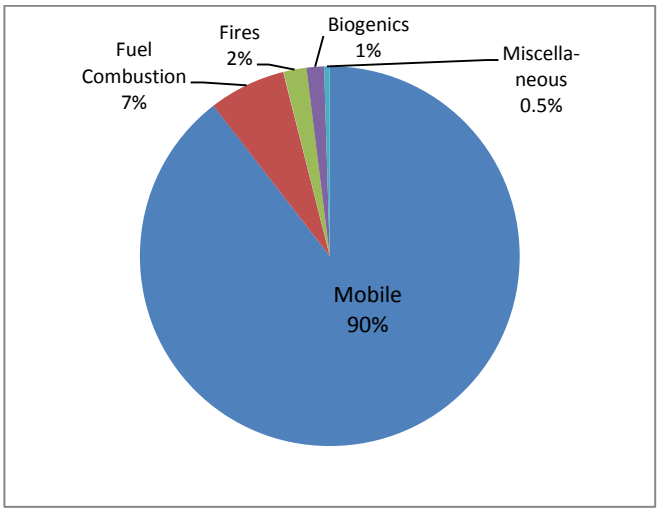
2014 Carbon Monoxide Summary

New Jersey Department of Environmental Protection

Nature and Sources

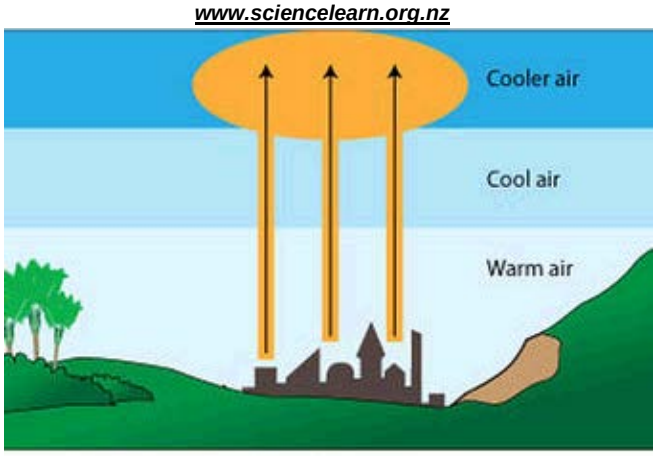
Carbon monoxide (CO) is a colorless, odorless gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes over 51 percent of all CO emissions nationwide, and 90% in New Jersey. Non-road vehicles and engines, such as construction equipment and 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

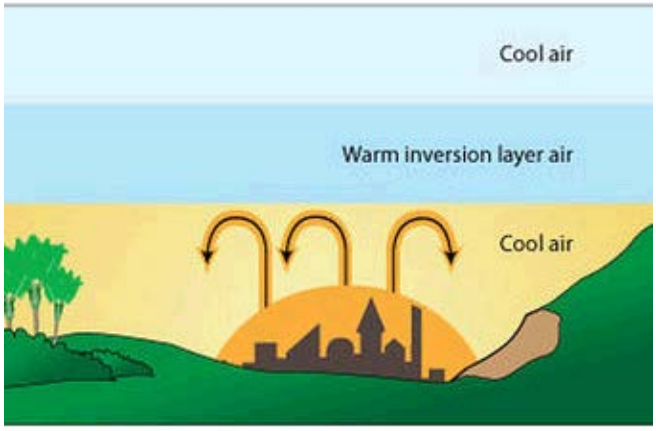


Source: www.epa.gov/air/emissions/index.htm

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



Normal pattern



Thermal inversion

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 3
2014 Carbon Monoxide Average Concentrations in New Jersey
Monthly Variation

