



# AMERICA'S CHILDREN AND THE ENVIRONMENT

OCTOBER 2019

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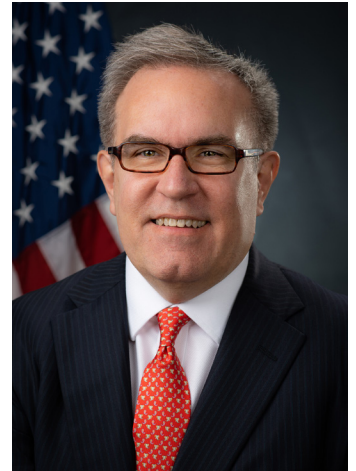
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# Letter from the Administrator

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One of the most important responsibilities of the U.S. Environmental Protection Agency is ensuring that children are safe from environmental hazards where they live, learn, and play. We know that children are especially vulnerable to the potential health effects of many environmental hazards, which can severely and permanently impact their health and development.

In order to understand the disproportionate impacts that environmental hazards have on children, EPA researchers work hard to stay ahead of emerging children's environmental health challenges. A key part of this research is to regularly update EPA's America's Children and the Environment indicators. America's Children and the Environment is a report of children's environmental health indicators that was initiated by EPA in 2000. These indicators help EPA and the public understand the progress we've made in protecting children's health, and they also identify areas that need further attention.



As part of EPA's ongoing commitment to improve our communications about environmental risks posed to children, EPA is announcing the latest updates to America's Children and the Environment. EPA regularly updates these indicators as new data becomes available. This is the most extensive update to the indicators since 2013.

This booklet highlights a selection of the updated indicators from America's Children and the Environment.

Some highlights include:

- The median concentration of lead in the blood of children between the ages of 1 and 5 years declined from 15 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) in 1976–1980 to 0.7  $\mu\text{g}/\text{dL}$  in 2015–2016, a decrease of 95%.
- From 1999 to 2017, the percentage of children living in counties with measured 24-hour average concentrations of fine particulate matter (PM<sub>2.5</sub>) above the level of the current 24-hour PM<sub>2.5</sub> standard at least once during the year decreased by 49 percent.
- The estimated percentage of children served by community drinking water systems that did meet all applicable health-based standards increased from 82% in 1993 to 94% in 2017.

The full set of America's Children and the Environment indicators is available on the America's Children and the Environment website at <https://www.epa.gov/americaschildrenenvironment>.

EPA has consistently maintained and updated this collection of children's environmental health indicators for nearly 20 years, and is committed to doing so in the years to come.

I want to thank the talented and dedicated staff at the agency who work hard every day to protect the health and future of our nation's children.

Sincerely,

A handwritten signature in black ink that reads "Andrew Wheeler". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

Andrew Wheeler  
Administrator

# Introduction

The mission of the U.S. Environmental Protection Agency (EPA) is to protect human health and the environment. Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, April 21, 1997, directs EPA and other federal agencies to “make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children.” To that end, EPA developed this report to highlight the environmental risks posed to children, the progress made in protecting children’s health, and areas for improvement.

Environmental contaminants can affect children quite differently than adults, both because children may be more highly exposed to contaminants, and because they are often more vulnerable to the toxic effects of contaminants. Children generally eat more food, drink more water, and breathe more air relative to their size than adults do, and consequently may be exposed to relatively higher amounts of environmental contaminants. Children’s normal activities, such as putting their hands in their mouths or playing on the ground, can result in exposures to environmental contaminants that adults do not face. In addition, some environmental contaminants may affect children disproportionately because their bodies are not fully developed, and their growing organs can be more easily harmed.

*America’s Children and the Environment* is EPA’s report presenting data on children and environmental health. *America’s Children and the Environment* brings together information from a variety of sources to provide national children’s environmental health indicators. This booklet presents a selection of these indicators that were updated in 2019 with newly available data. The full set of *America’s Children and the Environment* indicators is available on the *America’s Children and the Environment* website at: <https://www.epa.gov/americaschildrenenvironment>.

This report is motivated by EPA’s belief that it is valuable to be aware of, and to share with the public, information on trends in children’s environmental health. The purpose of *America’s Children and the Environment* is to compile information, and make it available to a broad audience, that can help identify areas that warrant additional attention, potential issues of concern, and persistent problems. EPA hopes that the development and presentation of these indicators will motivate continuing research, additional data collection, and, when appropriate, necessary interventions.

The first two editions of *America’s Children and the Environment* were published in 2000 and 2003, and included 17 and 21 indicators, respectively. *America’s Children and the Environment, Third Edition* was published in 2013 and presented 37 indicators. Updated indicator values for the 2013 set of indicators, based on the most current data available, have been incorporated on the *America’s Children and the Environment* website in 2015, 2017 and 2019. This is the most extensive update to the indicators since 2013.

This booklet and the EPA’s larger report on *America’s Children and the Environment* present indicators in three categories:

- Environments and Contaminants
- Biomonitoring
- Health

Each category includes several topics, and one or more indicators are presented for each topic. For example, the Environments and Contaminants category includes Criteria Air Pollutants as a topic, and the indicators for this topic present data on measured levels of air pollution. The indicators are based on data from EPA and other federal agencies that are updated in a consistent manner, so that indicator values may be compared over time.

For *America's Children and the Environment*, an indicator is defined as a summary of data on an aspect of children's or environmental health that represents the underlying data in a relevant, understandable, and technically appropriate manner. The data may represent measurements of environmental conditions, chemicals measured in the blood or urine of children and women of child-bearing age, or of the frequency of certain childhood diseases and health outcomes. Federal data on children's environmental health issues come from a variety of agencies and are often very detailed and complex; *America's Children and the Environment* brings this information together into one place and summarizes the data in graphics that convey the key information.

The *America's Children and the Environment* indicators focus on national statistics, although environmental exposures and health may vary significantly across communities. Patterns of environmental exposure may vary due to the nature and extent of pollutants found in each community. Patterns of health may vary across communities due to demographic and socioeconomic characteristics.

*America's Children and the Environment* includes topics for which scientific evidence is sufficient to conclude there is a causal relationship between exposure and health effects, as well as topics for which there is less extensive scientific evidence. Inclusion of a topic in *America's Children and the Environment*, therefore, does not imply that a cause-effect determination has been made.

Further details on the indicators and links to online resources with historical information and community-level information are available on the *America's Children and the Environment* website, <https://www.epa.gov/americaschildrenenvironment>.



# Environments and Contaminants

Pollutants or contaminants that can affect the health of children can be found in air, water, food, and soil. This category of *America's Children and the Environment* indicators describes contaminants in the air children breathe, the water they drink, and the food they eat. This category also addresses the conditions of children's environments by considering indoor environments and contaminated lands. Trends over time can indicate the successes and shortcomings of efforts to reduce potential exposures and also identify opportunities for future action.

Environments and Contaminants topics were selected for *America's Children and the Environment* based on: (1) research findings identifying environmental contaminants or characteristics that may have adverse effects on children's health; and (2) the availability of data suitable for constructing a national indicator. EPA obtained input from its Children's Health Protection Advisory Committee to assist in selecting topics from among the many contaminants and other aspects of the environment that may affect children's health. The *America's Children and the Environment* Environments and Contaminants indicators address the following topics:

- Criteria air pollutants
- Hazardous air pollutants
- Indoor environments
- Drinking water contaminants
- Chemicals in food
- Contaminated lands

This booklet presents updated indicators for criteria air pollutants, drinking water contaminants, and chemicals in food. All of these indicators now include data up through the year 2017. The most current versions of all Environments and Contaminants indicators are available at: <https://www.epa.gov/americaschildrenenvironment>.



# Criteria Air Pollutants

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Air pollution contributes to a wide variety of adverse health effects. The six most common air pollutants are called “criteria” air pollutants and include carbon monoxide, lead, ground-level ozone, particulate matter, nitrogen dioxide, and sulfur dioxide. Exposure to these pollutants has been associated with health effects like coughing and wheezing, aggravation of respiratory illnesses such as asthma, and neurodevelopmental effects (for lead). Children may be particularly susceptible to adverse effects of air pollution because their lungs and other organ systems are still developing and because they may experience higher exposure due to their activities such as outdoor play.

EPA has established national ambient air quality standards (NAAQS) for the six criteria pollutants. The standards are set at a level to protect public health, including the health of at-risk populations such as children.

