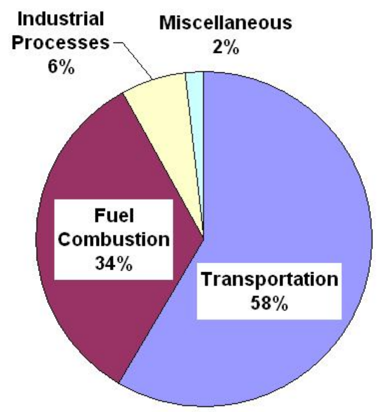
2009 Nitrogen Dioxide Summary

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 (NO_x) is a mixture of gases which is mostly comprised of NO and NO_2. These gases are emitted from the exhaust of motor vehicles, the burning of coal, oil or natural gas, and during industrial processes such as welding, electroplating, and dynamite blasting. Although most NO_x is emitted as NO, it is readily converted to NO_2 in the atmosphere. In the home, gas stoves and heaters produce substantial amounts of nitrogen dioxide. A pie chart summarizing the major sources of NO_x is shown below (Figure 1). As much of the NO_x in the air is emitted by motor vehicles, concentrations tend to peak during the morning and afternoon rush hours. This is shown in the graph in Figures 2-4 (pages 2-3). Figures 6-8 (pages 5-6) 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.

Figure 1
National Summary of 2005 Oxides of Nitrogen (NO_x) Emissions by Source Category



Source: USEPA National Summary of Nitrogen Oxides Emissions, 2005

HEALTH AND ENVIRONMENTAL EFFECTS

Short-term exposures (less than 3 hours) to low levels of nitrogen dioxide may aggravate pre-existing respiratory illnesses, and can cause respiratory illnesses, particularly in children ages 5-12. Symptoms of low level exposure to NO and NO_2 include irritation to eyes, nose, throat and lungs, coughing, shortness of breath, tiredness and nausea. Long-term exposures to NO_2 may increase susceptibility to respiratory infection and may cause permanent damage to the lung. NO and NO_2 are found in tobacco smoke, so people who smoke or breathe in second-hand smoke may be exposed to NO_x. The U.S. Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the U.S. Environmental Protection Agency (EPA) have determined that, with the available information, no conclusion can be made as to the carcinogenicity of NO or NO_2 to human beings.

Nitrogen Oxides contribute to a wide range of environmental problems. These include potential changes in the composition of some plants in wetland and terrestrial ecosystems, acidification of freshwater bodies, eutrophication of estuarine and coastal waters, increases in levels of toxins harmful to fish and other aquatic life, and visibility impairment.

STANDARDS

The primary (health based) and secondary (welfare based) National Ambient Air Quality Standards (NAAQS) for NO_2 are the same. They are set at a calendar year average concentration of 0.053 parts per million (ppm). The New Jersey Ambient Air Quality Standards (NJAAQS) are identical to the NAAQS except micrograms per cubic meter ($\mu g/m^3$) are the standard units and the state standard applies to any 12-month period, not just the calendar year. In 2007, the State of California changed their one-hour average standard of 470 $\mu g/m^3$ to 339 $\mu g/m^3$. New Jersey uses the State of California's standard as a guideline in assessing short-term impacts from specific sources. Table 1 provides a summary of the NO_2 standards.

Table 1
National and New Jersey Ambient Air Quality Standards for Nitrogen Dioxide (NO_2)
Parts Per Million (ppm) and Micrograms Per Cubic Meter (µg/m^3)

Averaging Period	Type	New Jersey	National	California
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			339 µg/m^3 (0.18 ppm)

Figure 2
Nitric Oxide – New Jersey
2009 Hourly Variation
Parts Per Million (ppm)

