



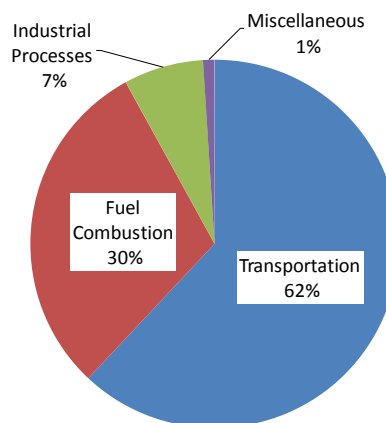
2012 Nitrogen Dioxide Summary

New Jersey Department of Environmental Protection

NATURE AND SOURCES

Nitrogen Dioxide (NO_2) is a reddish-brown, highly reactive gas that is formed in the air through the oxidation of Nitric Oxide (NO). When NO_2 reacts with other chemicals, it can form ozone, particulate matter, and other compounds which can contribute to regional haze and acid rain. Oxides of Nitrogen (NOx) is a mixture of gases which is mostly comprised of NO and NO_2 . These gases are emitted from the exhaust of motor vehicles, the burning of coal, oil or natural gas, and during industrial processes such as welding, electroplating, and dynamite blasting. Although most NOx is emitted as NO, it is readily converted to NO_2 in the atmosphere. In the home, gas stoves and heaters produce substantial amounts of nitrogen dioxide. A pie chart summarizing the major sources of NOx is shown in Figure 1. As much of the NOx in the air is emitted by motor vehicles, concentrations tend to peak during the morning and afternoon rush hours. This is shown in the graphs in Figures 2-4 (pages 2-3).

Figure 1
National Summary of 2008 Oxides of Nitrogen (NOx) Emissions by Source Category



Source: USEPA National Summary of Nitrogen Oxides Emissions, 2008

HEALTH AND ENVIRONMENTAL EFFECTS

Short-term exposures (less than 3 hours) to low levels of nitrogen dioxide may aggravate pre-existing respiratory illnesses, and can cause respiratory illnesses, particularly in children ages 5-12. Symptoms of low level exposure to NO and NO_2 include irritation to eyes, nose, throat and lungs, coughing, shortness of breath, tiredness and nausea. Long-term exposures to NO_2 may increase susceptibility to respiratory infection and may cause permanent damage to the lung. NO and NO_2 are found in tobacco smoke, so people who smoke or breathe in second-hand smoke may be exposed to NOx. The U.S. Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the U.S. Environmental Protection Agency (EPA) have determined that, with the available information, no conclusion can be made as to the carcinogenicity of NO or NO_2 to human beings. Nitrogen Oxides contribute to a wide range of environmental problems. These include potential changes in the composition of some plants in wetland and terrestrial ecosystems, acidification of freshwater bodies, eutrophication of estuarine and coastal waters, increases in levels of toxins harmful to fish and other aquatic life, and visibility impairment.

Figure 2
Nitric Oxide - New Jersey
2012 Hourly Variation
Parts Per Million (ppm)

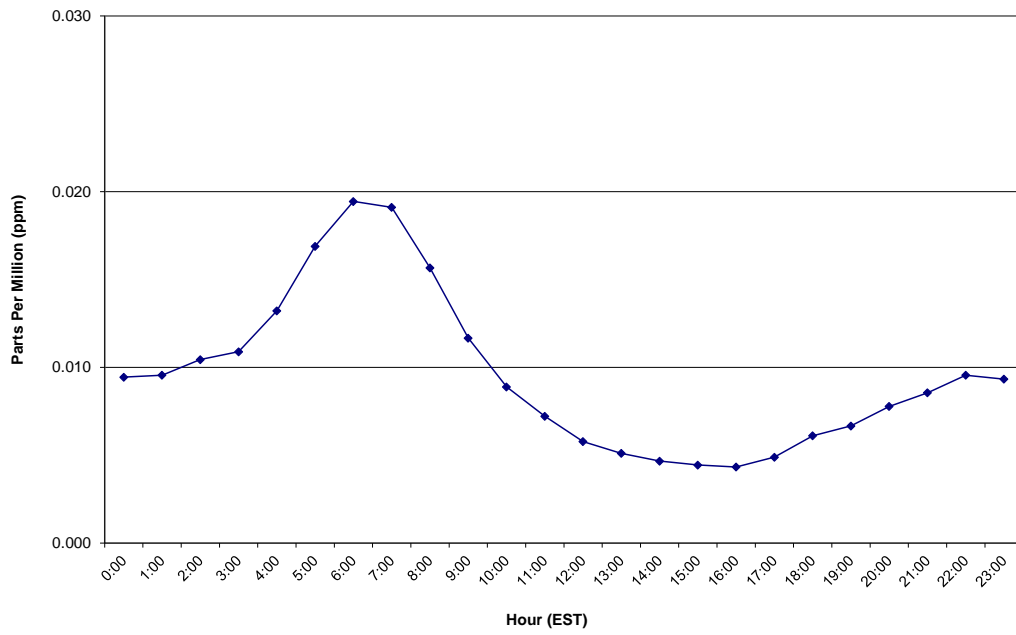


Figure 3
Nitrogen Dioxide - New Jersey
2012 Hourly Variation
Parts Per Million (ppm)