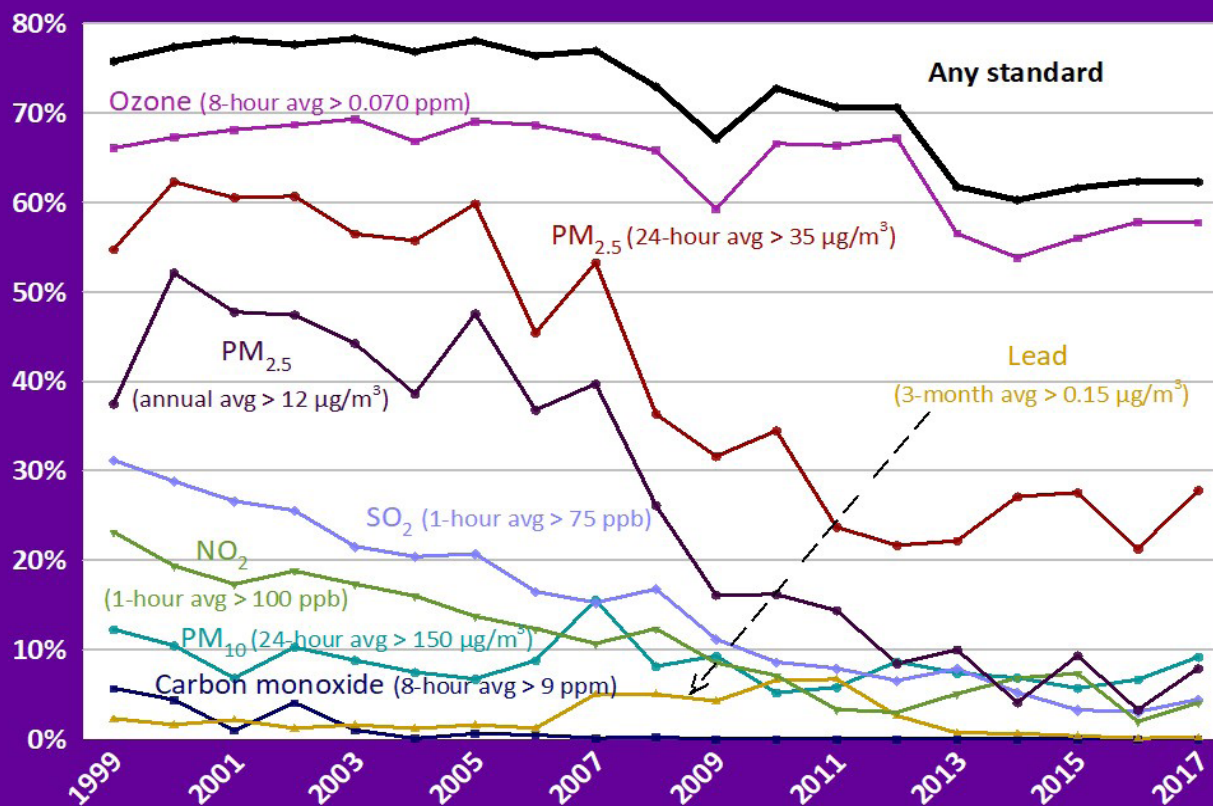
Indicator E1 presents the percentage of children ages 0 to 17 years living in counties with measured air pollutant concentrations above the levels of the current air quality standards from 1999-2017.

- The proportion of children living in counties with measured air pollutant concentrations above the levels of one or more national ambient air quality standards at least once during the year decreased from 1999 to 2017. In 1999 the percentage of children was 76%, and in 2017 it had decreased to 62%.
- The percentage of children living in counties with measured annual average concentrations of PM<sub>2.5</sub> above the level of the current annual PM<sub>2.5</sub> standard decreased from 1999 to 2017. In 1999 the percentage of children was 37%, and in 2017 it had decreased to 8%.
- The percentage of children living in counties with measured 24-hour average concentrations of fine particulate matter (PM<sub>2.5</sub>) above the level of the current 24-hour PM<sub>2.5</sub> standard at least once during the year decreased from 1999 to 2017. In 1999 the percentage of children was 55%, and in 2017 it had decreased to 28%.
- The percentage of children living in counties with measured sulfur dioxide concentrations above the level of the current one-hour standard for sulfur dioxide at least one day per year decreased from 1999 to 2017. In 1999 the percentage of children was 31%, and in 2017 it had decreased to 4%.
- The percentage of children living in counties with measured nitrogen dioxide concentrations above the level of the current one-hour standard for nitrogen dioxide at least one day per year decreased from 1999 to 2017. In 1999 the percentage was 23%, and in 2017 it had decreased to 4%.
- The percentage of children living in counties with measured ozone concentrations above the level of the current 8-hour ozone standard at least one day during the year decreased from 1999 to 2017. In 1999 the percentage was 66%, and in 2017 it had decreased to 58%.
- The percentage of children living in counties with measured carbon monoxide concentrations above the level of the current standard for carbon monoxide decreased from 1999 to 2017. The percentage of children was 6% in 1999, and in 2017 it had decreased to zero percent.
- The percentage of children living in counties with measured ambient air lead concentrations above the level of the current three-month standard for lead varied between 1999 and 2017. The percentage of children ranged between 0.1% and 7%.
- The percentage of children living in counties with measured PM<sub>10</sub> concentrations above the level of the current 24-hour standard for PM<sub>10</sub> at least one day per year varied between 1999 and 2017. The percentage of children ranged between 5% and 16%.

Further information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-environments-and-contaminants-criteria-air-pollutants>.

## Percentage of children ages 0 to 17 years living in counties with pollutant concentrations above the levels of the current air quality standards, 1999-2017



Data: U.S. Environmental Protection Agency, Office of Air and Radiation, Air Quality System

Note: Values shown represent measured pollutant concentrations above the levels of air quality standards at least once during a calendar year. Measuring concentrations above the level of a standard is not equivalent to violating the standard. The level of a standard may be exceeded on multiple days before the exceedance is considered a violation of the standard.

*America's Children and the Environment, Third Edition, Updated August 2019*

Indicator E1 presents the percentage of children living in counties where measured ambient concentrations of criteria pollutants were greater than the levels of the Clean Air Act air quality standards at any time during a year. For short-term standards based on pollutant concentrations averaged over one day or less, the indicator is based on counties with measured air pollutant concentrations above the levels of the current air quality standards at least once during a calendar year. Indicator E2 (see next page) presents information on the frequency with which 8-hour ozone and 24-hour PM<sub>2.5</sub> concentrations were measured above the levels of the air quality standards in 2017.



As shown in Indicator E1, the percentage of children living in counties with pollutant concentrations measured above the level of the NAAQS at any time during each year from 1999 to 2017 were highest for the 8-hour ozone standard and the 24-hour PM2.5 standard. However, Indicator E1 does not differentiate between counties in which pollutant concentrations were frequently above standard levels during the year and those areas in which concentrations were above standard levels only rarely. The frequency with which levels of the air quality standards are exceeded is also important to children's health.

Indicator E2 presents the percentage of children ages 0 to 17 years living in counties with 8-hour ozone and 24-hour PM2.5 concentrations above the levels of air quality standards, by frequency of occurrence, in 2017.

