2016 Ozone Summary

New Jersey Department of Environmental Protection

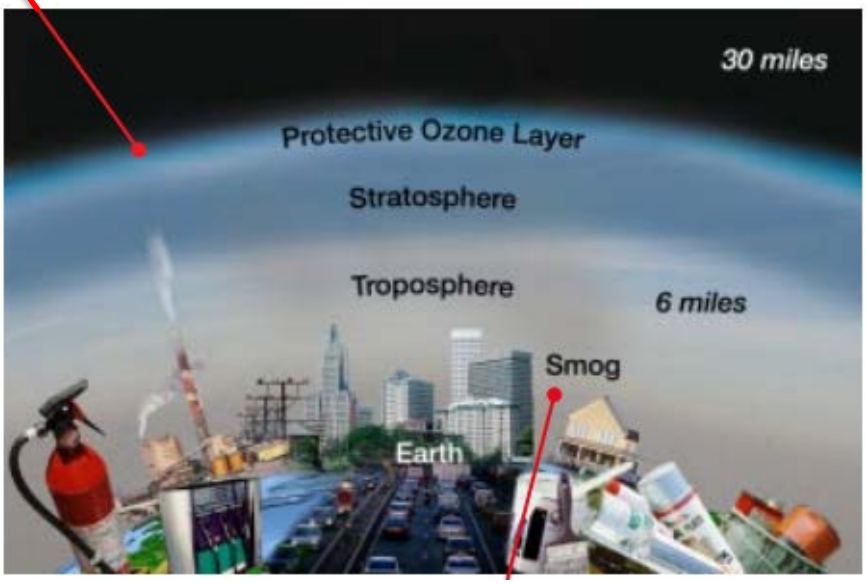
SOURCES

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 4-1). 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 4-2). 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 problem in the daytime 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, "Good Up High, Bad Nearby – What is Ozone?"

Figure 4-1. Good and Bad Ozone

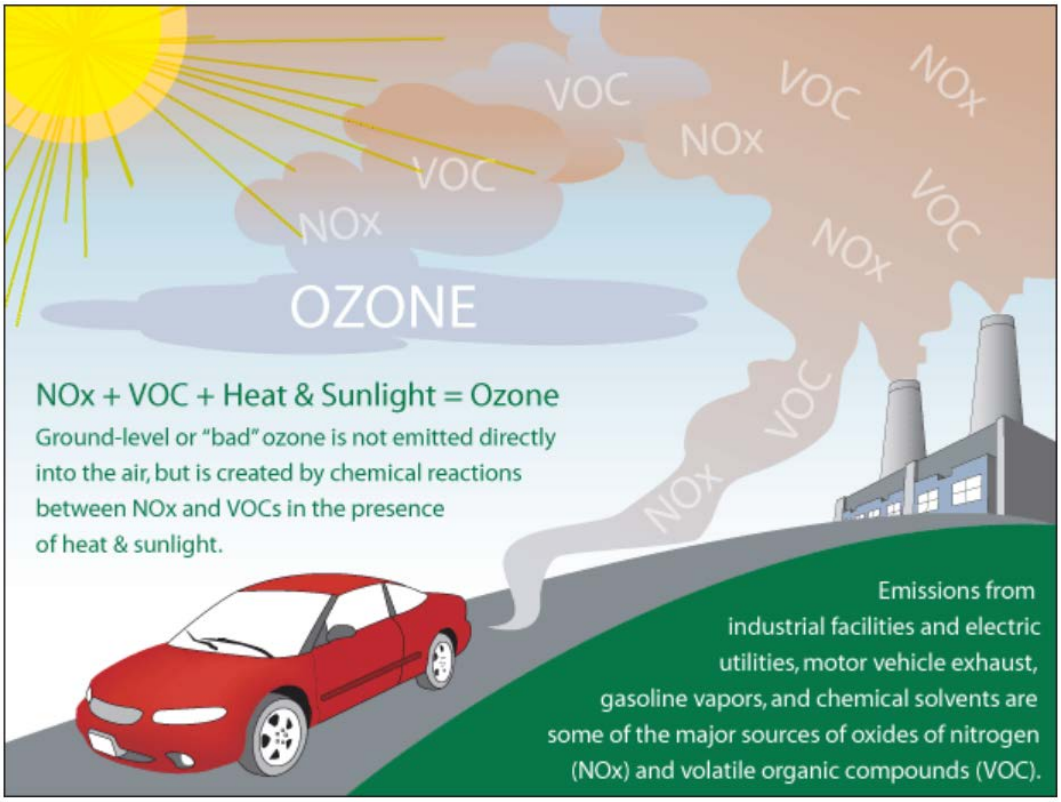
OZONE IS GOOD UP HERE…MANY POPULAR CONSUMER PRODUCTS LIKE AIR CONDITIONERS AND REFRIGERATORS INVOLVE CFCS OR HALONS DURING EITHER MANUFACTURING OR USE. OVER TIME, THESE CHEMICALS DAMAGE THE EARTH'S PROTECTIVE OZONE LAYER.



