Children's Health and the Environment in North America

A First Report on Available Indicators and Measures

Country Report: United States

Prepared by the US Environmental Protection Agency

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Executive Summary

Children's Health and the Environment in North America: A First Report on Available Indicators and Measures is the United States' contribution to the development of children's environmental health indicators for North America. Children's environmental health indicators provide quantitative information that can improve understanding of children's health and the environment. The aim is to increase awareness of the relationship between environmental issues and children's health and to provide a means of measuring trends, assist in assessing the effectiveness of interventions and policy, and help identify priorities for further research and policies.

Context

Children under the age of 18 accounted for about 26 percent of the US population, with approximately 72 million children in 2000. Over the last decade, the overall well-being of America's children has shown gains in some areas but has declined in others. The teen birth rate is at a new low, youth are less likely to become the victims of violent crimes, and the death rate has declined for children and young teens. There has been a small increase in the percentage of low birthweight infants, the percentage of infants who die before their first birthday, and the percentage of children who are living in poverty.

Key Findings for Children's Environmental Health Indicators

Asthma and Respiratory Diseases

Outdoor Air Pollution

- The highest number of exceedances of National Ambient Air Quality Standards is consistently reported for ozone. In 1990, approximately 55 percent of children lived in counties in which the eight-hour ozone standard was exceeded on at least one day per year. In 2003, approximately 58 percent of children lived in such counties.
- The percentage of children living in counties that exceeded the annual Particulate Matter 2.5 microns or greater ($PM_{2.5}$) air quality standard decreased from 30 percent in 1999 to approximately 19 percent in 2003.
- In 1990, about 2 percent of children lived in counties that exceeded the three-month air quality standard for airborne lead. In 2003, only one county, with less than 0.1 percent of US children, had airborne lead measurements that exceeded the standard for lead.

Indoor Air Quality

- The percentage of children ages 6 and under who are regularly exposed to environmental tobacco smoke in the home decreased from 27 percent in 1994 to 11 percent in 2003.
- The percent of children ages 4 to 11 with cotinine in their blood, a marker for exposure to environmental tobacco smoke, decreased from 88 percent in 1988–94 to 64 percent in 1999–2000..

Asthma

- Between 1980 and 1996, the percentage of children with asthma ranged from 3.6 percent to 6.2 percent, representing an annual increase of 4.3 percent per year during that period.
- In 2003, about 9 percent of children reported currently having asthma. These include children with active asthma symptoms and those whose asthma is well-controlled.
- In 2003, about 13 percent of children had been diagnosed with asthma at some time in their lives, though some of those children may no longer have asthma.

Effects of Lead and Other Chemicals, Including Pesticides

Lead

- The median concentration of lead in the blood of children 5 years old and under dropped from 15 micrograms per deciliter (µg/dL) in 1976–80 to 1.7 µg/dL in 2001–2002, a decline of 89 percent.
- The decline in blood lead levels is due largely to the phasing out of lead in gasoline between 1973 and 1995 and some to the reduction in the number of homes with lead-based paint from 64 million in 1990 to 38 million in 2000. Some decline also resulted from regulations reducing lead levels in drinking water, legislation banning lead from paint, restricting the content of lead in solder, faucets, pipes, and plumbing, and elimination or reduction of lead in food and beverage containers and ceramic ware, and in products such as toys, mini-blinds, and playground equipment.
- In 1999–2000 the median blood lead level in children ages 1–5 was 2.2 µg/dL. The median blood lead level for children living in families with incomes below the poverty level was 2.8 µg/dL and for children living in families above the poverty level it was 1.9 µg/dL.
- In 1999–2000, White non-Hispanic children ages 1–5 had a median blood lead level of about 2 µg/dL, unchanged from the level in 1992–1994. In 1992–94, Black non-Hispanic children ages 1–5 had a median blood lead level of 3.9 µg/dL and in 1999–2000 they had a median blood lead level of 2.8 µg/dL. In 1992–94, Hispanic children ages 1–5 had a median blood lead level of 2.6 µg/dL and in 1999–2000 they had a median blood lead level of 2.0 µg/dL.
- In 1998–2000, 40 percent of houses in the United States had paint that had some lead in it. Twenty-five percent of houses in the United States had a significant lead based paint hazard, which could be from deteriorating paint, contaminated dust, or contaminated soil outside the house.

Industrial Releases of Chemicals

- The total industrial facilities reporting releases of the 153 "matched" chemicals decreased over the reporting period of 1998 to 2002 as did the total releases which went from 1,450,616 tonnes (metric tons) in 1998 to 1,284,757 tonnes in 2002, a decrease of 11 percent. There were reductions in releases to on-site air, water and underground injection with on-site land and off-site releases reporting the only increase. "Matched chemicals" are from a data set compiled by the CEC in which only chemicals that are reported by both Canada NPRI and the US TRI are included.

Pesticides

- Between 1994 and 2001, the percentage of food samples with detectable organophosphate pesticide residues ranged between 19 percent and 29 percent. The highest detection rates were observed during 1996 and 1997, while the lowest detection rate was observed in 2001.

Waterborne Diseases

Drinking Water

- The percentage of children served by public water systems that reported exceeding a Maximum Contaminant Level (MCL) or violated a treatment standard decreased from 20 percent in 1993 to 8 percent in 1999.
- In 1993, approximately 22 percent of children lived in an area served by a public water system that had at least one major monitoring and reporting violation. This figure decreased to about 10 percent in 1999.

Waterborne Diseases

- Between 1971 and 2000, there were 751 voluntarily reported waterborne disease outbreaks associated with drinking water from individual, non-community systems, and community water systems.