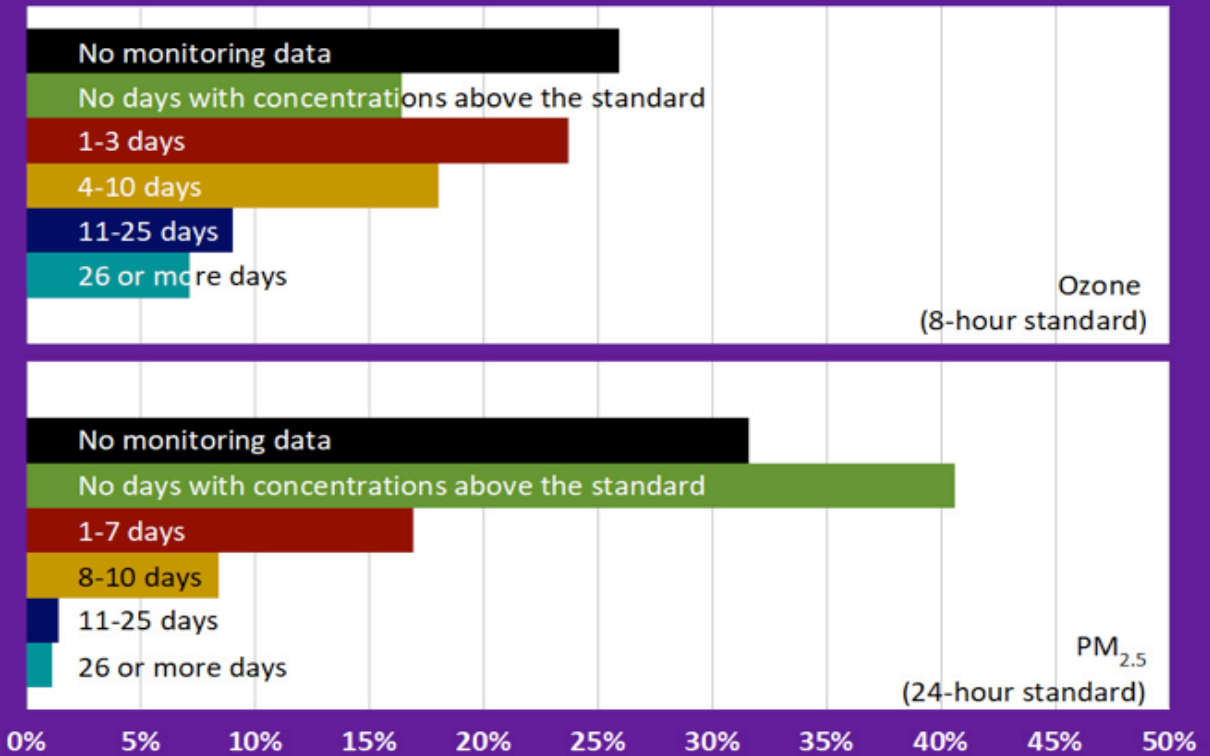
- In 1999, 6% of children lived in counties with measured PM2.5 concentrations above the level of the current 24-hour PM2.5 standard more than 25 days. An additional 11% of children lived in counties with measured concentrations above the level of this standard between 11 and 25 days, and 1% of children lived in counties with measured concentrations above the level of the 24-hour PM2.5 standard between 8 and 10 days.
- In 2017, 1% of children lived in counties with measured PM2.5 concentrations above the level of the 24-hour PM2.5 standard on more than 25 days. One percent of children lived in counties with measured concentrations above the level of this standard between 11 and 25 days, and an additional 8% of children lived in counties with measured concentrations above the level of the 24-hour PM2.5 standard between 8 and 10 days.
- In 1999, 37% of children lived in counties with measured ozone concentrations above the level of the current 8-hour ozone standard on more than 25 days. An additional 20% of children lived in counties with measured concentrations above the level of the ozone standard between 11 and 25 days, and 8% of children lived in counties where concentrations were above the level of the standard between 4 and 10 days.
- In 2017, 7% of children lived in counties with measured ozone concentrations above the level of the 8-hour ozone standard on more than 25 days. An additional 9% of children lived in counties with measured concentrations above the level of the ozone standard between 11 and 25 days, and 18% of children lived in counties where concentrations were above the level of the standard between 4 and 10 days.

Indicator values for years prior to 2017 and additional information on this indicator are available at:

<https://www.epa.gov/americaschildrenenvironment/ace-environments-and-contaminants-criteria-air-pollutants>.



Percentage of children ages 0 to 17 years living in counties with 8-hour ozone and 24-hour PM<sub>2.5</sub> concentrations above the levels of air quality standards, by frequency of occurrence, 2017



Data: U.S. Environmental Protection Agency, Office of Air and Radiation, Air Quality System

Note: EPA periodically reviews air quality standards and may change them based on updated scientific findings. Measuring concentrations above the level of a standard is not equivalent to violating the standard. The level of a standard may be exceeded on multiple days before the exceedance is considered a violation of the standard. See text for additional discussion.

*America's Children and the Environment, Third Edition, Updated August 2019*



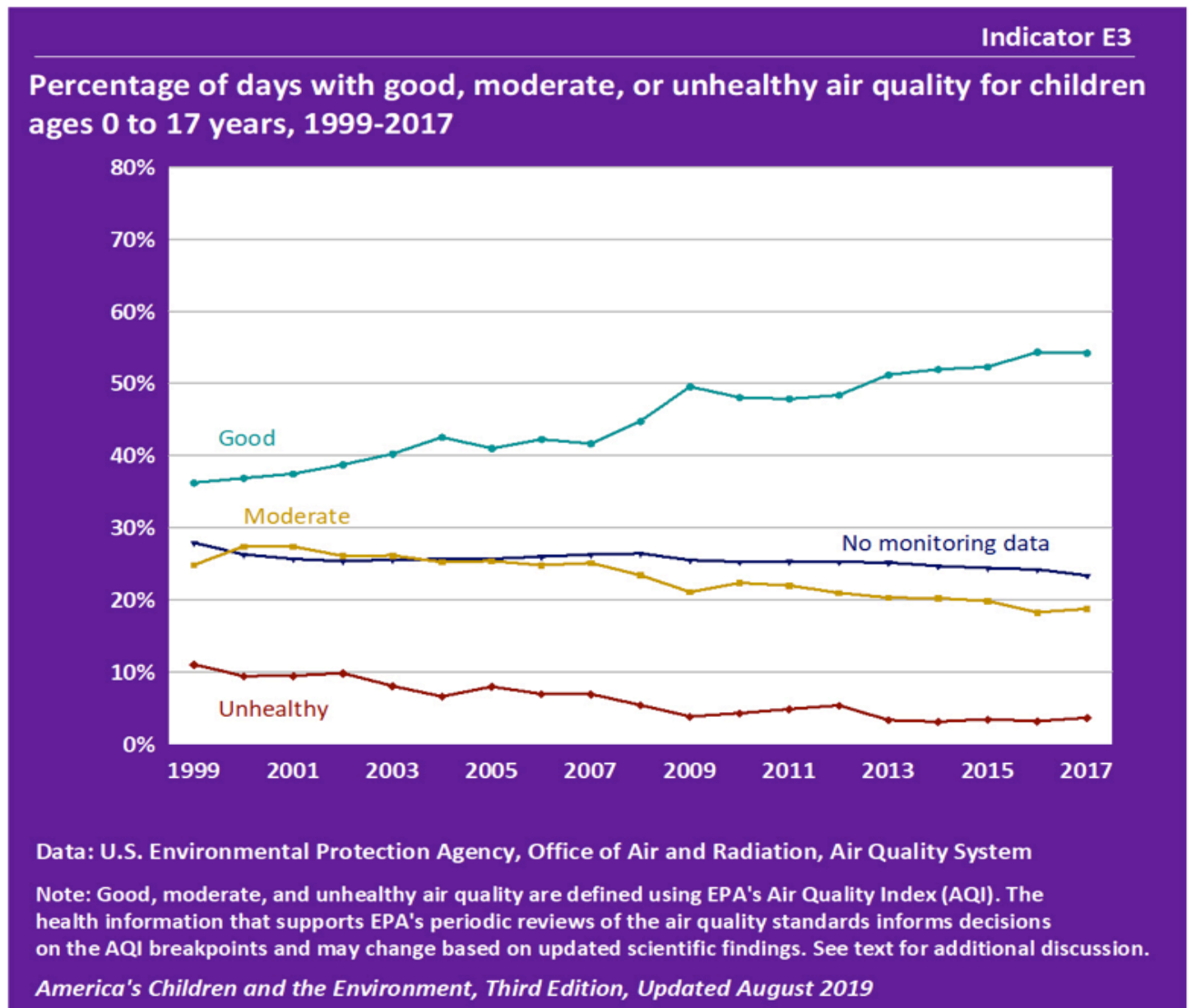
EPA's Air Quality Index (AQI) represents air quality for each individual day and is widely reported in newspapers and other media outlets in metropolitan areas. The AQI produces a rating of the air quality for each county on each day, considering all monitoring results available on that day for carbon monoxide, ozone, nitrogen dioxide, particulate matter, and sulfur dioxide. Daily air quality in each county is classified as "good," "moderate," or "unhealthy" based on the monitored pollutant concentrations.

Indicator E3 presents the percentage of days rated good, moderate, or unhealthy air quality for children ages 0 to 17 years from 1999-2017.

- The percentage of children's days with "good" air quality increased from 36% in 1999 to 54% in 2017.
- The percentage of children's days with "moderate" air quality decreased from 25% in 1999 to 19% in 2017.
- The percentage of children's days that were designated as having "unhealthy" air quality decreased from 11% in 1999 to 4% in 2017.

Further information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-environments-and-contaminants-criteria-air-pollutants>.



# Drinking Water Contaminants

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Many drinking water contaminants may be of concern for children's health. Examples include microorganisms, (e.g., *E. coli*, *norovirus*, and *Giardia*), inorganic chemicals (e.g., lead, arsenic, nitrates, and nitrites), organic chemicals (e.g., atrazine, glyphosate, trichloroethylene, and tetrachloroethylene), and disinfection byproducts (e.g., chloroform). These contaminants and others may be associated with increased risk of a range of diseases in children, including acute diseases such as gastrointestinal illness, developmental effects such as learning disorders, endocrine disruption, and cancer. EPA sets enforceable drinking water standards for public water systems. The drinking water standards include Maximum Contaminant Levels (MCLs) and treatment technique requirements for more than 90 chemical, radiological, and microbial contaminants, designed to protect people, including sensitive populations such as children and pregnant women, against adverse health effects.

