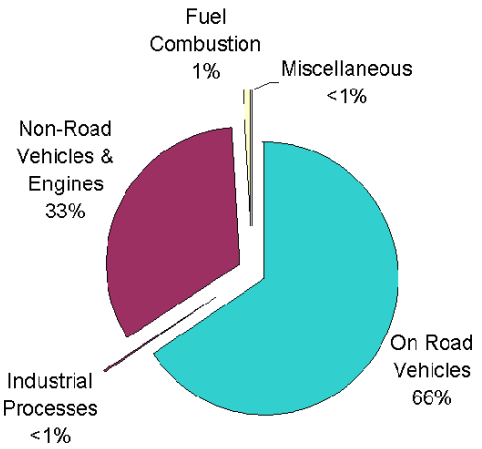
2009 Carbon Monoxide Summary

New Jersey Department of Environmental Protection

Nature and Sources

Carbon monoxide (CO) is a colorless, odorless, poisonous gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes over 56 percent of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions. Non-road engines and vehicles, such as construction equipment and boats, are also significant sources of CO. Overall, the transportation sector (Non-Road and On Road Vehicles combined) is responsible for about 99% of all CO emissions nationally. Other sources of CO include industrial processes, fuel combustion in sources such as boilers and incinerators, and natural sources such as forest fires. Figure 1 shows the national average contributions of these sources.

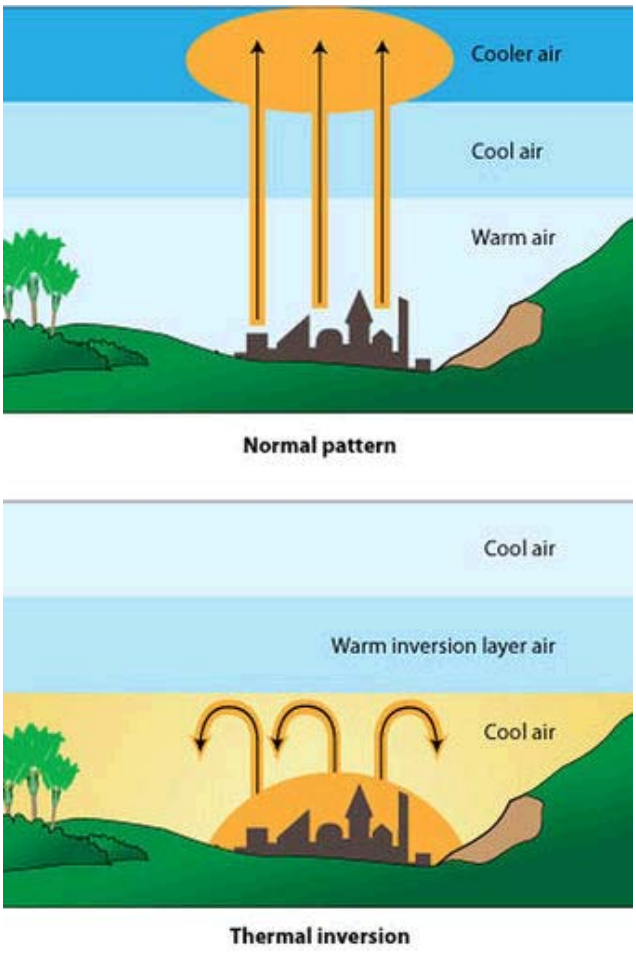
Figure 1
National Summary of
CO Emissions by Source Category



Source: United States Environmental Protection Agency
www.epa.gov/air/emissions/co.htm

Atmospheric inversions, which usually occur overnight when cooler air is trapped beneath a layer of warmer air, allow CO levels to accumulate near the ground. The inversion acts like a lid, preventing pollution from mixing in the atmosphere and effectively trapping it close to ground level (see Figure 2). Figure 3 shows that CO levels 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, and this diurnal variation is displayed in Figure 4.

Figure 2: Effect of Atmospheric Inversion on Air Pollution



Health and Environmental Effects

Carbon monoxide enters the bloodstream and reduces the body's ability to distribute 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 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.

STANDARDS

There are currently two national primary, or health based, standards for carbon monoxide. They are set at a one-hour 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 (welfare based) standards for CO at this time.