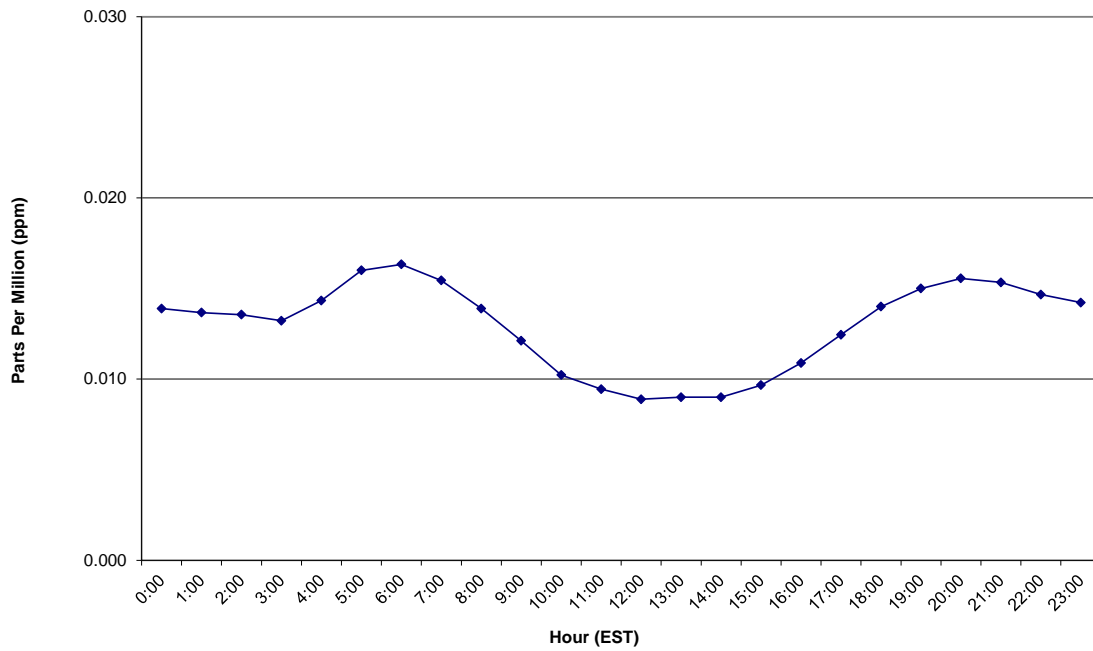
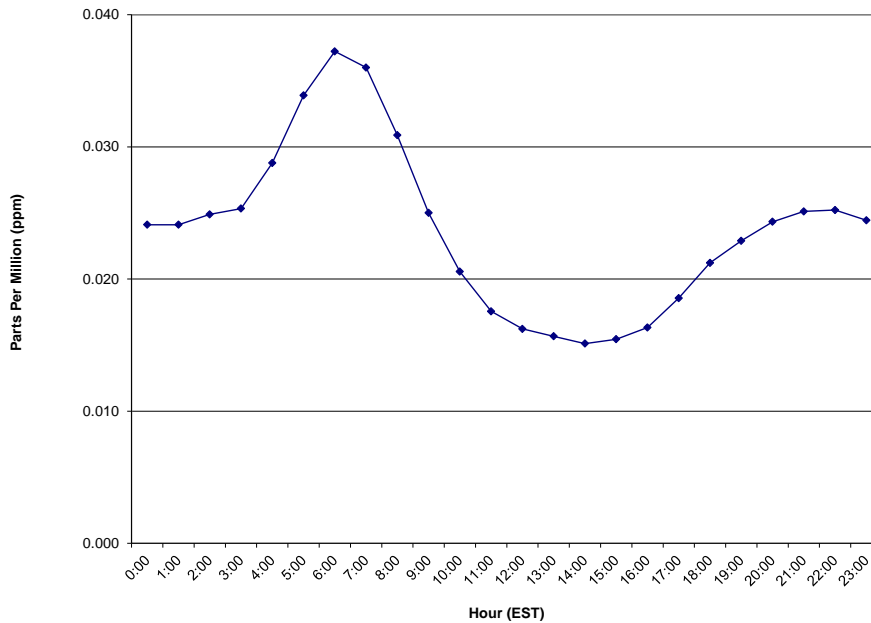


Figure 4
Total Oxides of Nitrogen – New Jersey
2012 Hourly Variation
Parts Per Million (ppm)