Indicator E7 presents the percentage of children ages 0 to 17 years served by community water systems that did not meet all applicable health-based drinking water standards from 1993-2017. Community water systems are public water systems that serve water to the same residential population year-round. This indicator does not account for the approximately 13% of the U.S. population served by non-public water systems, such as privately-owned household wells, that are not required to monitor or report the quality of drinking water to EPA.

In addition, this indicator does not provide a direct measure of children's exposure to drinking water contaminants and does not give an indication about how drinking water violations are related to health risks. A violation of a health-based standard represents a potential concern for children's health, but the importance of any violation depends on the particular contaminant, the magnitude and duration of the violation, and the extent of the violation within a system.

- The estimated percentage of children served by community drinking water systems that did not meet all applicable health-based standards declined from 18% in 1993 to 6% in 2017.
- Total coliforms indicate the potential presence of harmful bacteria, viruses and other microbiological contaminants associated with infectious illnesses. The estimated percentage of children served by community drinking water systems that did not meet the health-based standard for total coliforms was about 9% in 1993 and 0.4% in 2017.
- New regulatory requirements for surface water treatment were implemented in 2002. The estimated percentage of children served by community drinking water systems that did not meet surface water treatment standards varied between 1% and 5% from 2002 to 2017.
- A new standard for disinfection byproducts was adopted in 2001. The estimated percentage of children served by community water systems that had violations of the disinfection byproducts standard declined from 3% in 2003 to about 2% in 2017.

Further information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-environments-and-contaminants-drinking-water-contaminants>.

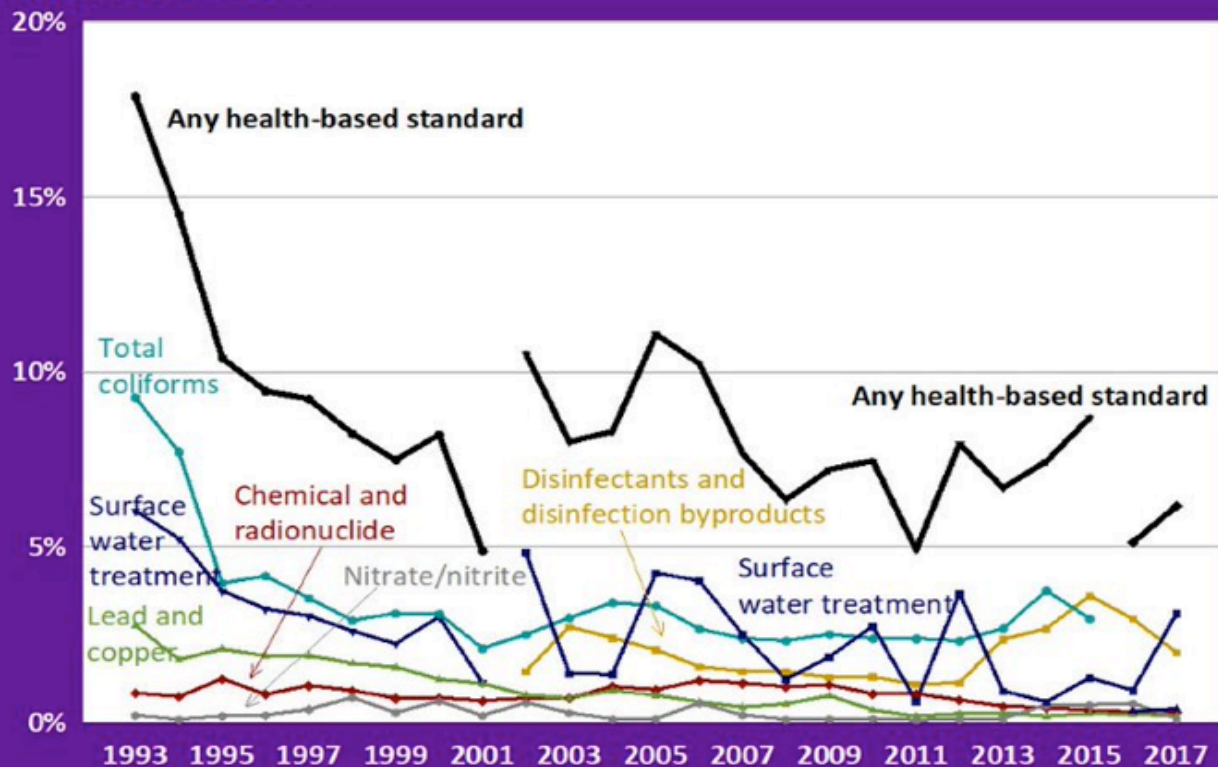
Earlier this month, EPA announced its proposal for the first major overhaul of the Lead and Copper Rule since 1991. We know a lot more now than we did in the 90s about the impact of lead in drinking water, especially on children. That is why our proposal takes a proactive and holistic approach, including a suite of new actions to identify and address the areas most impacted by lead exposure.

For example, we are proposing that all water systems prepare and update a publicly-available lead service line inventory and collect tap samples from homes with lead service lines. This will provide a valuable catalogue of where problems exist and where they are the worst. If lead levels are found to exceed 15 parts per billion, our proposal would require water systems to find and fix the sources of these elevated levels.

We are also proposing measures to strengthen treatment requirements, improve sampling reliability, and enhance our communication with the public. Finally, we are taking concrete actions to protect those most vulnerable to the harms of lead exposure: children. We are proposing that community water systems sample drinking water outlets at each school and each child care facility served by the system. This information would be publicly available as well. This is a major new step to protect the health and future of our nation's children.

Indicator E7

**Estimated percentage of children ages 0 to 17 years served by community water systems that did not meet all applicable health-based drinking water standards, 1993-2017**



Data: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System, Federal Version

Note: Breaks in lines reflect substantial regulatory changes implemented in 2002 (surface water treatment) and 2016 (total coliforms).

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# Chemicals in Food

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Children's diets are an important pathway for exposure to some environmental chemicals and other contaminants. A wide variety of chemicals from man-made sources may be found in or on foods, typically at low levels. Chemicals in foods may come from application of pesticides to crops, from transport of chemicals in the environment, or from chemicals used in food packaging products. Chemicals of concern for children's health that are frequently found in foods include methylmercury, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), per- and polyfluoroalkyl substances (PFAS), and organophosphate pesticides.

Organophosphate pesticides can interfere with the proper function of the nervous system when exposure is sufficiently high. Since 1999, EPA has restricted the use of some organophosphate pesticides on certain food crops and around the home largely due to concerns about potential exposures of children.

Indicator E9 presents the percentage of samples apples, carrots, grapes and tomatoes, with detectable residues of organophosphate pesticides for selected years from 1998-2016.