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 AirNow

Figure 4-2
Ozone Formation



Source: USEPA. https://airnow.gov/index.cfm?action=aqibasics.ozone

Health and Environmental Effects

Ozone can irritate the entire respiratory tract. 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 medical conditions 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. Children are at special risk for ozone-related problems. They breathe more air per pound of body weight than adults, and ozone can impact the development of their immature respiratory systems. They tend to be 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 4-3
Leaf Damage Caused by Ozone

Photos: Gerald Holmes, NCSU Dept. of Horticulture

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 harsh weather, disease, insects, and other pollutants. It 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 4-3, are damage caused by exposure to ground-level ozone.

AMBIENT AIR QUALITY STANDARDS

National and state air quality standards for ground-level ozone were first promulgated in 1971. There are both primary standards, which are set to provide public health protection (including protecting the health of sensitive populations such as asthmatics, children, and the elderly), 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 4-1). USEPA must periodically review the NAAQS to determine if they are sufficiently protective of public health based on the latest studies. In 2008 the 0.08 parts per million (ppm) 8-hour average daily maximum ozone NAAQS was changed to 0.075 ppm. There was also a primary 1-hour NAAQS that was revoked in 2008. It is still used for comparison purposes, although not to determine compliance. In October 2015 the 8-hour ozone NAAQS was lowered once again, to 0.070 ppm, effective in 2016.

Compliance with a NAAQS is based on meeting the design value, the actual statistic that determines whether the standard is being met. For ozone, calculating the design value is 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 monitoring site in the state for each of the three years. The values for each site are then used to calculate a three-year average. If this value exceeds the NAAQS at any site in the state, the state is determined to be in nonattainment.

Table 4-1
National and New Jersey Ambient Air Quality Standards for Ozone
Parts per Million (ppm)

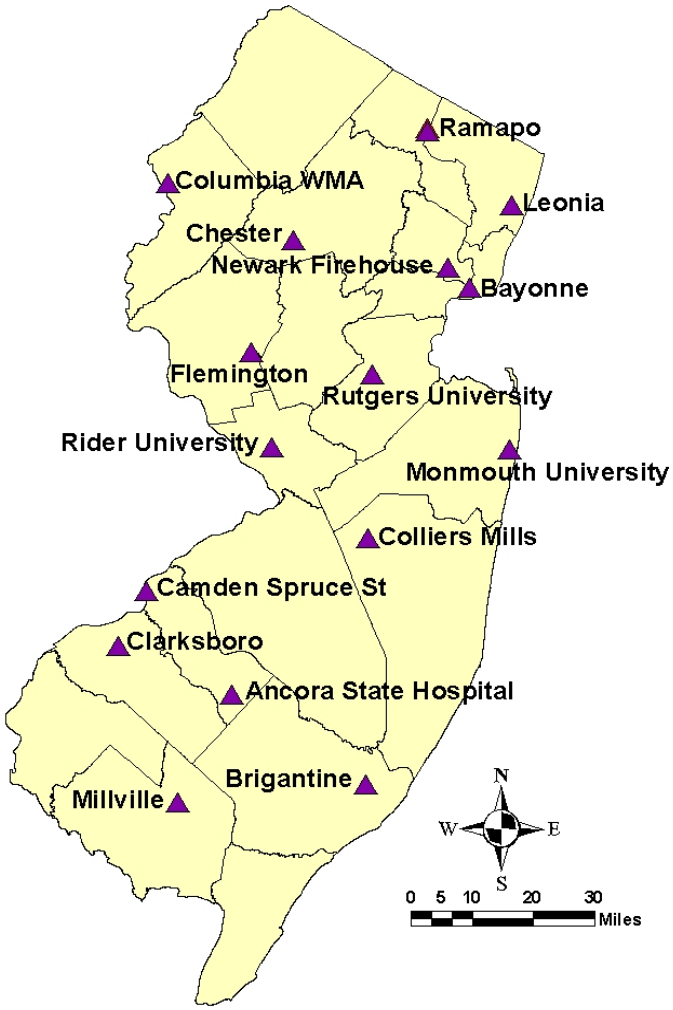
Averaging Period	Type	National	New Jersey
1-Hour	Primary	---	0.12 ppm
8-Hours	Primary & secondary	0.070 ppm	---