STANDARDS

The primary (health based) and secondary (welfare based) National Ambient Air Quality Standards (NAAQS) annual average for NO₂ are the same. They are set at a calendar year average concentration of 0.053 parts per million (ppm). The New Jersey Ambient Air Quality Standards (NJAAQS) are identical to the NAAQS except micrograms per cubic meter (µg/m³) are the standard units and the state standard applies to any 12-month period, not just the calendar year. In 2010, the EPA strengthened the primary NAAQS by adding a 1-hour NO₂ standard of 0.100 ppm along with the current annual average NO₂ standard of 0.053 ppm. 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 NO₂ concentrations measured in this area is less than 0.100 ppm. This statistic, also known as the design value, is determined by first obtaining the maximum 1-hour average NO₂ concentrations for each day. Then, determine the 98th percentile of the daily maximum NO₂ concentrations for the current

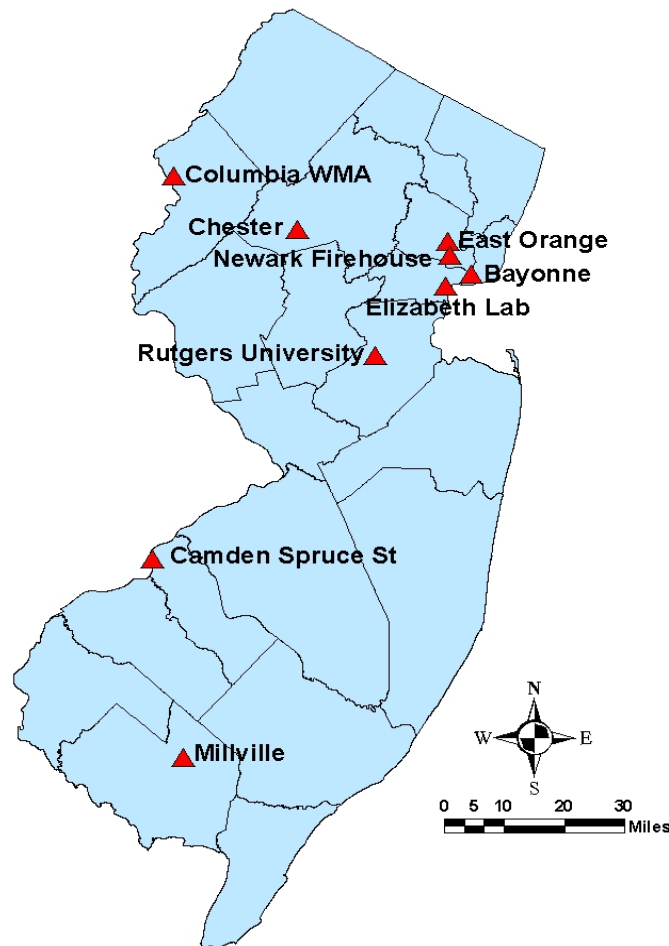
year, and for each of the previous two years. Finally, the average of these three 98th percentile values is the design value.

In addition to adding a 1-hour NO₂ standard of 0.100 ppm in 2010, the EPA requires a NO₂ near-roadway monitoring station to be operational by January 1, 2014. A near-roadway station must be located no more than 50 meters (164 feet) from the nearest traffic lane of a major roadway. NJDEP plans to establish one near-roadway NO₂ station in the New York-Northern New Jersey-Long Island Metropolitan area that meets the EPA criteria.

MONITORING LOCATIONS

The state monitored NO₂ levels at 9 locations in 2012. A NO₂ monitor was established in the Camden Spruce Street station in April 2012. Bayonne monitoring station was temporarily shut down in October 2012 due to site damage caused by Superstorm Sandy. Also Millville monitoring station was temporarily shut down in December 2012 due to site renovations. These sites are shown in Figure 5.

Figure 5
2012 Nitrogen Dioxide Monitoring Network



NO₂ LEVELS IN 2012

None of the monitoring sites recorded exceedances of either the National or New Jersey Air Quality Standards for NO₂ during 2012. The highest 12-month (calendar year) average concentration of NO₂ recorded was 0.022 ppm at the Elizabeth Lab site located at Exit 13 of the New Jersey Turnpike (Table 2, below and Figure 6, page 6). There were not any measurements of the 1-hour average NO₂ concentration above 0.100 ppm. The site that measured the highest 98th percentile of the daily maximum NO₂ concentrations in 2012 was Elizabeth Lab with 0.067 ppm (Table 2, below and Figure 8, page 7). The site that measured the highest 3-year average of the 98th percentiles from 2010 to 2012 was also Elizabeth Lab with 0.070 ppm (Table 2, below and Figure 9, page 7). All sites in New Jersey met the new 1-hour NO₂ standard. While national health and welfare standards have not been established for Nitric Oxide (NO), it is considered to be an important pollutant that contributes to the formation of ozone, fine particles and acid rain. The maximum annual average concentration of NO recorded in 2012 was 0.024 ppm, at the Columbia WMA site (Table 2, below and Figure 7, page 6).

