

## Lead Concentrations

Lead is a naturally occurring metal found in small amounts in rock and soil. Despite steep decreases in emissions since 1970 (the [Lead Emissions indicator](#)), lead remains an important environmental health issue because exposure to high levels has been associated with serious health effects, including neurological impairments such as seizures, mental retardation, and behavioral disorders (CDC, 2009; U.S. EPA, 2006). Low lead exposure can have adverse effects on the nervous systems of fetuses and young children (the [Blood Lead indicator](#)) (U.S. EPA, 2006). People can be exposed to lead by inhaling airborne particles that contain lead, drinking contaminated water, eating contaminated food items, or ingesting non-food items that contain lead, such as dust and paint chips.

Lead has been used industrially in the production of gasoline, ceramic products, paints, metal alloys, batteries, and solder. Emissions to ambient air and associated air lead concentrations have declined substantially over the past several decades. The most dramatic reductions in lead emissions occurred prior to 1990 in the transportation sector due to the removal of lead from gasoline used in on-road vehicles (the [Lead Emissions indicator](#)). The majority of lead emissions nationally is associated with combustion of leaded aviation gasoline by piston-driven aircraft. The largest sources on a local scale are generally associated with metals industries (U.S. EPA, 2014a,b).

This indicator presents ambient lead concentrations in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) from 1980 to 2011. Trends for this indicator are based on measurements made at 18 monitoring stations in 13 counties nationwide. These trend sites were selected because they are part of the State and Local Air Monitoring Stations network or are special purpose monitors and they have consistently measured ambient air concentrations of lead over the entire period of interest. Reported values are annual maximum 3-month averages. This indicator's exhibits displays the 2008 lead National Ambient Air Quality Standard (NAAQS) as a point of reference, but the fact that the average national lead concentrations fall below the standard does not mean that all monitoring sites also are below the standard.

### What the Data Show

Between 1980 and 2011, average lead concentrations decreased 91 percent nationally (Exhibit 1). This decrease, which occurred mostly during the 1980s and early 1990s, is largely attributed to reduced lead content in gasoline used in on-road vehicles (U.S. EPA, 2003). In addition, of the 18 sites used to determine this trend (out of 178 total monitoring sites that were operating in 2011), the number reporting annual maximum 3-month average lead concentrations above the level of the 2008 NAAQS ( $0.15 \mu\text{g}/\text{m}^3$ ) declined from 17 to 3 over the same period (Exhibit 2).

Also shown in Exhibit 1 are the 90<sup>th</sup> and 10<sup>th</sup> 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 exhibit displays the concentration range where 80 percent of measured values occurred for each year.

### Limitations

- The nationwide trends might not accurately reflect conditions outside the immediate monitoring areas. In addition, the 18 trend sites in this indicator are not dispersed uniformly

across all states in the EPA Regions. The 18 trend sites are located in six states. In the remaining 44 states, there currently are insufficient long-term data from the existing 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 lead 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 lead concentrations above the level of the lead standard over the time frame covered by this indicator. In 2011, for example, 34 monitoring sites measured 3-month average lead concentrations above the level of the 2008 NAAQS: 3 of these sites are shown in Exhibit 2, and 31 sites did not have sufficient long-term data to be considered trend sites for this indicator.

## Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on lead ambient air monitoring data in EPA's Air Quality System (U.S. EPA, 2013) (<http://www.epa.gov/ttn/airs/airsaqs/>). National trends in this indicator are based on the subset of lead monitoring stations that have sufficient data to assess trends since 1980.

## References

CDC (Centers for Disease Control and Prevention, National Center for Environmental Health). 2009. Fourth national report on human exposure to environmental chemicals. <http://www.cdc.gov/exposurereport/>.

U.S. EPA (United States Environmental Protection Agency). 2014a. History of the national ambient air quality standards for lead. [http://www.epa.gov/ttn/naaqs/standards/pb/s\\_pb\\_history.html](http://www.epa.gov/ttn/naaqs/standards/pb/s_pb_history.html).

U.S. EPA. 2014b. Policy assessment for the review of the lead National Ambient Air Quality Standards. EPA-452/R-14-001. Research Triangle Park, NC. [http://www.epa.gov/ttn/naaqs/standards/pb/data/140501\\_pa\\_pb\\_fin.pdf](http://www.epa.gov/ttn/naaqs/standards/pb/data/140501_pa_pb_fin.pdf) (PDF) (304 pp, 2.3MB).

U.S. EPA. 2013. Data from the Air Quality System. Accessed 2013. <http://www.epa.gov/ttn/airs/airsaqs/>.

U.S. EPA. 2008. National air quality: status and trends through 2007. EPA-454/R-08-006. Research Triangle Park, NC. <http://www.epa.gov/air/airtrends/2008>.

