Carbon Monoxide Concentrations

Carbon monoxide (CO) gas forms primarily when carbon fuels are not burned completely. Elevated ambient air concentrations of CO are hazardous because inhaled CO enters the bloodstream and reduces the amount of oxygen that the blood can deliver to the body's organs and tissues. If exposure concentrations are high enough, potentially serious cardiovascular and neurological effects can result. Visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks are all associated with exposure to elevated CO levels (U.S. EPA, 2000).

Motor vehicle exhaust currently accounts for the majority of CO emissions nationwide, and as much as 95 percent of CO emissions in cities with high traffic congestion. Other anthropogenic sources of CO emissions include fossil fuel combustion for heating and power generation, metals processing, and chemical manufacturing. The highest ambient air concentrations of CO often occur during nighttime inversion conditions, which trap pollutants near ground level. These conditions are most frequently observed during the cold winter months (U.S. EPA, 2003).

This indicator presents ambient CO concentrations in parts per million (ppm) from 1980 to 2011, based on continuous measurements averaged over 8-hour time frames. The 8-hour standard is indicative of exposures occurring over a sustained period of time, for example, an outdoor worker's exposure over the course of a work day. This indicator displays trends in the annual second highest 8-hour CO concentrations for 95 sites in 72 counties nationwide that have consistent data for the period of record in the State and Local Air Monitoring Stations network or by other special purpose monitors. It also shows trends in the average 8-hour measurements in each EPA Region. This indicator's exhibits display the National Ambient Air Quality Standard (NAAQS) for CO as a point of reference, but the fact that the national or any regional second highest 8-hour values fall below the standard does not mean that all monitoring sites nationally or in the EPA Regions also are below the standard. The indicator displays trends in the number of the 95 trend sites nationwide at which reported CO concentrations were above the level of the 8-hour standard in each year from 1980 to 2011, but this statistic is not displayed for each EPA Region.

What the Data Show

The 2011 annual second highest 8-hour CO concentration averaged across 95 monitoring sites nationwide was 82 percent lower than that for 1980, and is the lowest level recorded during the past 32 years (Exhibit 1). The downward trend in CO concentrations between 1990 and 2008 parallels the downward trend observed in CO emissions, which has been attributed largely to decreased emissions from mobile sources (the CO Emissions indicator). In addition, of the 95 sites used to determine this trend (out of 323 total monitoring sites that were operating in 2011), the number reporting CO concentrations above the level of the CO standard declined to zero over the same period (Exhibit 2).

Also shown in Exhibit 1 are the 90th and 10th percentiles based on the distribution of annual statistics at the monitoring sites. This provides additional graphical representation of the distribution of measured concentrations across the monitoring sites for a given year. Thus, the graphic displays the concentration range where 80 percent of measured values occurred for that year.

Consistent with the nationwide trend, CO levels in all ten EPA Regions have steadily decreased since 1980, with percent reductions over this period ranging from 69 percent (Region 7) to 88

percent (Region 1) (Exhibit 3).

Limitations

- Because most CO monitoring sites are located in high-traffic urban areas, the nationwide trends presented in this indicator might not accurately reflect conditions outside the immediate urban monitoring areas.
- Because of the relatively small number of trend sites in some EPA Regions, the regional trends are subject to greater uncertainty than the national trends. Some EPA Regions with low average concentrations may include areas with high local concentrations, and vice versa. In addition, the 95 trend sites in this indicator are not dispersed uniformly across all states in the EPA Regions. The 95 trend sites are located in 25 states. In the remaining 25 states, there currently are insufficient long-term data from the available monitoring sites to include in this indicator.
- To ensure that long-term trends are based on a consistent set of monitoring sites, selection criteria were applied to identify the subset of CO monitoring sites with sufficient data to assess trends since 1980. Monitoring sites without sufficient data are not included in the trend analysis. Some excluded monitoring sites reported CO concentrations above the level of the CO standard over the time frame covered by this indicator. In 2011, however, no monitoring sites in the U.S. measured CO concentrations above the level of the NAAQS.

Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on CO ambient air monitoring data in EPA's Air Quality System (U.S. EPA, 2012) (http://www.epa.gov/ttn/airs/airsaqs/). National and regional trends in this indicator are based on the subset of CO monitoring stations that have sufficient data to assess trends since 1980.

References

U.S. EPA (United States Environmental Protection Agency). 2014. History of the national ambient air quality standards for carbon monoxide. http://www.epa.gov/ttn/naaqs/standards/co/s_co_history.html.

U.S. EPA. 2012. Data from the Air Quality System. Accessed 2012. http://www.epa.gov/ttn/airs/airsaqs/.