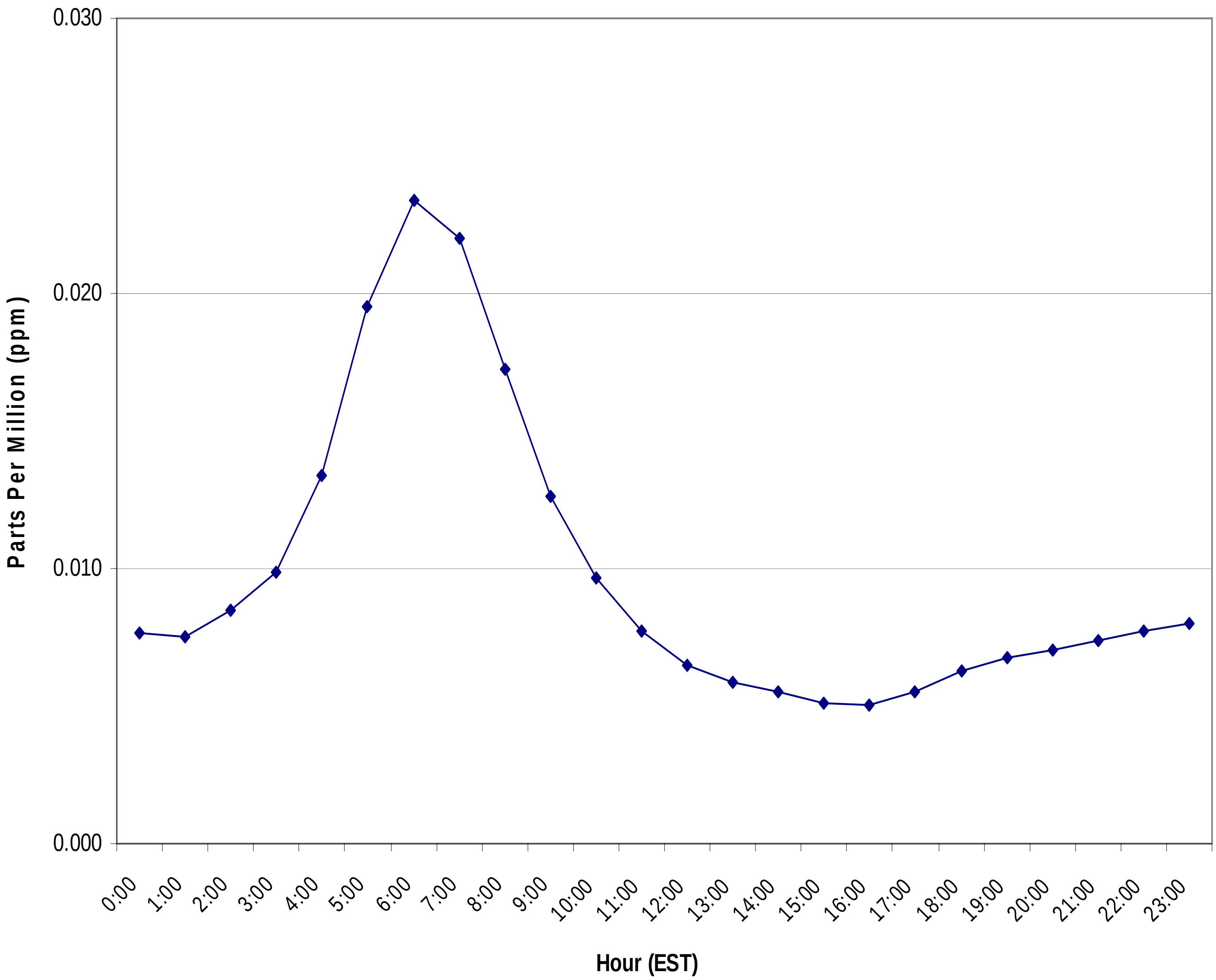


Figure 3
Nitrogen Dioxide – New Jersey
2009 Hourly Variation
Parts Per Million (ppm)

