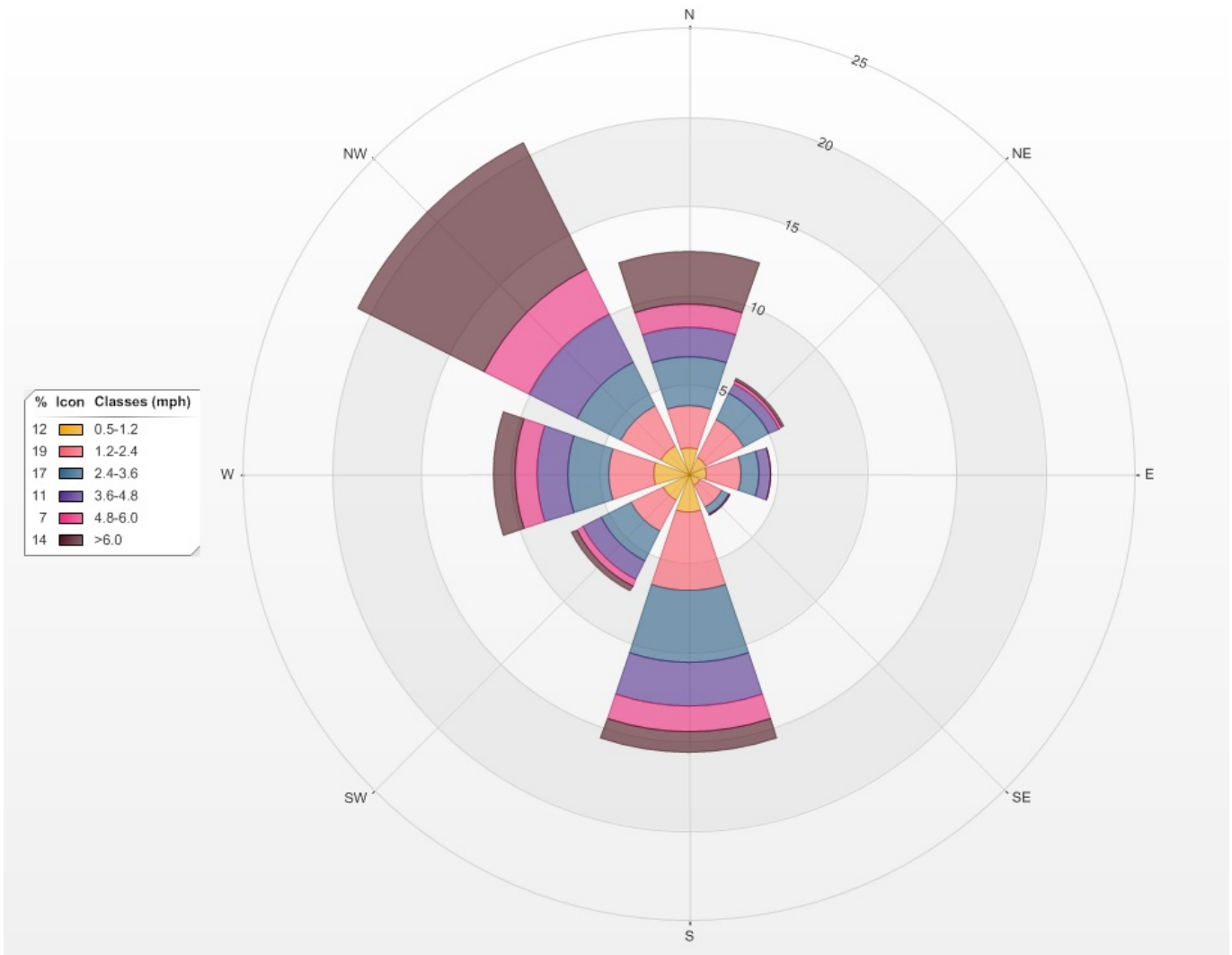


Figure 14
 2014 Wind Rose for Rider University
 Displaying Distribution of Wind Speed & Wind Direction



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2014 Regional Haze & Visibility Summary

New Jersey Department of Environmental Protection

THE BASICS OF HAZE

Haze is a type of visibility impairment usually associated with air pollution, and to a lesser extent, moisture in the atmosphere. Small particles and certain gaseous molecules can cause poor visibility by scattering or absorbing light before it reaches an observer (Figure 1). When high concentrations of such pollutants are well mixed in the atmosphere they form a uniform haze that can obscure distant objects.

Air pollutants come from a variety of natural and man-made sources, and haze can occur at any time of year. Natural sources include small particles from windblown dust and soot from wildfires and volcanoes. Man-made sources, which are the primary cause of visibility impairment, include motor vehicle emissions, electric utility and industrial fuel burning emissions, and manufacturing operations.

Pollution from both natural and man-made sources can be transported over long distances and across state borders on prevailing winds, contributing to the problem of regional haze.

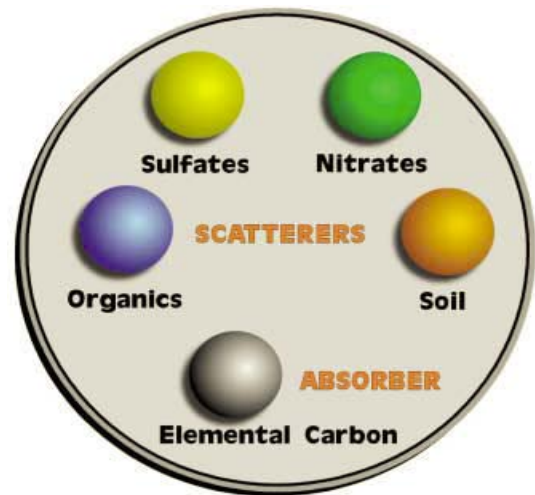
ANATOMY OF REGIONAL HAZE

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 contributors to haze in the eastern U.S. because of 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 can be emitted directly into the air or formed by the reaction of various gaseous hydrocarbons. Sources of direct and indirect organic carbon particles include vehicle exhaust, vehicle refueling, solvent evaporation (for example, from paints), 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.

Figure 1
Contributors to Visibility Impairment



Malm 1999

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 (such as 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 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.

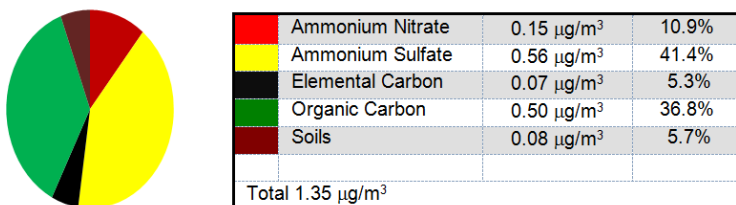
Soil particles enter the air from dirt roads, fields, and other open spaces as a result of wind, traffic, and other surface activities. Whereas other types of particles form from the condensation and growth of microscopic particles and gases, crustal particles result from the crushing and grinding of larger, earth-borne 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.

