

# October 2008 Final National Ambient Air Quality Standards for Lead



## General Overview

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- On October 15, 2008, EPA strengthened the national ambient air quality standards (NAAQS) for lead (Pb) to increase protection of public health and the environment.
  - Since 1978, ambient air lead standards have been set at  $1.5 \mu\text{g}/\text{m}^3$  (micrograms per cubic meter of air).
  - **Now, EPA is strengthening the lead standards by 90 percent to a level of  $0.15 \mu\text{g}/\text{m}^3$ .**
  - The level is based on the concentration of lead in total suspended particles (TSP)
  - EPA is also making changes to the lead monitoring network to ensure monitors are assessing air quality in areas that might violate the new standard.
- EPA followed the advice of the Clean Air Scientific Advisory Committee (CASAC) to set the standard no higher than  $0.20 \mu\text{g}/\text{m}^3$
- For more information go to <http://www.epa.gov/air/lead/>

## *Lead NAAQS Rulemaking Schedule*

- EPA Criteria Document released September 30, 2006
- EPA Staff Paper released November 1, 2007
- EPA Advance Notice of Proposed Rulemaking (ANPR) released December 5, 2007
- Proposal signed May 1, 2008
- Public hearings held in St. Louis and Baltimore on June 12, 2008
- Public comment period ended August 4, 2008
  - EPA received thousands of public comments, including:
    - EPA Children's Health Protection Advisory Committee and CASAC
    - American Academy of Pediatrics, American Medical Association, American Thoracic Society
    - 18 industry organizations or companies
    - Dozens of state, tribal and local governments
    - More than 6,000 citizens
- Final Rule signed October 15, 2008

## ***Basic Information About Lead Air Pollution***

- Lead is a metal found naturally in the environment as well as in manufactured products.
- Lead can be emitted into the air in the form of particles small enough to stay suspended in the air.
- EPA measures lead air pollution with monitors that capture all of those suspended particles, known as total suspended particles or TSP.
- Lead emitted into the air can be inhaled directly or ingested after it settles onto surfaces or soils.
  - Ingestion is the main route of human exposure to air lead.
- Once in the body, lead is rapidly absorbed into the bloodstream and can affect many of the body's organ systems.
  - Exposures to low levels of lead early in life have been linked to effects on IQ, learning, memory, and behavior that may persist into adulthood.