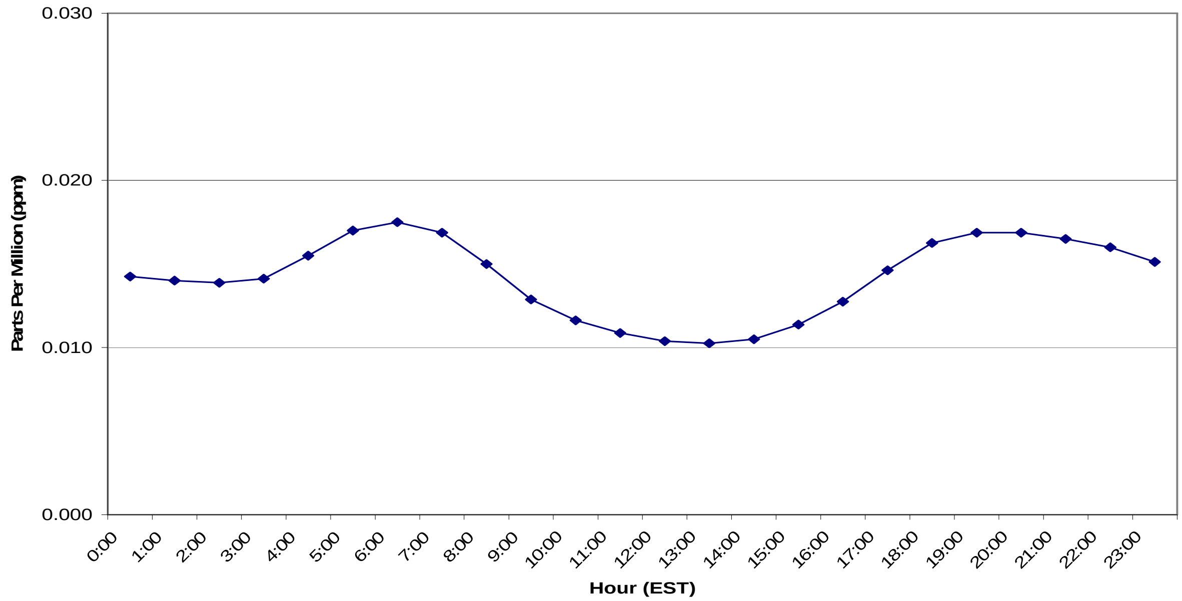
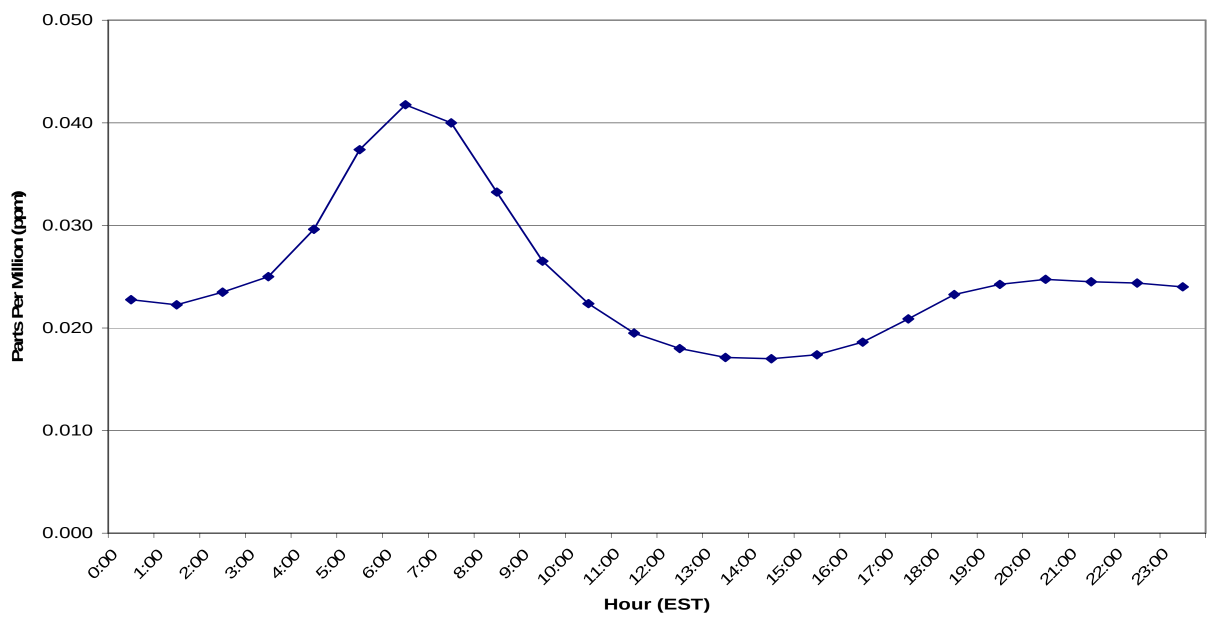


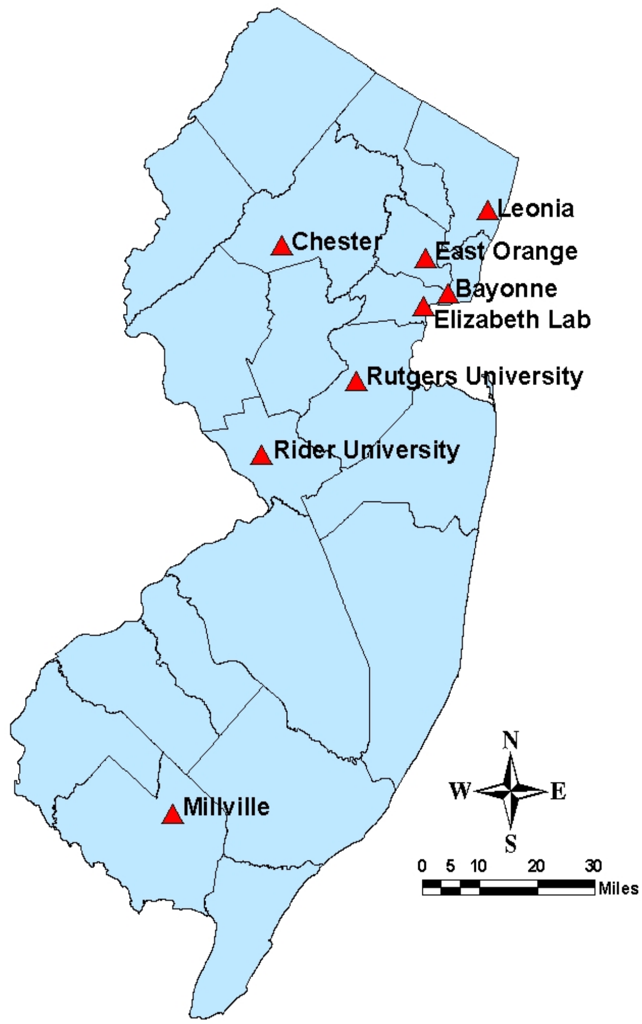
Figure 4
Total Oxides of Nitrogen – New Jersey
2009 Hourly Variation
Parts Per Million (ppm)