OZONE MONITORING NETWORK

Ozone was measured at 16 monitoring stations in New Jersey during 2016 (see Figure 4-5). Of those 16 sites, ten operate year-round and six operate only during the ozone season, which for 2016 was April 1st through October 31st. Bayonne, Brigantine, Camden Spruce Street, Chester, Columbia Wildlife Management Area (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.

There is an ozone monitor at Washington Crossing State Park in Mercer County which is maintained and operated by USEPA. Data from the site is also used in determining New Jersey's NAAQS compliance status, although it is not presented here.

Figure 4-5
2016 Ozone Monitoring Network



OZONE LEVELS IN 2016

During the 2016 ozone season, all 16 New Jersey monitoring sites recorded levels above the 8-hour standard of 0.070 ppm. However, on May 25 and 26 New Jersey ozone concentrations were unusually high because they were impacted by emissions from a huge wildfire in Fort McMurray, Alberta, Canada. Every ozone monitor in the state except Bayonne recorded exceedances of the 8-hour NAAQS on May 25. Two sites even went into the "Unhealthy" range. On May 26, ten sites exceeded the ozone standard.

In May 2017, NJDEP submitted a report to USEPA demonstrating that the emissions from the wildfire influenced New Jersey's air quality on May 25 and May 26, 2016, and requested that the data from the ozone monitors on those days be excluded from determining New Jersey's compliance with the ozone NAAQS. The federal Clean Air Act allows for the exclusion of air quality monitoring data that may be influenced by exceptional events, such as large fires, in determining attainment of the NAAQS. USEPA has stated that they concur with the exclusion of the data for all the monitors on May 25, and for ten of the monitors on May 26. Some neighboring states have also requested that USEPA allow exceedances on those days to be excluded from their compliance determinations.

For more information, see www.nj.gov/dep/baqp/ee.html.

Table 4-2 presents all the USEPA-approved 2016 ozone data (May 25 and May 26 exceedances are excluded). Of the 16 monitoring sites that operated during the 2016 ozone season, none recorded levels above the old 1-hour standard of 0.12 ppm. The highest 1-hour concentration was 0.103 ppm, recorded at Ramapo on June 20th. The last time the revoked 1-hour standard was exceeded in New Jersey was in 2010.

The highest daily maximum 8-hour average concentration was 0.081 at Camden Spruce Street on July 22. Seven sites in New Jersey (Camden Spruce Street, Clarksboro, Colliers Mills, Flemington, Leonia, Rider University, and Rutgers University) were above the design value (4th-highest 8-hour daily maximum >0.070 ppm). Figure 4-6 shows the one-hour and eight-hour data for each site. Figure 4-7 presents each site's 3-year average 8-hour design value for the 2014-2016 period.

The daily maximum 8-hour values for all sites for May 25 and 26 can be found in Table 4-3. The table also shows whether USEPA concurs with the exclusion of the data from the calculation of the 2016 design values.