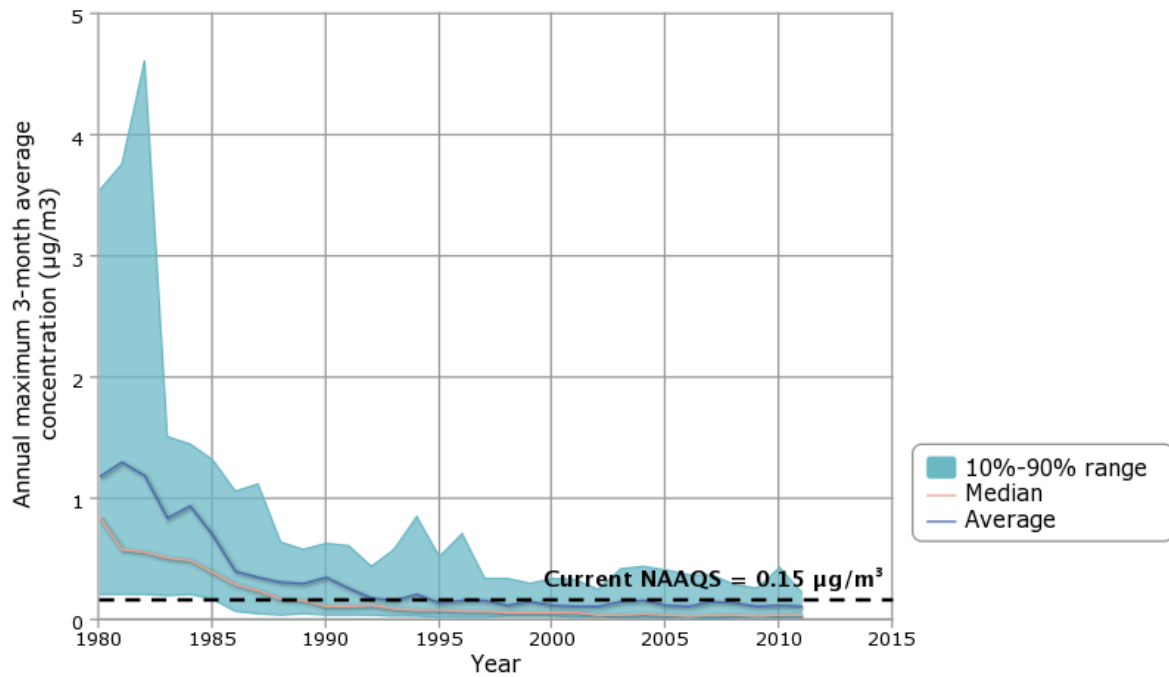
U.S. EPA. 2006. Air quality criteria for lead. EPA/600/R-5/144aF. Research Triangle Park, NC. <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=158823>.

U.S. EPA. 2003. National air quality and emissions trends report—2003 special studies edition. EPA/454/R-03/005. Research Triangle Park, NC. <http://www.epa.gov/air/airtrends/aqtrnd03/>.

..

..

### Exhibit 1. Ambient 3-month lead concentrations in the U.S., 1980-2011



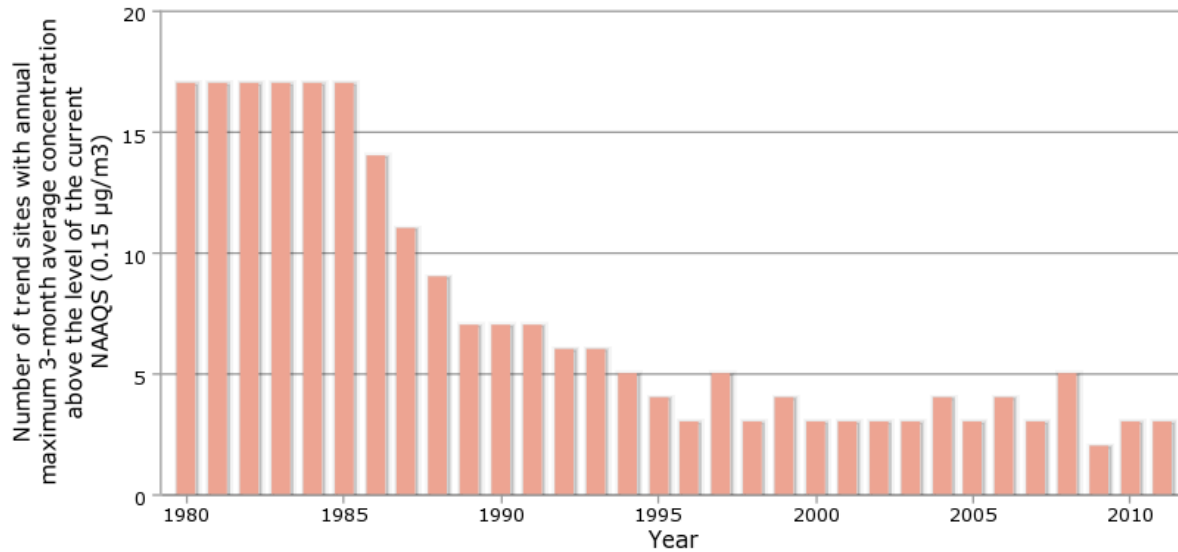
The current NAAQS was established in 2008 and is shown to provide context for the magnitude of pollutant concentrations. It is more stringent than all previous NAAQS (e.g., the concentration levels for the previous NAAQS are higher) (U.S. EPA, 2014).

**Coverage:** 18 monitoring sites in 13 counties nationwide (out of a total of 178 sites measuring lead in 2011) that have sufficient data to assess lead 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, 2013

## Exhibit 2. Ambient 3-month lead concentrations above the level of the current NAAQS in the U.S., 1980-2011



The current NAAQS was established in 2008 and is shown to provide context for the magnitude of pollutant concentrations. It is more stringent than all previous NAAQS (e.g., the concentration levels for the previous NAAQS are higher) (U.S. EPA, 2014).

**Coverage:** 18 monitoring sites in 13 counties nationwide (out of a total of 178 sites measuring lead in 2011) that have sufficient data to assess lead 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, 2013