Monitoring Locations

The state monitored NO_2 levels at 8 locations in 2009. These sites are shown in the map to the right.

Figure 5
2009 Nitrogen Dioxide Monitoring Network



NO_2 Levels in 2009

None of the monitoring sites recorded exceedances of either the National or New Jersey Air Quality Standards for NO_2 during 2009. The highest 12-month (calendar year) average concentration of NO_2 recorded was 0.026 ppm at the Elizabeth Lab site located at Exit 13 of the New Jersey Turnpike (Table 2, page 5 and Figure 9, page 7). 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 2009 was 0.027 ppm, also at the Elizabeth Lab site (Table 2, page 5 and Figure 10, page 7).

Trends

Routine monitoring for NO_2 began in 1966 and 1974 was the last year that concentrations exceeded the NAAQS in New Jersey. A graph of NO_2 levels provided in Figure 11 (page 8) shows the statewide average annual mean concentrations recorded from 1975 to 2009 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 NO_2 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.

Table 2
Nitrogen Dioxide (NO_2) and Nitric Oxide (NO) Data - 2009
1-Hour and 12-Month Averages
Parts Per Million (ppm)
California 1-Hour Standard = 0.18 ppm
National 12-Month Standard = 0.053 ppm

Monitoring Sites	Nitrogen Dioxide 1-Hour Average (ppm)		Nitrogen Dioxide 12-Month Average (ppm)		Nitric Oxides Annual Average(ppm)
	Maximum	2nd Highest	Maximum	Calendar year	
Bayonne	0.091	0.086	0.019	0.019	0.009
Chester	0.067	0.047	0.006	0.005	0.000
East Orange	0.094	0.088	0.021	0.020	0.015
Elizabeth Lab	0.094	0.091	0.026	0.026	0.027
Leonia	0.077	0.074	0.019	0.017	0.014
Millville	0.048	0.044	0.009	0.009	0.005
Rider University	0.045	0.044	0.009	0.008	0.005
Rutgers University	0.074	0.063	0.011	0.011	0.004

Figure 6
Nitric Oxide – New Jersey
2009 Monthly Variation
Parts Per Million (ppm)