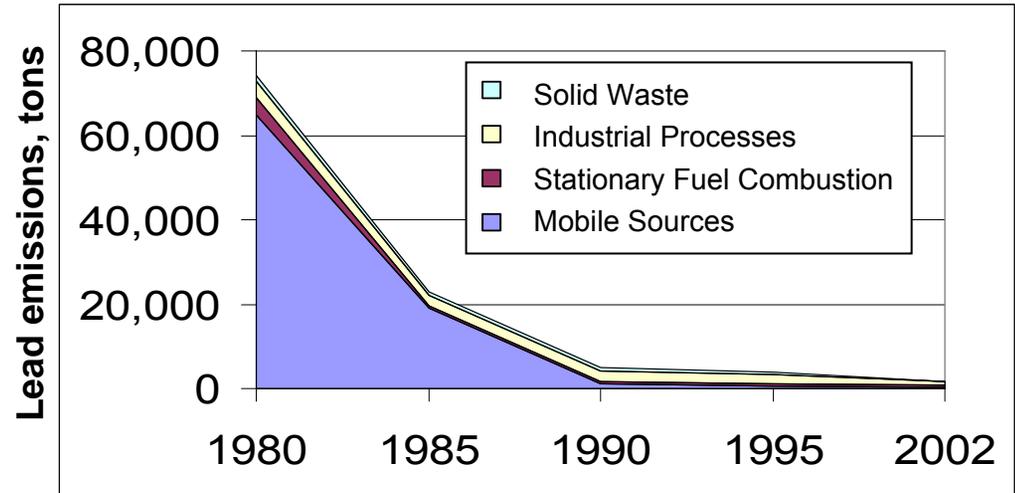
## Regulating Lead Pollution

- The Clean Air Act requires EPA to set two types of national ambient air quality standards (NAAQS) for 'criteria' air pollutants.
  - **Primary standards** to protect public health with an adequate margin of safety
  - **Secondary standards** to protect public welfare and the environment (visibility, wildlife, crops, vegetation, national monuments and buildings)
- EPA has set NAAQS for six common air pollutants:
  - **Lead**
  - Carbon monoxide
  - Nitrogen dioxide
  - Particulate matter
  - Ground-level ozone (smog)
  - Sulfur dioxide
- The law requires EPA to review the scientific information and the standards for each pollutant every five years, and to obtain advice from the Clean Air Scientific Advisory Committee (CASAC) on each review.
- Different considerations apply to setting NAAQS than to achieving them
  - Setting NAAQS: based on scientific evidence of health and environmental effects
  - Achieving NAAQS: account for cost, technical feasibility, time needed to attain
- EPA is revising the lead standards which have not been changed since 1978, when both the primary and secondary standards of lead were set at  $1.5 \mu\text{g}/\text{m}^3$  of lead in TSP. The new standards are  $0.15 \mu\text{g}/\text{m}^3$ .

## Reduction in Lead Pollution in the U.S.

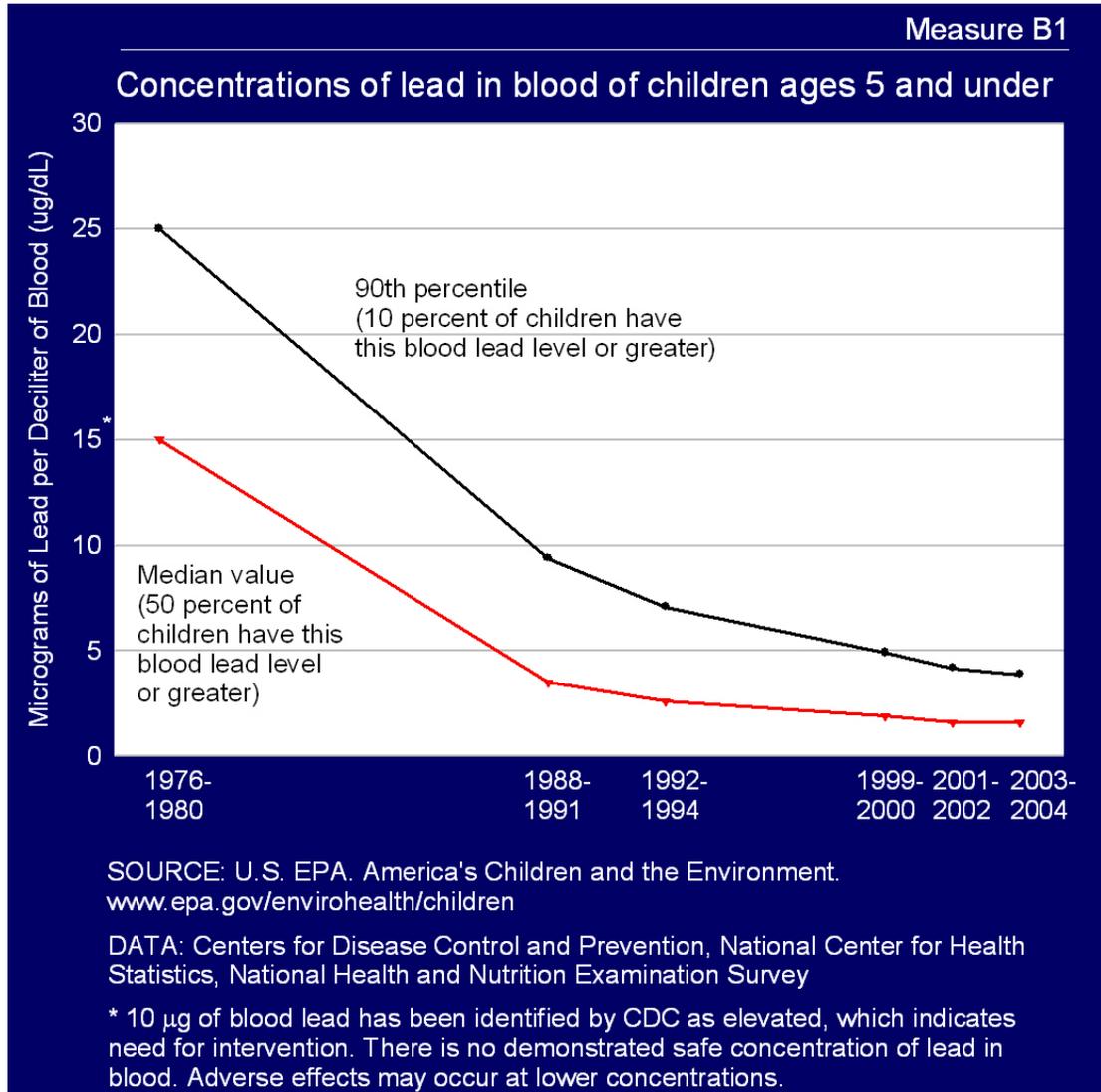
- As a result of the permanent phase-out of leaded gasoline, controls on emissions of lead compounds through EPA's air toxics program, and other national and state regulations, airborne lead concentrations in the U.S. decreased 94 percent between 1980 and 2007.

