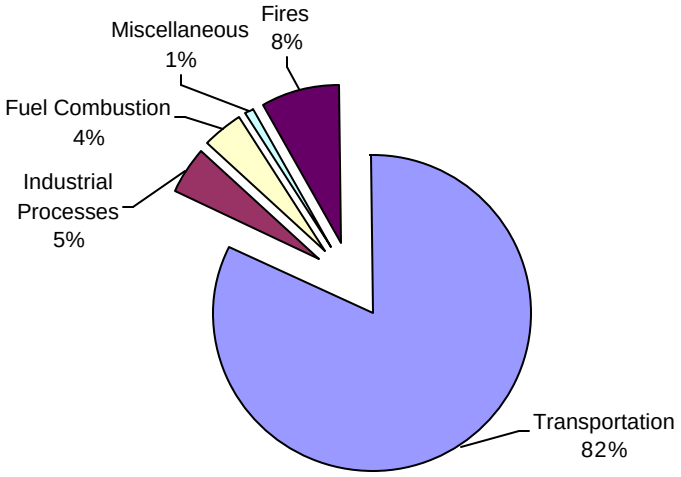
2003 Carbon Monoxide Summary

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 50 percent of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions, and high CO levels often coincide with morning and afternoon rush hours (Figure 3 on page 2). Non-road engines and vehicles, such as construction equipment and boats, are also significant sources of CO and overall the transportation sector is responsible for about 82% 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.

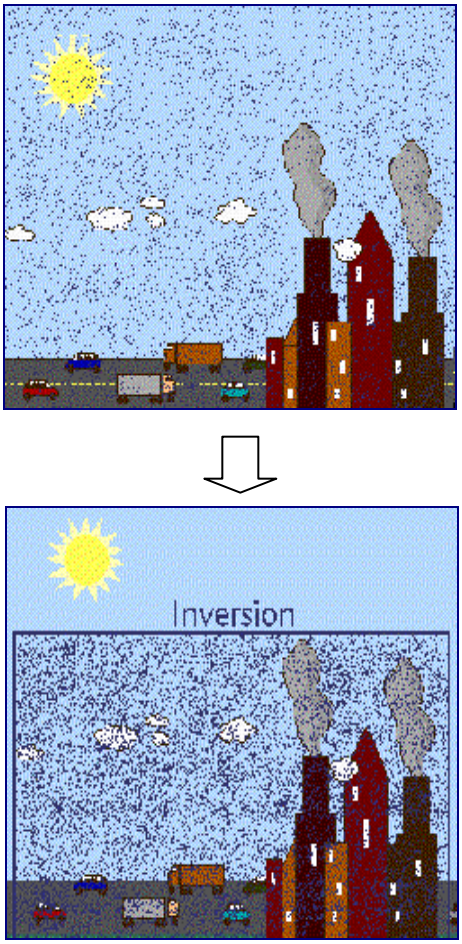
Figure 1
National Summary of 2002
CO Emissions by Source Category



Source: USEPA National Air Quality Emissions Trends Report, 2003 Special Studies, September 2003

Figure 3 also shows that CO levels are typically higher in the winter. This is because motor vehicles do not burn fuel as efficiently when they are cold. Atmospheric inversions are also more frequent during the winter months. Inversions usually occur overnight when cooler air is trapped beneath a layer of warmer air aloft. When this occurs, 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 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.

