Lead Emissions

Lead is a naturally occurring metal found in small amounts in rock and soil. Lead has been used industrially in the production of gasoline, ceramic products, paints, metal alloys, batteries, and solder. In the past, automotive sources were the major contributors of lead emissions to the atmosphere. After leaded motor vehicle fuels were phased out in 1995, the contribution of air emissions of lead from the transportation sector, and particularly the automotive sector, greatly declined. Today, the majority of lead emissions nationally are associated with combustion of leaded aviation gasoline by piston-driven aircraft; and locally elevated levels of airborne lead are usually found near industrial operations that process materials containing lead, such as smelters (U.S. EPA, 2013). Lead that is emitted into the air can be inhaled or, after it settles out of the air, can be ingested. Ingestion of lead that has settled onto surfaces is the main route of human exposure to lead originally released into the air. Refer to the Lead Concentrations indicator and the Blood Lead Level indicator for information on the health hazards associated with lead exposures.

This indicator presents lead emissions from traditionally inventoried anthropogenic source categories: (1) "Fuel combustion," which includes emissions from coal-, gas-, and oil-fired power plants and industrial, commercial, and institutional sources, as well as residential heaters and boilers; (2) "Other sources," which includes chemical production and petroleum refining; (3) "On-road vehicles," which includes cars, trucks, and motorcycles; (4) "Nonroad engines," (i.e., piston-engine aircraft in the case of lead but other nonroad sources typically inventoried include farm and construction equipment, lawnmowers, chainsaws, boats, ships, snowmobiles and others); and (5) "Metals industrial processing." Since metals processing is one of the largest sources of lead emissions, the indicator includes a metals source category in addition to the four categories presented in the other emissions indicators.

For the years 1970 through 1985, the primary source for lead emissions data was the National Emissions Data System (NEDS) archives. Since 1990, lead emissions data have been tracked by the National Emissions Inventory (NEI). The NEI is a composite of data from many different sources, including EPA models, numerous state, tribal, and local air quality management agencies, and industry. Different data sources use different data collection methods, and many of the emissions data are based on estimates rather than actual measurements. For most industrial processes and fuel combustion sources, emissions are estimated using emission factors. For mobile sources, the aircraft emissions are based on data from the U.S. Federal Aviation Administration for specific aircraft, often using state-supplied model inputs, and fuel consumption data. Emissions from other sources of nonroad mobile lead emissions, such as commercial marine vessels and railroad locomotives, are estimated based on emission factors and related metal fractions (U.S. EPA, 2018a).

Data for lead emissions cover all 50 states and their counties, D.C., the U.S. territories of Puerto Rico and Virgin Islands, and some of the territories of federally recognized American Indian nations.

What the Data Show

Between 1970 and 2014, estimated nationwide lead emissions decreased by 99.7 percent (220,000

tons) mostly due to elimination of lead from gasoline for on-road vehicles (Exhibit 1). Sharp declines in nationwide air concentrations of lead between 1980 and 1990 paralleled the emissions reductions (the Lead Concentrations indicator). Between 1999 and 2014, lead emissions from metals industrial processing, fuel combustion, and "other sources" all decreased by approximately 90 percent. The largest remaining source category is nonroad vehicles and engines, which accounted for 63 percent of the anthropogenic lead emissions in 2014.

Limitations

- Although lead emissions trends have been generated using well-established estimation methods, the data reflect estimates based on empirical and engineering models and not actual measurement of lead emissions. These estimates have uncertainties inherent in the emission factors and emissions models used to represent sources for which emissions have not been directly measured.
- The method for estimating lead emissions for fuel combustion and industrial sources changed in 1999 to reduce uncertainties inherent in the previous method (U.S. EPA, 2003); and the method used for estimating nonroad mobile source emissions changed in 2002 (U.S. EPA, 2018a). Further, for utility coal boilers, the 2008 and 2011 NEI data are based primarily on test data from 2010 collected as part of the Mercury and Air Toxics Standard (MATS) development, and the 2014 NEI data for this sector included more data submissions by state, local, and tribal agencies. Despite these and other changes in methodology, the long-term trend is still reliable.
- Not all states and local air quality management agencies provide the same data or level of detail for a given year.

Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on anthropogenic lead emissions data in the NEI. The most recent data are taken from Version 2 of the 2014 NEI (U.S. EPA, 2018b). These and earlier emissions data can be accessed from EPA's emission inventory website (https://www.epa.gov/air-emissions-inventories/national-emissions-inventory). The NEI Technical Support Document (U.S. EPA, 2018a) describes the method used to calculate annual inventories for lead emissions from piston-engine aircraft. This indicator aggregates NEI data by source category.