New Jersey state standards for CO are based on different units (milligrams per cubic meter as opposed to parts per million), and our standards are not to be exceeded more than once in any 12-month period. The state has set secondary (welfare based) 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)	----

Figure 3
2009 Carbon Monoxide Concentrations – New Jersey
Monthly Variation
Parts Per Million (PPM)

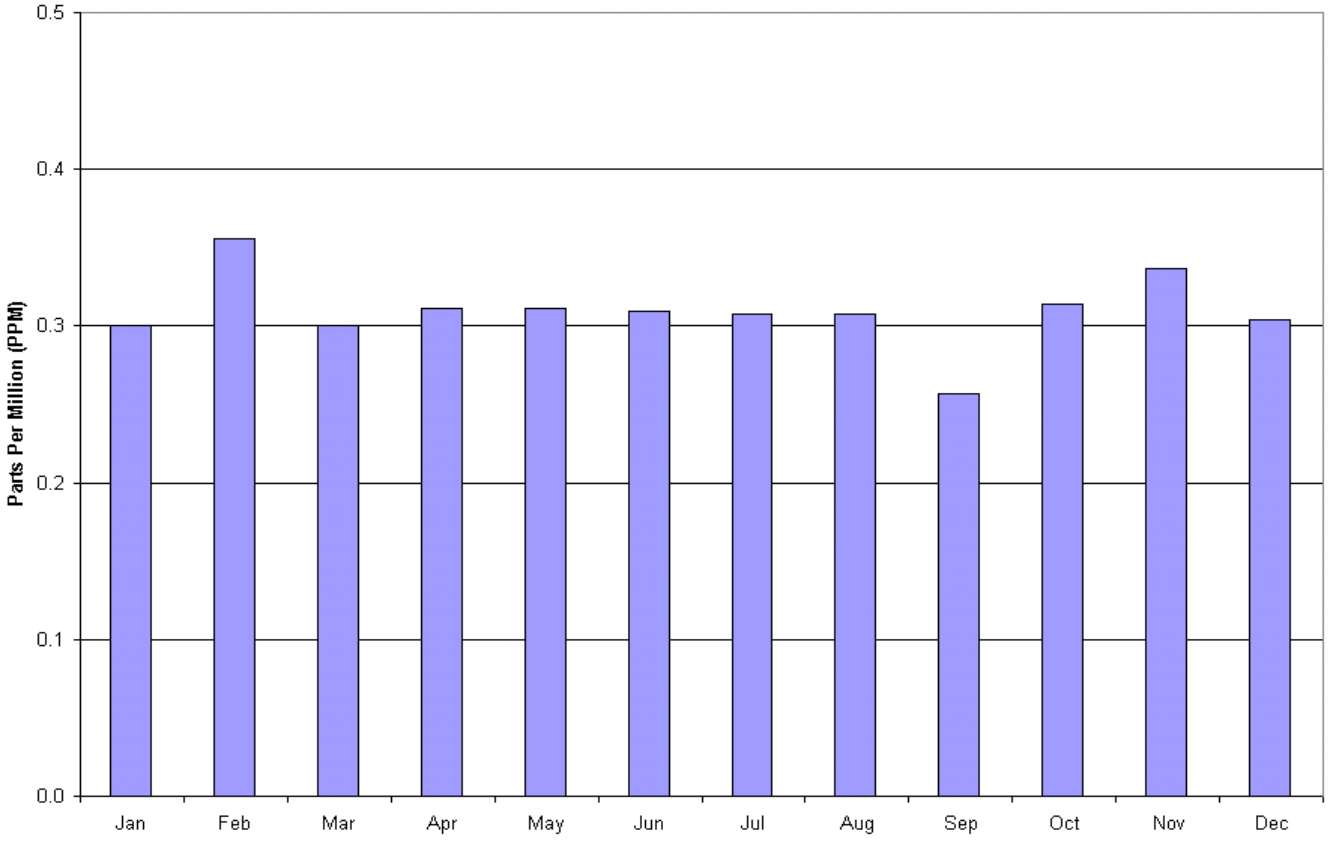
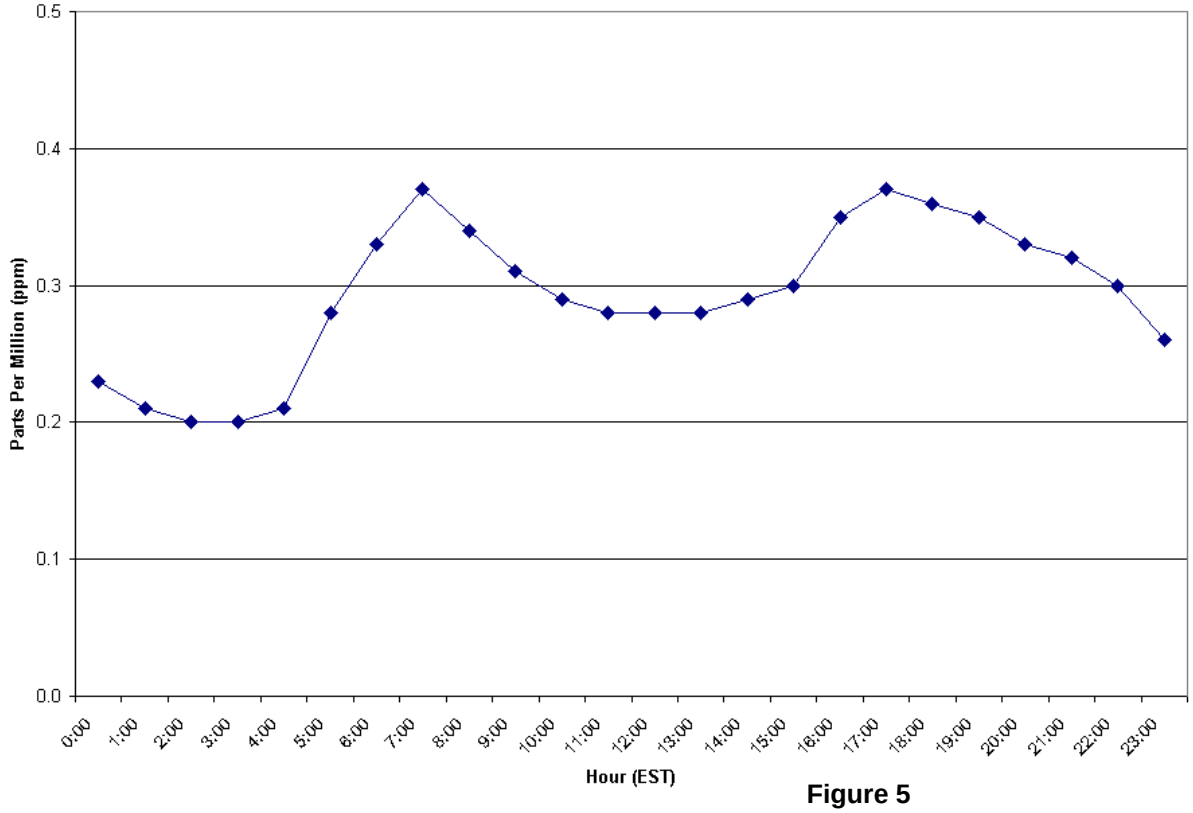