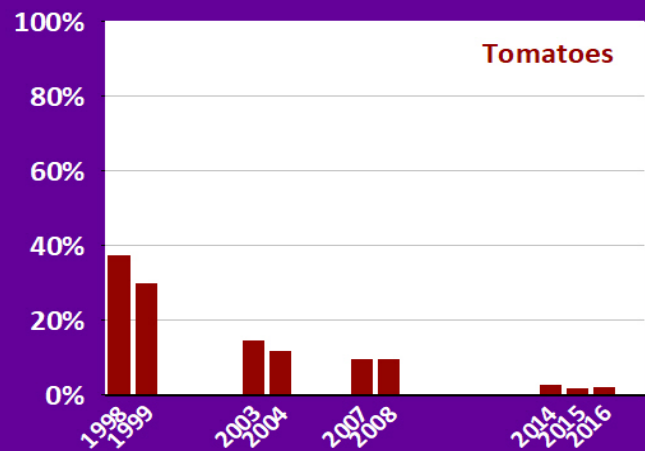
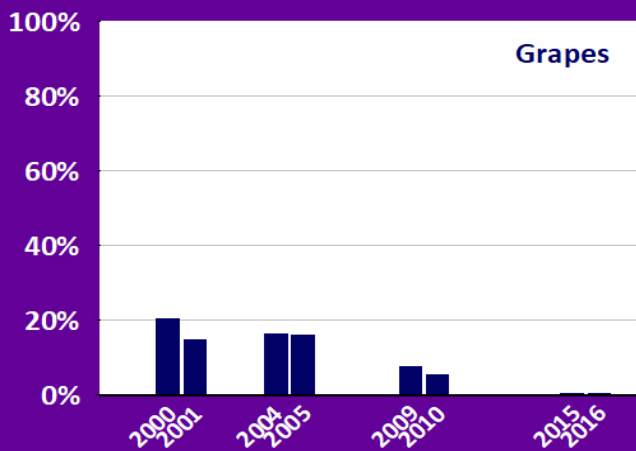
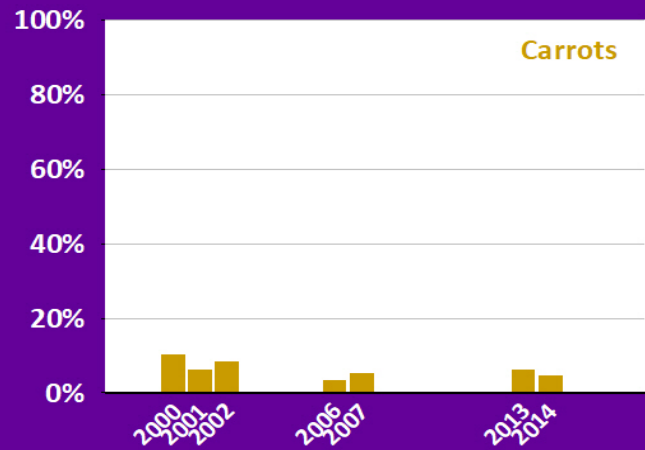
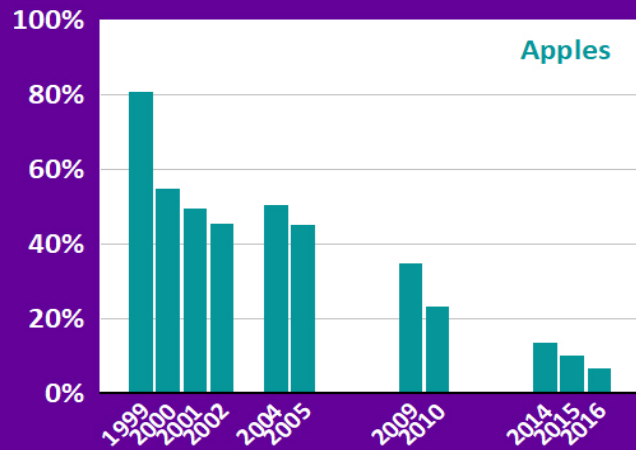
- In 1998, 37% of sampled tomatoes had detectable organophosphate pesticide residues. In 2016, 2% had detectable residues.
- In 1999, 81% of sampled apples had detectable organophosphate pesticide residues. In 2016, 6% had detectable residues.
- In 2000, 21% of sampled grapes had detectable organophosphate pesticide residues. In 2016, less than 1% had detectable residues.
- In 2000, 10% of sampled carrots had detectable organophosphate pesticide residues. In 2014, 5% had detectable residues.

Further information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-environments-and-contaminants-chemicals-food>.



Percentage of sampled apples, carrots, grapes, and tomatoes with detectable residues of organophosphate pesticides, 1998-2016



Data: U.S. Department of Agriculture, Pesticide Data Program

Note: Pesticide residues were measured only in selected years for each food.

Years without data represent missing values, rather than absence of residues.

America's Children and the Environment, Third Edition, Updated August 2019



# Biomonitoring

Biomonitoring is the measurement of chemicals in human body fluids and tissues, such as blood, urine, breast milk, saliva, and hair. Measurements of the levels of pollutants in children's bodies provide direct information about their exposures to contaminants. Measurements in women who may become pregnant, currently are pregnant, or currently are breastfeeding provide information about exposures that may affect conception, the fetus, or the developing child. The National Health and Nutrition Examination Survey (NHANES) conducted by the National Center for Health Statistics (NCHS) provides biomonitoring data from a nationally representative sample of the U.S. population for more than 200 chemicals.

Biomonitoring topics were selected for *America's Children and the Environment* based on: (1) research that indicates an association between exposure and children's health or suggests a potential association between exposure and children's health; (2) significant public interest; and (3) the nature of the biomonitoring data available from NHANES (for example, range of ages for which data are available and frequency of detection). EPA obtained input from its Children's Health Protection Advisory Committee to assist in selecting topics from among the many chemicals with biomonitoring data available. The *America's Children and the Environment* Biomonitoring indicators address the following topics:

- Lead
- Mercury
- Cotinine (a marker for environmental tobacco smoke exposure)
- Perfluorochemicals (PFCs) – also known as per- and polyfluoroalkyl substances (PFAS)
- Polychlorinated biphenyls (PCBs)
- Polybrominated diphenyl ethers (PBDEs)
- Phthalates
- Bisphenol A (BPA)
- Perchlorate

For several of the chemicals addressed by the biomonitoring indicators, including mercury and PFCs, scientific findings have reported associations between children's health and the mother's exposure during pregnancy. For this reason, some of the biomonitoring indicators present data for women of child-bearing age—defined here as ages 16 to 49 years.<sup>1</sup>

The biomonitoring indicators present median (50th percentile) values and 95th percentile values. The median is the value in the middle of the chemical's distribution: half of the measured population has levels of the chemical in their blood or urine that are greater than the median, and half has levels below the median. The 95th percentile is a value representing the upper range of levels: 5% of the specified group has levels of the chemical in their blood or urine that are greater than the 95th percentile. This value therefore can be thought of as representing a high level relative to the rest of the population, but not a maximum level.

This booklet presents updated indicators for lead, mercury and PFCs. These indicators now include data up through the year 2016. The most current versions of all biomonitoring indicators are available at:

<https://www.epa.gov/americaschildrenenvironment>.

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<sup>1</sup> Adjustments were applied in calculating the population distribution of women ages 16 to 49 years to incorporate birth rates specific to age and race/ethnicity. These adjustments give greater weight to women of ages more likely to give birth, and reduce the contribution to the calculated indicator values of women of ages less likely to give birth (e.g., those ages 40 to 49 years). Without the birth rate adjustment, the indicator values would be calculated as if all women ages 16 to 49 years are equally likely to give birth.



# Lead

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Lead is a metal used in the production of fuels, paints, and a variety of consumer products. The use of leaded gasoline and lead-based paint was eliminated or restricted in the United States beginning in the 1970s, substantially reducing exposure to lead. However, children continue to be exposed to lead due to the widespread distribution of lead in the environment, including lead-contaminated house dust resulting from deteriorated or disrupted lead-based paint. Drinking water can also be an exposure route of concern, as illustrated by recent problems with lead in drinking water in Flint, Michigan and Newark, New Jersey.

Lead is particularly dangerous to children because their developing brains and nervous systems are more sensitive to the damaging effects of lead, which include effects on learning and behavior. Babies and young children can also be more highly exposed to lead from house dust and soil because they often put their hands and other objects into their mouths. A blood lead level of 5 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) is defined as “elevated” for purposes of identifying children for follow-up activities such as environmental investigations and ongoing monitoring, but no level of childhood lead exposure is considered safe, as per the Centers for Disease Control and Prevention.