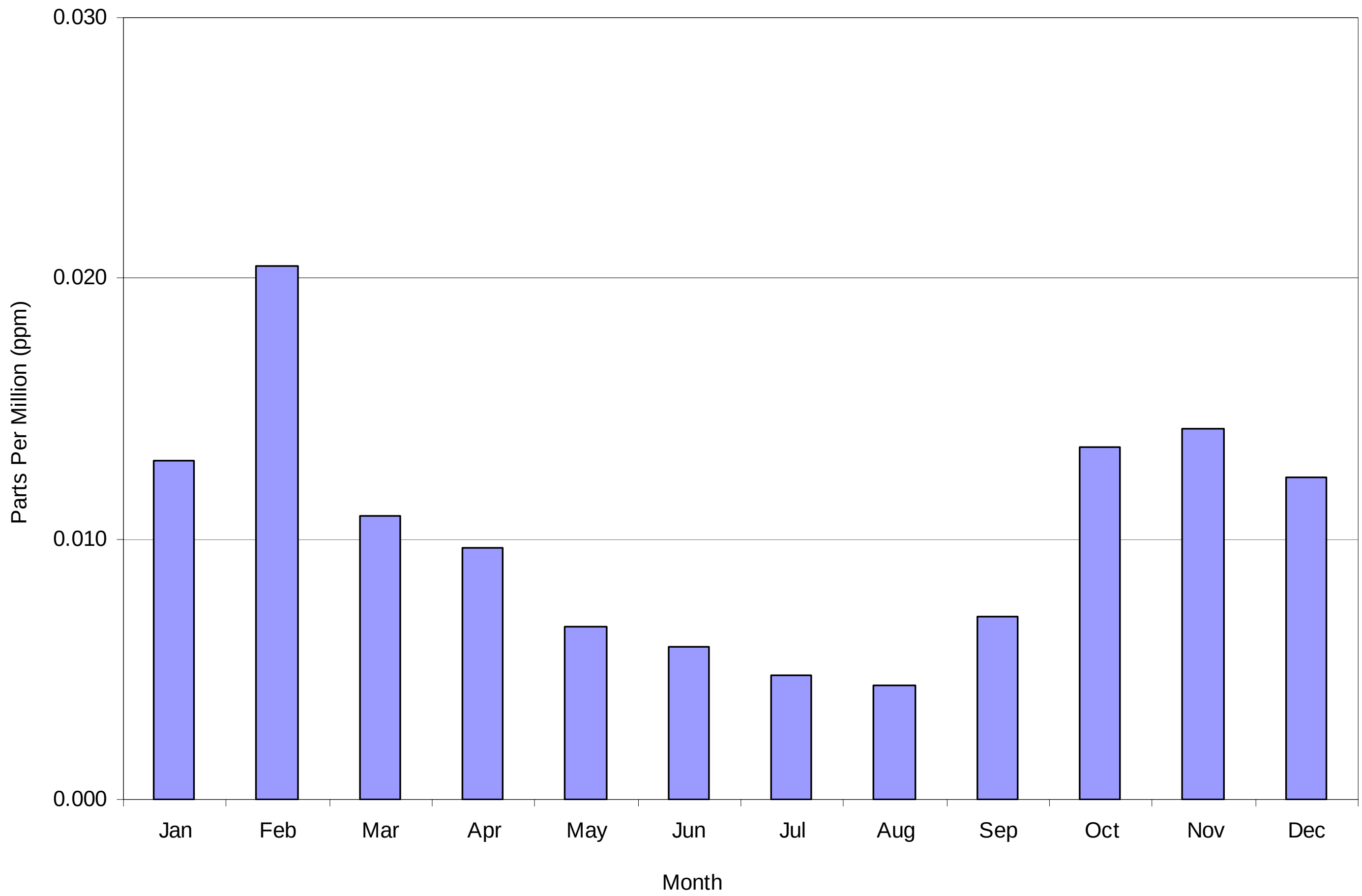


Figure 7
Nitrogen Dioxide – New Jersey
2009 Monthly Variation
Parts Per Million (ppm)

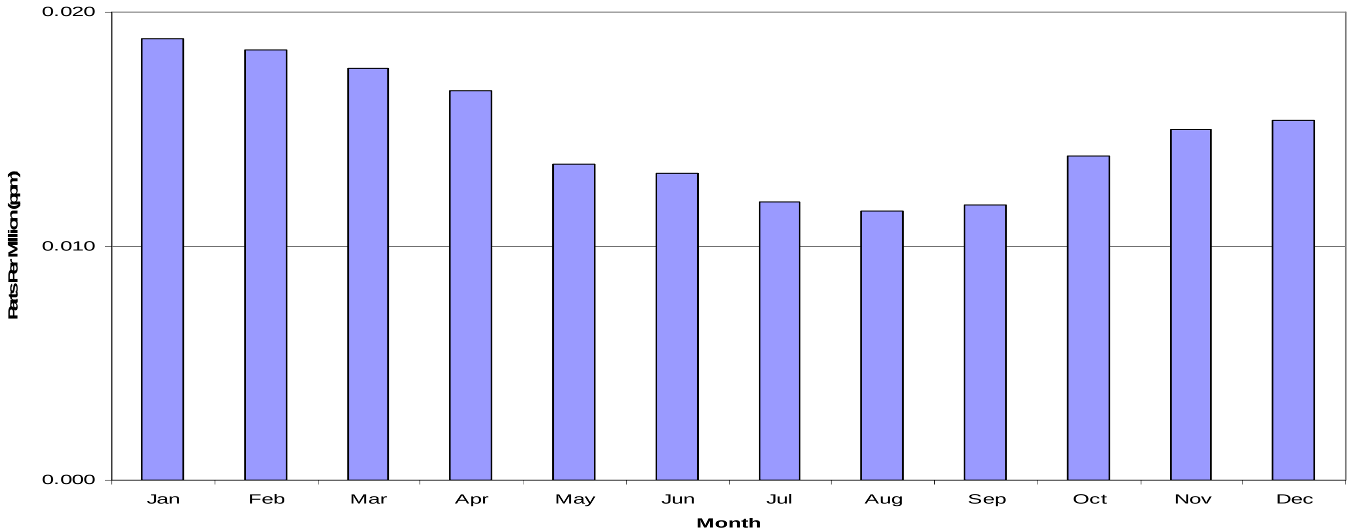


Figure 8
Total Oxides of Nitrogen – New Jersey
2009 Monthly Variation
Parts Per Million (ppm)

