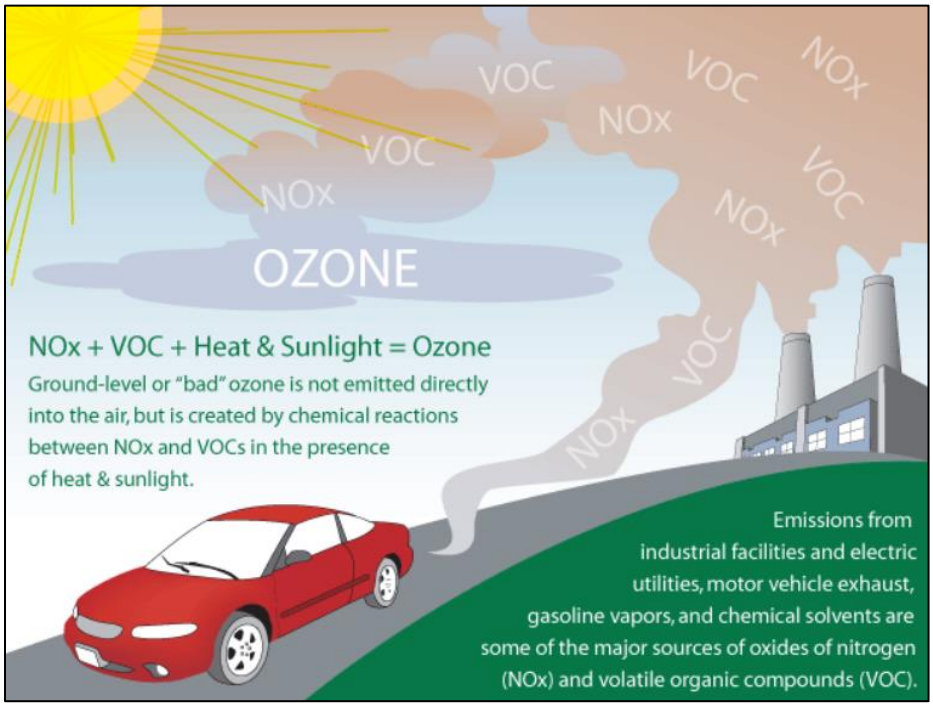
2018 Ozone Summary

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. 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 4-1). 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.