Table 2
Nitrogen Dioxide (NO₂) and Nitric Oxide (NO) Data - 2012
1-Hour and 12-Month Averages
Parts Per Million (ppm)
National 1-Hour Standard = 0.100 ppm
National 12-Month Standard = 0.053 ppm

Monitoring Sites	Nitrogen Dioxide				Nitrogen Dioxide		Nitric Oxide
	Daily Maximum	2nd Highest Daily Max.	2012 98th%-ile	2010-2012 98 th %-ile (3-year Avg.)	12-Month Average (ppm)	Calendar year	12-Month Average (ppm)
					Maximum (Running 12-month)		Calendar Year
Bayonne	0.066	0.064	0.053	0.062 (a)	0.018	0.015	0.007
Camden Spruce Street	0.051	0.049	0.043	---*	0.012	0.011	0.005
Chester	0.039	0.038	0.033	0.037	0.005	0.005	0.000
Columbia WMA	0.049	0.046	0.043	---*	0.013	0.013	0.024
East Orange	0.081	0.080	0.053	0.060	0.020	0.018	0.011
Elizabeth Lab	0.090	0.086	0.067	0.070	0.024	0.022	0.022
Millville	0.036	0.035	0.033	0.036 (b)	0.007	0.006	0.004
Newark Firehouse	0.066	0.065	0.057	---*	0.020	0.018	0.009
Rutgers University	0.058	0.049	0.044	0.045	0.009	0.009	0.004

* Camden Spruce Street, Columbia WMA, and Newark Firehouse do not have enough data to calculate a 3-year average.

(a) Bayonne temporarily shut down due to Superstorm Sandy. Bayonne did not meet EPA data completeness requirements for the 2010-2012 design value for the NO₂ 1-hour NAAQS.

(b) Millville temporarily shut down due to site renovations. Millville did not meet EPA data completeness requirements for the 2010-2012 design value for the NO₂ 1-hour NAAQS.

Figure 6
 Annual Average Nitrogen Dioxide Concentrations
 In New Jersey – 2012
 Parts Per Million (ppm)

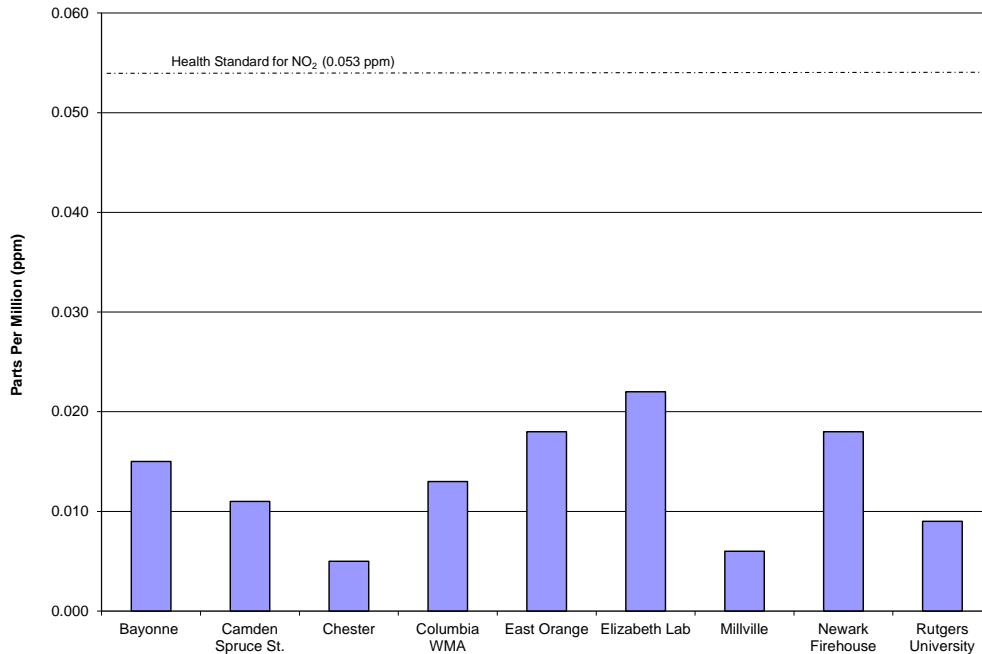


Figure 7
 Annual Average Nitric Oxide Concentrations
 In New Jersey – 2012
 Parts Per Million (ppm)