PARTICLES AND VISIBILITY

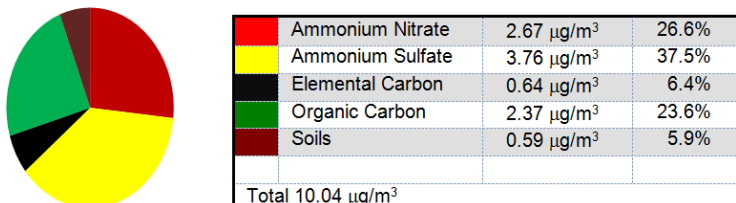
Figure 2 below shows the composition of fine particles collected at the Interagency Monitoring of Protected Visual Environments (IMPROVE) site, located at the Brigantine air monitoring station. It is operated by the New Jersey Department of Environmental Protection (NJDEP), in the Edwin B. Forsythe National Wildlife Refuge, just north of Atlantic City.

Figure 2
Composition of Fine Particles on Days with Good Visibility Compared to Days with Poor Visibility
Brigantine, NJ
July 2013 – June 2014**

Average Fine Mass Composition on Days with Good Visibility



Average Fine Mass Composition on Days with Poor Visibility



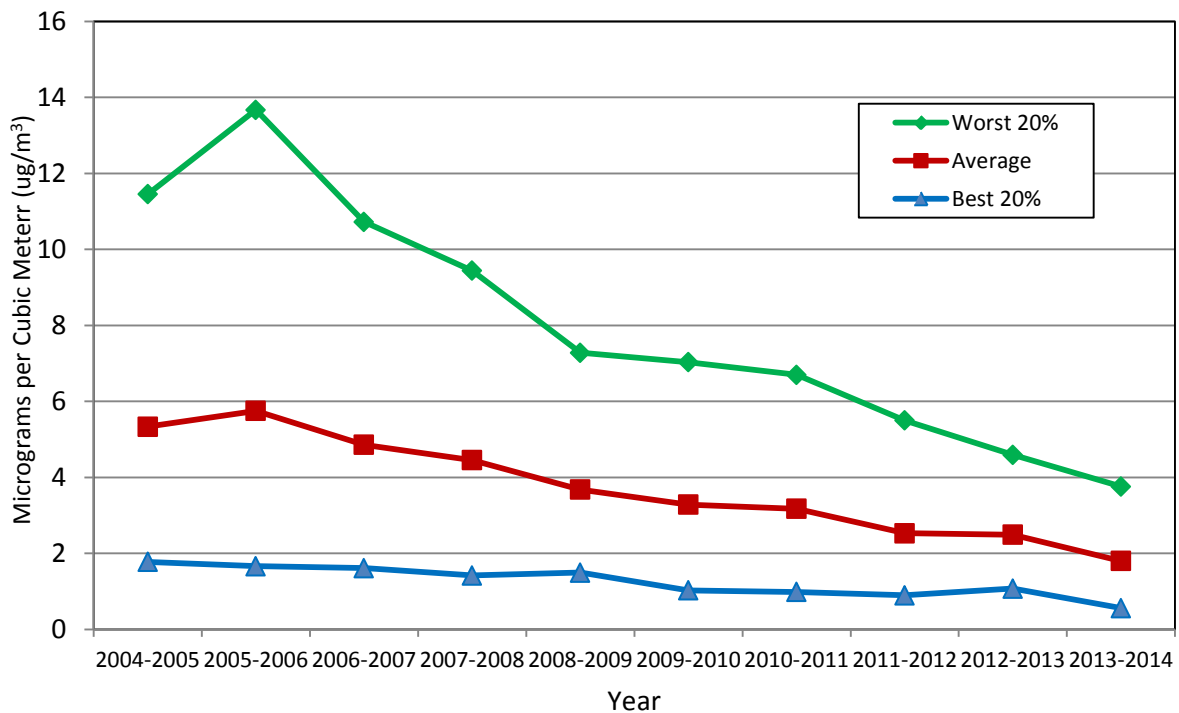
Most visibility impairment is due to sulfate, which can have a greater effect on light extinction (a measure of visibility impairment) because of its ability to accumulate water and grow in size in humid conditions. The data for 2013-2014 show that sulfates accounted for approximately 41% of the total fine particle mass on days with good visibility, and approximately 37.5% on bad visibility days. Higher sulfate values in the summer can be attributed to the greater rate of photochemical conversion of sulfur dioxide to sulfate, which results from increased sunlight during the summertime (Malm 1999).

The graph below in Figure 3 represents the annual trend of sulfates, expressed in micrograms per cubic meter, measured at the Forsythe National Wildlife Refuge.

** For this report annual data for a given year is defined as data from July 1 to June 30 of the following year.

The graph shows the annual average for each year as well as the average concentration on the days with the best visibility, and the average on the days with the worst visibility, using the upper and lower 20% of the data as a cut off. Sulfate trends have improved over the last few years as a result of more stringent regulations and guidelines from both the United States Environmental Protection Agency (USEPA) and the state of New Jersey.

Figure 3
Sulfate Trend Summary**
Brigantine, NJ
2004-2014



**For this report annual data for a given year is defined as data from July 1 to June 30 of the following year.

HOW IS HAZE REGULATED?

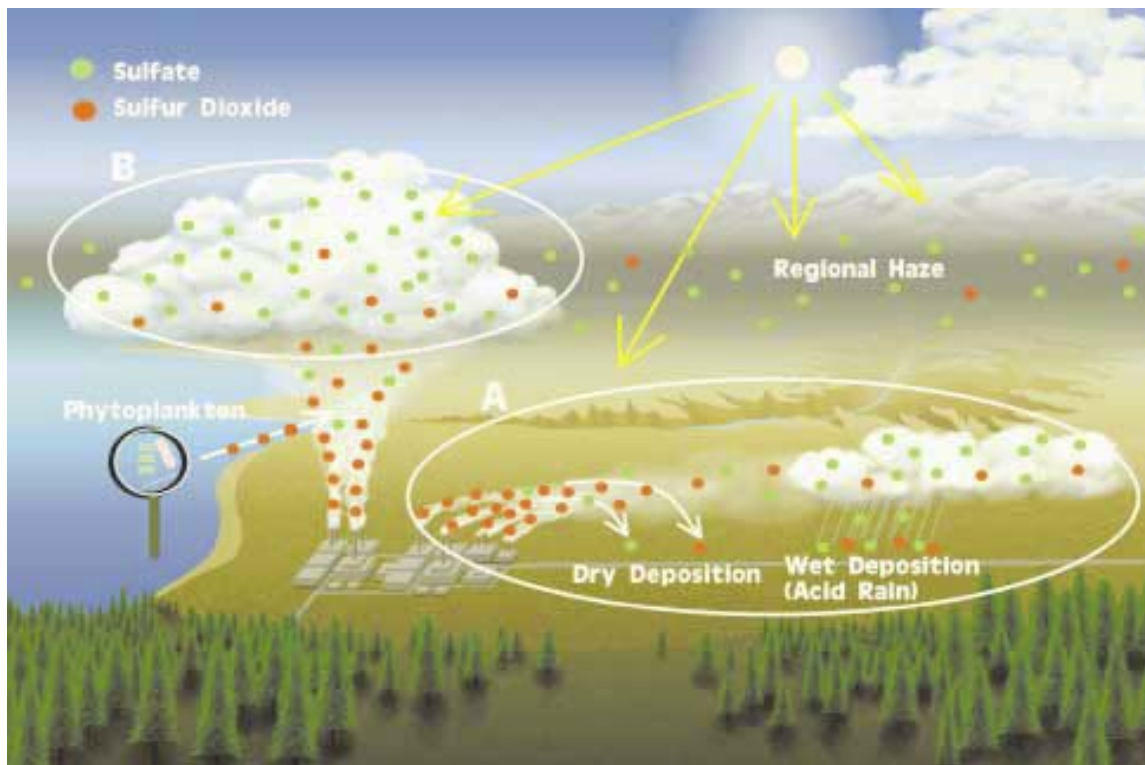
In 1999, USEPA announced a major effort to improve air quality in national parks and wilderness areas, aimed at achieving national visibility goals by 2064. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas such 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. This definition includes the Edwin B. Forsythe National Wildlife Refuge in Brigantine, New Jersey. The rule requires states, in coordination with USEPA, 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 were due to USEPA between 2003 and 2008.