Figure 4-1
Ozone Formation

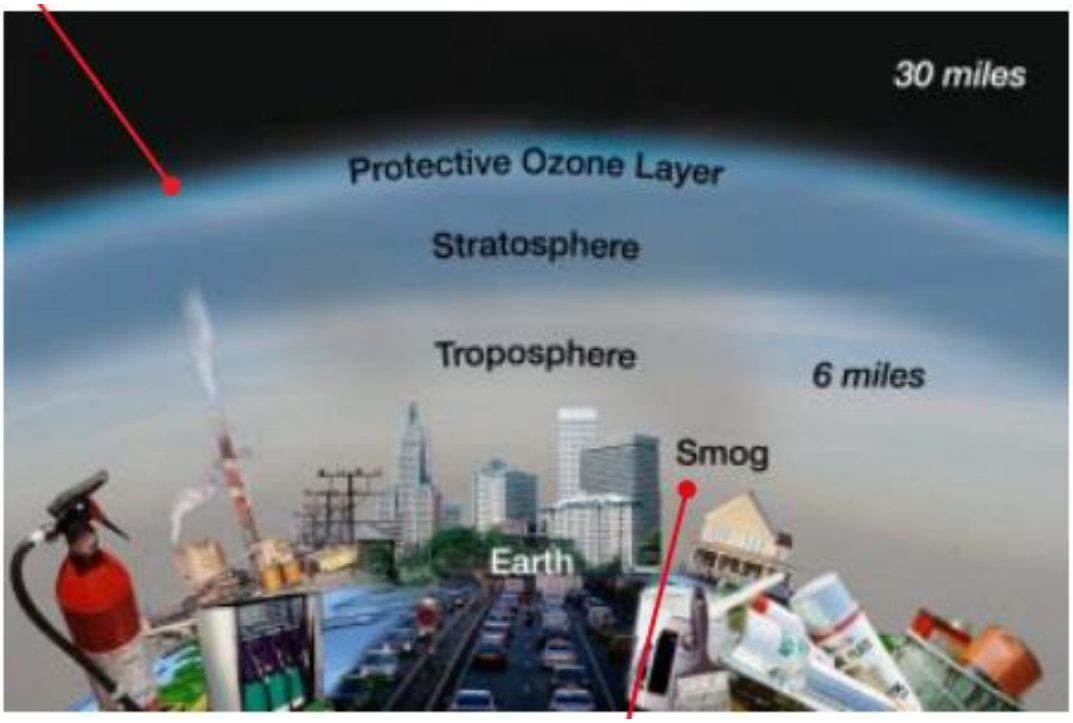


https://airnow.gov/index.cfm?action=aqibasics.ozone

Since ground-level ozone needs sunlight to form, it is mainly a problem in the daytime during the summer months. The U.S. Environmental Protection Agency (USEPA) requires New Jersey to monitor ozone from March 1st to October 31st, the so-called "ozone season." Weather patterns have a significant effect on ozone formation, and hot dry summers will result in more ozone than cool wet ones. For a more complete explanation of the difference between ozone in the upper and lower atmosphere, see Figure 4-2, and the USEPA publication, "Good Up High, Bad Nearby – What is Ozone?"

Figure 4-2. 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.

https://www3.epa.gov/airnow/gooduphigh/ozone.pdf

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.

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 brown areas on the leaf shown in Figure 4-3 are damage caused by exposure to ground-level ozone.

Figure 4-3
Leaf Damage Caused by Ozone

https://www.ars.usda.gov/

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). The USEPA must periodically review the NAAQS to determine if they are sufficiently protective of public health based on the latest studies. Initially, the ozone NAAQS was an hourly average of 0.12 ppm, established in 1979. It has since been revoked by USEPA, although New Jersey still uses it as a primary state standard. In 1997, the 0.08 parts per million (ppm) ozone NAAQS was promulgated, based on the maximum 8-hour average daily concentration. It was changed to 0.075 ppm in 2008. 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)

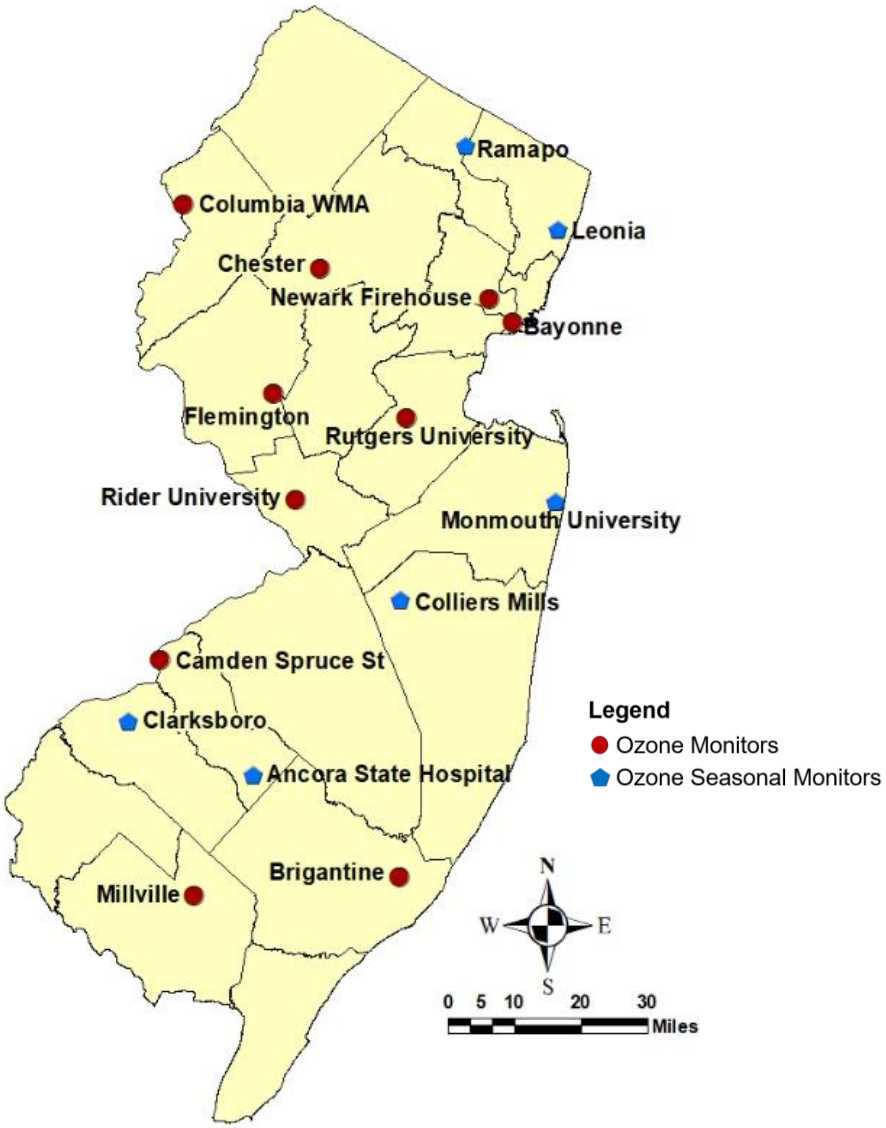
Averaging Period	Type	National	New Jersey
1-Hour	Primary	---	0.12 ppm
8-Hours	Primary & secondary	0.070 ppm	---