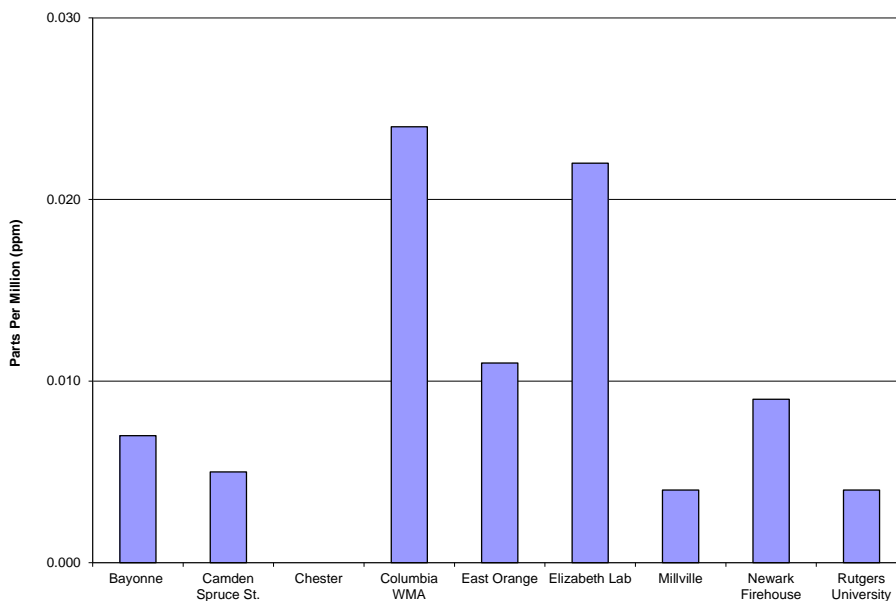


Figure 8
 2012 98th Percentile Daily Maximum 1-Hour
 Nitrogen Dioxide Concentration in New Jersey
 Parts Per Million (ppm)

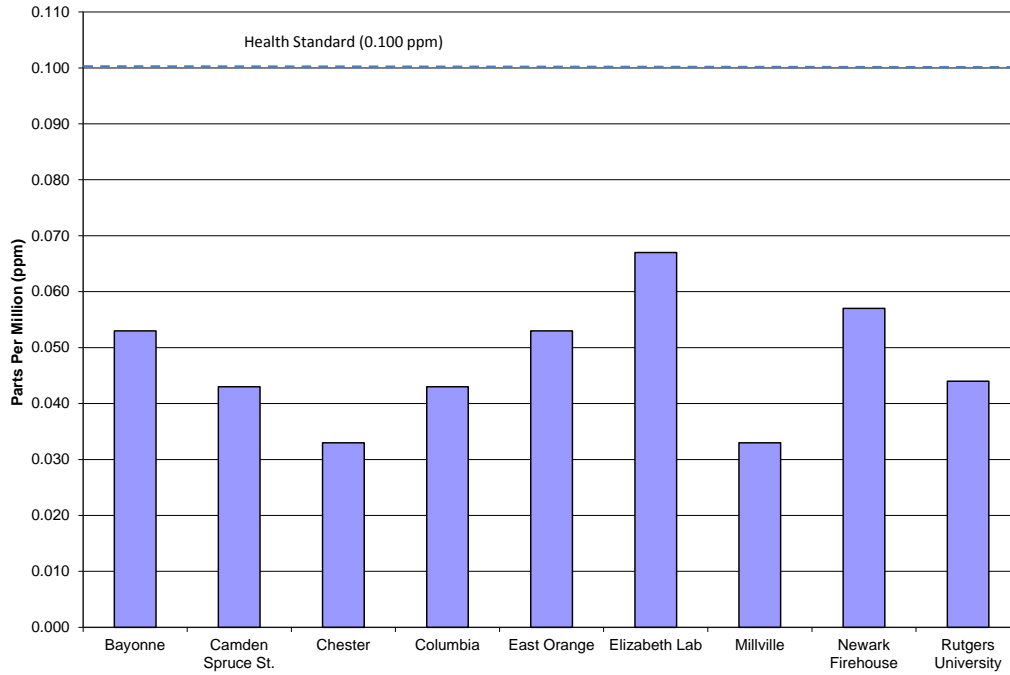
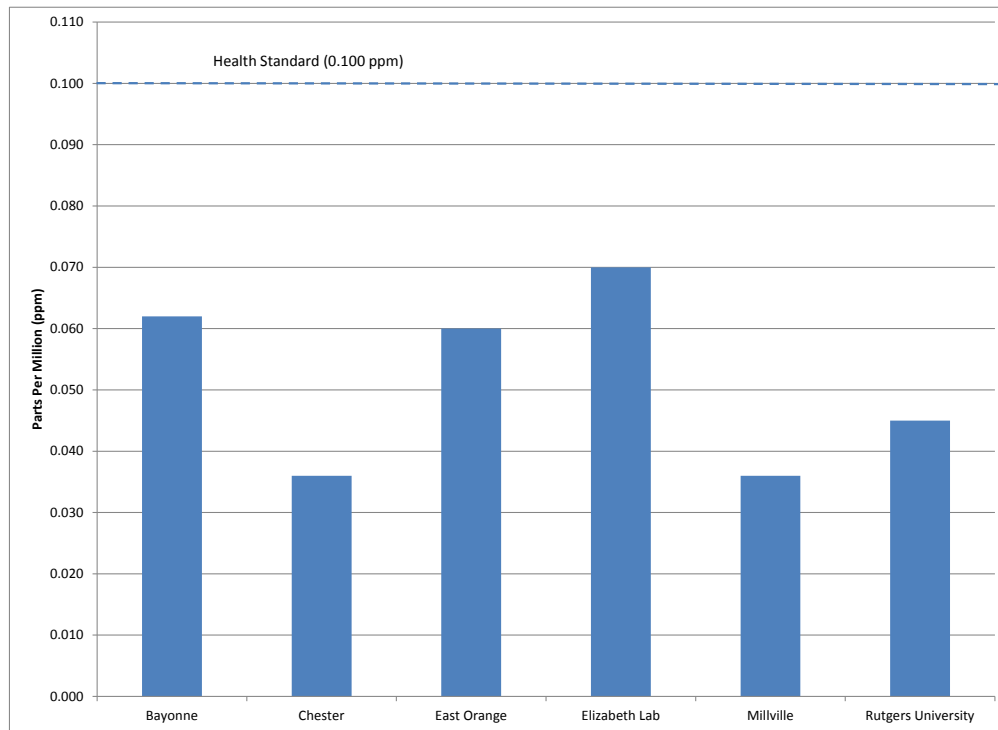