Table 4-2
2016 Ozone Concentrations in New Jersey
(Excluding 5/25-26/2016 Exceedance Data)
Parts per Million (ppm)

Monitoring Site	1-Hour Daily Maximum	8-Hour Averages		
		Highest Daily Maximum	4th-Highest Daily Maximum	2014-2016 Average of 4th-Highest Daily Max.
Ancora	0.092	0.076	0.064	0.068
Bayonne	0.090	0.074	0.068	0.072
Brigantine	0.077	0.068	0.063	0.064
Camden Spruce St.	0.091	0.081	0.076	0.074
Chester	0.092	0.072	0.068	0.068
Clarksboro	0.101	0.079	0.074	0.073
Colliers Mills	0.095	0.077	0.071	0.072
Columbia	0.085	0.072	0.065	0.063
Flemington	0.088	0.078	0.073	0.070
Leonia	0.095	0.077	0.073	0.074
Millville	0.081	0.070	0.068	0.067
Monmouth University	0.090	0.073	0.068	0.069
Newark Firehouse	0.094	0.071	0.068	0.070
Ramapo	0.103	0.079	0.068	0.068
Rider University	0.094	0.076	0.071	0.071
Rutgers University	0.093	0.078	0.075	0.074

Table 4-3
2016 Ozone Concentrations in New Jersey
Daily Maximum 8-Hour Values for 5/25-26/2016
Parts per Million (ppm)

Monitoring Site	May 25		May 26	
	Concen-tration	Excluded	Concen-tration	Excluded
Ancora	0.076	Yes	0.064	No
Bayonne	0.069	Yes	0.076	Yes
Brigantine	0.079	Yes	0.062	No
Camden Spruce St.	0.078	Yes	0.068	No
Chester	0.083	Yes	0.086	Yes
Clarksboro	0.083	Yes	0.070	No
Colliers Mills	0.090	Yes	0.070	No
Columbia	0.076	Yes	0.073	Yes
Flemington	0.083	Yes	0.088	Yes
Leonia	0.086	Yes	0.085	Yes
Millville	0.081	Yes	0.069	No
Monmouth University	0.081	Yes	0.065	No
Newark Firehouse	0.081	Yes	0.077	Yes
Ramapo	0.079	Yes	0.081	Yes
Rider University	0.082	Yes	0.082	Yes
Rutgers University	0.084	Yes	0.086	Yes

Figure 4-6
2016 Ozone Concentrations in New Jersey
(Excluding 5/25-26/2016 Exceedance Data), Parts per Million (ppm)