Ozone Monitoring Network

Ozone was measured at 16 monitoring stations in New Jersey during 2018 (see Figure 4-4). Of those 16 sites, ten operate year-round and six operate only during the ozone season, which is March 1st through October 31st. Bayonne, Brigantine, Camden Spruce Street, Chester, Columbia, 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. It can be obtained from USEPA.

Figure 4-4
2018 Ozone Monitoring Network



OZONE LEVELS IN 2018

During the 2018 ozone season, 14 of the 16 New Jersey monitoring sites recorded levels above the 8-hour standard of 0.070 ppm at least once. There were twenty-one (21) days, between May 1 and August 29, on which the standard was exceeded somewhere in the state (including USEPA's Washington Crossing site). On three of those days (July 1, 2 and 10), the Air Quality Index reached the "Unhealthy" category (see the Air Quality Index section for details).

Table 4-2 presents the USEPA-verified 2018 New Jersey ozone data. Of the 16 monitoring sites that operated during the 2018 ozone season, two recorded levels above the New Jersey 1-hour standard of 0.12 ppm. The highest daily 1-hour concentration was 0.135 ppm, recorded at Flemington on July 2nd. The Leonia site also exceeded the 1-hour standard that day, with a value of 0.131 ppm. The last time the 1-hour standard was exceeded in New Jersey was in 2010. Figure 4-5 shows the one-hour data for each site.

The highest daily maximum 8-hour average concentration was 0.097 at Flemington on July 9th. All sites except Millville and Monmouth University exceeded the 8-hour standard (0.070 ppm) at least once (see Figure 4-6). Leonia had the most exceedances with 13. Ten sites (Bayonne, Camden Spruce Street, Chester, Clarksboro, Colliers Mills, Flemington, Leonia, Newark Firehouse, Rider University, and Rutgers University) were above the design value (4th-highest 8-hour daily maximum>0.070 ppm). Figure 4-7 presents each site's 8-hour daily maximum average values, and Figure 4-8 shows the 3-year average 8-hour design value for the 2016-2018 period.

Table 4-2
2018 Ozone Concentrations in New Jersey
Parts per Million (ppm)

Monitoring Site	1-Hour Daily Maximum	8-Hour Averages		
		Highest Daily Maximum	4th-Highest Daily Maximum	2016-2018 Average of 4th-Highest Daily Max.
Ancora	0.091	0.082	0.068	0.066
Bayonne	0.110	0.095	0.078	0.071
Brigantine	0.080	0.074	0.063	0.063
Camden Spruce St.	0.091	0.076	0.075	0.075
Chester	0.110	0.081	0.073	0.070
Clarksboro	0.096	0.084	0.077	0.074
Colliers Mills	0.098	0.083	0.074	0.073
Columbia	0.078	0.074	0.067	0.065
Flemington	0.135	0.097	0.072	0.072
Leonia	0.131	0.091	0.079	0.075
Millville	0.078	0.065	0.063	0.064
Monmouth University	0.085	0.071	0.068	0.065
Newark Firehouse	0.120	0.096	0.071	0.067
Ramapo	0.108	0.085	0.069	0.067
Rider University	0.113	0.091	0.076	0.072
Rutgers University	0.098	0.080	0.076	0.075

Figure 4-5
2018 Ozone Concentrations in New Jersey
1-Hour Daily Maximum Concentrations
Parts per Million (ppm)