Figure 4
2009 Carbon Monoxide Concentrations – New Jersey
Diurnal Variation
Parts Per Million (PPM)



MONITORING LOCATIONS

The state monitored CO levels at 12 locations in 2009. These sites are shown in the map in Figure 5. The Fort Lee station was temporarily shutdown on November 4, 2009 due to utility problems. The Burlington station was shutdown at the end of December 2009 because the NJDEP permanently lost access to the location. A CO analyzer was installed on June 1, 2009 at the newly established Newark Firehouse station. The NJDEP is actively pursuing the establishment of a new monitoring station in Camden.

CO LEVELS IN 2009

None of the monitoring sites recorded exceedances of any CO standard during 2009. The maximum one-hour average concentration recorded was 4.4 ppm at the Freehold station. The highest 8-hour average concentration recorded was 2.6 ppm at the East Orange station. Summaries of the 2009 data are provided in Figure 6 and Table 2 (page 4).

Figure 5
2009 Carbon Monoxide
Monitoring Network

Figure 6
Highest and 2nd Highest 8-Hour Averages
Of Carbon Monoxide in New Jersey – 2009
Parts Per Million (PPM)

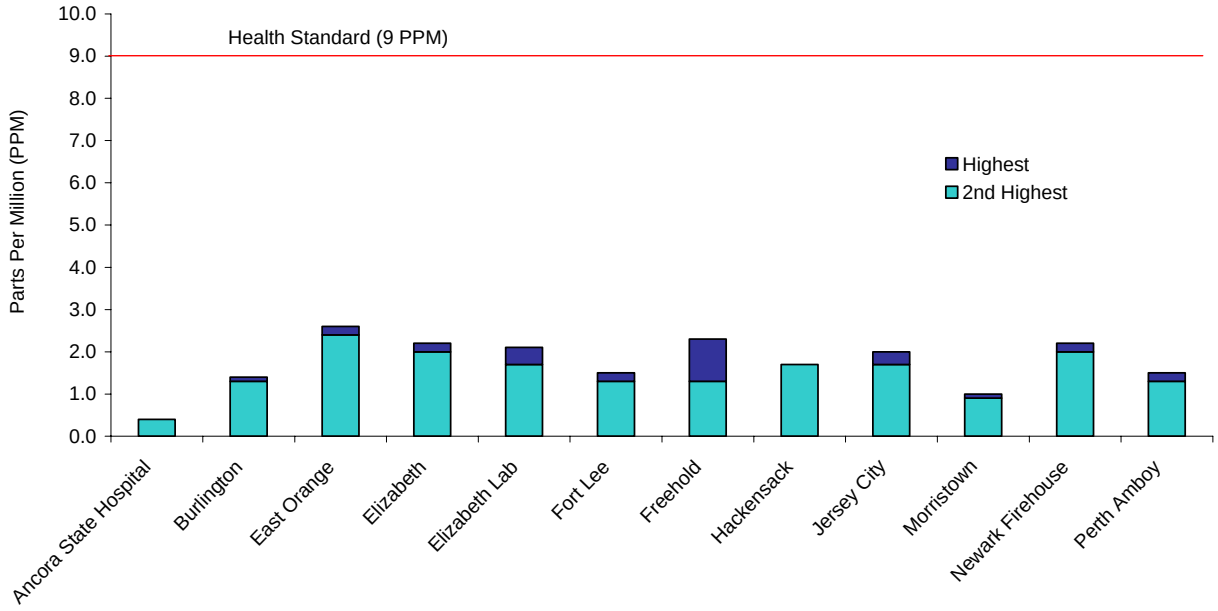


Table 2
Carbon Monoxide Data – 2009
1-Hour and 8-Hour Averages

Parts Per Million (ppm)
1-hour standard = 35 ppm
8-hour standard = 9 ppm

Monitoring Sites	Maximum 1-Hour Average	2nd Highest 1-Hour Average	Maximum 8-Hour Average	2nd Highest 8-Hour Average
Ancora State Hospital	0.9	0.8	0.4	0.4
Burlington	2.5	2.2	1.4	1.3
East Orange	4.0	3.9	2.6	2.4
Elizabeth	3.5	2.9	2.2	2.0
Elizabeth Lab	2.5	2.4	2.1	1.7
Fort Lee (a)	3.0	2.1	1.5	1.3
Freehold	4.4	4.2	2.3	1.3
Hackensack	2.1	2.1	1.7	1.7
Jersey City	3.3	2.8	2.0	1.7
Morristown	2.1	2.0	1.0	0.9
Newark Firehouse (b)	2.7	2.6	2.2	2.0
Perth Amboy	2.3	2.3	1.5	1.3

(a) Data not available after November 4, 2009
(b) Data not available prior to June 1, 2009

Trends

Carbon monoxide levels have improved dramatically over the past 20 years. The last time the CO standard was exceeded in New Jersey was in January of 1995 (Figure 7), and the entire state was officially declared as having attained the CO standard on 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. A trend graph of CO levels showing the maximum, minimum, and average concentrations recorded since 1975 is provided in Figure 8. The graph depicts the second highest 8-hour value recorded; as this is the value that determines if the health standard is being met (one exceedance per site is allowed each year).