**Trend in U.S. Lead Emissions since 1980**



- EPA has also reduced lead in the environment through other programs including:
  - Standards for lead-based paint hazards and lead dust cleanup in most pre-1978 housing and child-occupied facilities (such as daycare centers)
  - Standards for managing lead in solid and hazardous waste
  - Requirements for cleanup of lead contamination at Superfund sites
  - Standards for lead in drinking water
- In addition, EPA's Lead Awareness Program works to protect human health and the environment by making people aware of the dangers of lead pollution.

# Changes in Children's Blood Lead Levels Since 1978



- Concentrations of lead in children's blood have dropped significantly, from a median level of 15  $\mu\text{g}/\text{dL}$  in the late 1970s to 1.6  $\mu\text{g}/\text{dL}$  in 2003-04 (most recent data)

## *Sources Contributing to Lead Pollution*

- More than 1,300 tons of lead are still emitted each year from about 16,000 sources, many of which emit a fraction of a ton.
- The highest levels of lead in air are generally found near lead smelters.
- Lead particles emitted into the air from sources can end up in water, soil and dust.
- Lead is a persistent pollutant, so over time the particles can re-enter the air.
- This cycling of lead in the environment means people can be exposed to lead that was emitted just yesterday or years ago.

# Sources Contributing to Lead Pollution

- Sources of lead emissions include:
  - Gasoline for piston-engine aircraft (not used in commercial passenger aircraft)
  - Metal industries
    - Lead smelting
    - Iron and steel foundries
    - Copper smelting
    - Metal mining
  - Manufacturing industries
    - Glass manufacturing
    - Cement manufacturing
  - Waste incinerators
  - Industrial/commercial/utility boilers
- Based on current information, more than 600 tons per year of lead are emitted due to use of aviation gasoline.
  - EPA received and is currently considering a petition to address lead in aviation gasoline.
  - For more information, see [www.epa.gov/otaq/aviation.htm](http://www.epa.gov/otaq/aviation.htm)