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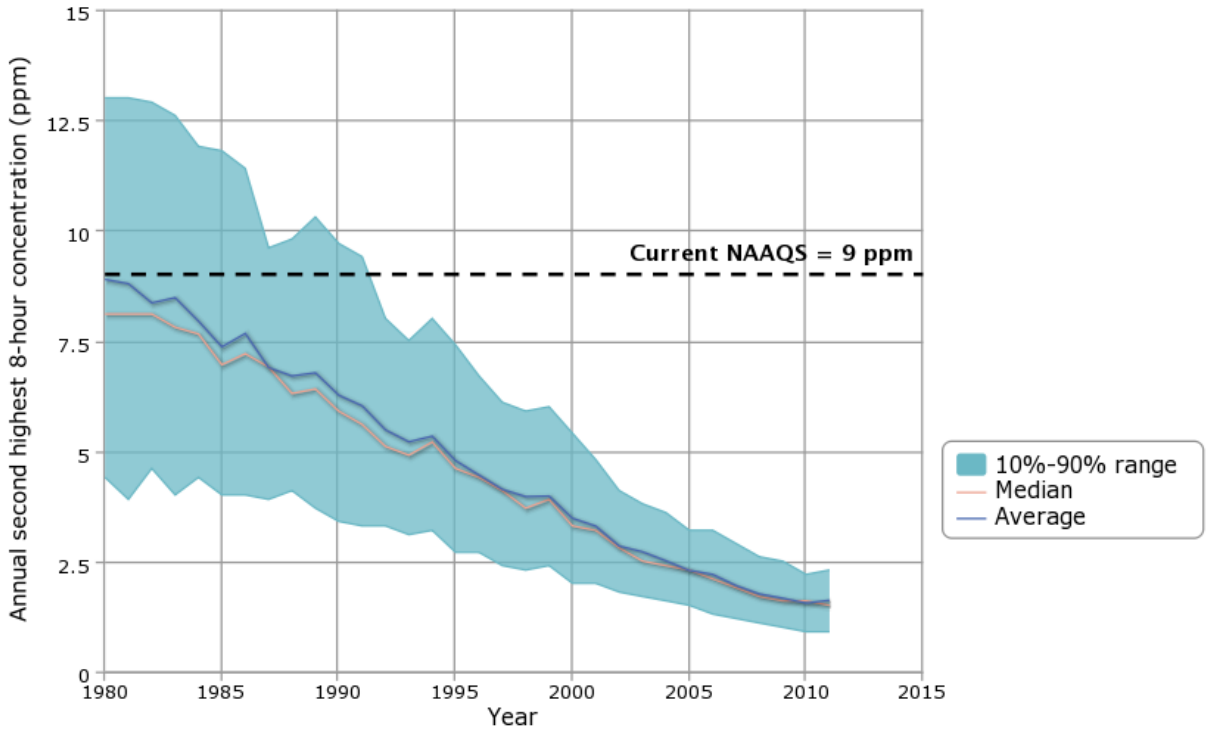
U.S. EPA. 2000. Air quality criteria for carbon monoxide, 2000. EPA/600/P-99/001F. Research Triangle Park, NC. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=18163.

Exhibit 1. Ambient 8-hour CO concentrations in the U.S., 1980-2011



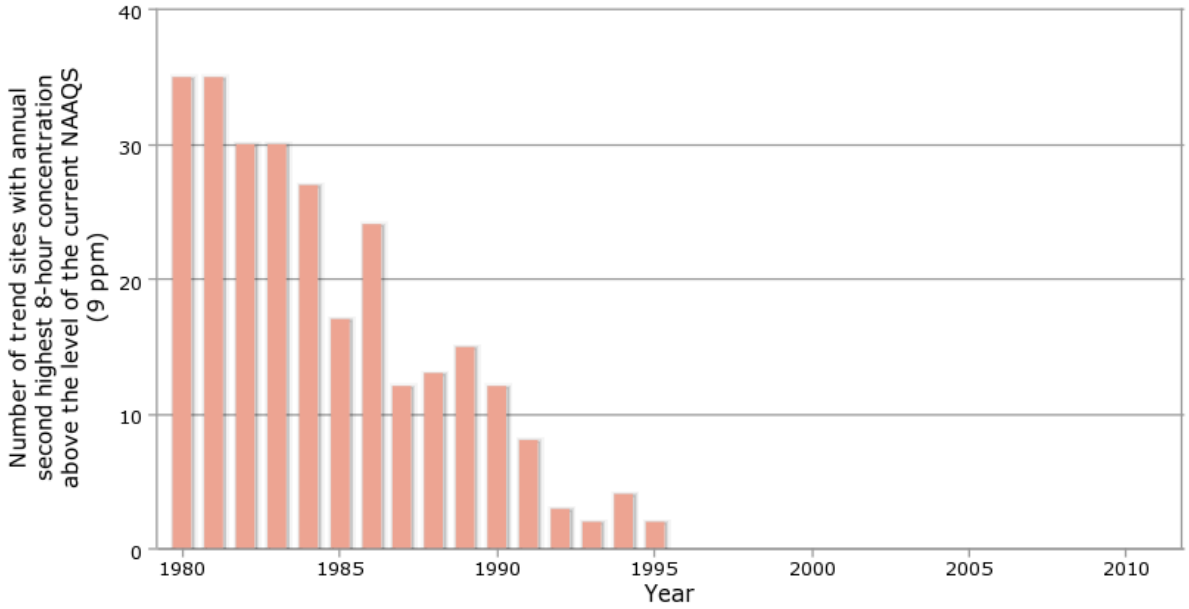
The current NAAQS was established in 1971 and has not been revised since (U.S. EPA, 2014).