1 Introduction

Children's Health and the Environment in North America: A First Report on Available Indicators and Measures is the United States' contribution to the development of children's environmental health indicators for North America. Children's environmental health indicators provide quantitative information that can improve understanding of children's health and the environment. The aim is to increase awareness of the relationship between environmental issues and children's health and to provide a means of measuring trends, assist in assessing the effectiveness of interventions and policy, and help identify priorities for further research and policies.

Environmental contaminants can affect children quite differently than adults, both because children may be more highly exposed to contaminants and because they may be 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 contaminants. Children's normal activities, such as putting their hands in their mouths or playing on the ground, can result in exposures to contaminants that adults do not face. In addition, environmental contaminants may affect children disproportionately because their immune defenses are not fully developed and their growing organs are more easily harmed.

In June 2002, the environment ministers of Canada, Mexico and the United States, members of the Council of the Commission for Environmental Cooperation (CEC), agreed to a Cooperative Agenda to protect children from environmental risks. The Cooperative Agenda committed the three countries to selecting and publishing a core set of indicators of children's health and the environment for North America. The core set of indicators were based on the three priority areas that are associated with illness and death in North American children identified by the CEC Council:

- Asthma and Respiratory Diseases
- Effects of Lead and Other Toxics Substances
- Water-borne Diseases

A Steering Group was established from the three countries and it recommended the use of the World Health Organization's (WHO) Multiple Exposure – Multiple Effect (MEME) model (see Figure 1.1) as the guiding framework for developing children's environmental health indicators. The MEME model illustrates the complex interactions between the environment and children's health. The MEME model highlights the fact that environmental exposures and health outcomes are based on many links between the environment and health and are rarely based on simple, direct relationships. The model illustrates that environmental exposures and health outcomes are influenced by social, economic and demographic factors (context). These factors are among a number of factors that are known to influence health outcomes and are frequently referred to as determinants of health.

Figure 1.1: The MEME model

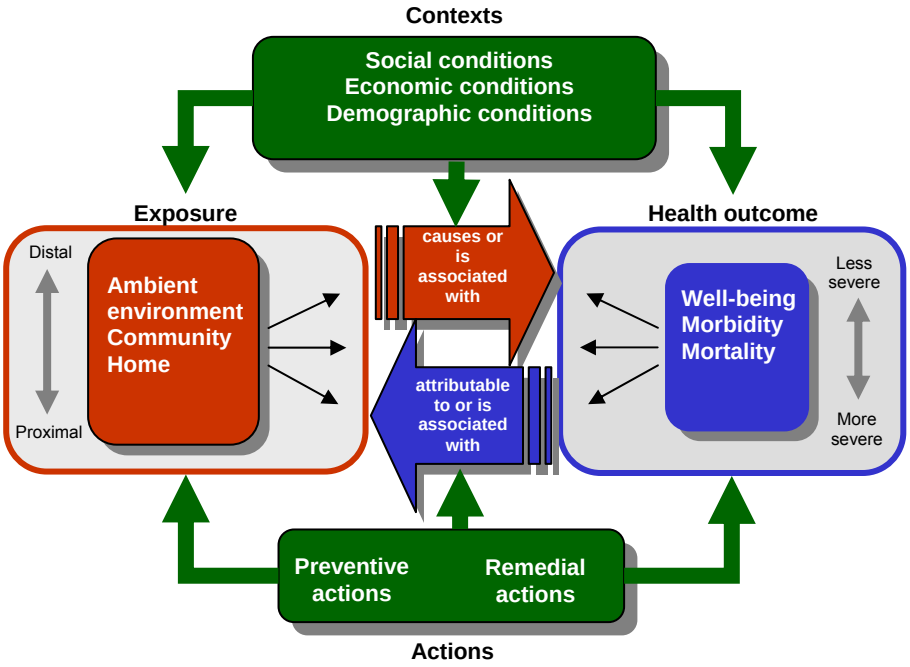


Figure 1.1:The MEME model
The Multiple Exposure-Multiple Effect (MEME) model emphasizes the many-to-many links between environment and health. Exposures, in different environmental settings (on the left) lead to many different health effects (on the right). Individual health effects (on the right) can be traced back to many different exposures (on the left). Both exposures and health outcomes—as well as the associations between them—are affected by contextual conditions, such as social, economic or demographic factors.Actions can be targeted at either exposures or health outcomes (and in the longer term, also, at the underlying contexts).[1]

The Steering Committee also recommended that the three countries report a set of initial 12 indicators of children's health and the environment based on the four priority areas identified by the CEC Council (Table 1.1). The indicators presented by the US are shown alongside.

Table 1.1: Children's health indicator priority areas identified by the CEC council, the 12 target indicators and the US indicators presented in this report

Asthma and Respiratory Disease			
Issue area	**Current Indicator**	**Purpose of Indicator**	**Indicator Used in the US Report**
Outdoor Air Pollution	Percentage of children living in areas where air pollution levels exceed relevant air quality standards	To provide information on children's potential exposures to outdoor air pollution, with a focus on common air contaminants	Percentage of children living in counties in which air quality standards were exceeded in the United States, 1990–2003
			Percentage of children's days with good, moderate, or unhealthy air quality, 1990–1999