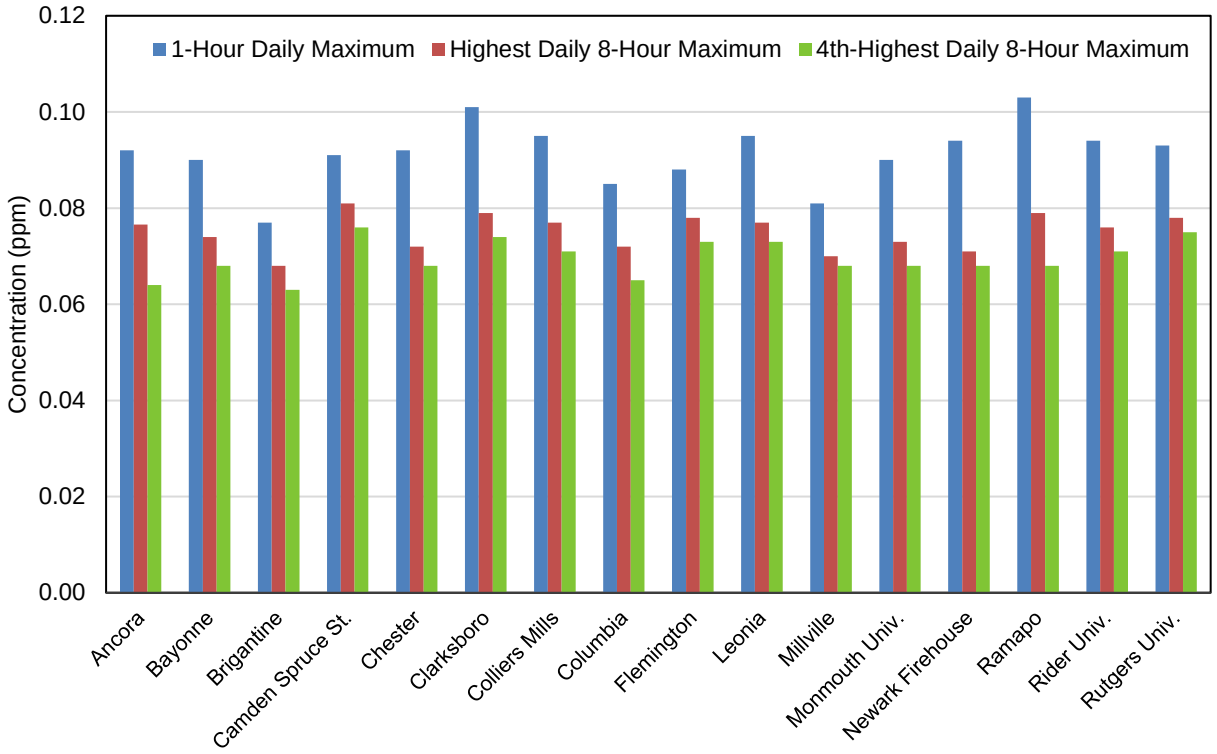
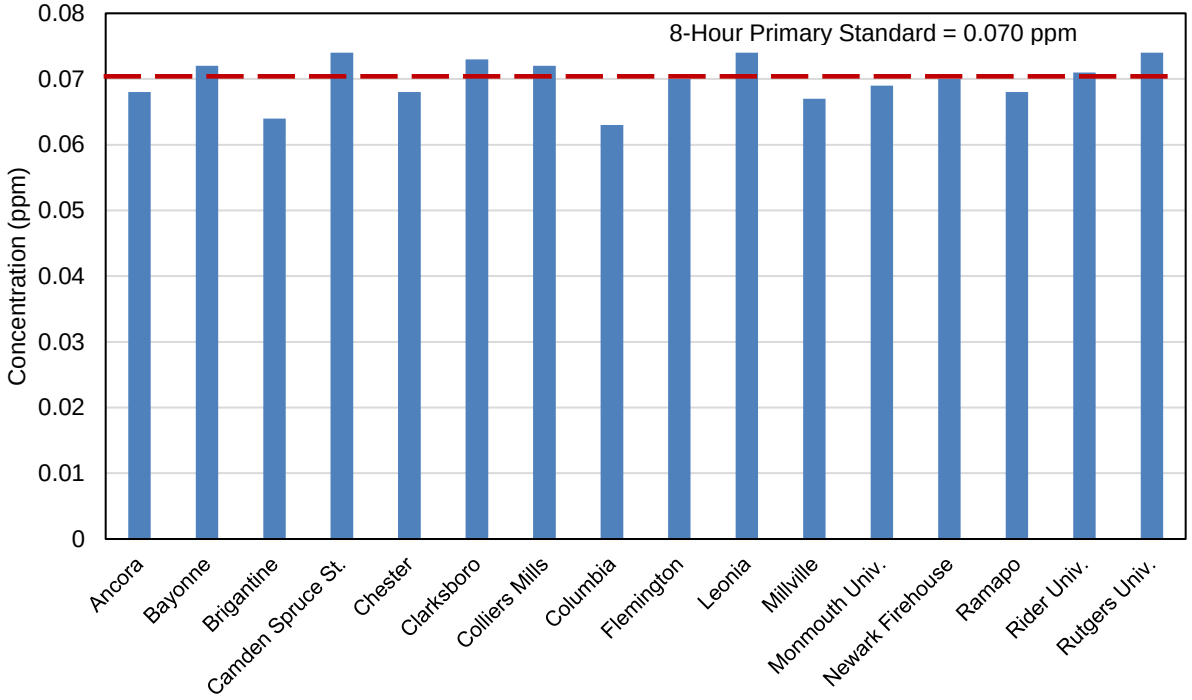


Figure 4-7
New Jersey Ozone Design Values for 2014-2016
3-Year Average of the 4th Highest Daily Maximum 8-Hour Average
(Excluding 5/25-26/2016 Exceedance Data), Parts per Million (ppm)