Coverage: 95 monitoring sites in 72 counties nationwide (out of a total of 323 sites measuring CO in 2011) that have sufficient data to assess CO trends since 1980.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2012

Exhibit 2. Ambient 8-hour CO concentrations above the level of the current NAAQS in the U.S., 1980-2011



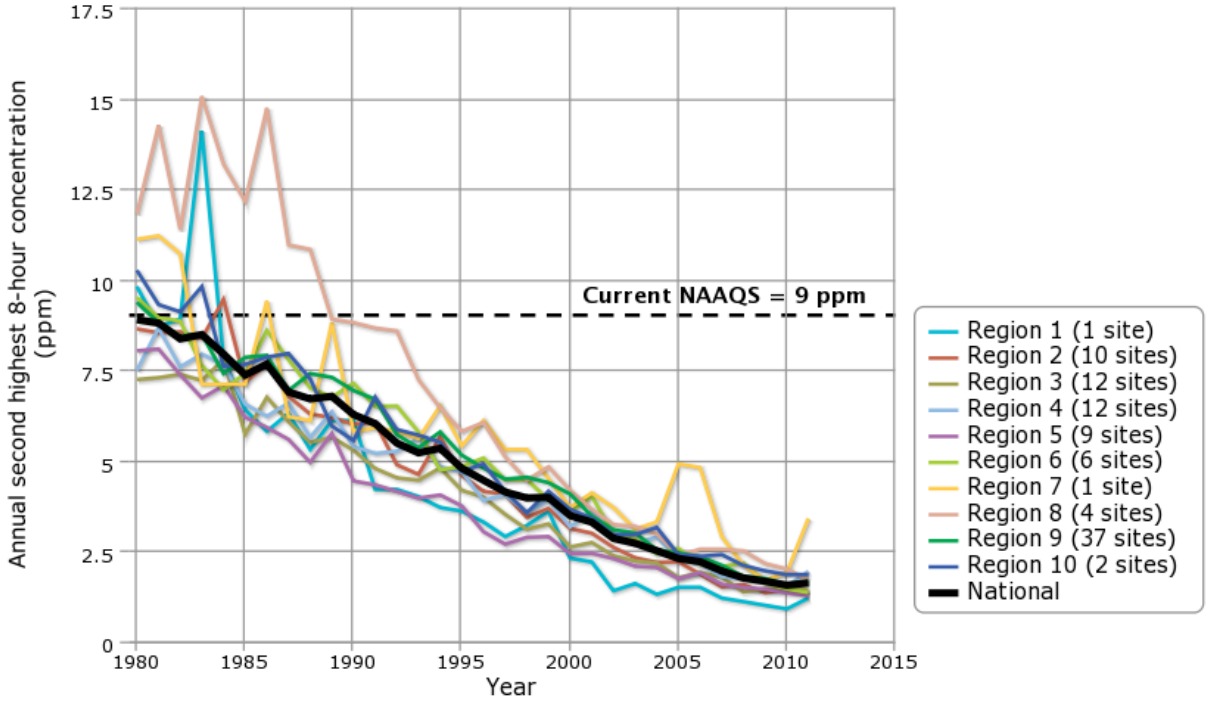
The current NAAQS was established in 1971 and has not been revised since (U.S. EPA, 2014).

Coverage: 95 monitoring sites in 72 counties nationwide (out of a total of 323 sites measuring CO in 2011) that have sufficient data to assess CO trends since 1980.

Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2012

Exhibit 3. Ambient 8-hour CO concentrations in the contiguous U.S. by EPA Region, 1980-2011



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