Indoor Air Pollution	Measure of children exposed to environmental tobacco smoke (Canada, United States); measure of children exposed to emissions from the burning of biomass fuels (Mexico)	To provide information on children's potential exposures to indoor air pollution, with a focus on environmental tobacco smoke and emissions from the burning of biomass fuels	Percentage of children ages 6 and under regularly exposed to secondhand smoke in US homes, 1994–2003
			Percentage of children ages 4-11 with detectable blood cotinine by race and ethnicity, 1988–94 and 1999–2000
Asthma	Prevalence of asthma in children	To track asthma in children	Percentage of children with asthma in the United States, 1980–2003
			Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, 1997–2000
Effects of Exposure to Lead and Other Toxic Substances			
Issue area	**Current Indicator**	**Purpose of Indicator**	**Indicator Used in the US Report**
Lead Body Burden	Blood lead levels in children	To provide information on children's exposure to lead	Concentrations of lead in the blood of children five and under in the United States, 1976–2002
			Distribution of concentrations of lead in blood of children ages 1-5 in the United States, 1999–2000
			Median concentrations of lead in blood of children ages 1-5, by race/ethnicity and family income, 1999–2000
Lead in the Home	Percentage of children living in homes with a potential source of lead	To provide information on children's potential exposure to sources of lead in the home	Lead in US housing, 1998–2000
Industrial Releases of Lead	Pollutant release and transfer register (PRTR) data on industrial releases of lead	To provide information on industrial releases of lead	On- and off-site industrial releases of lead (and its compounds) in the United States, 1995–2000

Industrial Releases of Selected Chemicals	PRTR data on industrial releases of 153 chemicals	To provide information on industrial releases of selected chemicals	On- and off-site industrial releases of matched chemicals in the United States, 1998–2002
			On- and off-site releases of matched chemicals from major industrial sources, in the United States, 1998–2002
			Total on- and off-site releases of matched chemicals, by industry sector, in the United States, 1998–2002
Pesticides	Pesticide residues on foods	To provide information on children's potential exposure to pesticides	Percentage of fruits, vegetables, and grains with detectable residues of organophosphate pesticides, 1994–2001
Waterborne Diseases			
Issue Area	**Current Indicator**	**Purpose of Indicator**	**Indicator Used in the US Report**
Drinking Water	(a) Percentage of children (households) without access to treated water (b) Percentage of children living in areas served by public water systems in violation of local standards	To provide information on the percentage of children potentially exposed to contaminants and pathogens in drinking water	Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated a treatment requirement, 1993–1999
			Percentage of children living in areas served by public water systems with major violations of drinking water monitoring and reporting requirements in the United States, 1993–1999
Sanitation	Percentages of children (households) that are not served by sanitary sewers	To provide information on the percentage of children who are potentially exposed to untreated sewage in their immediate surroundings	Not provided

Waterborne Diseases	(a) Morbidity: number of cases of childhood illnesses attributed to waterborne diseases (Canada, Mexico, United States) (b) Mortality: number of child deaths attributed to waterborne diseases (Mexico)	To provide information on children who have been sick from or have died as a result of waterborne diseases	Waterborne disease outbreaks by year and type of water system in the United States, 1971–2000

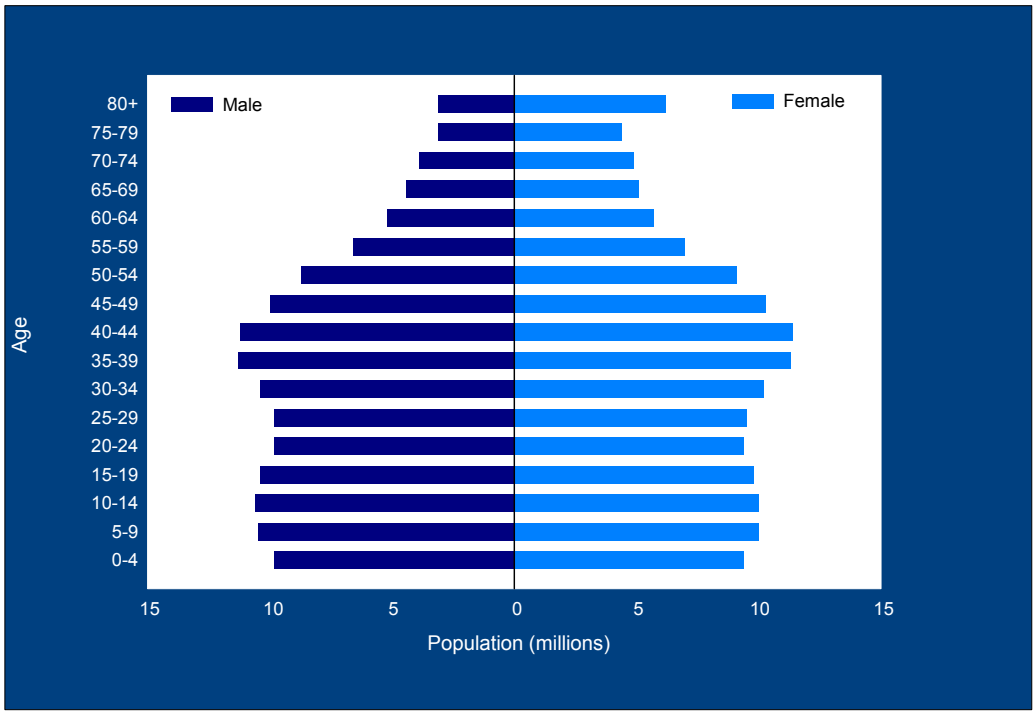
1.1 Context Indicators

The effects of environmental exposures and health outcomes are influenced by social, economic, and demographic factors. Socioeconomic factors, such as family income and parental education, can influence a child's health status. For example, children living in poverty are more likely to suffer certain health effects and may be less likely to have access to care than are children living in middle- or upper-class homes. In addition, the health status of children can influence a child's response to environmental contaminants. For example, children with existing asthma can be more sensitive to exposure to air pollution. This section provides a set of common indicators used by Canada, the United States, and Mexico to provide basic information on child well-being and demographics.