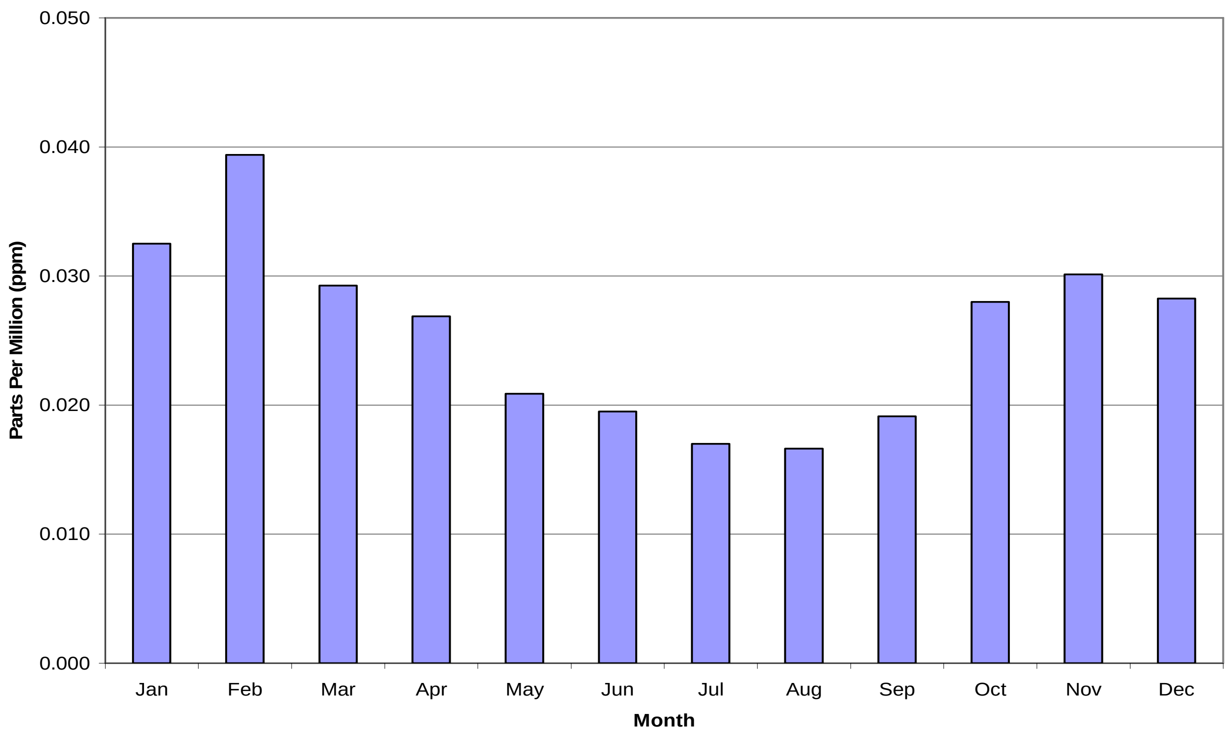


Figure 9
Annual Average Nitrogen Dioxide Concentrations
In New Jersey – 2009
Parts Per Million (ppm)