Figure 9
 3-Year Average of the 98th Percentile Daily Maximum 1-Hour Average
 Nitrogen Dioxide Concentration in New Jersey (2010-2012)
 Parts Per Million (ppm)



TRENDS

Figures 10-12 (pages 8-9) indicate that concentrations tend to be higher in the winter than the summer. This is due in part to space heating and 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 began in 1966 and 1974 was the last year that the annual mean NO₂ concentrations exceeded the NAAQS in New Jersey. A graph of NO₂ levels provided in Figure 13 (page 10) shows the statewide average annual mean concentrations recorded from 1975 to 2012 in the form of a trendline. The graph also includes the levels of the sites that measured the highest annual mean and lowest annual mean in each year as points above and below this trendline. Although NO₂ concentrations are well within the NAAQS, there is still a great deal of interest in oxides of nitrogen because of their role in the formation of other pollutants – most notably ozone and fine particles. Both these pollutants are of concern over much of the northeastern United States and efforts to reduce levels of ozone and fine particles are likely to require reductions in NO emissions.

Figure 10
Nitric Oxide – New Jersey
2012 Monthly Variation
Parts Per Million (ppm)

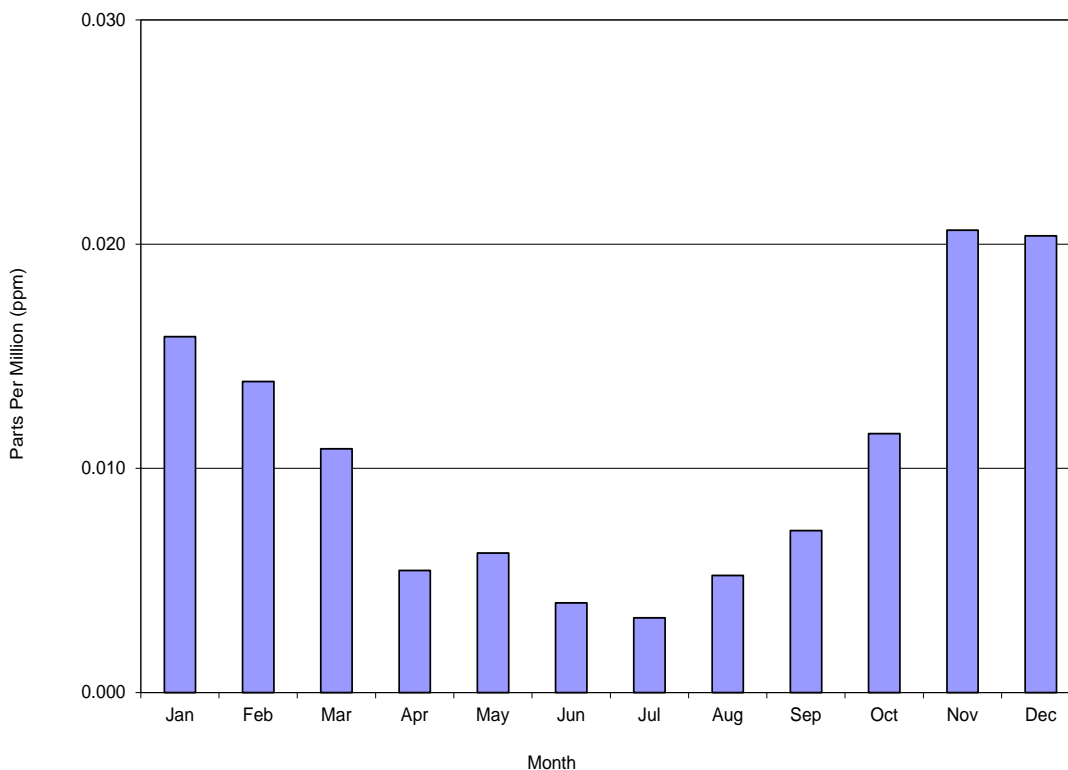


Figure 11
Nitrogen Dioxide - New Jersey
2012 Monthly Variation
Parts Per Million (ppm)