1.1.1 Overview of Population Demographics

In the United States, 28 percent of its 281 million citizens were 19 years of age or under as of 2000. (See Figure 1.2 below and Vol. 1) This is a reduction from the peak at the end of the baby boom in 1964, when children comprised 36 percent of the population. Children (defined in this report as under the age of 18, unless otherwise indicated) are projected to be 24 percent of the population by 2020.[2] The current child population in the United States is evenly distributed among the age groups 0–4, 5–9, 10–14, and 15–19. (Table 1.2)

Figure 1.2: Population Pyramid for the United States, 2000



Source: U.S. Census Bureau

The crude birth rate in the United State fell 16 percent from 16.7 births per 1,000 persons in 1990 to 14.1 in 2001. During this time, the rate declined in all by 2 years (1998 and 2000). Between 1990 and 1997, the rate fell 15 percent accounting for most of the decline. The most striking decline in birth rate has been among teenagers of ages 15 to 19, which dropped steadily since 1991 to a record low of 24.7 births per 1,000 among teenagers of ages 15 to 17 in 2002. The steepest decline has been among Black, non-Hispanic adolescents who experienced a decline of more than half between 1991 and 2002 (from 86 to 41 per 1,000, respectively). The birth rate for older teenagers also declined during this period but the decline was more moderate.[3]

Table 1.2: US Child Population by Age Group, 2000

Age	Population (millions)
0–4	19.2
5–9	20.2
10–14	20.6
15–19	20.3

Source: US Census Bureau
http://www.census.gov/cgi-bin/ipc/idbsum?cty=US

*Note that the Census does not provide an age breakdown for 18 and under to correspond with this report's definition of children.

1.1.2 Overview of Child Mortality and Morbidity

In the United States, infant mortality rates (infants are defined as less than one year old) were 6.9 deaths per 1000 live births in 2000, while child mortality for children 1 to 4 years was 0.3 per 1000 in the same year. Table 1.3 shows the leading causes of child mortality in the United States for various age groups.

The leading cause of mortality for children up to one year was congenital malformations, deformations and chromosomal abnormalities. After the first year of life, the primary cause of death for US children 1 to 17 years of age is unintentional injuries (e.g., accidents and poisonings, though homicide/suicide are included in addition to injuries for ages 15 to 19). For children 15 to 19 years of age, the leading cause of death were injuries including homicide and suicide. Table 1.4 shows the leading causes of hospitalizations. The leading cause of hospitalization for ages 1-9 years of age was respiratory disease and the leading cause of hospitalization for children 10–14 years of age was mental disorders. Lastly, for 15 to 19-year-olds, the leading cause of hospitalization in the United States was pregnancy/childbirth. Note that unless otherwise indicated, this report defines "children" as under the age of 18. Table 1.5 provides additional general indicators of children's health.

Table 1.3: Leading Causes of Child Mortality in the United States, by Age Group, 2000

Age	Top Three Causes of Mortality
0–1	1. Congenital malformations, deformations, and chromosomal abnormalities 2. Disorders related to short gestation and low birth weight 3. Sudden Infant Death Syndrome
1–4	1. Unintentional injuries 2. Birth defects 3. Cancer
5–14	1. Unintentional injuries 2. Birth defects 3. Cancer
15–19	1. Injuries (including homicide/suicide) 2. Birth defects 3. Cancer

Source:
Ages 0-1: Centers for Disease Control and Prevention, 2002, Infant mortality statistics from the 2000 period linked birth/infant death data set. National Vital Statistics Reports, 50 (12). http://www.cdc.gov/nchs/data/nvsr/nvsr50/nvsr50_12.pdf.
Ages 1-14: Federal Interagency Forum on Child and Family Statistics, *America's Children 2003* http://www.childstats.gov/ac2003/indicators.asp?IID=126&id=4;
Adolescents: Federal Interagency Forum on Child and Family Statistics, *America's Children 2003* http://www.childstats.gov/ac2003/indicators.asp?IID=130&id=4

Table 1.4: Leading Causes of Child Hospitalizations in the United States, by Age Group, 2000

Age	Top Three Causes of Hospitalizations
1–4	1. Respiratory diseases 2. Endocrine, nutritional, and metabolic diseases and immunity disorders 3. Infectious and parasitic diseases
5–9	1. Respiratory diseases 2. Diseases of the digestive system 3. Accidents
10–14	1. Mental disorders 2. Diseases of the digestive system 3. Injury
15–19	1. Pregnancy/childbirth 2. Mental disorders 3. Injury

Source: Maternal and Child Health Bureau, US Department of Health and Human Services, 2003. *Child Health USA 2002.* http://www.mchirc.net/HTML/CHUSA-02/main_pages/page_30.htm

Table 1.5: General Children's Health Indicators, 2000

	Rate	Source
Infant Mortality*	6.9 per 1,000 live births	US Centers for Disease Control and Prevention, National Center for Health Statistics http://www.cdc.gov/nchs/data/hus/tables/2003/03hus002.pdf
Perinatal Mortality**	6.9 per 1,000 live births	US Centers for Disease Control and Prevention, National Center for Health Statistics http://www.cdc.gov/nchs/data/hus/tables/2003/03hus002.pdf
Child Mortality (ages 1-4 years)	32 per 100.000 children aged 1-4 years	Federal Interagency Forum on Child and Family Statistics, *America's Children 2003* http://www.childstats.gov/ac2003/indicators.asp?IID=126&id=4
Immunization Combined series***	76%	Federal Interagency Forum on Child and Family Statistics, *America's Children 2003* http://www.childstats.gov/ac2003/tbl.asp?iid=123&id=4&indcode=HEALTH4
Measles only	91%	Federal Interagency Forum on Child and Family Statistics, *America's Children 2003* http://www.childstats.gov/ac2003/tbl.asp?iid=123&id=4&indcode=HEALTH4

*Infant death is defined as the death of a live-born child before its first birthday.
** Perinatal death is defined as death around the time of birth, including late fetal death as well as infant death within 7 days of birth.
****Vaccinations in the combined series are 4 doses of a vaccine containing diphtheria and tetanus toxoids (either diphtheria, tetanus toxoids, and pertussis vaccine [DTP] or diphtheria and tetanus toxoids vaccine [DT]), 3 doses of polio vaccine, 1 dose of a measles-containing vaccine (MCV), and 3 doses of Haemophilus influenzae type b (Hib) vaccine. The recommended immunization schedule for children is available at http://www.cdc.gov/nip/recs/child-schedule.pdf.