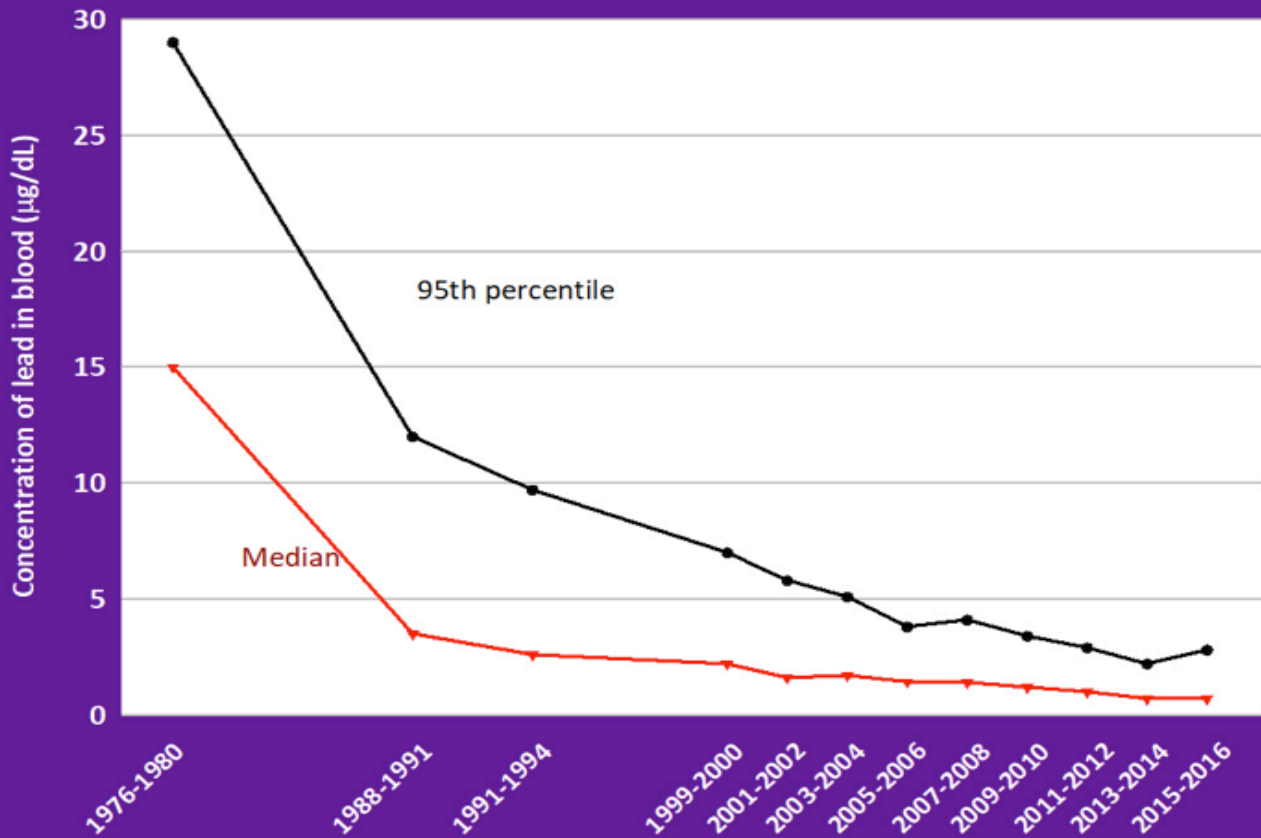
Indicator B1 presents concentrations of lead in blood of children ages 1 to 5 from 1976-2016.

- The median concentration of lead in the blood of children between the ages of 1 and 5 years declined from 15  $\mu\text{g}/\text{dL}$  in 1976–1980 to 0.7  $\mu\text{g}/\text{dL}$  in 2015–2016, a decrease of 95%.
- The concentration of lead in blood at the 95th percentile in children ages 1 to 5 years declined from 29  $\mu\text{g}/\text{dL}$  in 1976–1980 to 2.8  $\mu\text{g}/\text{dL}$  in 2015–2016, a decrease of 90%.

Further information on this indicator is available at: <https://www.epa.gov/americaschildrenenvironment/ace-biomonitoring-lead>.



### Lead in children ages 1 to 5 years: Median and 95th percentile concentrations in blood, 1976-2016



Data: Centers for Disease Control and Prevention, National Center for Health Statistics and National Center for Environmental Health, National Health and Nutrition Examination Survey *America's Children and the Environment, Third Edition, Updated August 2019*



# Mercury

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Methylmercury is the most common organic mercury compound found in the environment. Methylmercury is formed when mercury in the atmosphere is deposited into oceans, rivers, and lakes, and converted into methylmercury by bacteria and other microorganisms.

Consumption of fish is the main way that people are exposed to methylmercury. Methylmercury exposure is of particular concern for women of child-bearing age because prenatal exposure may harm a child's developing nervous system, affecting their ability to think and learn. Although ingestion of methylmercury in fish may be harmful, nutrients naturally present in many fish are beneficial to the developing fetus. Pregnant and breastfeeding women are encouraged to consume up to 12 ounces per week of a variety of fish that are lower in mercury, and to avoid consumption of fish species that contain high levels of mercury.

Indicator B3 presents concentrations of mercury in blood of women ages 16 to 49 years from 1999-2016.

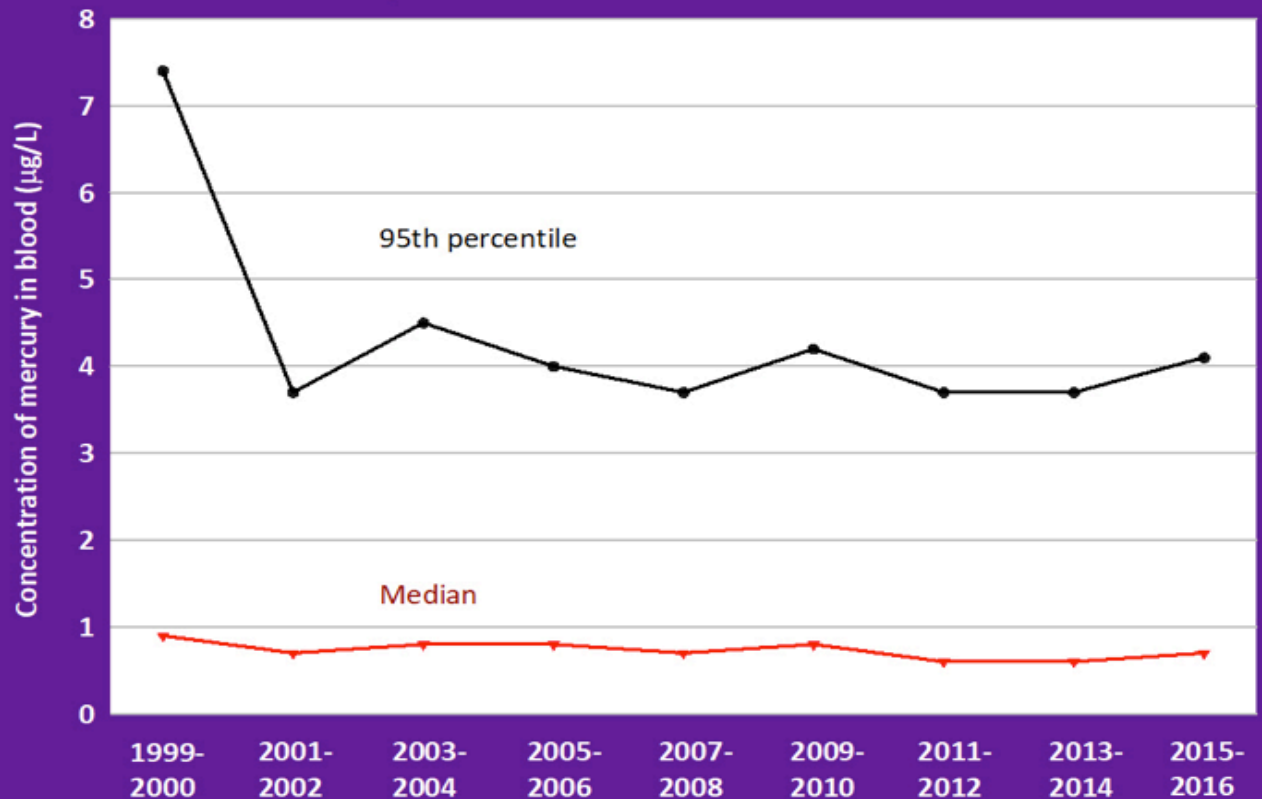
- The median concentration of total mercury in the blood of women ages 16 to 49 years decreased from 0.9 micrograms per liter ( $\mu\text{g/L}$ ) in 1999-2000 to 0.7  $\mu\text{g/L}$  in 2015-2016.
- Among women in the 95th percentile of exposure, the concentration of total mercury in blood decreased from 7.4  $\mu\text{g/L}$  in 1999-2000 to 3.7  $\mu\text{g/L}$  in 2001-2002. From 2001-2002 to 2015-2016, the 95th percentile of total blood mercury remained between 3.7 and 4.5  $\mu\text{g/L}$ .

Further information on this indicator is available at: <https://www.epa.gov/americaschildrenenvironment/ace-biomonitoring-mercury>.

According to the United Nation's 2018 Global Mercury Assessment, a much greater share of mercury deposited in North America comes from foreign sources, predominantly East Asia, than domestic sources. In North America, the share of anthropogenic mercury deposited from domestic sources is 15 percent, down from 23 percent in the 2013 assessment. For more information visit: <https://wedocs.unep.org/bitstream/handle/20.500.11822/27579/GMA2018.pdf?sequence=1&isAllowed=y>.



## Mercury in women ages 16 to 49 years: Median and 95th percentile concentrations in blood, 1999-2016



Data: Centers for Disease Control and Prevention, National Center for Health Statistics and National Center for Environmental Health, National Health and Nutrition Examination Survey

Note: To reflect exposures to women who are pregnant or may become pregnant, the estimates are adjusted for the probability (by age and race/ethnicity) that a woman gives birth.