New Jersey proposed its first regional haze plan for the Brigantine Class I area in September 2008, and it was finalized in July 2009.

ENVIRONMENTAL EFFECTS

Regional haze is most closely associated with its effects on prized vistas such as the Grand Canyon, Acadia National Park, and other Class I areas, such as the Edwin B. Forsythe National Wildlife Refuge in Brigantine. Its impacts may be difficult to quantify but it certainly has a negative overall effect on aesthetics and the outdoors, and the enjoyment of natural areas throughout the nation. Haze also affects urban vistas, and can obscure or eclipse the view of an urban skyline or important landmarks such as the Washington Monument. The pollution that causes regional haze has additional effects on the environment because of the acidic makeup of fine particles such as sulfates. Sulfates eventually make their way into the ecosystem through atmospheric deposition, that is, they are transferred from the air into the water and soils (Figure 4). Too much atmospheric deposition can have adverse environmental effects by upsetting the delicate balance of the ecosystem, causing damage to waterways, plants, soils, and wildlife. For more information, see the summary on Atmospheric Deposition.

Figure 4
How Sulfates Enter the
Ecosystem by Way of Deposition



MONITORING HAZE IN NEW JERSEY

The 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 western U.S., the typical visual range is 60 to 90 miles, or about one-half of the visual range under natural conditions. Haze diminishes this natural visual range (see 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 individual buildings, are easily distinguishable (Figure 5). The Manhattan skyline appears non-existent when conditions are conducive to haze formation (Figure 6).

Visibility Camera at the New Jersey Transit Building, Newark

Figure 5



Figure 6



The IMPROVE site located within the Edwin B. Forsythe National Wildlife Refuge in Brigantine also monitors haze and visibility using a digital camera. Figure 7 below is an example of a clear day in Brigantine, when the Atlantic City skyline is easily distinguishable along the horizon. The example of a hazy day in Brigantine is illustrated in Figure 8, where the skyline is barely visible.

Visibility Camera – Brigantine National Wildlife Refuge

Figure 7

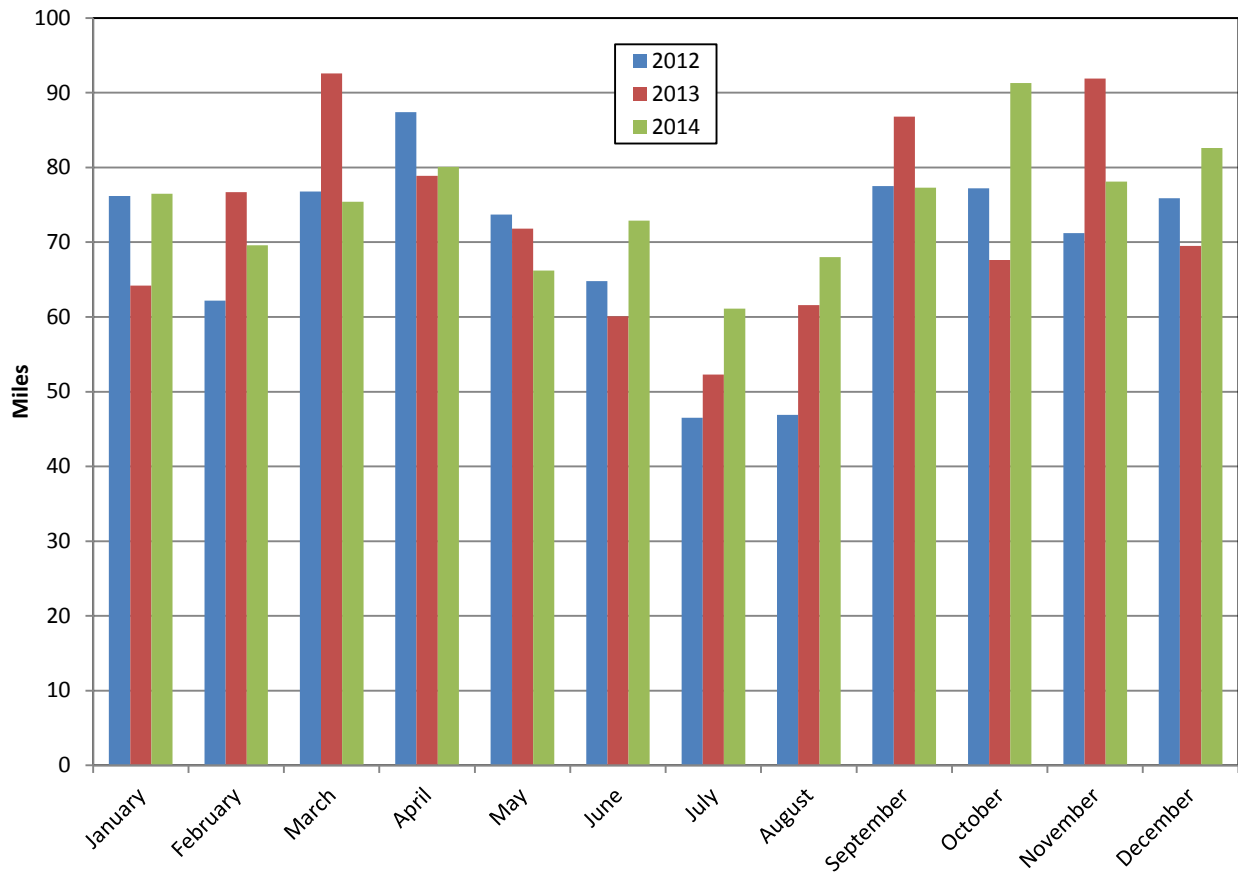


Figure 8



Brigantine also provides a real-time estimate of visibility using a nephelometer, an instrument that measures the scattering of light by particles in the air. The nephelometer in Brigantine does not measure moisture in the air, and therefore the visual range values reported below in Figure 9 are higher than those normally reported for the eastern United States. Visual range is most impaired during the summer when warm, hazy, humid conditions are most frequent, as illustrated by the following graph.