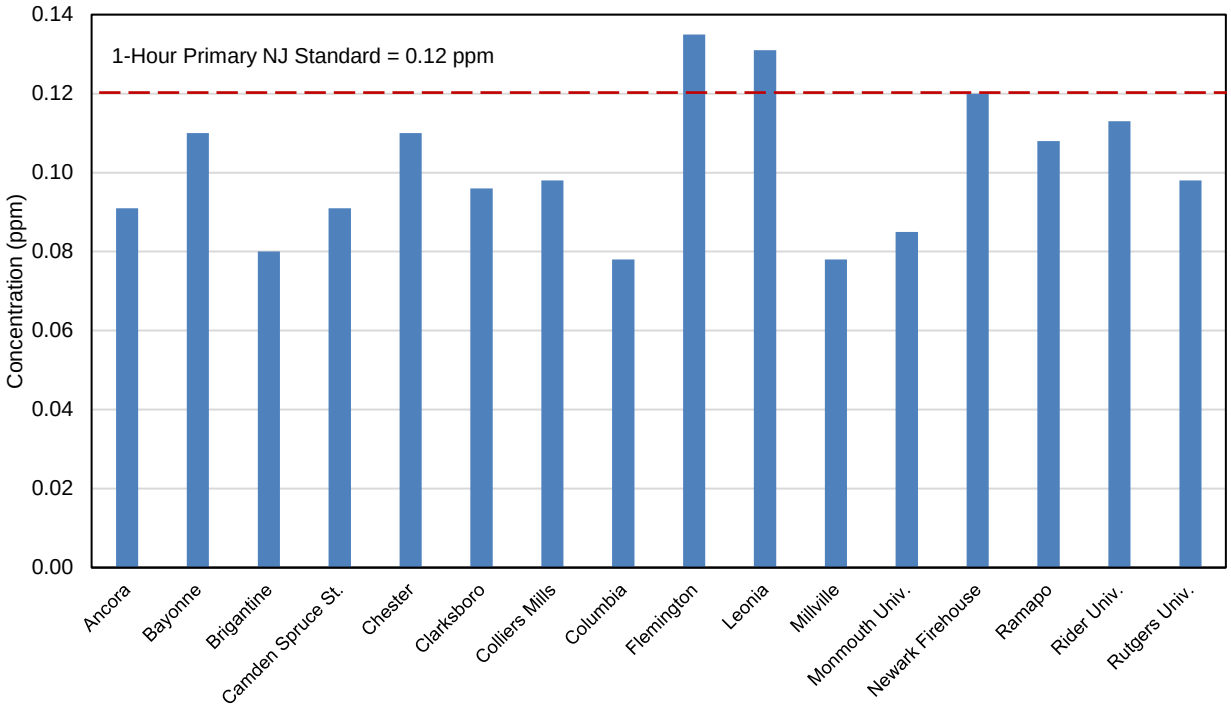


Figure 4-6
Number of Exceedance Days of the 8-Hour O_3 NAAQS in 2018 at New Jersey's Monitors