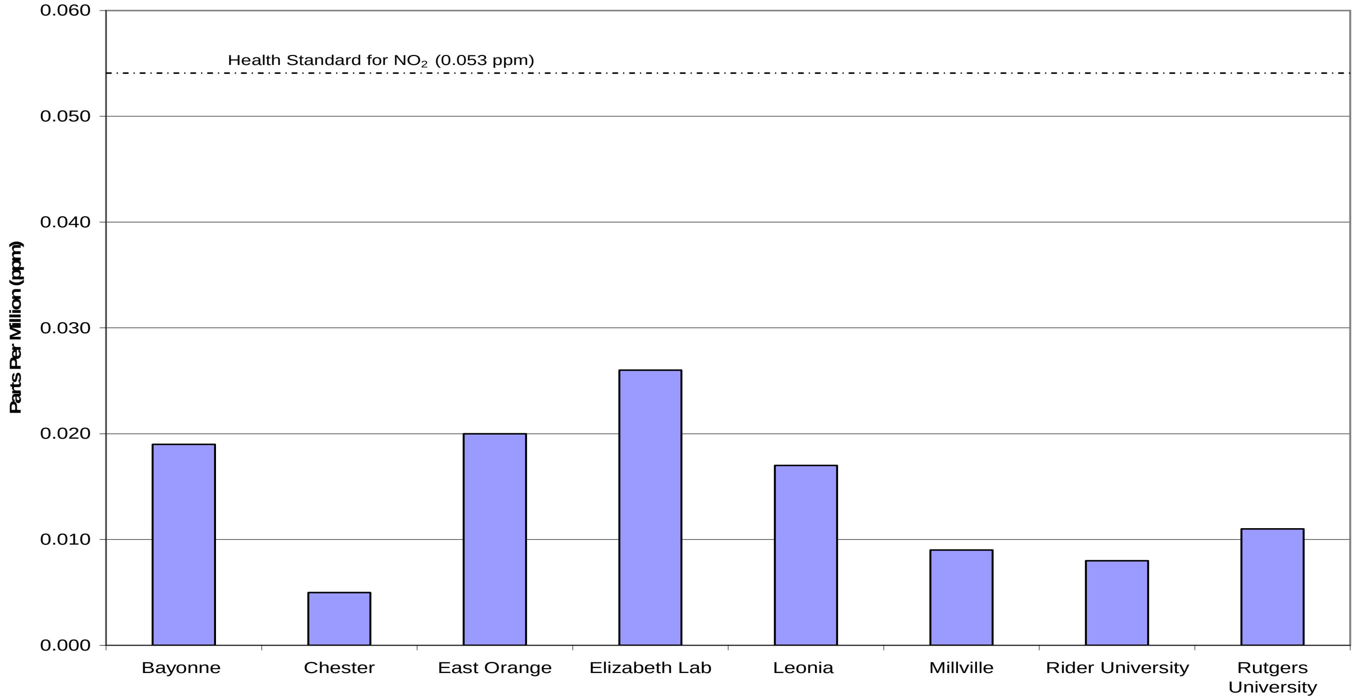


Figure 10
Annual Average Nitric Oxide Concentrations
In New Jersey – 2009
Parts Per Million (ppm)