Figure 9
 Monthly Average Visual Range
 Brigantine, NJ
 2012-2014



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Appendix A: 2014 Air Monitoring Sites

New Jersey Department of Environmental Protection

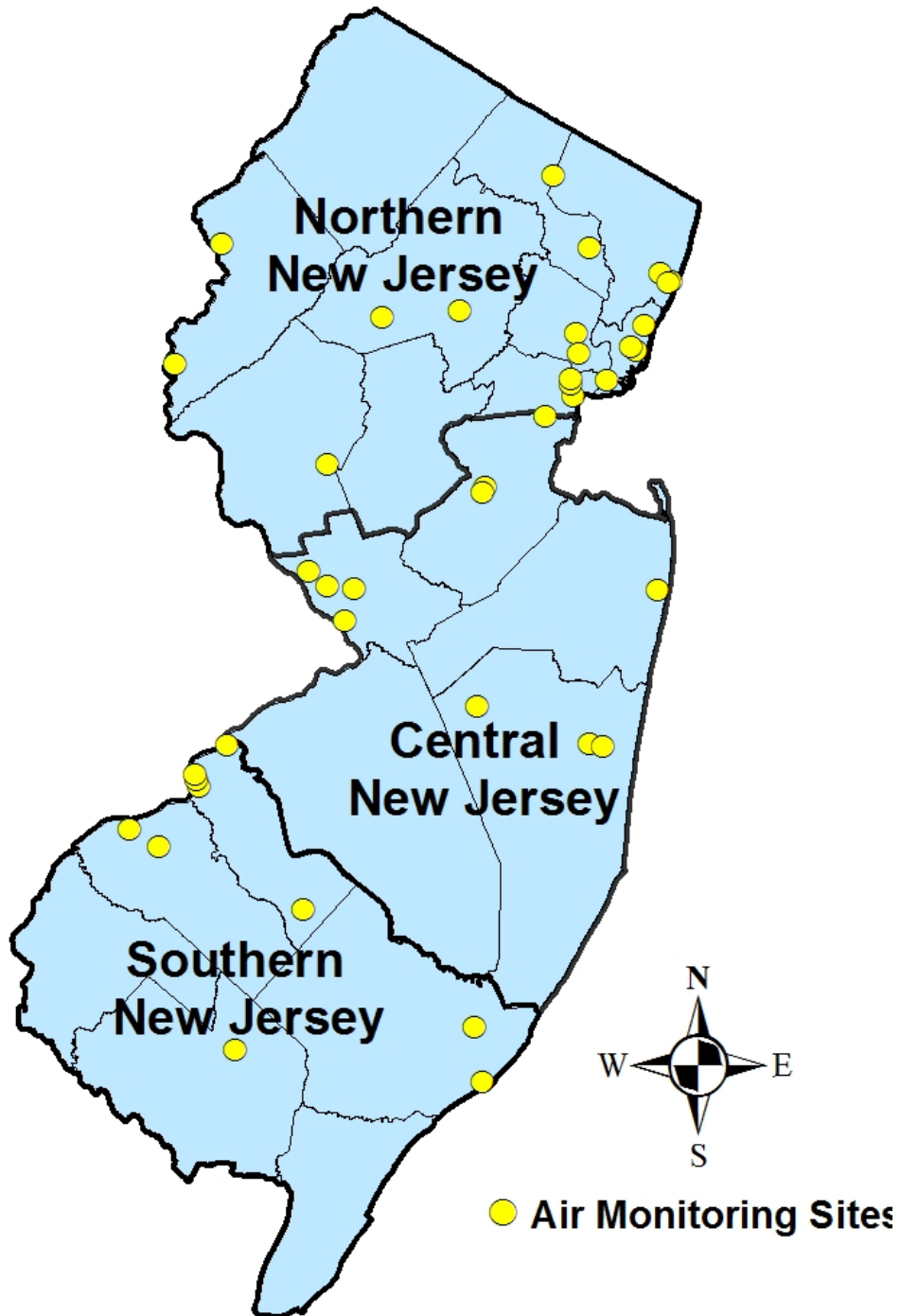
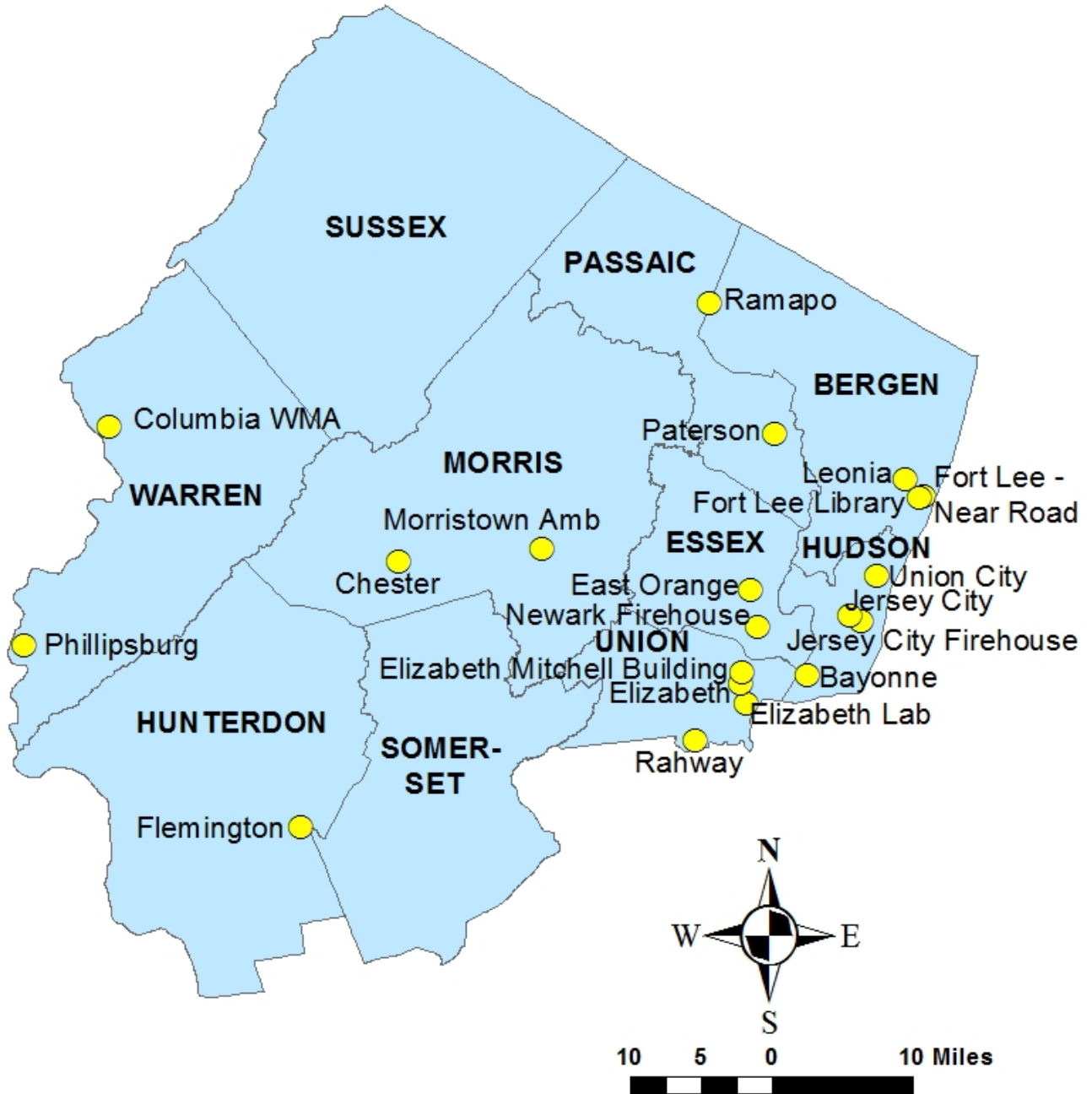