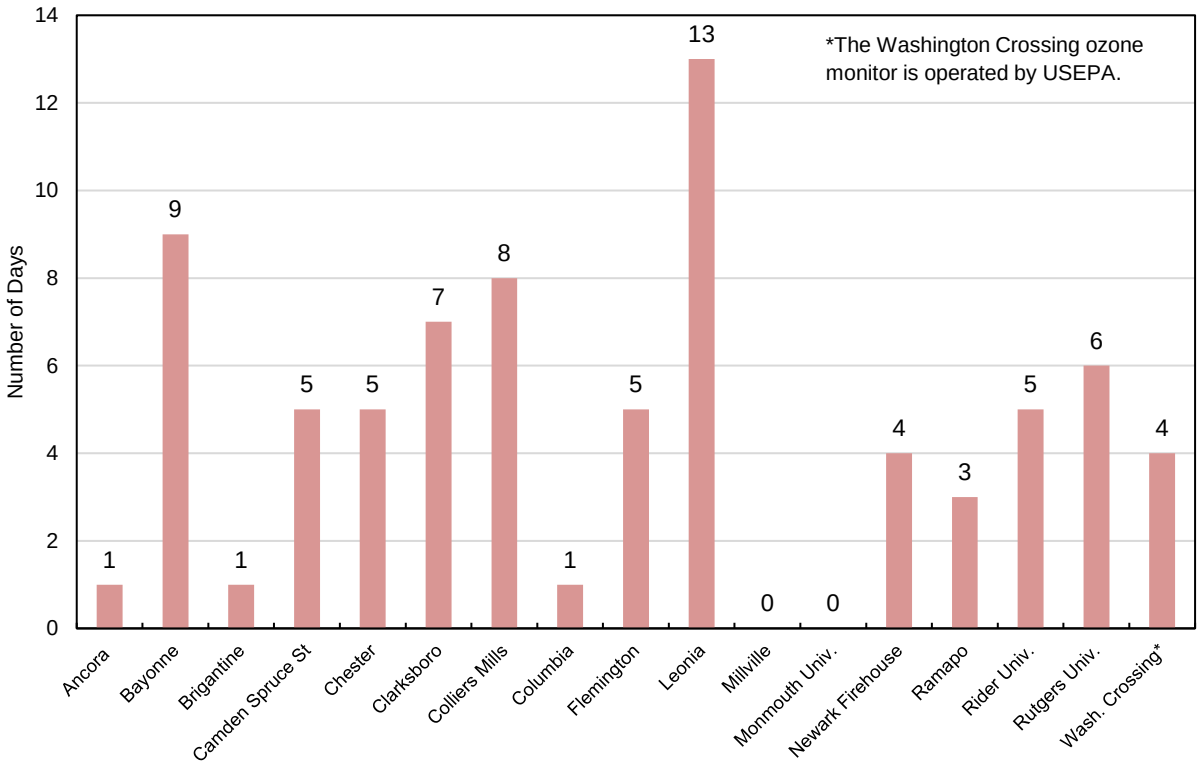


Figure 4-7
2018 Ozone Concentrations in New Jersey
8-Hour Daily Maximum Concentrations