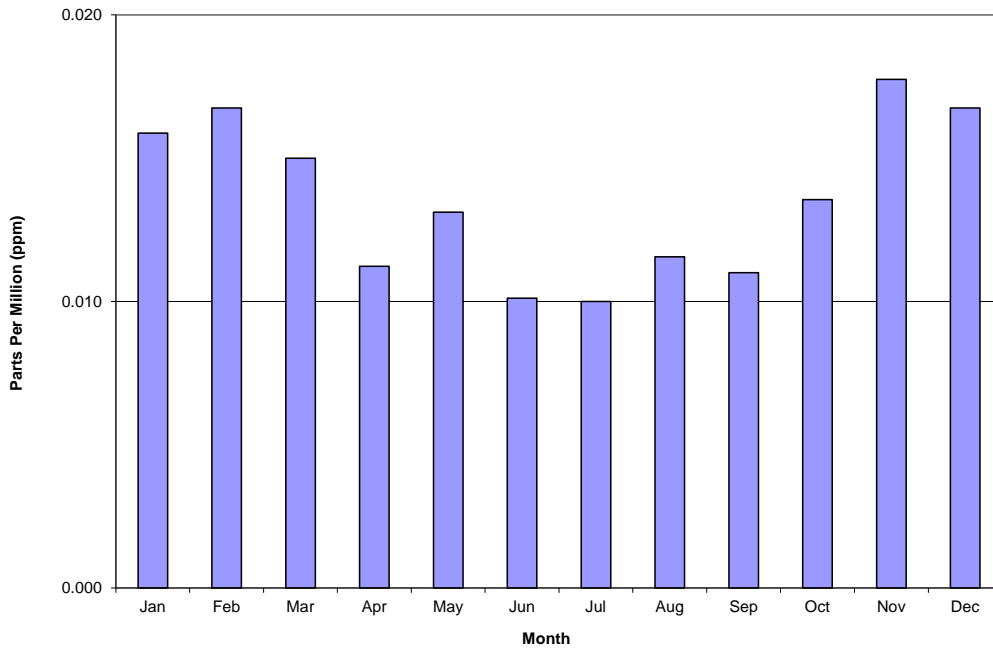


Figure 12
Total Oxides of Nitrogen - New Jersey
2012 Monthly Variation
Parts Per Million (ppm)