FIGURE 1
NORTHERN NEW JERSEY
AIR MONITORING SITES

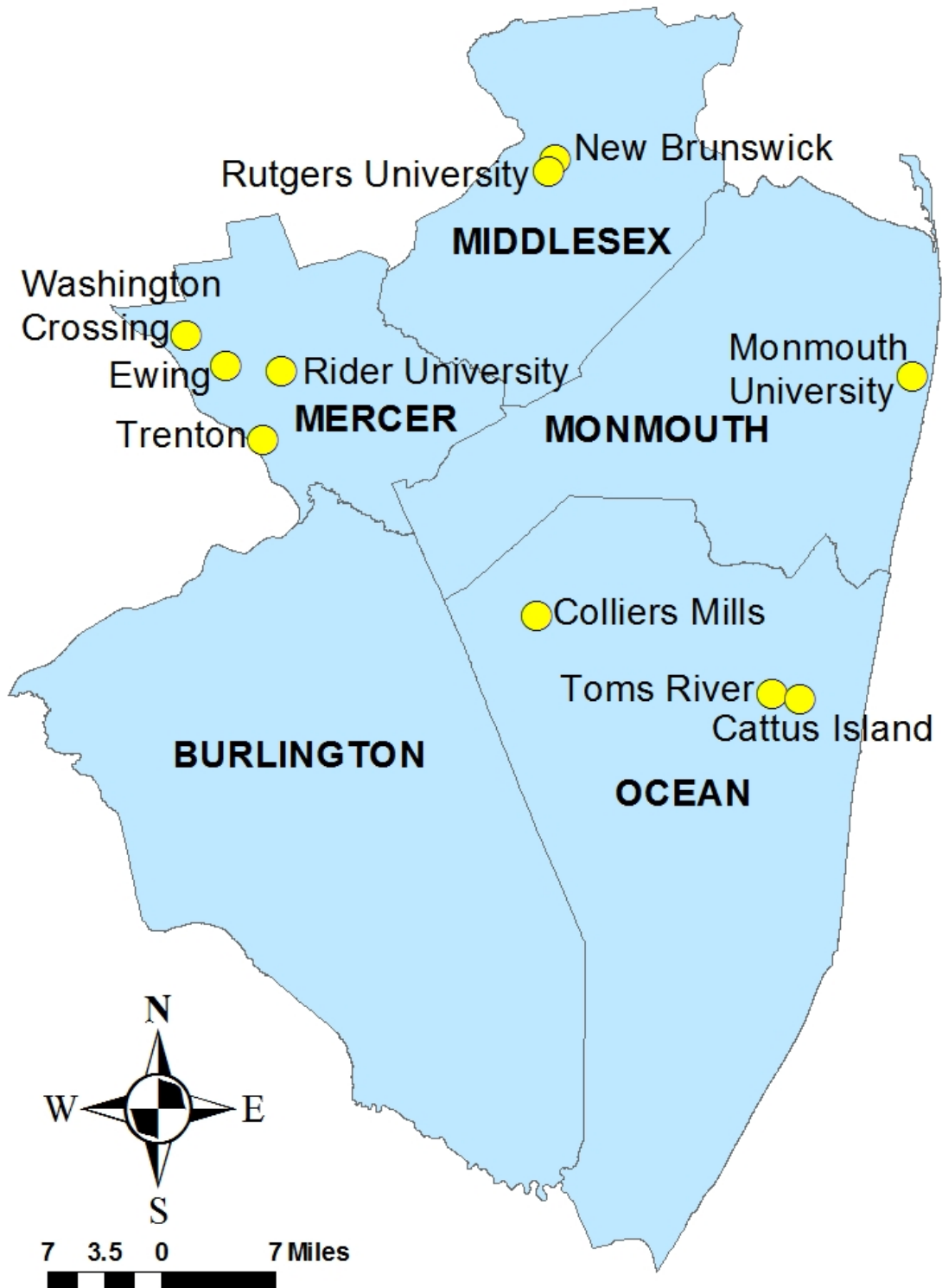


**Table 1
Northern New Jersey Air Monitoring Sites**

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Decimal degrees)		Address
				Latitude	Longitude	
BERGEN	Fort Lee Library	34 003 0003	PM _{2.5}	40.852256	- 73.973314	Fort Lee Public Library, 320 Main Street
	Fort Lee Near Road	34 003 0010	CO, NO _x , Beta	40.85355	-73.9661	2047 Central Ave
	Leonia	34 003 0006	O ₃	40.870436	-73.991994	Overpeck Park, 40 Fort Lee Road
ESSEX	East Orange	34 013 1003	CO, NO _x , MET	40.757501	- 74.200500	Engine No. 2, Main Street and Greenwood Avenue
	Newark Firehouse	34 013 0003	CO, O ₃ , SO ₂ , PM _{2.5} , PM _{2.5} Spec, MET, NO _y , NO _x , BTEX, Pb, Beta	40.720989	-74.192892	360 Clinton Avenue
HUDSON	Bayonne	34 017 0006	NO _x , O ₃ , SO ₂ , BTEX, Black Carbon, MET	40.670250	- 74.126081	Veterans Park on Newark Bay, 25th St. near Park Road
	Jersey City	34 017 1002	CO, SO ₂ , SS	40.731645	- 74.066308	2828 Kennedy Boulevard
	Jersey City Firehouse	34 017 1003	PM _{2.5} , PM ₁₀ , TEOM	40.725454	- 74.052290	Consolidated Firehouse, 355 Newark Avenue
	Union City	34 017 2002	PM _{2.5}	40.772793	-74.031718	Health Department, 714 , 31 st Street
HUNTERDON	Flemington	34 019 0001	O ₃ , MET, TEOM	40.515262	-74.806671	Raritan Twp. Municipal Utilities Authority, 365 Old York Road