References

U.S. EPA (United States Environmental Protection Agency). 2018a. 2014 National Emissions Inventory, Version 2, technical support document. https://www.epa.gov/sites/production/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf (PDF) (414 pp, 9.7MB).

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Exhibit 1. Anthropogenic lead emissions in the U.S. by source category, 1970–2014
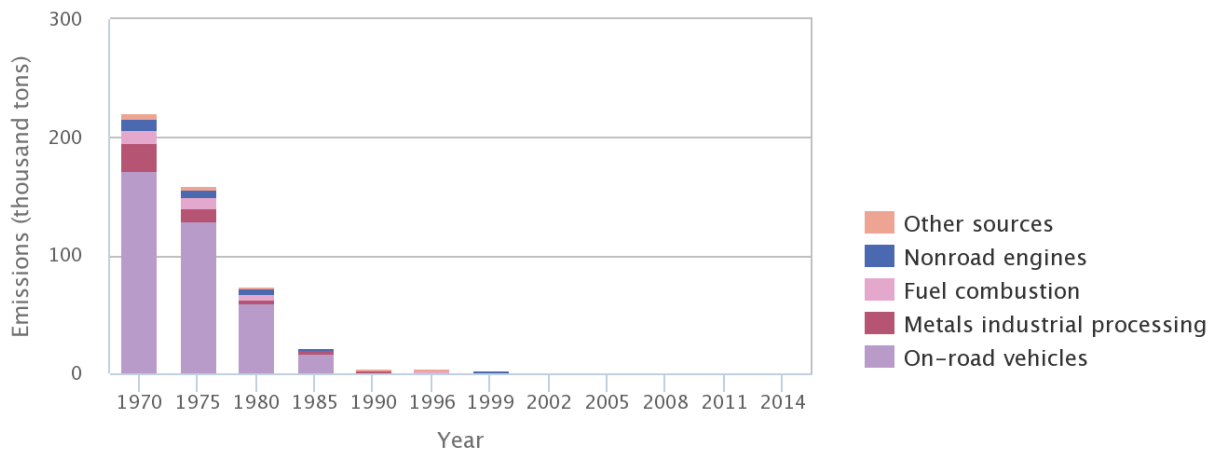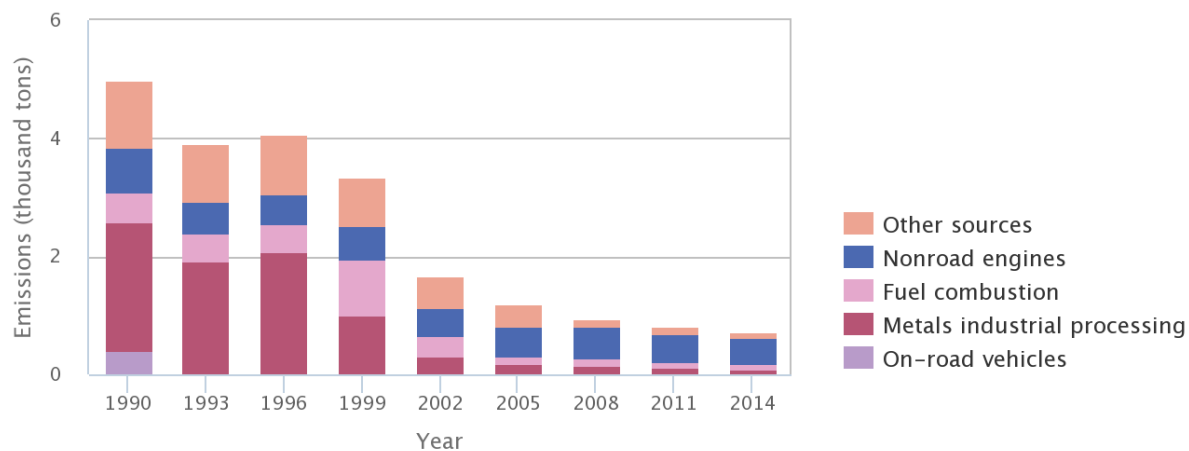

Emissions inventory data are presented for years that allow reliable estimation of long-term trends.

Changes shown from 1970–2014 include both emissions changes and methods changes. While trends shown are generally representative, actual changes from year to year could have been larger or smaller than those shown.

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, 2018b

Exhibit 2. Anthropogenic lead emissions in the U.S. by source category, 1990–2014

Emissions inventory data are presented for years that allow reliable estimation of long–term trends.

Changes shown from 1990–2014 include both emissions changes and methods changes. While trends shown are generally representative, actual changes from year to year could have been larger or smaller than those shown.

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, 2018b