Parts per Million (ppm)

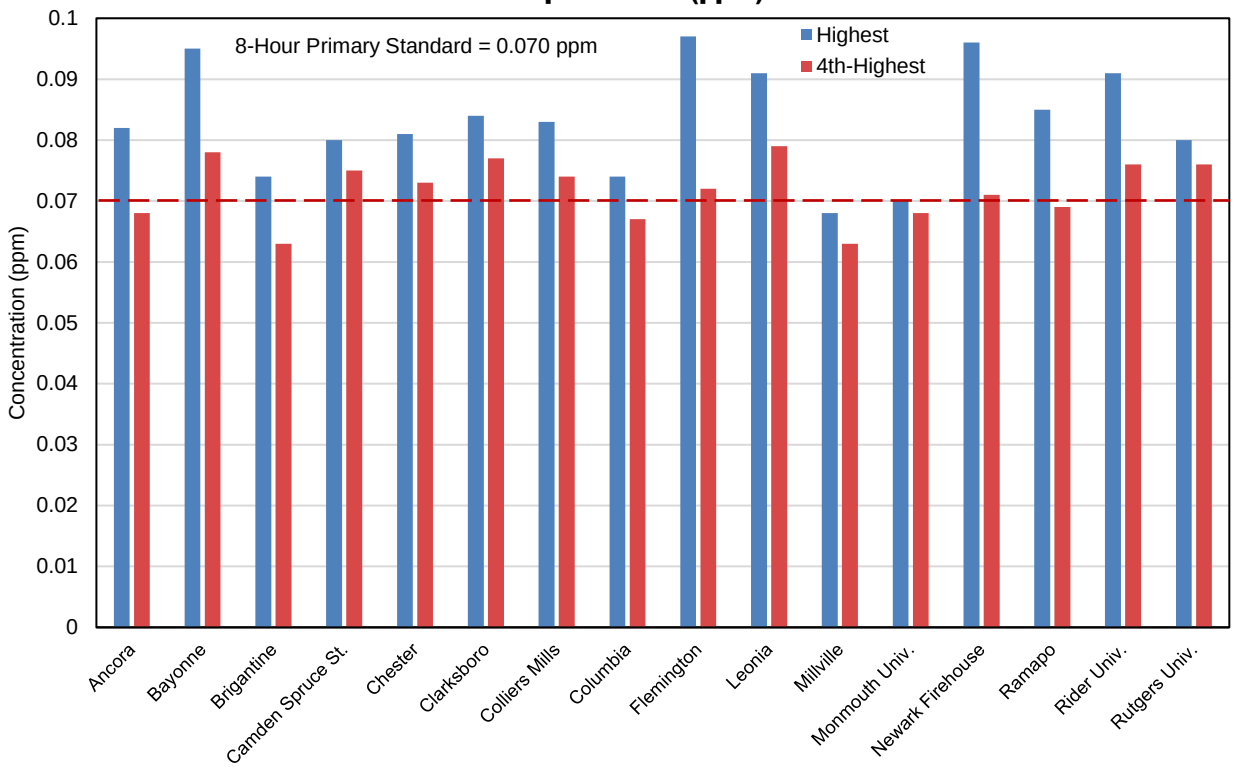
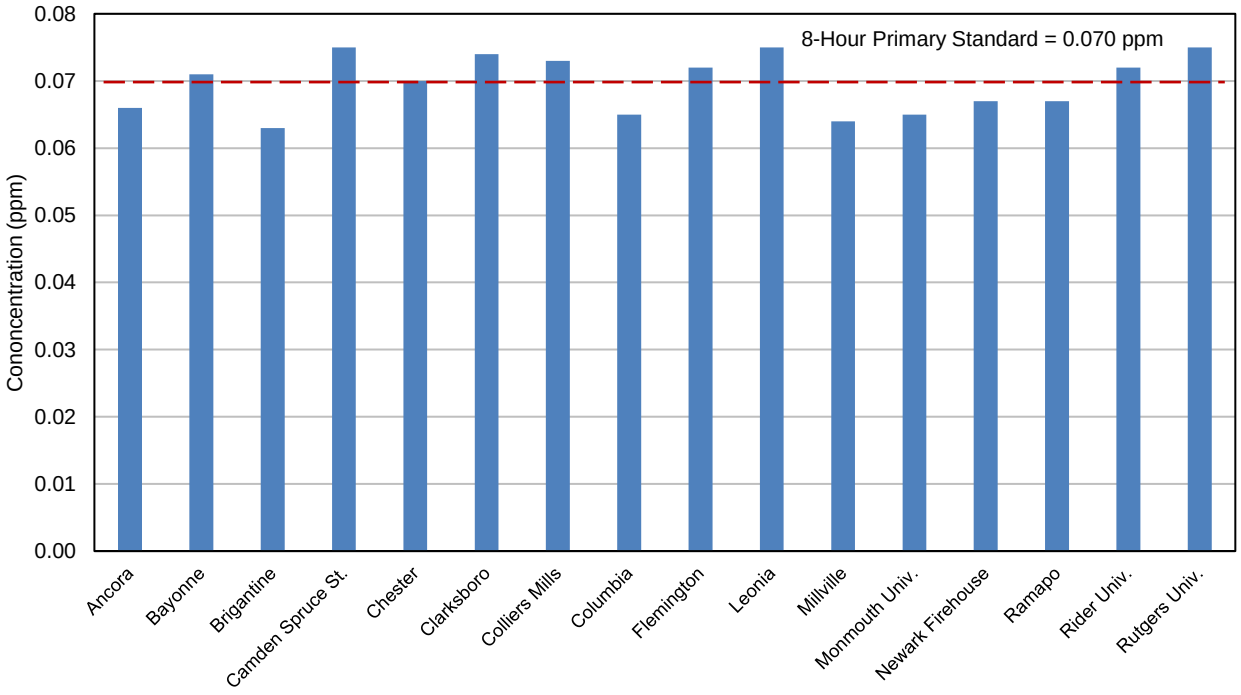