**Source Sectors of Lead Emissions in the U.S.**

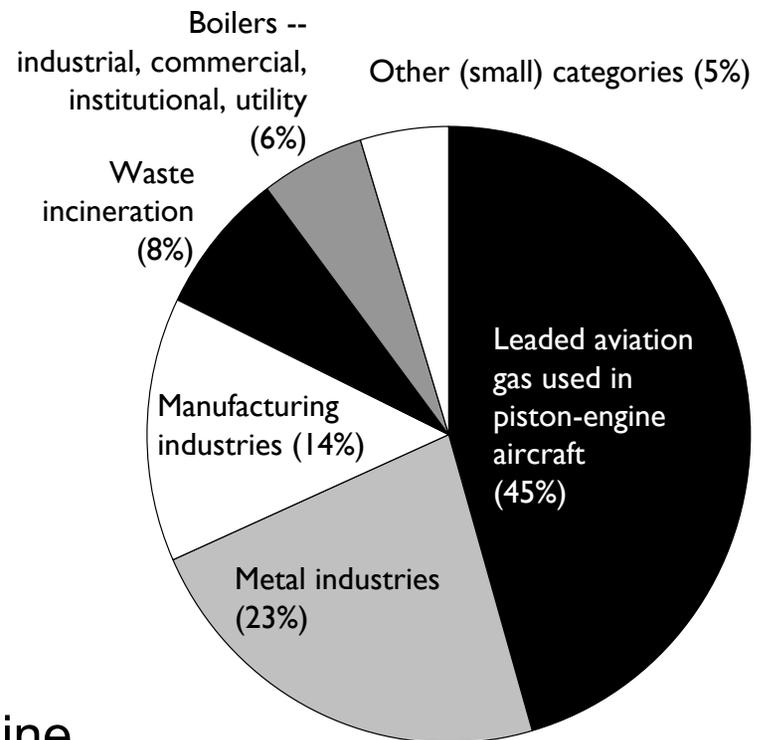


Chart based on EPA's 2002 National Emission Inventory (NEI) with modifications documented in Tom Pace's 05/01/08 memorandum and Marion Hoyer's 05/12/08 and 05/14/08 memoranda to the docket.

## *Impacts of Lead Pollution on Public Health*

- Exposure to lead pollution is associated with a broad range of health effects, including damage to the central nervous system, cardiovascular system, kidneys, immune system and red blood cells.
- Children are more likely to be exposed to lead because they exhibit greater hand-to-mouth activity.
- Children are also the most vulnerable to damaging effects of lead because their bodies are developing rapidly.
- Effects in children include:
  - Effects on developing nervous system, including the brain
    - IQ loss
    - Poor academic achievement, permanent learning disabilities, increased risk of delinquent behavior
    - Effects generally persist into early adulthood; can affect lifetime education and achievement
  - Weakened immune system
- Adults can also experience effects of lead exposure such as:
  - Increased blood pressure
  - Cardiovascular disease
  - Decreased kidney function

## ***New Health Evidence in this Review***

- More than 6,000 studies on lead health effects, environmental effects and lead in the air have been published since 1990
- Evidence from health studies shows that serious health effects occur at much lower levels of lead in blood than those recognized as harmful when the 1978 standard set
  - Strong evidence of adverse effects at blood lead levels well below 10 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ )
  - No threshold or “safe” level for lead in blood has been identified
- Large number of studies focus on effects in children, with epidemiological evidence associating elevated blood lead levels with loss of IQ and other neurocognitive effects
  - Results are remarkably consistent across numerous studies with varying designs and study populations
  - Several studies show that as children’s blood lead levels get lower, they experience a greater IQ loss as a result of a 1  $\mu\text{g}/\text{dL}$  increase in blood lead than children with higher blood lead levels

## *New Welfare Evidence in this Review*

- A significant number of new studies available since 1978 address the ways lead moves through the environment and impacts plant and animal species.
- These studies indicate lead may persist in the environment for decades, and may damage the reproduction and growth of birds, mammals, and organisms living in the soil.
- Limited available data suggest lead build-up in ecosystems may be linked to a wide variety of effects, including reduced species diversity, damage to vegetation, changes in community composition, reduced ecosystem productivity, and increased number of invasive species.
- While overall deposition rates of lead air pollution have decreased dramatically since the phase-out of leaded gasoline, lead from the air continues to deposit in aquatic and terrestrial ecosystems, contributing to lead in soils and sediments.
- Ecosystems may continue to be affected by lead when soils and sediments on land and in water are disturbed.