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# Perfluorochemicals (PFCs)

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Perfluorochemicals (PFCs), also referred to as per- and polyfluoroalkyl substances (PFAS), are a group of man-made chemicals that includes perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), GenX, and many other chemicals that have been used in a variety of industries and consumer products. PFOA and PFOS have been the most extensively produced and studied of these chemicals. Both chemicals are very persistent in the environment and in the human body – meaning they don't break down and they can accumulate over time. Although PFOA and PFOS are no longer manufactured in the United States, they may continue to persist in the environment and in people for many years. People can be exposed to PFAS chemicals through food and food packaging, drinking water, indoor and outdoor air, breast milk, and house dust. Some human health studies and laboratory animal toxicology studies have found associations between prenatal exposure to PFOS or PFOA and a range of developmental health effects including adverse birth outcomes, such as reduced birth weight.

Indicator B6 presents concentrations of PFCs in blood serum of women ages 16 to 49 years from 1999-2016.

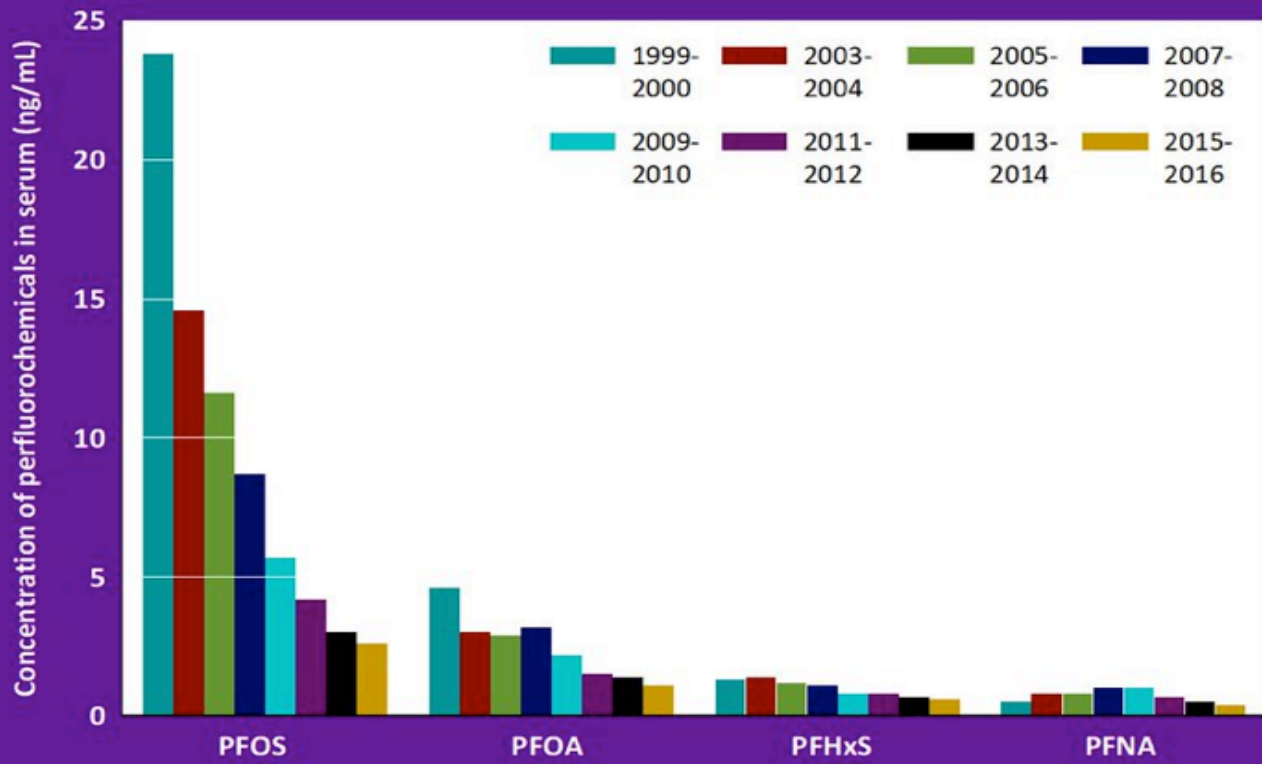
- Median blood serum levels of PFOS in women of child-bearing age declined from 24 nanograms per milliliter (ng/mL) in 1999-2000 to 3 ng/mL in 2015-2016.
- Median blood serum levels of PFOA in women of child-bearing age declined from 5 ng/mL in 1999-2000 to 1 ng/mL in 2015-2016.
- Median levels of perfluorohexane sulfonic acid (PFHxS) in women of child-bearing age decreased from 1.3 ng/mL in 1999-2000 to 0.6 ng/mL in 2015-2016.
- Median blood serum levels of perfluorononanoic acid (PFNA) in women of child-bearing age increased from 0.5 ng/mL in 1999-2000 to 1.0 ng/mL in 2009-2010, and then decreased to 0.4 ng/mL in 2015-2016.
- The concentration of PFOS in blood serum at the 95th percentile in women of child-bearing age decreased from 50 ng/mL in 1999–2000 to 8 ng/mL in 2015–2016. The concentration of PFOA in blood serum at the 95th percentile in women of child-bearing age decreased from 8 ng/mL in 1999-2000 to 3 ng/mL in 2015–2016.

The 95th percentile concentrations of PFCs and additional information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-biomonitoring-perfluorochemicals-pfcs>.



Perfluorochemicals in women ages 16 to 49 years: Median concentrations in blood serum, 1999-2016



Data: Centers for Disease Control and Prevention, National Center for Health Statistics and National Center for Environmental Health, National Health and Nutrition Examination Survey

Note: To reflect exposures to women who are pregnant or may become pregnant, the estimates are adjusted for the probability (by age and race/ethnicity) that a woman gives birth.

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# Health

The central goal of efforts to protect children's environmental health is the reduction of disease, disability, and mortality. Many different factors contribute to children's health, including nutrition, prenatal and childhood exposure to toxins in the environment, genetics, socioeconomic status, access to medical care, and exercise. Data on children's health outcomes can provide important information about changes over time and differences between demographic groups. In particular, monitoring children's health outcomes for which causes are unknown or not well established can help stimulate hypotheses, some of which may point to environmental factors, which then can be examined rigorously in future studies.

Health outcomes were selected for *America's Children and the Environment* Indicators based on: (1) magnitude of prevalence and/or trend in prevalence, and severity of health outcome; (2) research findings that indicate environmental contaminants or characteristics may be contributing factors; and (3) the availability of nationally representative data suitable for constructing an indicator. EPA obtained input from its Children's Health Protection Advisory Committee to assist in selecting topics from among the many diseases and health disorders that affect children. The indicators address the following topics:

- Respiratory diseases
- Childhood cancer
- Neurodevelopmental disorders
- Obesity
- Adverse birth outcomes

For some of the selected health outcomes, the scientific evidence suggests that environmental contaminants may play a role in the development of the disease or disorder. For other health outcomes, available evidence is less clear as to whether environmental contaminants are involved. The inclusion of the selected health outcomes in *America's Children and the Environment* does not imply that environmental contaminants or other environmental factors definitely play a role in the selected health outcomes. Furthermore, the inclusion of the selected health outcomes in *America's Children and the Environment* does not imply that environmental factors, in cases where they do play a role, are the only cause of the disease or disorder. Most often, health outcomes are a result of multiple causes that may include genetics, nutrition, and socioeconomic factors, as well as prenatal and childhood exposure to environmental contaminants, and other environmental factors.

This booklet presents updated indicators for respiratory diseases (percentage of children with asthma, through 2017) and childhood cancer (cancer incidence and mortality through 2016). The most current versions of all health indicators are available at: <https://www.epa.gov/americaschildrenenvironment>.



# Respiratory Diseases

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Respiratory diseases and illness, such as asthma, bronchitis, pneumonia, allergic rhinitis, and sinusitis, can greatly impair a child's ability to function and are an important cause of missed school days and limitations of activities. Asthma is a disease of the lungs that can cause wheezing, difficulty in breathing, and chest pain. It is one of the most common chronic diseases among children. Asthma varies greatly in severity. Some children who have been diagnosed with asthma may not experience any serious respiratory effects. Other children may have mild symptoms or may respond well to management of their asthma, typically through the use of medication. Some children with asthma may, however, suffer serious attacks that greatly limit their activities, result in visits to emergency rooms or hospitals, or, in rare cases, cause death. Environmental factors such as air pollution and secondhand tobacco smoke, along with infections, exercise, and allergens, can trigger asthma attacks in children who have the disease.

Indicator H1 presents the percentage of children ages 0 to 17 years with asthma from 1997-2017.