1.1.3 Socioeconomic Information and Other Determinants of Health

Socioeconomic factors, such as family income and parental education, are important social determinants of child health. In addition, particular racial or ethnic groups can be at higher risk for certain childhood diseases. Children who have lower socioeconomic status may also be more exposed to environmental pollutants. Similarly, children of different race and ethnic groups may be at higher risk for certain environmental hazards.

In 2000, Non-Hispanic White children made up 60.9 percent of the US child population, Hispanic children made up 17.1 percent, Non-Hispanic Black children made up 14.7 percent, Asian and Pacific Islanders made up 3.4 percent, and Native American and Alaska Natives made up 1.2 percent.[4]

In the United States, 21.7 percent of children were born to mothers with less than 12 years of education in 2000 (Table 1.6).[5] The proportion of children living in absolute poverty (living under nationally defined poverty level) in 2000 was 16.1 percent.

In 2002, the number of children under 18 in poverty was 12.1 million, up from 11.7 million in 2001. Children represented a larger share of the people in poverty (35.1 percent), than represented in the overall population (one-fourth of total population). In 2002, the poverty rate for related children under 6 was 18.5 percent, unchanged from 2001.[5]

As part of the North American Indicators effort, all three countries are reporting on the same socioeconomic information, including maternal educational level, the proportion of children living in poverty, and the percentage of the population living in urban and rural areas. In addition, racial and ethnic information is provided above, since race and ethnicity are important determinants of health.

Table 1.6: Determinants of Health

Maternal Educational Level, 2000	Proportion of Children Living in Poverty, 2000	Percentage of Population Living in Urban/Rural Areas, 2000
Less than 12 years of education: 21.7 percent of live births **At least 16 years of education:** 24.7 percent of live births	**Children living in absolute poverty (living under nationally defined poverty level):** 16.1% of total population under age 18. **Children living in relative poverty (families in the lowest income quintile):** 22.6%.	**Urban:** 79% **Rural:** 21%
Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, Birth Files. http://www.cdc.gov/nchs/data/hus/tables/2003/03hus010.pdf	Source: US Census Bureau Absolute poverty: http://ferret.bls.census.gov/macro/032001/pov/new25_003.htm Relative poverty: Calculated from Census data.	Source: US Census Bureau http://factfinder.census.gov/servlet/DTTable?ds_name=D&geo_id=D&mt_name=DEC_2000_SF1_U_P002&_lang=en

Additional indicators on child well-being that relate to health, economic, and social measures where children live can be found in *America's Children in Brief: Key National Indicators of Well-Being, 2004,* which provides a useful context on the health of America's children.[2]

2 Asthma and Respiratory Disease

2.1 Outdoor Air Pollution

Common (Criteria) Air Pollutants

Air pollution contributes to a wide variety of adverse health effects. Six of the most common air pollutants—carbon monoxide, lead, ground-level ozone, particulate matter, nitrogen dioxide, and sulfur dioxide—are known as "criteria" pollutants because the US EPA uses health-based criteria as the basis for setting permissible levels of these pollutants in the atmosphere.

EPA periodically conducts comprehensive reviews of the scientific literature on health effects associated with exposure to the criteria air pollutants. The resulting "criteria documents" critically assess the scientific literature and serve as the basis for making regulatory decisions about whether to retain or revise the National Ambient Air Quality Standards (NAAQS) that specify the allowable concentrations of each of these pollutants in the air. The standards are set at a level that protects public health with an adequate margin of safety. However, the standards are not "risk free." Even in areas that meet the standards, there may be days when unusually sensitive individuals, including children, experience health effects related to air pollution. This is especially the case for pollutants such as ozone and particulate matter that do not have discernible thresholds below which health effects are absent.

Some of the standards are designed to protect the public from adverse health effects that can occur after being exposed for a short time, such as one hour or one day. Other standards are designed to protect people from health effects that can occur after being exposed for a much longer time, such as a year. For example, current standards for carbon monoxide are for short-term periods of one hour and eight hours. By contrast, the current standard for nitrogen dioxide is for one year. Some pollutants have both short-term and long-term standards.

Ground-level Ozone

Short-term (also known as "acute") exposure to ground-level ozone can cause a variety of respiratory health effects, including inflammation of the lung, reduced lung function, and respiratory symptoms such as cough, chest pain, and shortness of breath. It also can decrease the capacity to perform exercise.[6] Exposure to ambient concentrations of ozone also has been associated with the exacerbation of asthma, bronchitis, and respiratory effects serious enough to require emergency room visits and hospital admissions.[6] Some evidence suggests that high ozone concentrations may contribute to increased mortality.[6]

Health effects associated with long-term (also known as "chronic") exposure to ozone are not as well established and documented as health effects associated with short-term exposure, but long-term exposures also are of concern. In 1996, EPA's criteria document for ozone concluded that there was insufficient evidence to determine whether health effects resulted directly from long-term exposure, although the evidence suggested that long-term ozone exposure, along with other environmental factors, could be responsible for health effects.[6] Since 1996, a few studies suggest that long-term exposure to ozone is associated with decreases in lung function in humans,[7] increased prevalence of asthma,[8] increased development of asthma in children who exercise outdoors,[9] and exacerbation of existing asthma.[10]