OZONE TRENDS

Studies have shown that in order to lower ground-level ozone concentrations, emissions of VOCs and NOx must be reduced. Over the past couple of decades, this effort has resulted in a relatively steady decrease in ozone levels in New Jersey. The chart in Figure 4-8 shows the fourth-highest statewide 8-hour maximum average concentration recorded each year since 1986. In 2016, the value was 0.076 ppm. In 2016, the design value (three-year average of the 4th-highest maximum daily 8-hour concentration at any site) was 0.074 ppm, as shown in Figure 4-9. This exceeds the 0.070 ppm NAAQS, but is an improvement over earlier design values. Ozone levels in New Jersey are greatly impacted by emissions from upwind sources in other states, so the effort to reduce VOC and NOx emissions must be implemented in regions beyond our state borders.

Figure 4-8
Ozone Concentrations in New Jersey, 1997-2016
4th-Highest Daily Maximum 8-Hour Averages
(Excluding 5/25-26/2016 Exceedance Data), Parts per Million (ppm)

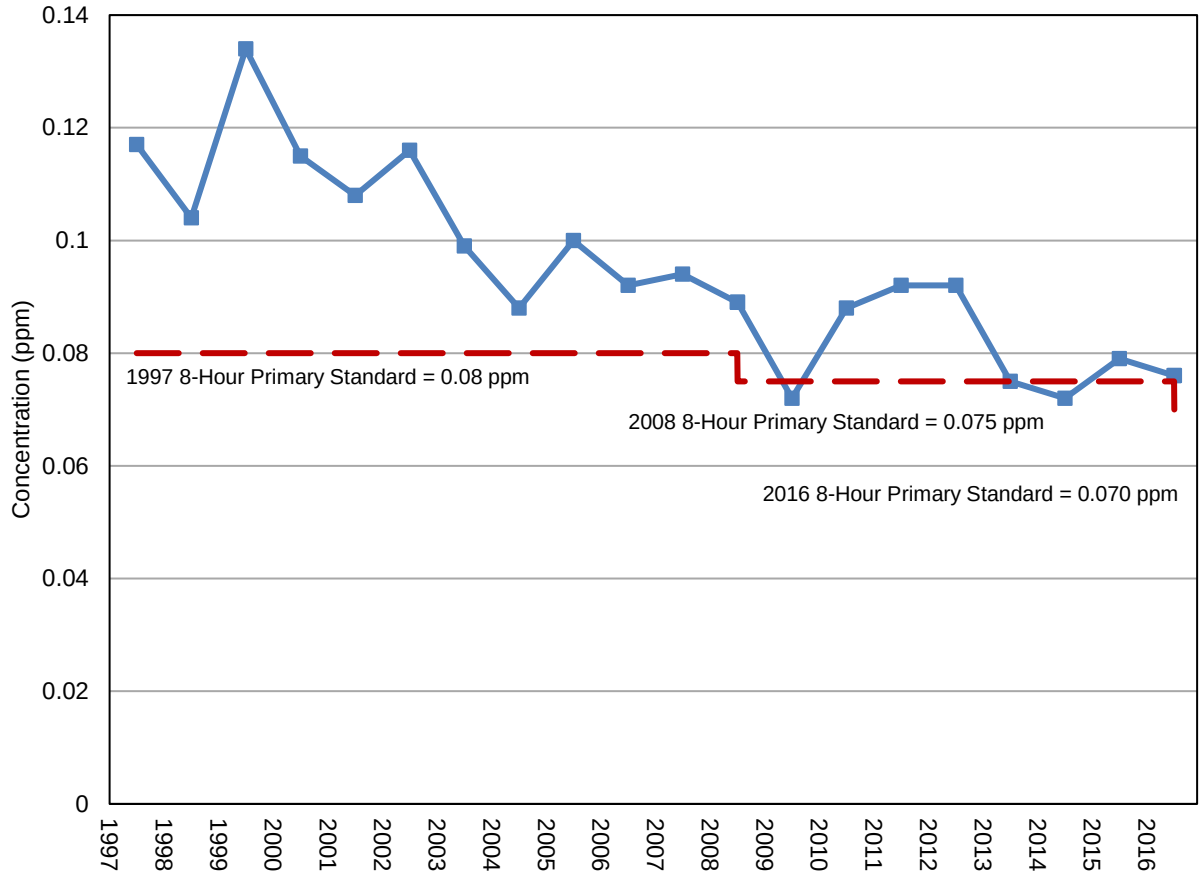
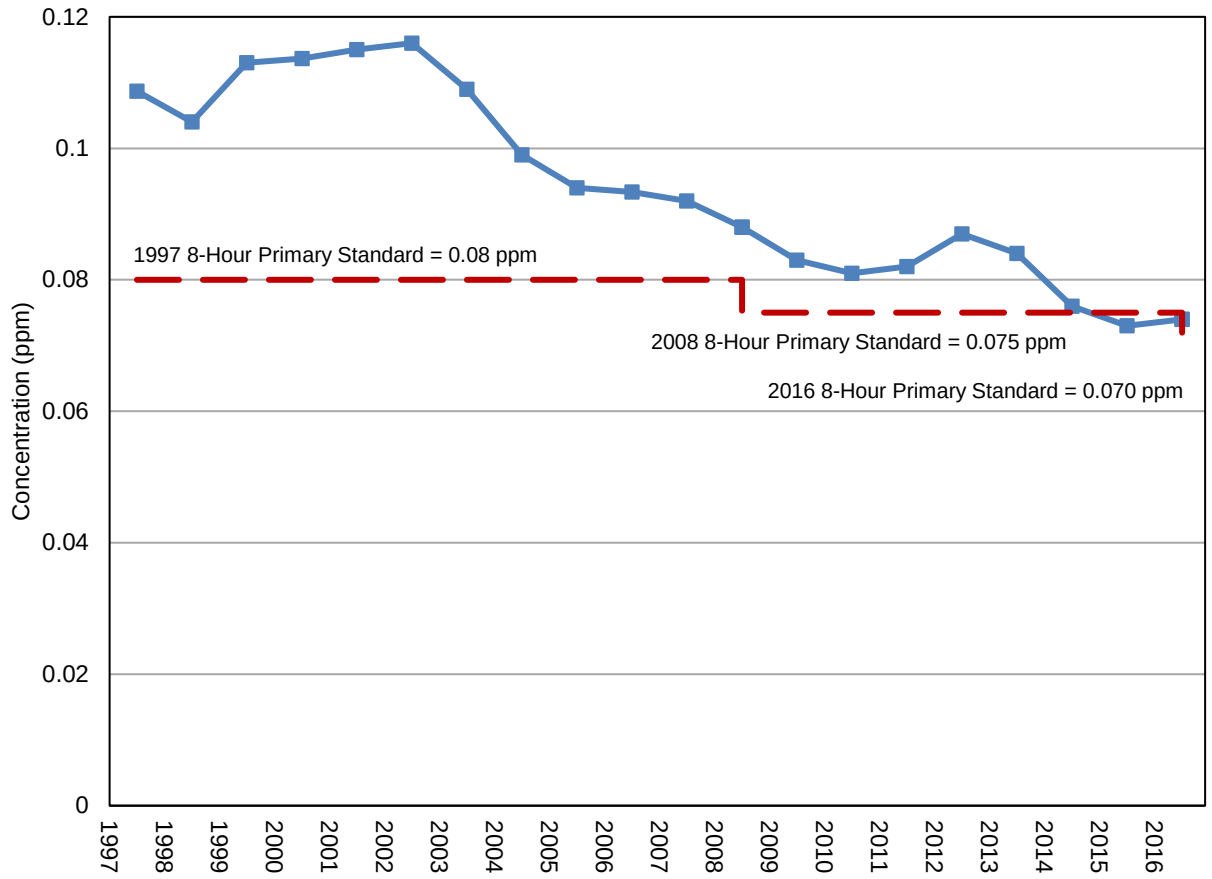


Figure 4-9
Ozone Design Values in New Jersey, 1990-2016
3-Year Average of 4th-Highest Daily Maximum 8-Hour Average Concentration
(Excluding 5/25-26/2016 Exceedance Data), Parts per Million (ppm)