Figure 7
Carbon Monoxide
Unhealthful Days 1985-2009

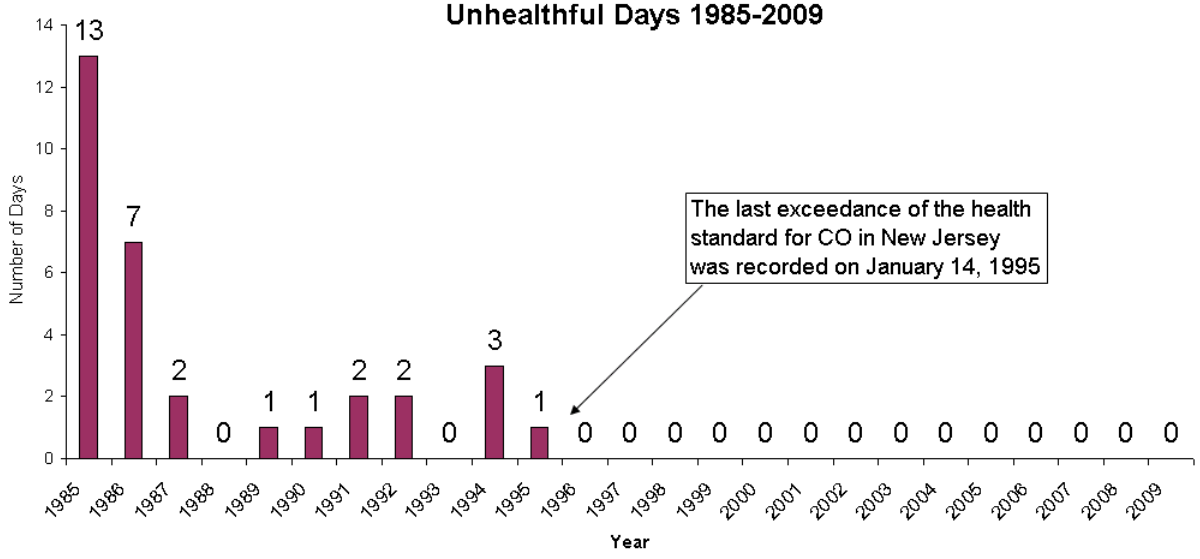
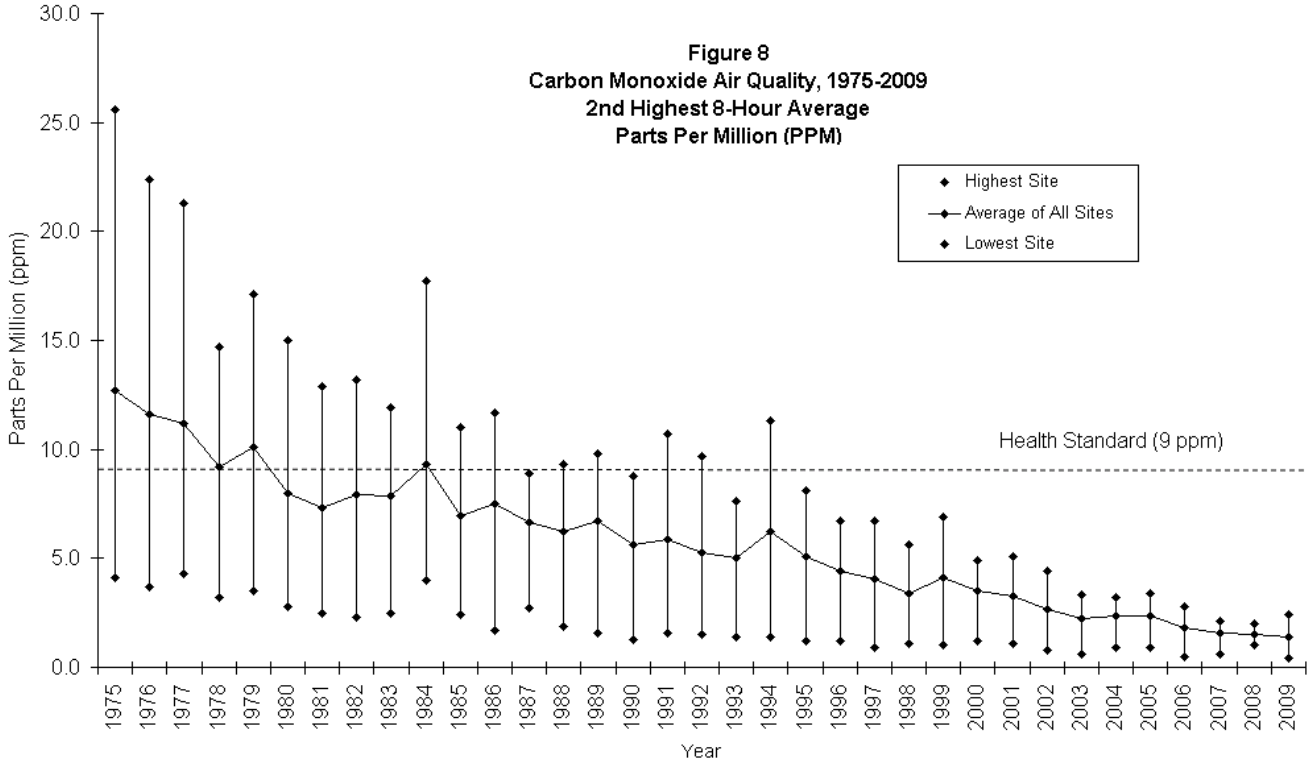


Figure 8
Carbon Monoxide Air Quality, 1975-2009
2nd Highest 8-Hour Average
Parts Per Million (PPM)



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