Particulate Matter

Particulate matter has been found to cause increased risk of mortality (death), hospital admissions and emergency room visits for heart and lung diseases, respiratory effects including incidence of asthma and other respiratory symptoms such as bronchitis, and decreases in lung function.[11] Such health effects have been associated with both short-term and long-term exposure to particulate matter. Children and adults

with asthma are considered to be among the groups more sensitive to respiratory effects.[11-15] Studies also have confirmed that chronic exposure to particulate matter is associated with mortality in adults[16-18] and suggest that it may be associated with mortality in infants.[11,19] In addition, while there is limited evidence on the potential risks from particulate matter on other important child health outcomes, such as low birthweight and preterm birth, this has been identified as an emerging area of concern.[11]

Prior to 1997, the National Ambient Air Quality Standard for particulate matter was based on particulate matter measuring 10 microns or less (PM_{10}). In 1997, the standard was revised based on scientific evidence to address the health risks from particulate matter measuring 2.5 microns or less ($PM_{2.5}$).

Lead

Lead accumulates in bones, blood, and soft tissues of the body. Exposure to lead can affect development of the central nervous system in young children, resulting in neurobehavioral effects such as reduced intelligence and cognitive development.[20-22] Studies also have found that childhood exposure to lead contributes to attention-deficit/hyperactivity disorder[23] and hyperactivity and distractibility;[24-26] increases the likelihood of dropping out of high school, having a reading disability, lower vocabulary, and lower class standing in high school;[27] and increases the risk for antisocial and delinquent behavior.[28]

Sulfur Dioxide

Sulfur dioxide poses particular concerns for those with asthma, who are considered to be especially susceptible to its effects.[29] Short-term exposures of asthmatic individuals to elevated levels of sulfur dioxide while exercising at a moderate level may result in breathing difficulties accompanied by symptoms such as wheezing, chest tightness, or shortness of breath. Effects that have been associated with longer-term exposures to high concentrations of sulfur dioxide, in conjunction with high levels of particulate matter include respiratory illness, alterations in the lung's defenses, and aggravation of existing cardiovascular diseases.

Carbon Monoxide

Exposure to carbon monoxide reduces the capacity of the blood to carry oxygen, thereby decreasing the supply of oxygen to tissues and organs such as the heart. Short-term exposure can cause effects such as reduced time to onset of angina pain, neurobehavioral effects, and a reduction in exercise performance.[30] Long-term exposure has not been studied adequately in humans to draw conclusions regarding possible chronic effects, though a recent study reported an association between long-term exposure to carbon monoxide and other traffic-related pollutants and respiratory symptoms in children.[31]

Nitrogen Dioxide

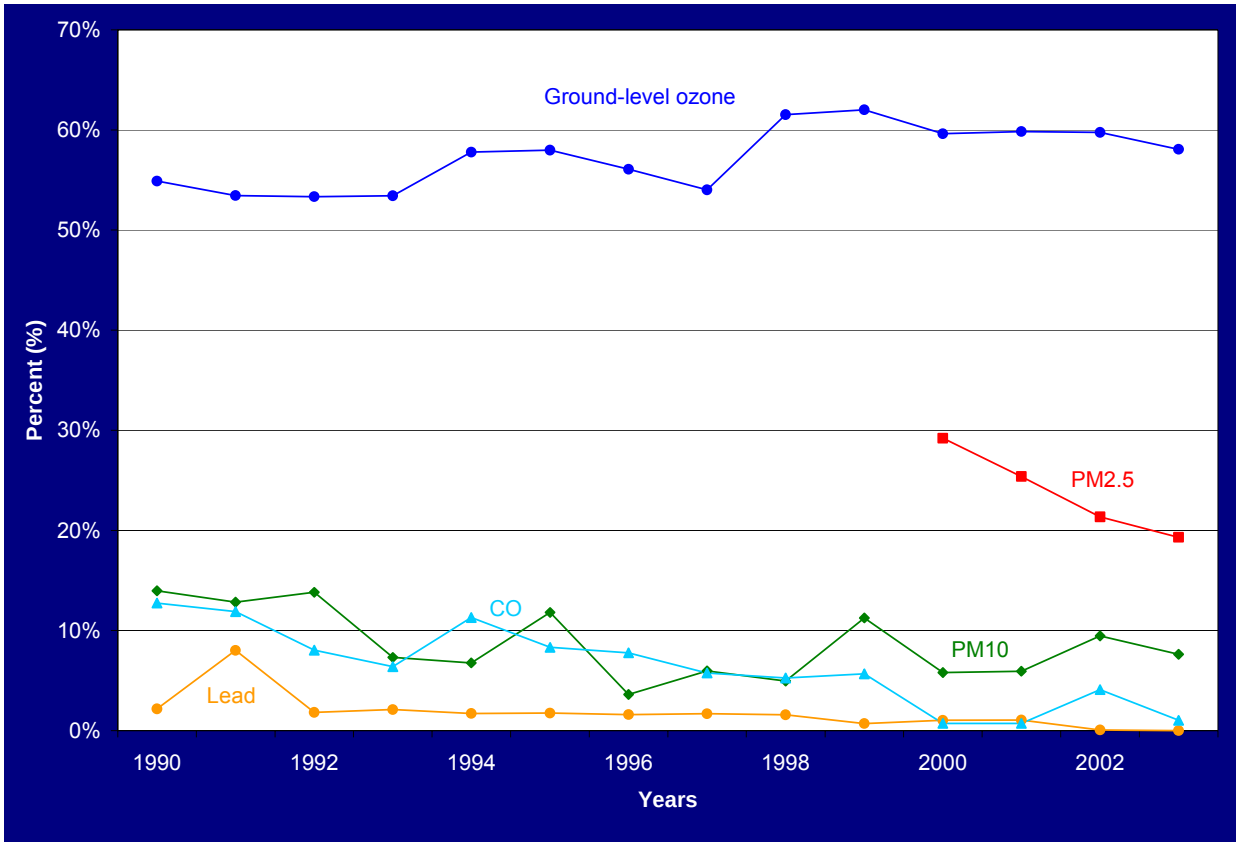
Exposure to nitrogen dioxide has been associated with a variety of health effects.[32] Effects include decreased lung function,[31,33,34] increased respiratory symptoms or illness,[12,31,35-37] and increased symptoms in children with asthma.[38] Nitrogen dioxide also is a major contributor to the formation of ground-level ozone.[6]