Figure 4-8
New Jersey Ozone Design Values for 2015-2018
3-Year Average of the 4th-Highest Daily Maximum 8-Hour Average
Parts per Million (ppm)



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, emissions reductions have resulted in a relatively steady decrease in ozone levels in New Jersey. However, it will take some new initiatives for the state to further decrease ozone concentrations in order to meet the lower 2016 standard. The chart in Figure 4-9 shows the fourth-highest statewide 8-hour maximum average concentration recorded each year since 1997. In 2018, this value was 0.079 ppm (measured at Leonia). The 2018 design value, which is the three-year average of the 4th-highest maximum daily 8-hour concentration at any site statewide, was 0.075 ppm, as shown in Figure 4-10. This exceeds the 0.070 ppm NAAQS.

Figure 4-9
Ozone Trend in New Jersey, 1997-2018
4th-Highest Daily Maximum 8-Hour Averages
Parts per Million (ppm)

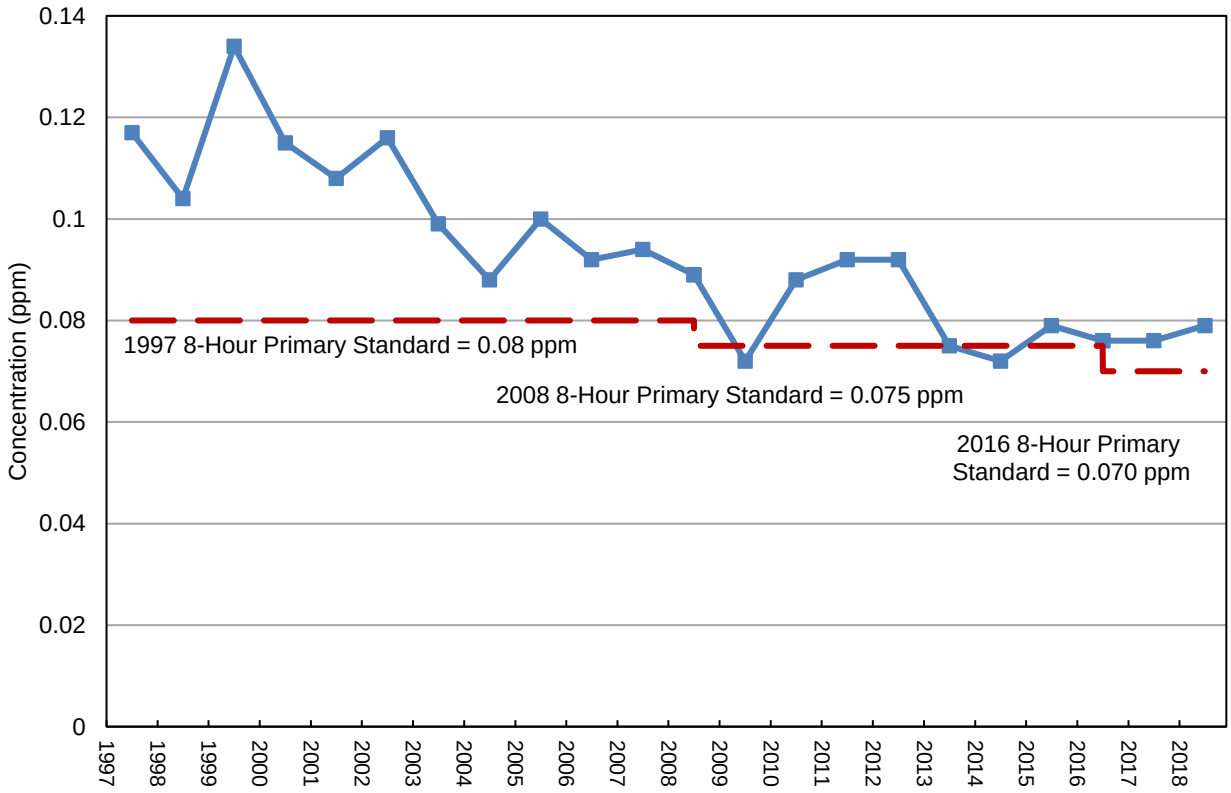
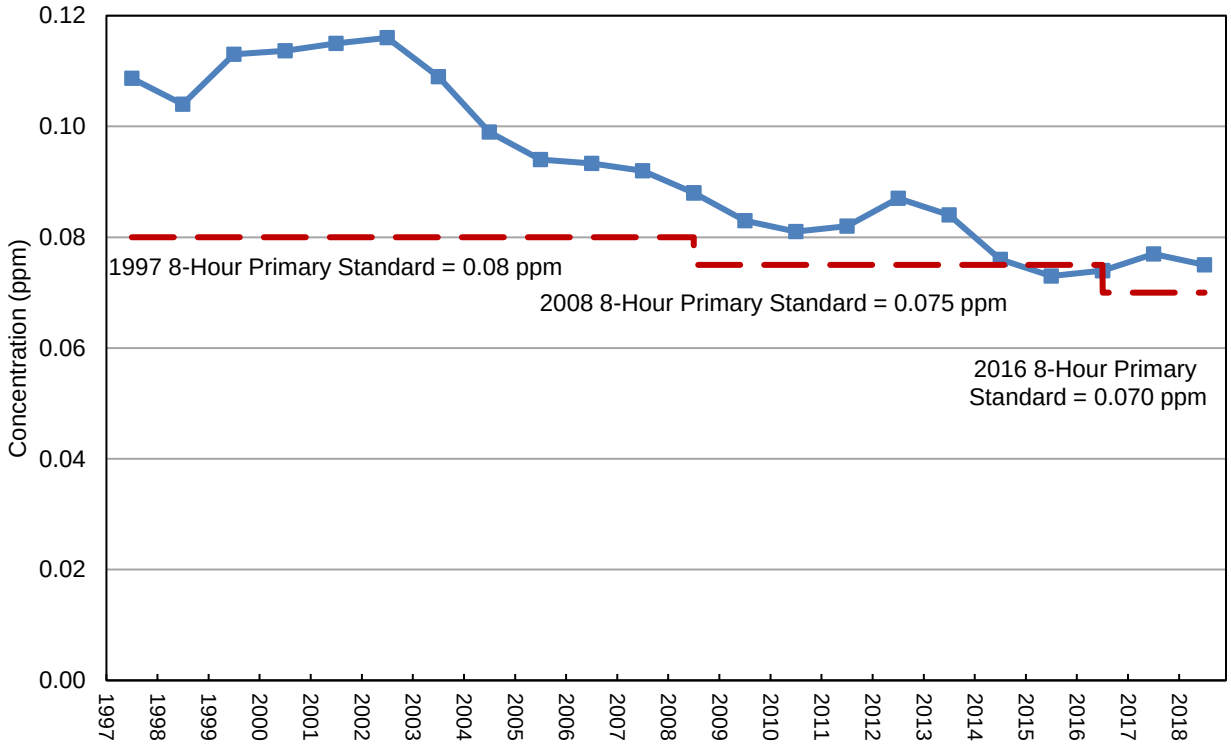