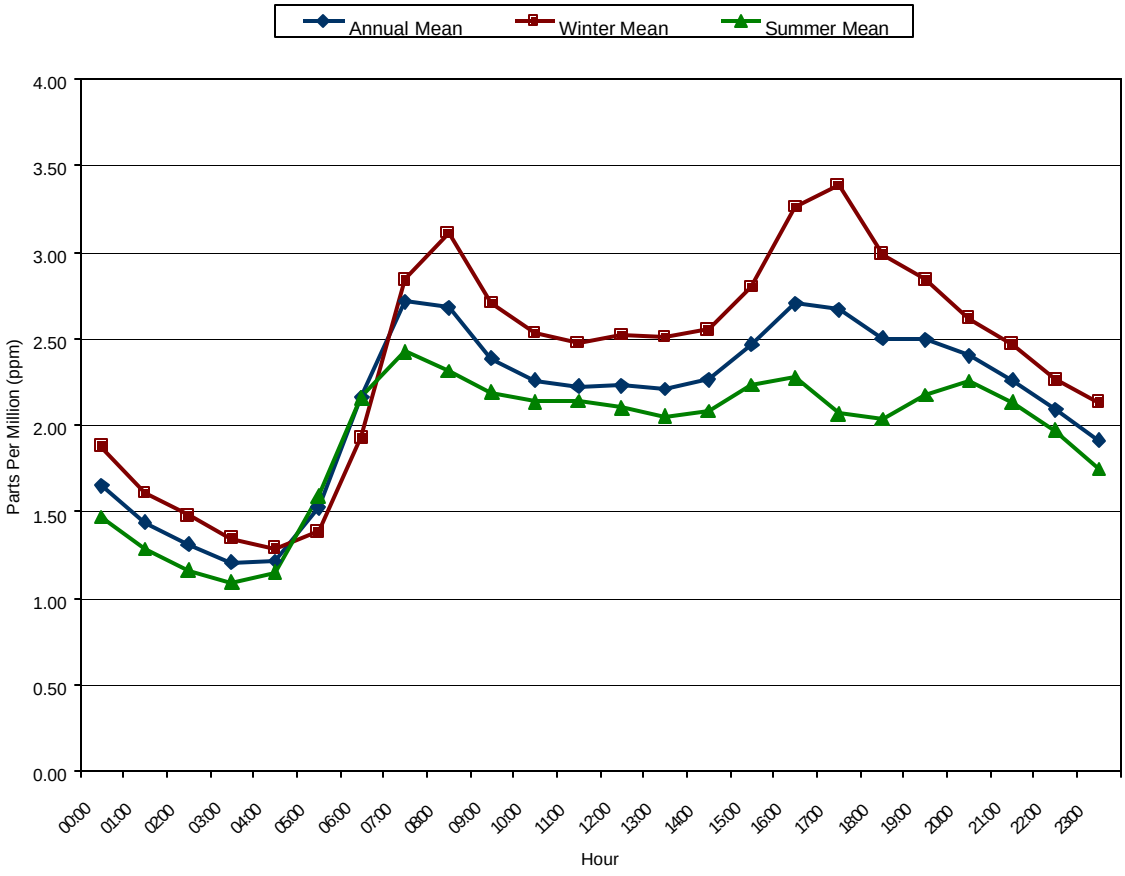
New Jersey state standards for CO are based on different units (milligrams per cubic meter as opposed to parts per million), and our standards are not to be exceeded more than once in any 12-month period. The state has set secondary (welfare based) standards for CO at the same level as the primary standards. 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
Carbon Monoxide Concentrations – New Jersey
1967-1999
Seasonal and Hourly Variations



MONITORING LOCATIONS

The state monitored CO levels at 13 locations in 2003. These sites are shown in the map in Figure 4. The site in Newark was shut down on June 5, 2003 when the location was selected for the construction of a new school building. The site in Camden was shut down on September 22, 2003 for renovations.

CO LEVELS IN 2003

None of the monitoring sites recorded exceedances of any CO standard during 2003. The maximum one-hour average concentration recorded was 9.5 ppm at the site in Hackensack. The highest 8-hour average level recorded was 4.3 ppm, at the East Orange site. Summaries of the 2003 data are provided in Figure 5 and Table 2 (page 4).

Figure 4
2003 Carbon Monoxide Monitoring Network

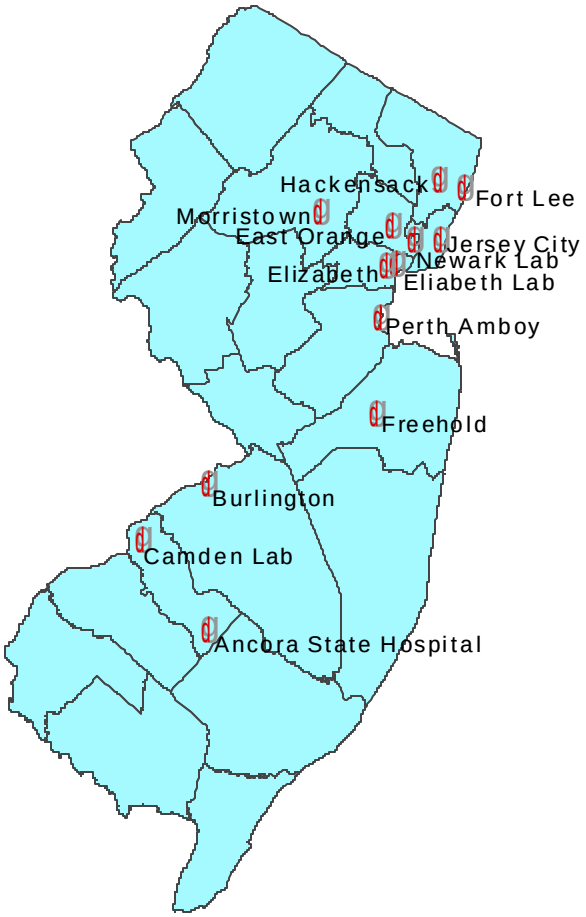


Figure 5
Highest and 2nd Highest 8-Hour Averages of Carbon Monoxide in New Jersey - 2003