MORRIS	Chester	34 027 3001	NO _x , O ₃ , SO ₂ , PM _{2.5} , TOXICS, Hg, PM _{2.5} Spec, MET	40.787628	- 74.676301	Bldg. #1, Department of Public Works, (DPW), Route 513
	Morristown Amb Squad	34 027 0004	PM _{2.5}	40.801211	- 74.483433	16 Early Street
PASSAIC	Paterson	34 031 0005	PM _{2.5}	40.918381	-74.168092	Health Department, 176 Broadway Avenue
	Ramapo	34 031 5001	O ₃	41.058617	- 74.255544	Ramapo Mountain State Forest, Access Road, off Skyline Drive
UNION	Elizabeth	34 039 0003	CO, SO ₂ , SS	40.662389	- 74.214817	7 Broad Street
	Elizabeth Lab	34 039 0004	CO, NO _x , SO ₂ , SS, MET, PM _{2.5} , TOXICS, Hg, PM _{2.5} Spec, BTEX, Black Carbon, Beta	40.641440	- 74.208365	Interchange 13, New Jersey Turnpike
	Elizabeth Mitchell Bldg	34 039 0006	PM _{2.5}	40.673406	-74.213889	Mitchell Bldg., 500 North Broad Street
	Rahway	34 039 2003	PM _{2.5} , TEOM	40.603943	- 74.276174	Fire Dept. Bldg., 1300 Main Street
WARREN	Columbia WMA	34 041 0007	NO _x , O ₃ , SO ₂ , PM _{2.5} , MET, Beta	40.924580	-75.067815	Columbia Wildlife Management Area, Delaware Road
	Phillipsburg	34 041 0006	PM _{2.5}	40.699207	- 75.180525	Municipal Bldg., 675 Corliss Avenue

¹ See Table 4, Parameter Codes.

FIGURE 2
CENTRAL NEW JERSEY
AIR MONITORING SITES



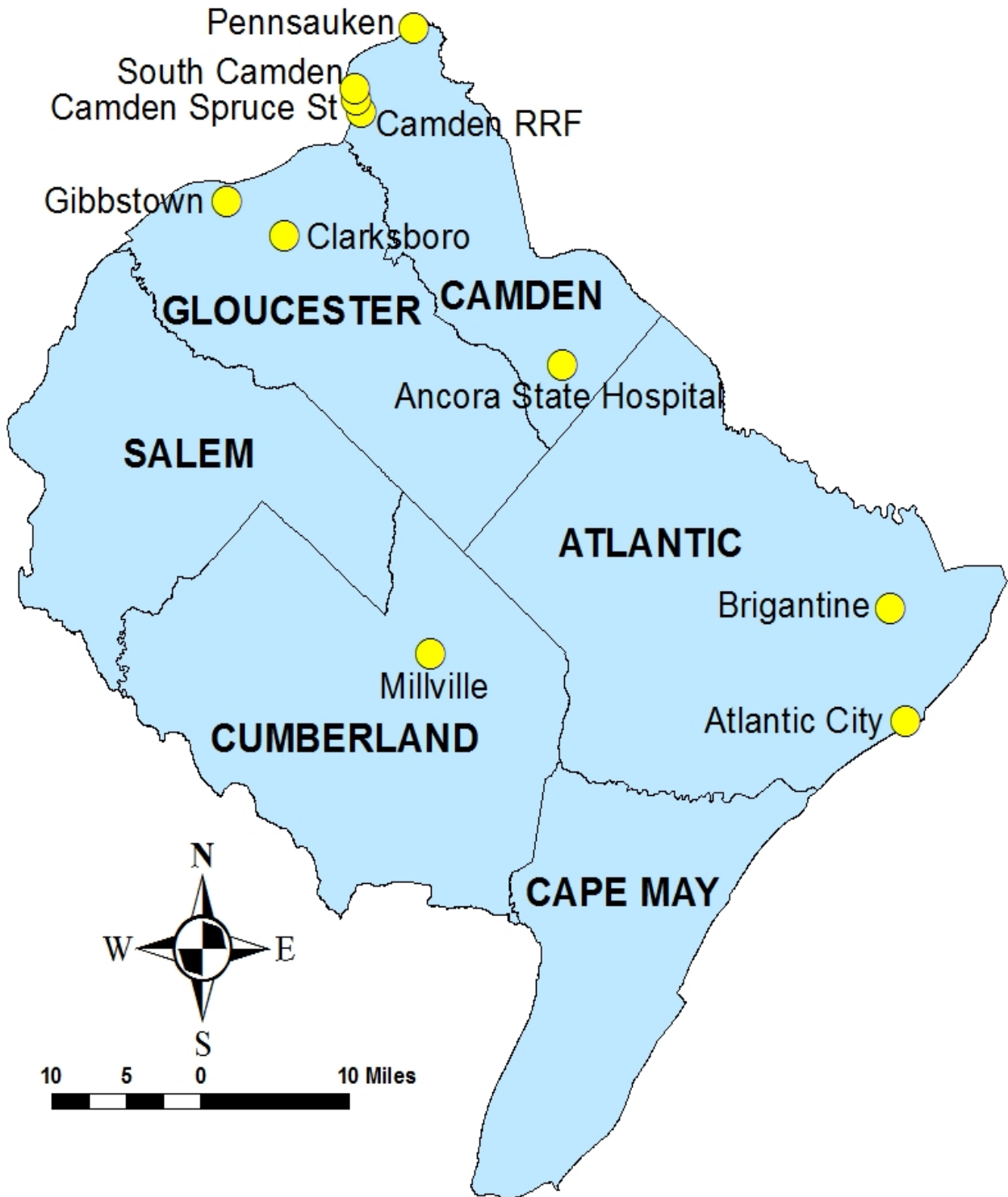
**Table 2
Central New Jersey Air Monitoring Sites**