Percentage of Children Living In Counties in Which Air Quality Standards Were Exceeded in the United States

This indicator uses EPA air quality data from counties with monitors across the United States. One use of the monitors is to inform the public about their air quality through the Air Quality Index and National Ambient Air Quality Standards. The indicator simply shows whether the level of any standard was exceeded at any time during a year. The indicator shows the percentage of children living in counties with any such exceedances. These children may be exposed to poor daily air quality at some point during a year. The measure includes air quality data for ozone, particulate matter, lead, and carbon monoxide (nitrogen dioxide and sulfur dioxide had essentially no exceedances).

This measure does not differentiate between counties in which the indicators are exceeded frequently or by a large margin, and counties in which indicators are exceeded only rarely or by a small margin. It should be noted that this measure is slightly different from the air quality standard used by EPA to identify areas that must develop plans to lower air pollution levels. For ozone, the standard for developing further plans is based on the day with the 4th highest 8-hour average ozone concentration.

Figure 2.1: Percentage of Children Living In Counties in Which Air Quality Standards Were Exceeded in the United States, 1990–2003



Source: US Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System

Key Observations

- The highest number of exceedances is consistently reported for ground-level ozone. In 1990, approximately 55 percent of children lived in counties in which the eight-hour ozone standard was exceeded on at least one day per year. In 2003, approximately 58 percent of children lived in such counties.
- In 2000, approximately 30 percent of children lived in counties that exceeded the annual $PM_{2.5}$ standard. In 2003, approximately 19 percent of children lived in such counties. The standard for particulate matter was revised in 1997 to include $PM_{2.5}$. The standard is intended to protect against both short-term and long-term health effects.
- In 1990, approximately 13 percent of children lived in counties in which the carbon monoxide standard was exceeded. In 2003, approximately 1 percent of children lived in such counties.
- From 1990 to 2001, the percentage of children living in counties that exceeded the one-day standard for PM_{10} fluctuated, but was as high as 14 percent in 1990 and 1991, and 11 percent in 1999. The percentage remained around 6 to 9 percent during 2000–2003.
- In 1990, about 2 percent of children lived in counties that exceeded the three-month standard for lead. In 2003, only one county, with less than 0.1% of children, had airborne lead measurements that exceeded the standard for lead.
- Few exceedances of the sulfur dioxide and nitrogen dioxide standards have occurred since 1993. Consequently, they were not included on the graph.

Data Table 2.1: Percentage of Children Living in Countries in Which Air Quality Standards were Exceeded in the United States, 1990–2003

1990-1995						
	1990	**1991**	**1992**	**1993**	**1994**	**1995**
Ozone	54.9%	53.4%	53.3%	53.4%	57.8%	58.0%
PM_{10}	14.0%	12.8%	13.8%	7.3%	6.8%	11.8%
Carbon monoxide	12.7%	11.9%	8.0%	6.4%	11.3%	8.3%
Lead	2.2%	8.0%	1.8%	2.1%	1.7%	1.7%
Sulfur dioxide	0%	0%	0%	0%	0%	0%
Nitrogen dioxide	3.7%	3.7%	0%	0%	0%	0%
Any standard*	58.7%	58.1%	55.8%	55.2%	58.8%	59.8%
1996–2001						
	1996	**1997**	**1998**	**1999**	**2000**	**2001**
Ozone	56.1%	54.0%	61.5%	62.0%	59.6%	59.8%
PM_{10}	3.6%	6.0%	5.0%	11.3%	5.8%	5.9%
$PM_{2.5}$					29.2%	25.4%
Carbon monoxide	7.8%	5.8%	5.3%	5.7%	0.7%	0.7%
Lead	1.6%	1.7%	1.6%	0.7%	1.0%	1.0%
Sulfur dioxide	0%	0%	0%	0%	0%	0%
Nitrogen dioxide	0%	0%	0%	0%	0%	0%
Any standard*	56.9%	55.2%	62.5%	64.8%	64.1%	63.1%
2002–2003	**2002**	**2003**				
Ozone	59.8%	58.1%				
PM_{10}	9.5%	7.6%				

$PM_{2.5}$	21.4%	19.3%				
Carbon monoxide	4.1%	1.0%				
Lead	0.1%	0.0%				
Sulfur dioxide	0%	0%				
Nitrogen dioxide	0%	0%				
Any standard*	61.2%	60.0%				

*Does not include the $PM_{2.5}$ standard

SOURCE: US Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System

Limitations
This indicator does not differentiate between counties in which the indicators are exceeded frequently or by a large margin, and counties in which indicators are exceeded only rarely or by a small margin. It should be noted that this measure is slightly different from the air quality standard used by EPA to identify areas that must develop plans to lower air pollution levels. For ozone, the standard for developing further plans is based on the day with the 4th highest 8-hour average ozone concentration. The standards are set at a level that protects public health with an adequate margin of safety. However, the standards are not "risk free." Even in areas that meet the standards, there may be days when unusually sensitive individuals, including children, experience health effects related to air pollution. This is especially the case for pollutants such as ozone and particulate matter that do not have discernible thresholds below which health effects are absent.