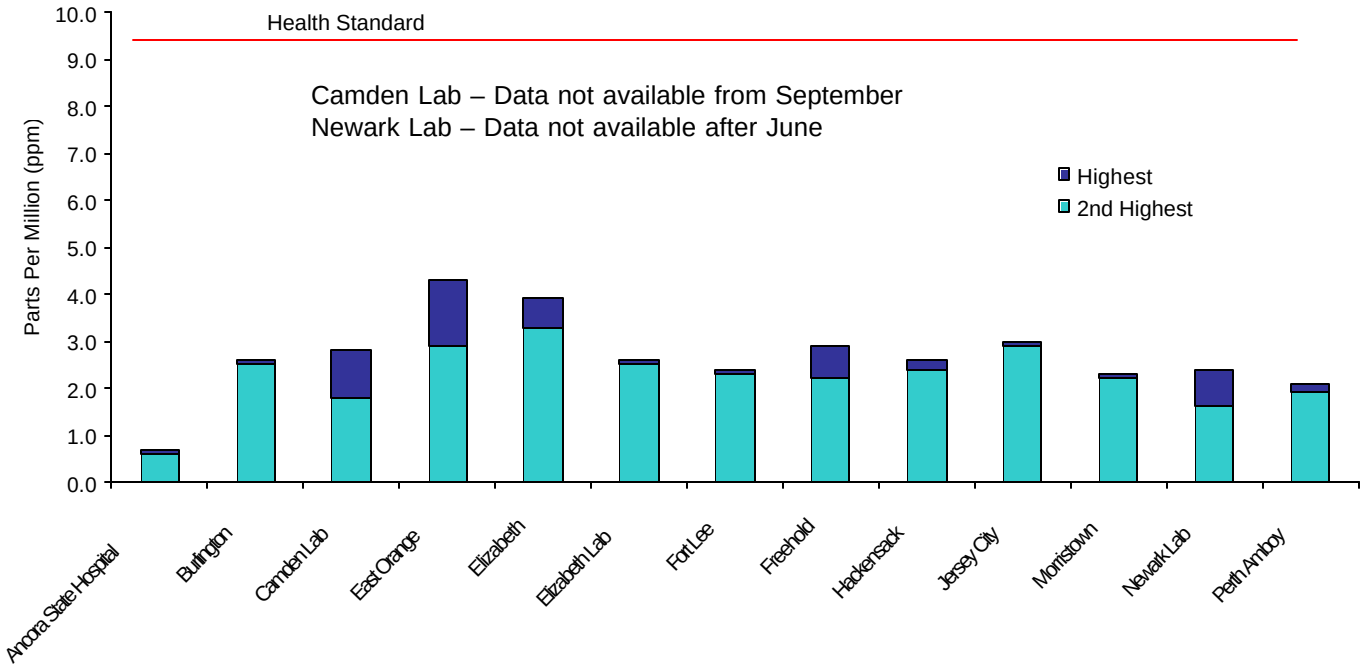


Table 2
Carbon Monoxide Data – 2003
1-Hour and 8-Hour Averages

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	1.1	1.1	0.7	0.6
Burlington	5.4	5.3	2.6	2.5
Camden Lab[a]	3.0	2.9	2.8	1.8
East Orange	6.5	5.8	4.3	2.9
Elizabeth	6.4	6.0	3.9	3.3
Elizabeth Lab	3.7	3.5	2.6	2.5
Fort Lee	3.8	2.7	2.4	2.3
Freehold	6.3	6.0	2.9	2.2
Hackensack	9.5	5.2	2.6	2.4
Jersey City	4.6	4.0	3.0	2.9
Morristown	4.5	3.6	2.3	2.2
Newark Lab[b]	3.3	3.0	2.4	1.6
Perth Amboy	3.7	3.7	2.1	1.9

[a] Data not available after September
[b] Data not available after June

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 (see Figure 6, page 5), 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 – as much as a hundred days a year at some sites. 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 2nd highest average 8-hour concentrations recorded since 1975 is provided in Figure 7 (page 5). 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 6
Carbon Monoxide
Unhealthy Days 1985-2003