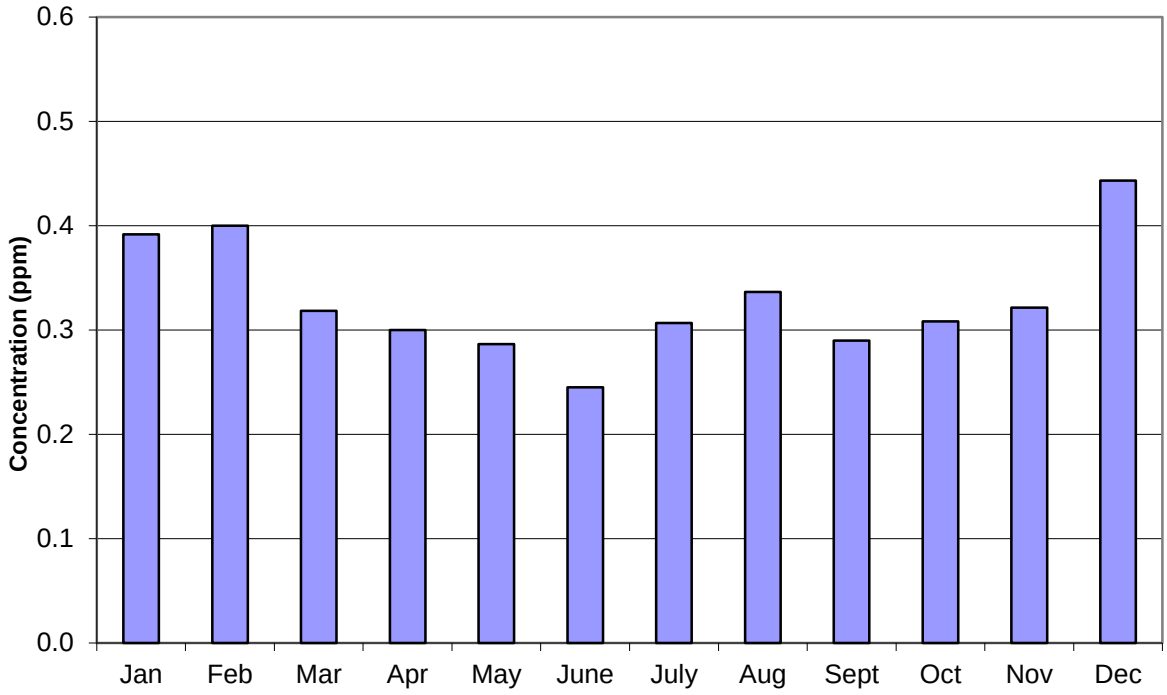
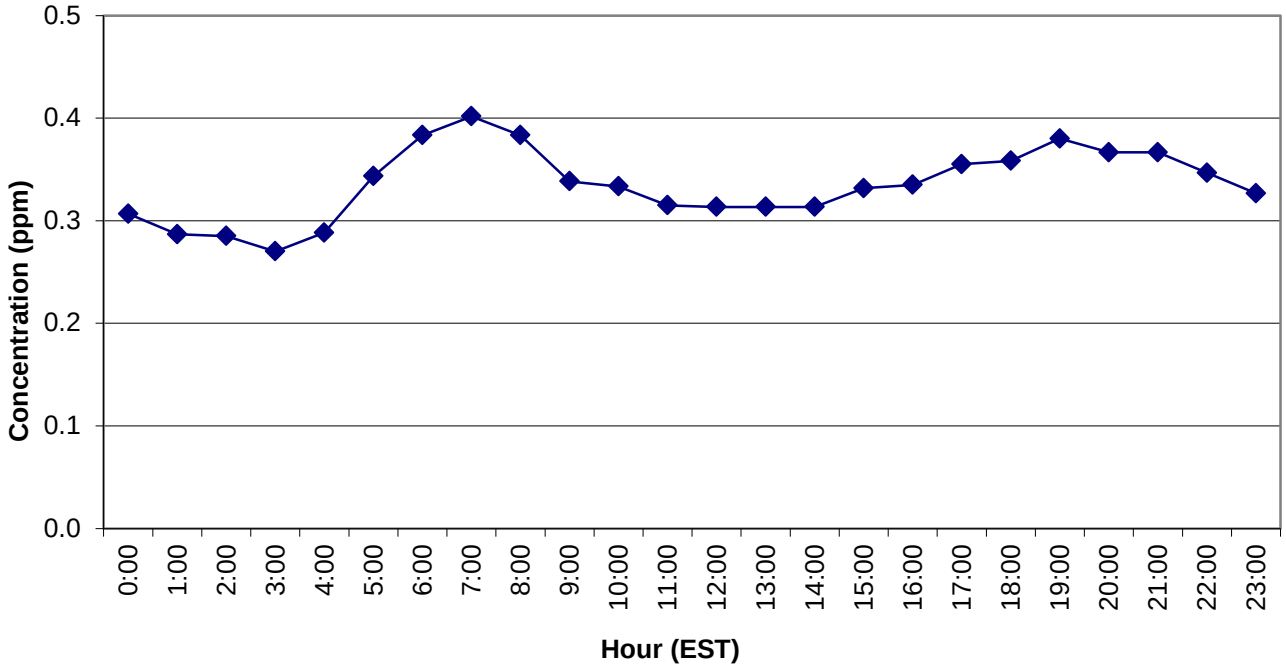