County	Monitoring Site	AIRS Code	Parameter(s) Measured ¹	Coordinates (Decimal degrees)		Address
				Latitude	Longitude	
MERCER	Ewing	34 021 0010	TEOM	40.287530	-74.807770	Bureau of Air Monitoring Technical Center, 380 Scotch Road
	Rider University	34 021 0005	O ₃ , MET	40.283092	-74.742644	Athletic Fields, Route 206 South
	Trenton	34 021 0008	PM _{2.5}	40.222411	-74.763167	Trenton Library, 120 Academy Street
	Washington Crossing	34 021 8001	PM _{2.5} , ACID	40.312390	-74.872660	Washington Crossing State Park, near 66 Church Road
MIDDLESEX	New Brunswick	34 023 0006	PM _{2.5} , Hg, Beta, PM _{2.5} Spec, TOXICS	40.472825	- 74.422403	Cook College, Log Cabin Road near Horticulture Lab
	Rutgers University	34 023 0011	NO _x , O ₃ , MET ² , PAMS	40.462182	- 74.429439	Horticultural Farm #3, off Ryder's Lane
MONMOUTH	Monmouth University	34 025 0005	O ₃	40.277647	- 74.005100	Edison Science Bldg., 400 Cedar Avenue
OCEAN	Cattus Island	N/A	ACID	39.989400	-74.134400	1170 Cattus Island Blvd, Toms River
	Colliers Mills	34 029 0006	O ₃	40.064830	-74.444050	Colliers Mills Wildlife Management Area
	Toms River	34 029 2002	PM _{2.5}	39.994908	-74.170447	Hooper Avenue Elementary School, 1517 Hooper Avenue

¹ See Table 4, Parameter Codes.

² Meteorological measurements at the site are collected by Rutgers University.

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 (Decimal degrees)		Address
				Latitude	Longitude	
ATLANTIC	Atlantic City	34 001 1006	PM _{2.5}	39.363260	-74.431000	1535 Bacharach Boulevard
	Brigantine	34 001 0006	Visibility, O ₃ , SO ₂ , Beta, PM _{2.5} , Hg, ACID ³	39.464872	-74.448736	Edwin B. Forsythe National Wildlife Refuge Visitor Center, Great Creek Road
CAMDEN	Ancora State Hospital	34 007 1001	O ₃	39.684250	- 74.861491	Ancora State Hospital, 202 Spring Garden Road
	South Camden	34 007 0010	TEOM	39.923969	-75.122317	Camden County Municipal Utilities Authority, 1645 Ferry Avenue
	Camden RRF	34 007 0009	PM ₁₀	39.912431	- 75.116864	Camden RRF, Morgan Blvd. & I-676 entrance ramp
	Camden Spruce Street	34 007 0002	CO, NO _x , O ₃ , SO ₂ , PM _{2.5} PM _{2.5} Spec, BTEX, Black Carbon, TOXICS, MET, Beta	39.934446	-75.125291	Spruce St. near Locust St.
	Pennsauken	34 007 1007	PM _{2.5}	39.989036	-75.050008	Morris-Delair Water Treatment Plant Off Griffith Morgan Lane
CUMBERLAND	Millville	34 011 0007	NO _x , O ₃ , Beta	39.422273	- 75.025204	Lincoln Avenue & Route 55. Northeast of Millville
GLOUCESTER	Clarksboro	34 015 0002	O ₃	39.800339	-75.212119	Clarksboro Shady Rest Home, Shady Lane and County House Road
	Gibbstown	34 015 0004	PM _{2.5}	39.830806	-75.284723	Municipal Maintenance Yard, North School Street, North of Morse Avenue

¹ See Table 4, Parameter Codes.

³ The United States Fish and Wildlife Service, Air Quality Branch (USFWS-AQB) is responsible for sample collection for this parameter.

**Table 4
Parameter Codes**

ACID	Acid Deposition	O₃	Ozone
Black Carbon	Measured by Aethalometer	PAMS	Photochemical Assessment Monitoring Station measure for ozone precursors
Beta	Real-Time PM _{2.5} Analyzer	PM₁₀	Coarse particles (10 Microns or less) collected by a Federal Reference Method PM ₁₀ Sampler
BTEX	Measured Benzene, Toluene, Ethyl benzene, and Xylenes	PM_{2.5}Spec	Speciated (2.5 Microns or Less) fine particles
CO	Carbon Monoxide	PM_{2.5}	Fine Particles (2.5 Microns or less) collected by a Federal Reference Method PM _{2.5} Sampler
Hg	Mercury	TEOM	Real-Time PM _{2.5} Analyzer
Pb	Lead	SO₂	Sulfur Dioxide
MET	Meteorological Parameters	SS	Smoke Shade
NO_x	Nitrogen Dioxide and Nitric Oxide	TOXICS	Air Toxics
NO_y	Total Reactive Oxides of Nitrogen	Visibility	Measured by Nephelometer



Appendix B: 2014 Fine Particulate Speciation Summary

New Jersey Department of Environmental Protection

Table 1
2014 Fine Particulate Speciation Data
CAMDEN SPRUCE STREET NJ
Concentrations in Micrograms per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2 nd -Highest Concentration
Aluminum	0.034	0.363	0.273
Ammonium	0.864	3.690	3.380
Antimony	0.019	0.067	0.058
Arsenic	0.0009	0.009	0.007
Barium	0.006	0.030	0.030
Bromine	0.004	0.020	0.010
Cadmium	0.002	0.020	0.017
Calcium	0.038	0.193	0.189
Cerium	0.005	0.043	0.043
Cesium	0.008	0.023	0.023
Chlorine	0.178	2.420	2.150
Chromium	0.006	0.113	0.089
Cobalt	0.001	0.005	0.003
Copper	0.007	0.052	0.035
Elemental carbon	0.555	1.930	1.790
Indium	0.009	0.038	0.029
Iron	0.181	1.150	0.973
Lead	0.005	0.044	0.032
Magnesium	0.011	0.096	0.040
Manganese	0.003	0.014	0.013
Nickel	0.003	0.028	0.027
Nitrate	1.444	7.830	7.550
Organic carbon	2.591	6.520	5.220
Phosphorus	0.005	0.008	0.008
Potassium	0.112	1.030	0.537
Rubidium	0.001	0.002	0.002
Selenium	0.001	0.006	0.003
Silicon	0.067	0.597	0.183
Silver	0.006	0.019	0.019
Sodium	0.145	0.946	0.715
Strontium	0.001	0.010	0.006
Sulfate	1.698	5.100	4.910
Sulfur	0.590	1.780	1.690
Tin	0.011	0.033	0.029
Titanium	0.003	0.017	0.009
Total mass *	10.800	27.800	23.100
Vanadium	0.002	0.017	0.009
Zinc	0.029	0.328	0.154
Zirconium	0.003	0.015	0.012

* Total mass analysis discontinued as of October 2014.