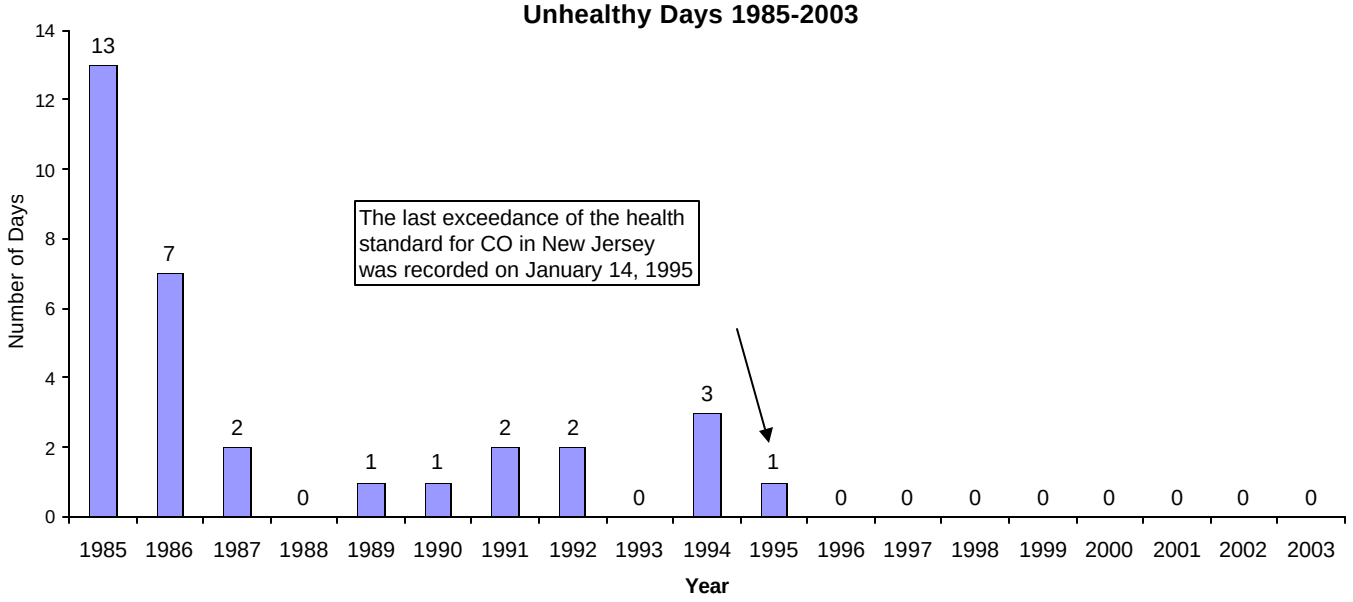
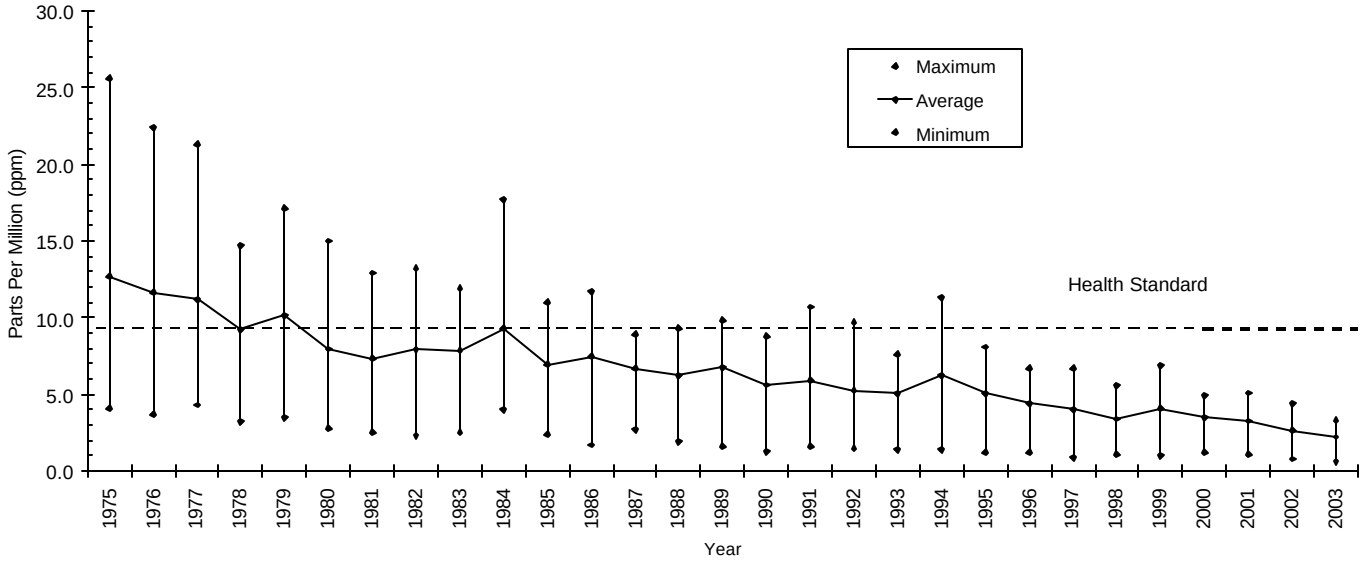


Figure 7
Carbon Monoxide Air Quality, 1975-2003
2nd Highest 8-Hour Average



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