- The proportion of children reported to currently have asthma increased from 8.7% in 2001 to 9.4% in 2010, and then decreased to 8.4% in 2017.
- In 1997, 5.5% of all children were reported to have had one or more asthma attacks in the previous 12 months. The rate decreased to 4.6% in 2017.
- In 2001, 61.7% of children with current asthma had one or more asthma attacks in the previous 12 months, and by 2017 this figure had declined to 51.6%.

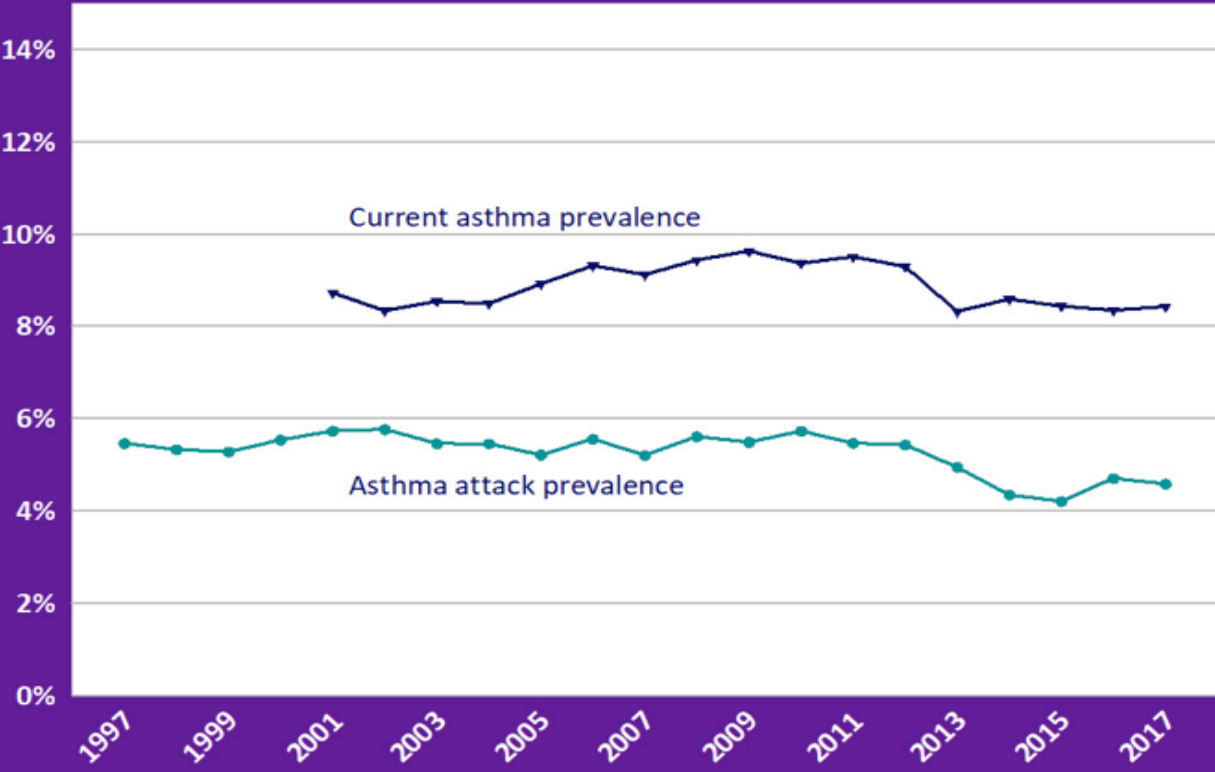
Further information on this indicator is available at:

<https://www.epa.gov/americaschildrenenvironment/ace-health-respiratory-diseases>.





### Percentage of children ages 0 to 17 years with asthma, 1997-2017



Data: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey

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# Childhood Cancer

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Cancer in childhood is rare compared with cancer in adulthood, but still causes more deaths than any factor, other than injuries, among children from infancy to age 15 years. The annual incidence of childhood cancer has increased over the last 35 years; however, childhood cancer mortality has declined due largely to improvements in treatment.

The causes of cancer in children are poorly understood, though in general it is thought that different forms of cancer have different causes. Established risk factors for the development of childhood cancer include family history, specific genetic syndromes (such as Down syndrome), high levels of radiation, and certain pharmaceutical agents used in chemotherapy. A number of studies suggest that environmental contaminants may play a role in the development of childhood cancers. The majority of these studies have focused on pesticides and solvents, such as benzene.

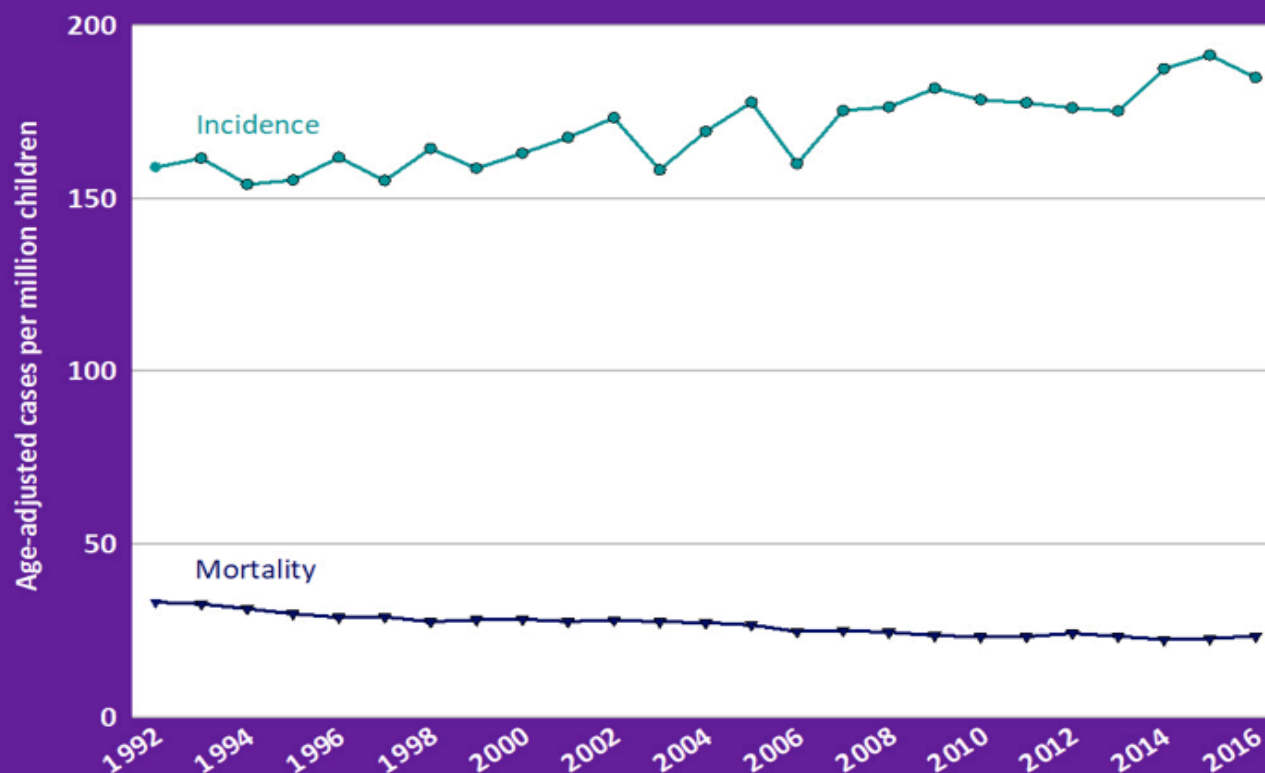
Indicator H4 presents cancer incidence and mortality for children ages 0 to 19 years from 1992-2016.

- The age-adjusted annual incidence of cancer ranged from 154 to 161 cases per million children between 1992 and 1994 and from 185 to 191 cases per million children between 2014 and 2016.
- Childhood cancer mortality decreased from 33 deaths per million children in 1992 to 23 deaths per million children in 2016.

Further information on this indicator is available at: <https://www.epa.gov/americaschildrenenvironment/ace-health-childhood-cancer>.



## Cancer incidence and mortality for children ages 0 to 19 years, 1992-2016



Data: National Cancer Institute, Surveillance, Epidemiology and End Results Program

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## Conclusion

This report presents a selection of indicators of environmental risks posed to children.

All indicators in this booklet have been updated to include the most current data available at this time - up through either 2016 or 2017, depending on the indicator. EPA will continue to periodically update the America's Children and the Environment indicators as more current data become available.

For additional data used to develop this report, go to: <https://www.epa.gov/americaschildrenenvironment>.

To learn more about what EPA is doing to protect children's health, visit: <https://www.epa.gov/children>.



[www.epa.gov/americaschildrenenvironment](http://www.epa.gov/americaschildrenenvironment)

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