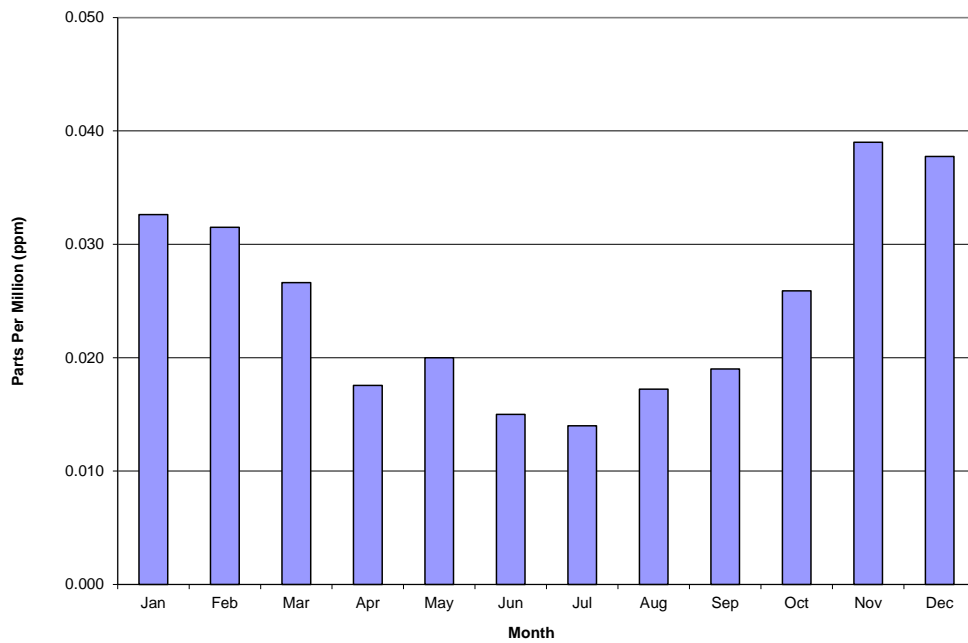
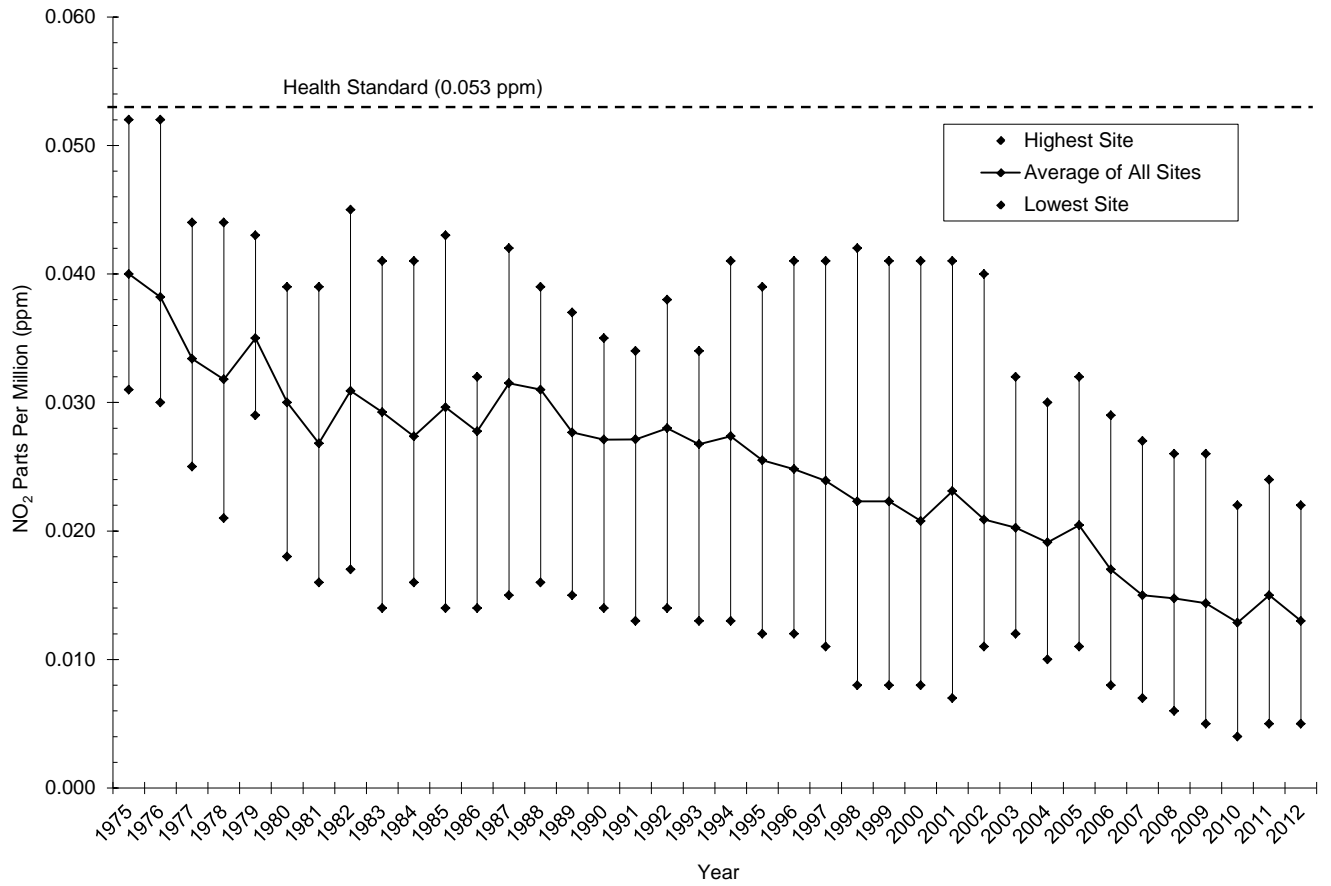


Figure 13
 Nitrogen Dioxide Concentrations in New Jersey 1975-2012
 12-Month (Calendar Year) Average
 Parts Per Million (ppm)



REFERENCES

Fact Sheet Final Revisions to the National Ambient Air Quality Standards for Nitrogen Dioxide, USEPA, January 22, 2010, URL: <http://www.epa.gov/airquality/nitrogenoxides/pdfs/20100122fs.pdf>.

History of California's Ambient Air Quality Standards, California Air Resources Board (CARB), Sacramento, California, March 5, 2008, URL: <http://www.arb.ca.gov/research/aaqs/caaqs/hist1/hist1.htm>

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

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

National Summary of Nitrogen Oxides Emissions, USEPA, Research Triangle Park, NC, 2008, URL: http://www.epa.gov/cgi-bin/broker?_service=data&_debug=0&_program=dataprog.national_1.sas&polchoice=NOX

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

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

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

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

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

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

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