Figure 4-10
Ozone Design Value Trend in New Jersey, 1997-2018
3-Year Average of 4th-Highest Daily Maximum
8-Hour Average Concentration
Parts per Million (ppm)

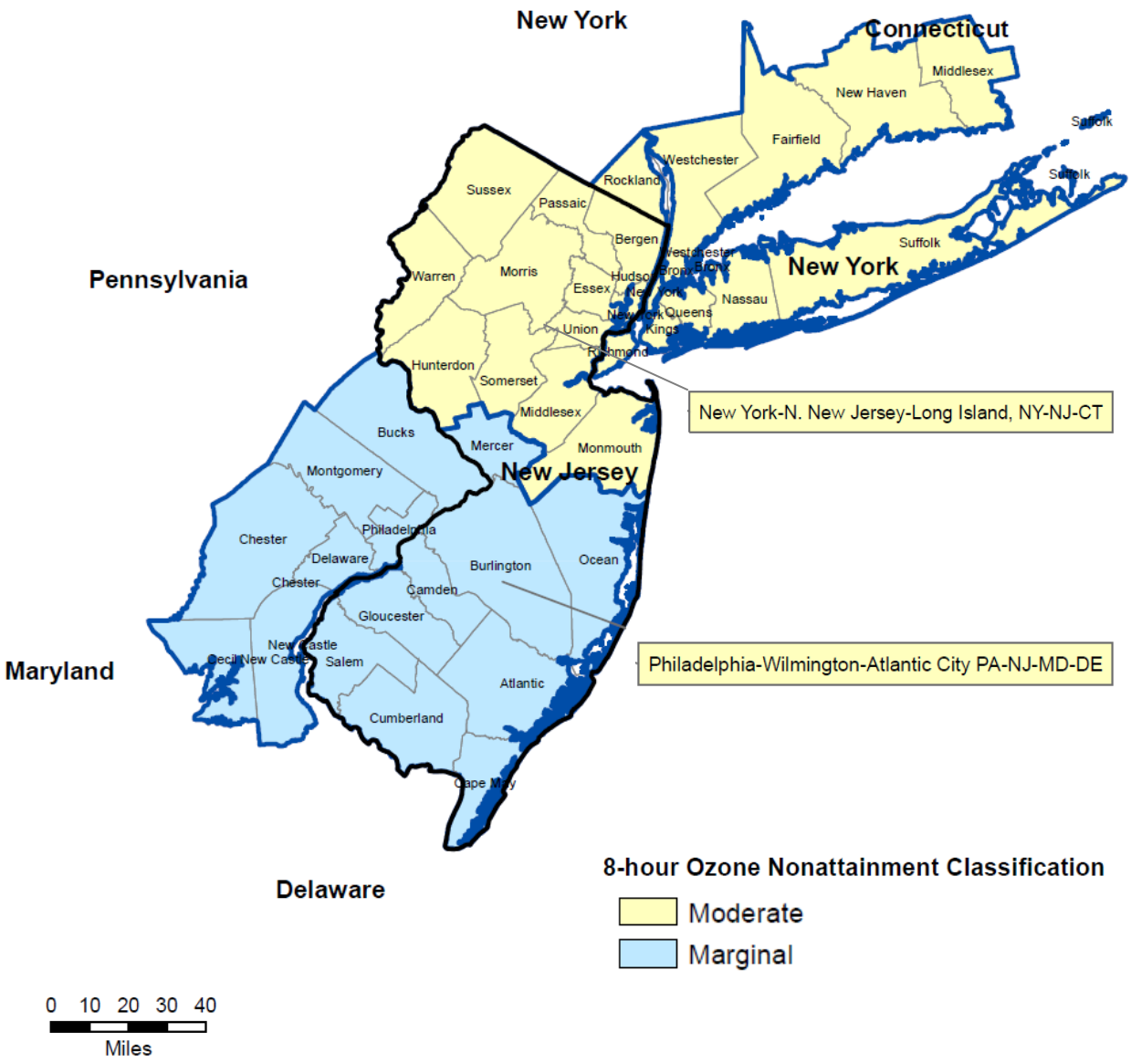


Ozone Nonattainment Areas in New Jersey

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 2016 8-hour standard is shown in Figure 4-11.

Figure 4-11
New Jersey 8-Hour Ozone Nonattainment Areas



Source: https://www3.epa.gov/airquality/greenbook/map/nj8_2015.pdf

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