## *CASAC Advice and Recommendations*

- 1978 standards of  $1.5 \mu\text{g}/\text{m}^3$  quarterly average are not adequate to protect public health and welfare
- EPA should substantially strengthen the primary lead NAAQS to a level no higher than  $0.2 \mu\text{g}/\text{m}^3$
- Population loss of 1-2 IQ points is highly significant from a public health perspective
- EPA should use Pb-TSP as the indicator if the standard is set higher than  $0.10 \mu\text{g}/\text{m}^3$
- A monthly average is the most appropriate choice for the averaging time and form of the standard
  - If a quarterly average is used, CASAC supports a “rolling” three-month average as more appropriate than a calendar quarterly average
- The secondary standard should be revised to a level at least as low as that recommended for the revised primary standard

## ***Revisions to the Lead Standards: Level***

- Based on a review of the full body of the evidence, EPA has determined that the 1978 primary lead standard of  $1.5 \mu\text{g}/\text{m}^3$  is not requisite to protect public health with an adequate margin of safety.
- EPA is strengthening the primary standard to a level of  $0.15 \mu\text{g}/\text{m}^3$ .
- The strengthened standard will provide increased protection for public health, especially the health of children.
- EPA used a framework as a guide in decision making based on IQ loss in relation to children's exposure to lead in air.
  - The framework helped EPA consider the relationship between lead in the air and lead in children's blood (air-to-blood ratio), and the relationship between lead in children's blood and IQ loss (concentration response (C-R) function) in an integrated manner.
- The level of  $0.15 \mu\text{g}/\text{m}^3$  reflects the weight of scientific evidence about the relationships in the context of the framework.
- EPA is strengthening the secondary standard to be identical to the primary standard of  $0.15 \mu\text{g}/\text{m}^3$  to protect public welfare.

## ***Revisions to the Lead Standards: Averaging Time and Form***

- EPA revised the averaging time and form used to determine whether an area meets the standard.
- EPA will use a maximum (not-to-be-exceeded) rolling three-month average evaluated over a three-year period.
- Any three-month average exceeding  $0.15 \mu\text{g}/\text{m}^3$  within a three-year period will be considered a violation of the NAAQS
- More scientifically appropriate than the previous averaging time of calendar quarter
  - Rolling average gives equal weight to all three-month periods
- More health protective than the previous averaging time of calendar quarter
  - Rolling average yields 12 three-month averages each year to be compared to the NAAQS (as opposed to four averages in each year for block calendar quarters).

## *Revisions to the Lead Standards: Averaging Time and Form*

- Air agencies will determine whether an area is in compliance with the lead standards by following these steps:
  - Average three consecutive monthly averages together to get a three-month average (e.g. January-March, February-April, March-May, etc.)
  - For each three-year period, this will yield 36 three-month averages
  - Compare each three-month average to the NAAQS
    - To be in attainment, all 36 three-month averages must be below the  $0.15 \mu\text{g}/\text{m}^3$
    - If one of these averages is above  $0.15 \mu\text{g}/\text{m}^3$ , the site will violate the standard
- EPA will still require a sampling frequency of 1 in 6 days.
  - Monitoring agencies must collect one 24-hour lead sample every six days

## *Revisions to the Lead Standards: Indicator*

- EPA retains the current indicator based on measuring lead in the air using total suspended particles (TSP) monitors, reflecting evidence that lead particles of all sizes pose health risks.
- EPA will allow the use of lead-PM10 monitoring instead of lead-TSP monitoring in only certain limited circumstances
  - Lead-PM10 low-volume monitoring would be allowed where:
    - Lead is not expected to occur as large particles; and
    - A monitoring agency can demonstrate that lead concentrations are not expected to have three-month averages greater than or equal to  $0.1 \mu\text{g}/\text{m}^3$
  - If a lead-PM10 monitor measures three-month levels greater than or equal to  $0.1 \mu\text{g}/\text{m}^3$ , then the monitoring agency would have to install and operate a lead-TSP monitor within six months
  - Lead- PM10 measurements greater than the NAAQS violate the standard.