Figure 4
2014 Carbon Monoxide Average Concentrations in New Jersey
Hourly Variation



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.

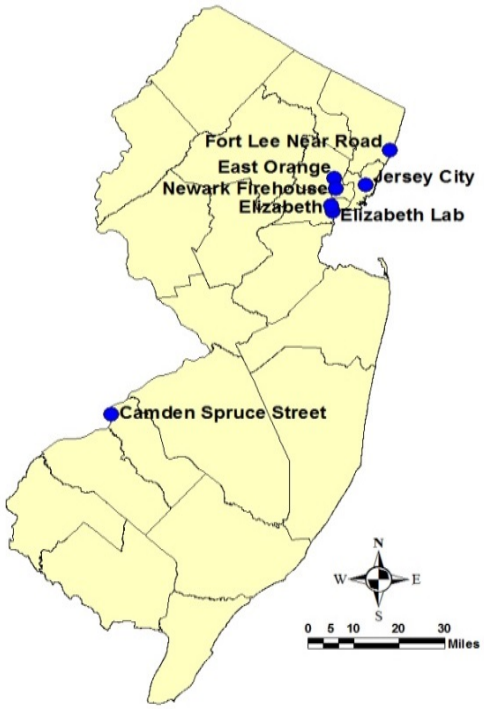
Table 1
National and New Jersey Ambient Air Quality Standards
for Carbon Monoxide
mg/m^3 = Milligrams per cubic meter
ppm = Parts per million

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.

Figure 5
2014 Carbon Monoxide
Monitoring Network



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.

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	2nd Highest 1-Hour Average Concentration	Maximum 8-Hour Average Concentration	2nd 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