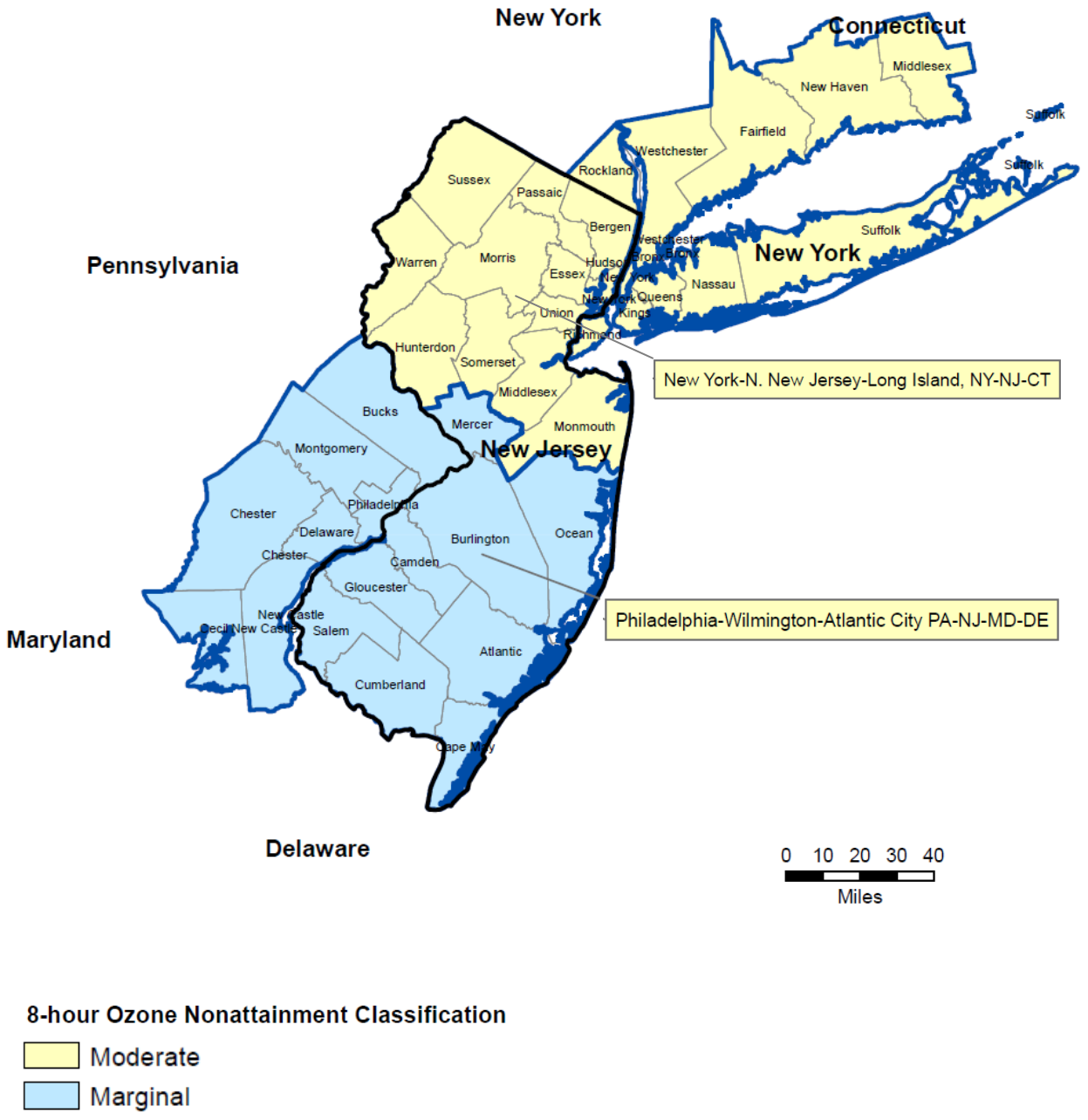


Ozone Nonattainment Areas in New Jersey

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 state of New Jersey has been in nonattainment for the ozone NAAQS with the northern part of the state classified as being "moderate" and the southern part of the state classified as being "marginal." New Jersey's current classification with respect to the 2008 8-hour standard is shown in Figure 4-10.

Figure 4-10
New Jersey 8-Hour Ozone Nonattainment Areas



Source: www3.epa.gov/airquality/greenbook/map/nj8_2008.pdf

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