## *Revisions to the Lead Monitoring Requirements*

- EPA is expanding and redesigning the monitoring network for lead to ensure the public health protections provided by the 2008 lead standards.
- EPA is requiring:
  - Monitoring in areas near sources with lead emissions greater than or equal to 1 ton per year (tpy). According to EPA's 2002 emissions estimates, 135 sources meet this criterion.
    - This source-oriented monitoring requirement may be waived by the EPA Regional Administrator if the monitoring agency can demonstrate that the lead source will not contribute to maximum lead concentrations greater than 0.075 ug/m<sup>3</sup> (50% of the NAAQS)
  - The operation of a lead monitor in every urban area with a population of 500,000 or more. The latest population estimates indicate there are 101 such areas.
- EPA estimates that 236 new or relocated monitoring sites will be necessary to satisfy these monitoring requirements
  - Approximately half of the new monitors will be required to be operational by January 1, 2010
  - The rest of the new monitors will be required to be operational by January 1, 2011

## *Implementation of Lead Standards*

- In this rule, EPA is also defining requirements for states to clean the air in areas with levels of lead pollution that do not meet the 2008 standards.
- EPA will designate areas as “attainment,” “nonattainment” or “unclassifiable” for the 2008 lead standards after monitoring data is collected by state, local and tribal governments.
  - The Clean Air Act requires EPA to designate within two years of collecting monitoring data.
    - EPA has the discretion to extend the deadline up to one year if there is insufficient information to make designations
  - EPA intends to complete initial designations as soon as possible where data is sufficient from the existing monitoring network
  - Remaining designations, using information from the expanded lead monitoring network, will be effective no later than January 2012.
- Once an area is designated nonattainment, the Clean Air Act requires states to submit a state implementation plan (SIP) within 18 months.
- The rule includes a transitional strategy from the 1978 lead standard to the strengthened 2008 lead standard (antibacksliding).
  - EPA will retain the 1978 lead NAAQS:
    - in all existing attainment areas until one year after all initial designations are completed
    - In all existing nonattainment areas until a new SIP is submitted and approved that demonstrates attainment with the new standard

## *Timeline For Implementing Revised Lead NAAQS*

<b>Milestone</b>	<b>Date</b>
<b>Signature—Final Rule</b>	Oct. 15, 2008
<b>State Designation Recommendations to EPA</b>	No later than October 2009 (based on existing network data)
<b>Monitoring Network</b>	At least half of required sites operational by Jan. 1, 2010 (additional required sites operational by Jan. 1, 2011)
<b>Final Designations</b>	No later than effective date Jan. 1, 2012* *Based on one-year deadline extension due to insufficient information; some areas may be designated earlier based on existing data.
<b>Transitional Strategy (Antibacksliding)</b>	Revoke 1978 Pb NAAQS in pre-2009 attainment areas no later than Jan. 1, 2012
<b>Attainment Demonstration SIPs Due</b>	No later than June 2013 (18 month maximum)
<b>Attainment Date</b>	No later than January 2017 (5 year maximum)

## ***Revisions to the Lead Standards: Health Benefits and Costs***

- The Clean Air Act prohibits EPA from considering costs in setting or revising NAAQS.
- To inform the public, EPA analyzes the benefits and costs of meeting the standards as required by Executive Order 12866 and guidance from the White House Office of Management and Budget
- EPA estimates that the revised standards will yield health benefits valued between \$3.7 billion and \$6.9 billion. The benefits reflect an expected increase in lifetime earnings as a result of avoiding IQ loss.
  - To estimate the benefits, EPA used peer-reviewed studies of health and welfare effects, and peer reviewed studies of the dollar values of public health improvements.
- EPA estimates that at full implementation of the lead NAAQS in 2016, the costs in that year will be approximately \$150 million to \$2.8 billion.
  - To estimate the costs, EPA analyzed the cost of using both existing controls and controls that may be developed in the future for reducing lead from industrial sources.