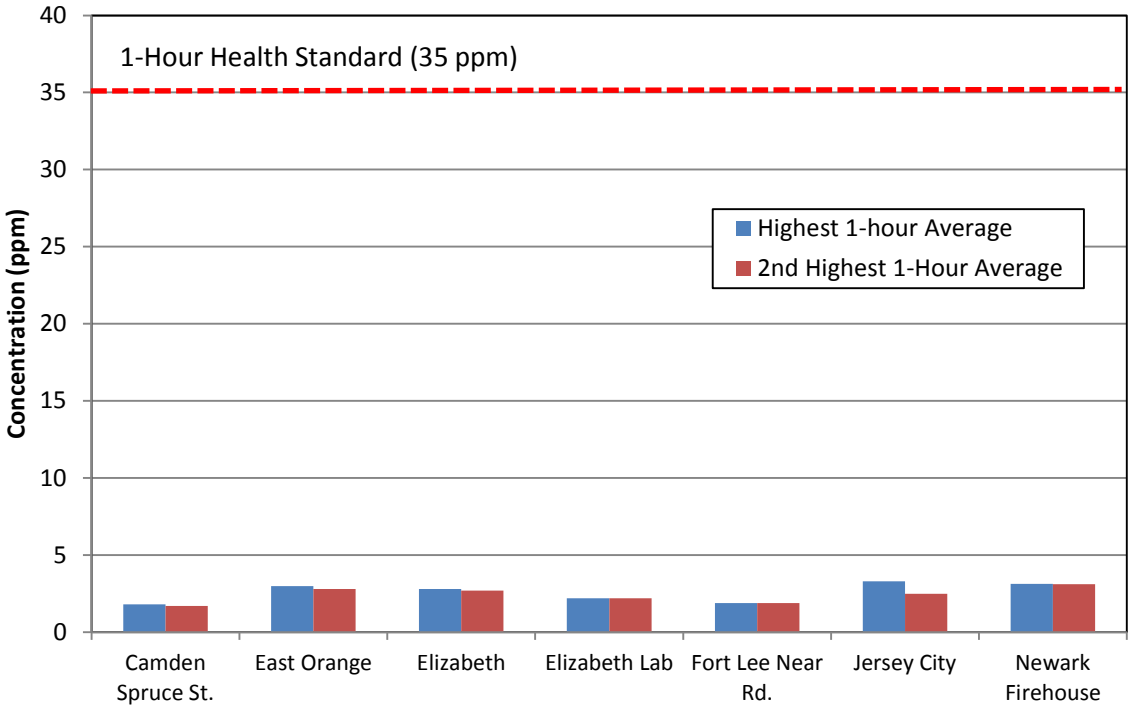
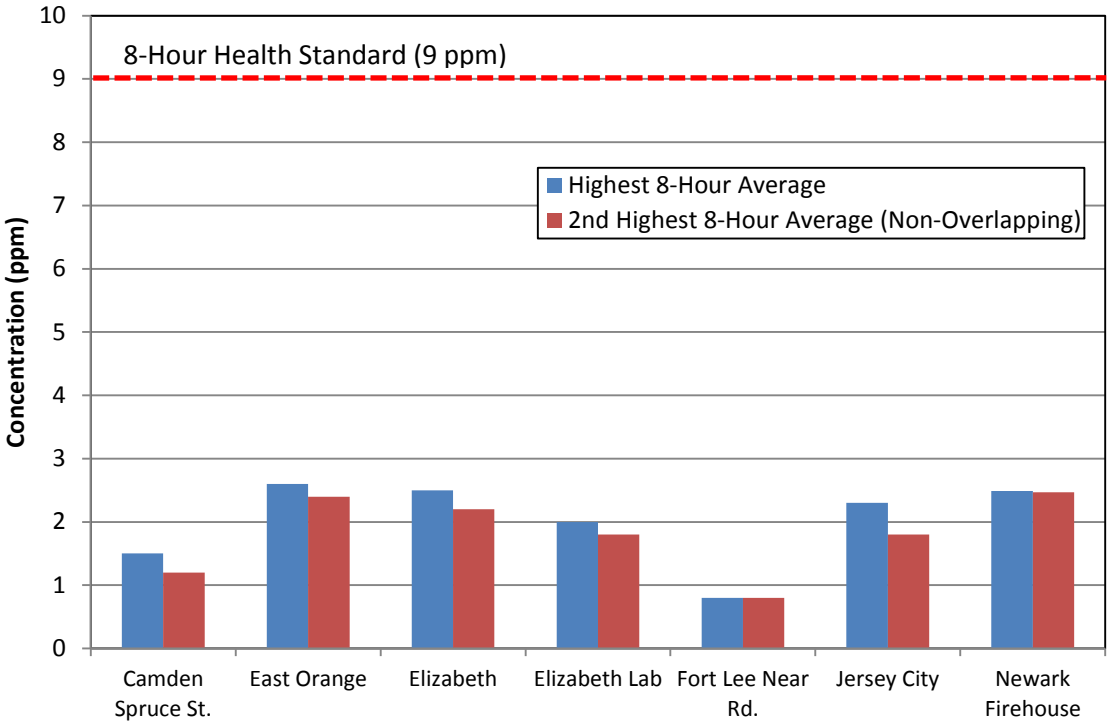