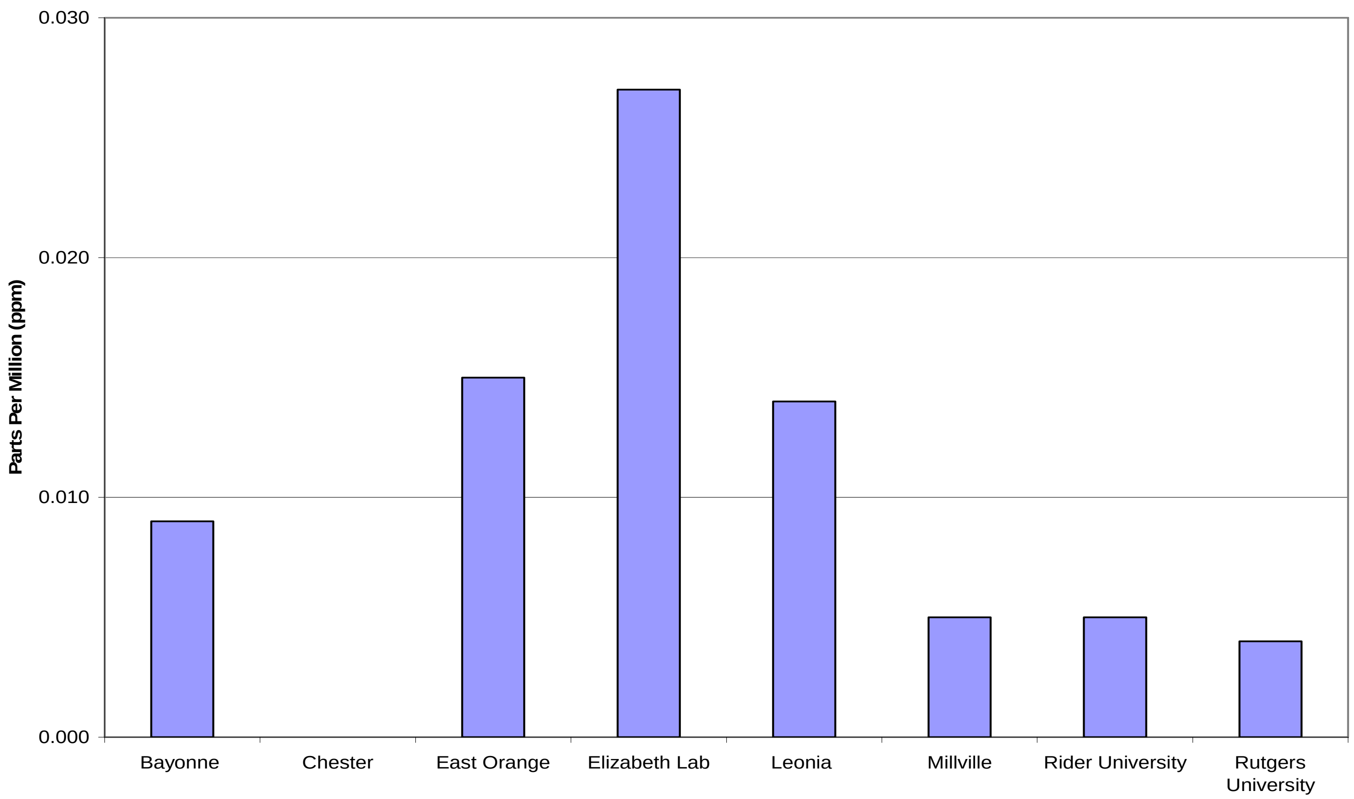
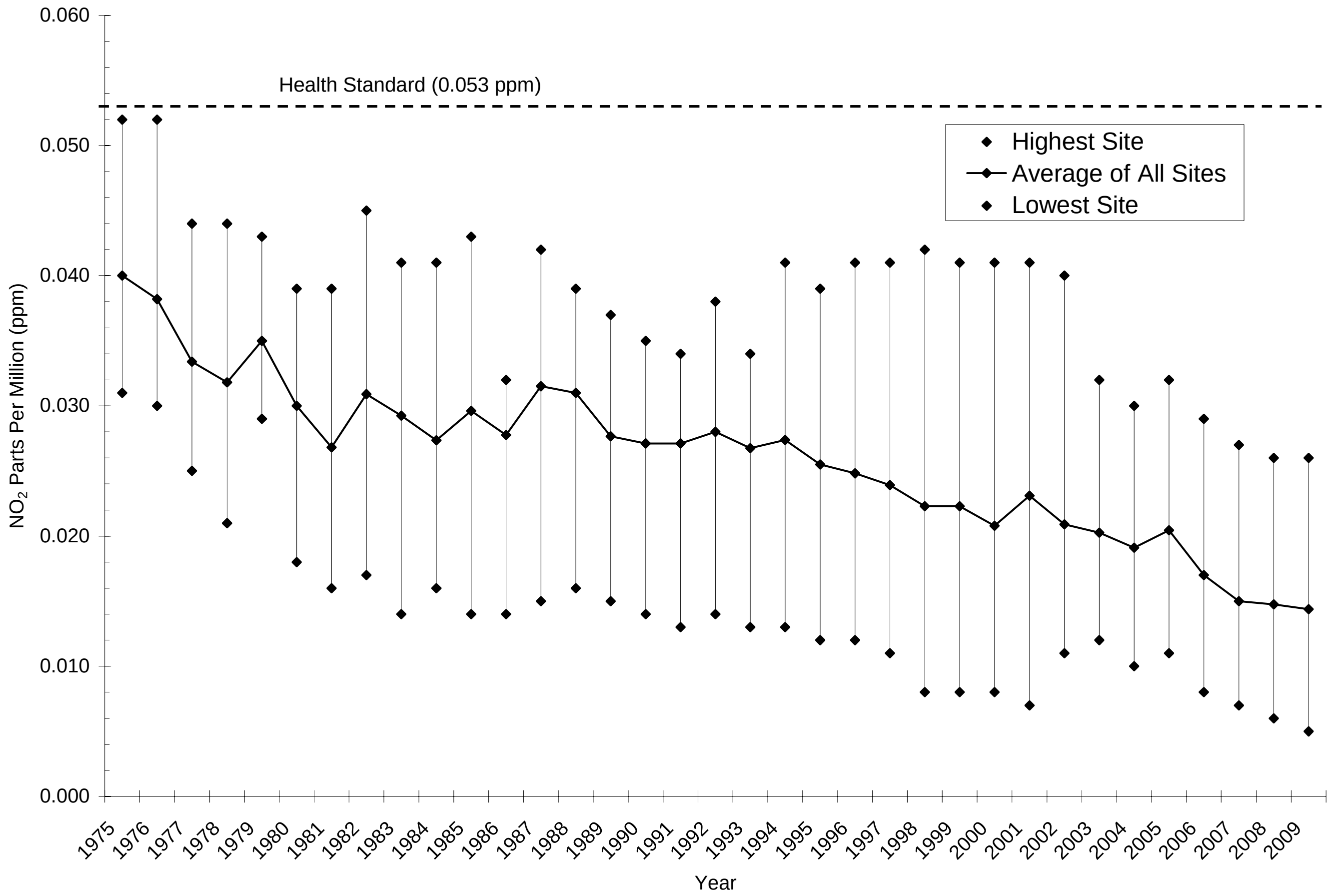


Figure 11
Nitrogen Dioxide Concentrations in New Jersey 1975-2009
12-Month (Calendar Year) Average
Parts Per Million (ppm)



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