Table 2
2014 Fine Particulate Speciation Data
CHESTER NJ
 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	0.028	0.661	0.287
Ammonium	0.554	2.380	2.320
Antimony	0.017	0.045	0.040
Arsenic	0.0004	0.002	0.002
Barium	0.005	0.030	0.030
Bromine	0.002	0.007	0.007
Cadmium	0.001	0.019	0.012
Calcium	0.009	0.056	0.049
Cerium	0.005	0.043	0.043
Cesium	0.008	0.023	0.023
Chlorine	0.006	0.075	0.033
Chromium	0.004	0.143	0.047
Cobalt	0.001	0.002	0.002
Copper	0.002	0.023	0.016
Elemental carbon	0.166	0.736	0.500
Indium	0.008	0.025	0.019
Iron	0.040	0.485	0.166
Lead	0.001	0.007	0.005
Magnesium	0.008	0.053	0.039
Manganese	0.001	0.005	0.004
Nickel	0.001	0.039	0.016
Nitrate	1.027	5.720	5.460
Organic carbon	1.657	3.850	3.780
Phosphorus	0.005	0.009	0.008
Potassium	0.035	0.093	0.092
Rubidium	0.001	0.002	0.002
Selenium	0.001	0.003	0.003
Silicon	0.037	0.385	0.240
Silver	0.006	0.019	0.019
Sodium	0.058	0.288	0.242
Strontium	0.001	0.010	0.002
Sulfate	1.374	4.120	3.790
Sulfur	0.461	1.270	1.230
Tin	0.011	0.046	0.033
Titanium	0.003	0.012	0.011
Total mass *	7.700	17.400	16.300
Vanadium	0.001	0.003	0.002
Zinc	0.004	0.021	0.019
Zirconium	0.002	0.012	0.012

* Total mass analysis discontinued as of October 2014.

Table 3
2014 Fine Particulate Speciation Data
ELIZABETH LAB NJ
 Concentrations in Micrograms per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2 nd -Highest Concentration
Aluminum	0.029	0.365	0.231
Ammonium	0.852	4.360	3.140
Antimony	0.016	0.052	0.051
Arsenic	0.0004	0.003	0.003
Barium	0.007	0.030	0.030
Bromine	0.003	0.009	0.008
Cadmium	0.002	0.020	0.017
Calcium	0.028	0.144	0.120
Cerium	0.005	0.043	0.043
Cesium	0.008	0.023	0.023
Chlorine	0.038	0.560	0.547
Chromium	0.003	0.041	0.025
Cobalt	0.001	0.003	0.002
Copper	0.005	0.019	0.019
Elemental carbon	0.986	4.260	3.070
Indium	0.009	0.030	0.017
Iron	0.133	0.411	0.400
Lead	0.001	0.010	0.005
Magnesium	0.011	0.110	0.080
Manganese	0.002	0.008	0.007
Nickel	0.002	0.019	0.017
Nitrate	1.658	8.410	8.130
Organic carbon	2.482	6.610	6.130
Phosphorus	0.005	0.008	0.008
Potassium	0.044	0.236	0.135
Rubidium	0.001	0.002	0.002
Selenium	0.001	0.002	0.002
Silicon	0.070	0.798	0.289
Silver	0.006	0.019	0.019
Sodium	0.100	0.476	0.433
Strontium	0.001	0.012	0.006
Sulfate	1.642	5.330	4.200
Sulfur	0.566	1.740	1.390
Tin	0.012	0.043	0.038
Titanium	0.003	0.024	0.015
Total mass *	11.500	33.500	27.900
Vanadium	0.002	0.011	0.010
Zinc	0.010	0.049	0.037
Zirconium	0.002	0.012	0.012

* Total mass analysis discontinued as of October 2014.

Table 4
2014 Fine Particulate Speciation Data
NEW BRUNSWICK NJ
 Concentrations in Micrograms per Cubic Meter ($\mu\text{g}/\text{m}^3$)

Pollutant	Annual Average Concentration	Daily Average Maximum Concentration	Daily Average 2 nd -Highest Concentration
Aluminum	0.021	0.169	0.160
Ammonium	0.583	3.070	2.770
Antimony	0.018	0.069	0.059
Arsenic	0.0005	0.005	0.004
Barium	0.005	0.030	0.030
Bromine	0.003	0.008	0.008
Cadmium	0.002	0.021	0.019
Calcium	0.015	0.133	0.068
Cerium	0.004	0.043	0.043
Cesium	0.009	0.023	0.023
Chlorine	0.014	0.469	0.121
Chromium	0.003	0.040	0.026
Cobalt	0.001	0.002	0.002
Copper	0.003	0.021	0.012
Elemental carbon	0.292	0.931	0.778
Indium	0.009	0.041	0.017
Iron	0.063	0.212	0.197
Lead	0.001	0.012	0.011
Magnesium	0.010	0.063	0.049
Manganese	0.001	0.012	0.009
Nickel	0.001	0.010	0.008
Nitrate	1.259	6.410	5.930
Organic carbon	1.835	4.460	3.670
Phosphorus	0.005	0.013	0.008
Potassium	0.043	0.362	0.133
Rubidium	0.001	0.002	0.001
Selenium	0.001	0.002	0.001
Silicon	0.049	0.366	0.266
Silver	0.006	0.020	0.019
Sodium	0.076	0.539	0.466
Strontium	0.001	0.006	0.006
Sulfate	1.378	4.110	4.090
Sulfur	0.485	1.370	1.360
Tin	0.011	0.037	0.021
Titanium	0.003	0.014	0.010
Total mass *	8.700	20.500	20.500
Vanadium	0.001	0.005	0.003
Zinc	0.008	0.058	0.045
Zirconium	0.003	0.020	0.017

* Total mass analysis discontinued as of October 2014.

Table 5
2014 Fine Particulate Speciation Data
NEWARK NJ
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	0.028	0.261	0.185
Ammonium	0.801	4.560	3.220
Antimony	0.018	0.077	0.050
Arsenic	0.0005	0.003	0.003
Barium	0.006	0.030	0.030
Bromine	0.003	0.011	0.010
Cadmium	0.002	0.030	0.027
Calcium	0.023	0.135	0.112
Cerium	0.005	0.044	0.044
Cesium	0.008	0.023	0.023
Chlorine	0.027	0.426	0.374
Chromium	0.004	0.100	0.069
Cobalt	0.001	0.004	0.002
Copper	0.005	0.024	0.021
Elemental carbon	0.482	2.450	2.080
Indium	0.009	0.035	0.035
Iron	0.089	0.397	0.349
Lead	0.001	0.012	0.008
Magnesium	0.009	0.043	0.036
Manganese	0.001	0.007	0.006
Nickel	0.002	0.028	0.021
Nitrate	1.642	9.290	8.240
Organic carbon	2.284	6.040	6.040
Phosphorus	0.005	0.013	0.008
Potassium	0.046	0.466	0.132
Rubidium	0.001	0.002	0.002
Selenium	0.001	0.003	0.001
Silicon	0.056	0.362	0.334
Silver	0.007	0.019	0.019
Sodium	0.096	0.628	0.588
Strontium	0.001	0.008	0.007
Sulfate	1.522	5.430	4.150
Sulfur	0.527	1.860	1.340
Tin	0.011	0.019	0.019
Titanium	0.003	0.013	0.009
Total mass *	10.600	32.400	28.300
Vanadium	0.002	0.006	0.005
Zinc	0.011	0.064	0.053
Zirconium	0.003	0.013	0.012

* Total mass analysis discontinued as of October 2014.