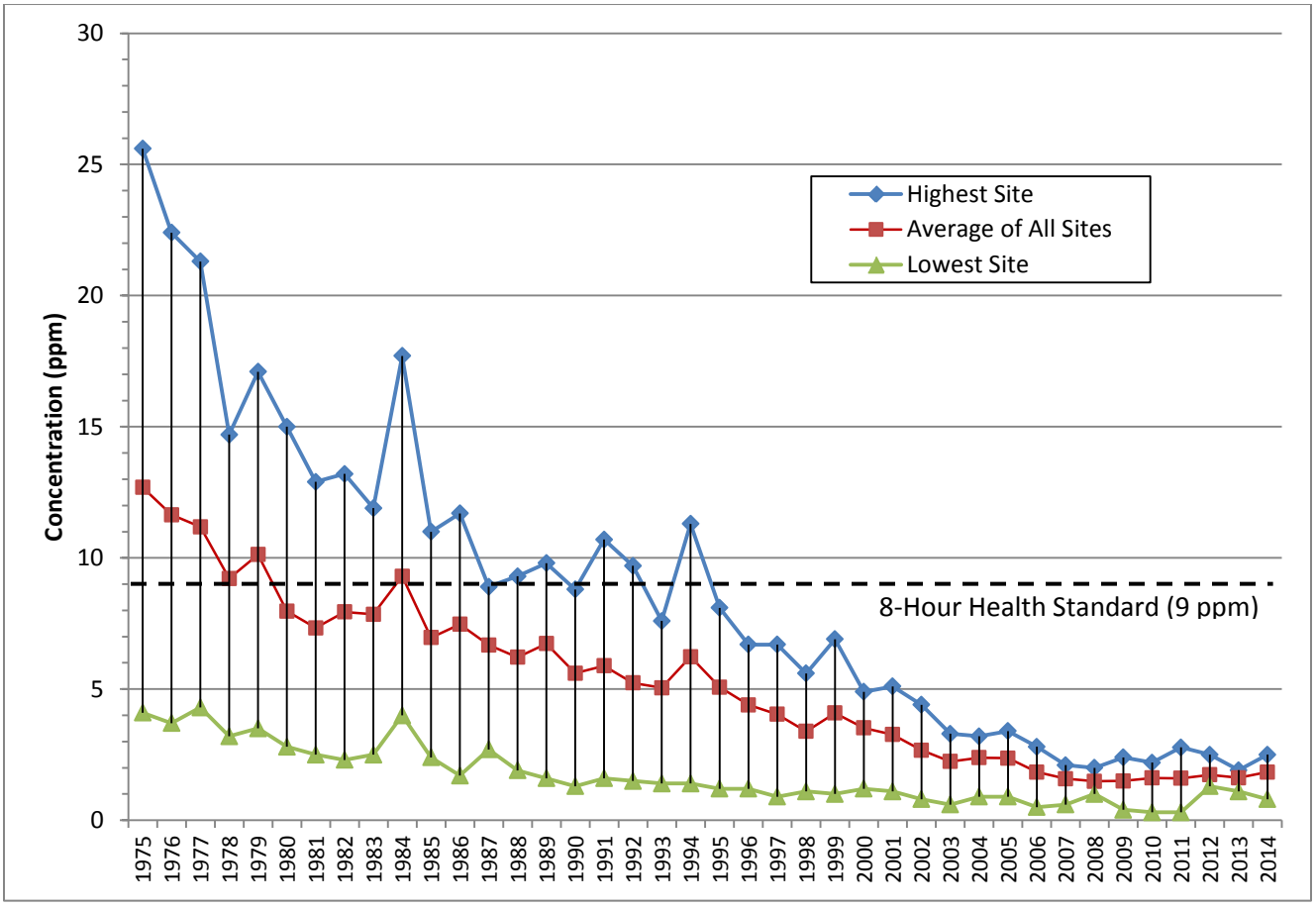
Figure 7
2014 Carbon Monoxide Concentrations in New Jersey
8-Hour Averages



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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