Additional Indicators
In this report:

- Percentage of children's days with good, moderate, or unhealthy air quality, in the United States, 1990 – 1999
- Percentage of children with asthma, in the United States, 1980 – 2003
- Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, in the United States, 1997–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Children's emergency room visits for asthma and other respiratory causes
- Children's hospital admissions for asthma and other respiratory causes
- Percentage of children's days with good, moderate, or unhealthy air quality
- Long-term trends in annual average concentrations of criteria pollutants
- Number of children living in counties with high annual averages of PM_{10}

Opportunities for Improvement
The indicators could provide additional information to reflect the number, margin, and duration of exceedances to help distinguish among exceedances.

Related Programs/Activities
Objective 8-01 of Healthy People 2010 aims to reduce the proportion of persons exposed to air that exceeds the levels of the US Environmental Protection Agency's health-based standards for harmful air pollutants.

AIRNow, is a government-backed program and through AIRNow, EPA, the National Oceanic and Atmospheric Administration (NOAA), National Air and Space Agency (NASA) Langley Laboratory, National Park Services (NPS) Air Resources and Environment Canada, and news media, tribal, state and local agencies work together to report conditions for ozone and particle pollution. **http://www.epa.gov/airnow/**

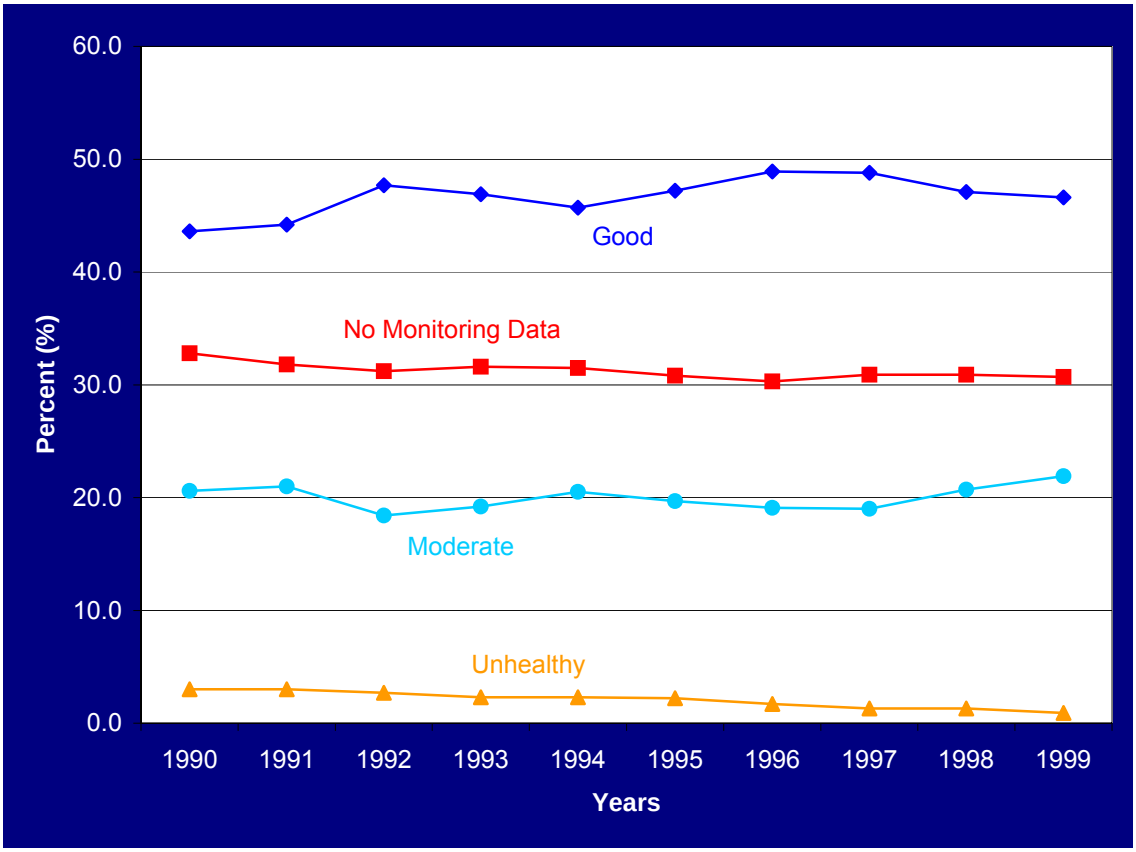
Daily Air Quality

EPA provides an Air Quality Index (AQI) that represents air quality for specific days and is widely reported in newspapers and other media outlets in metropolitan areas.

The AQI is based on measurements of up to five of the six air quality criteria pollutants (carbon monoxide, ground-level ozone, nitrogen dioxide, particulate matter, and sulfur dioxide). Lead is not included in the AQI. The specific pollutants considered in the AQI for each metropolitan area depend on which pollutants are monitored in that area. Each pollutant concentration is given a value on a scale that is related to the air quality standards for that pollutant. An AQI value of 100 for a criteria pollutant generally corresponds to the short-term National Ambient Air Quality Standard for that pollutant, and is the level EPA has set to protect public health for a single day. Above this level, pollutant-specific health advisories are issued. The daily AQI is based on the pollutant with the highest index value on the scale that day. It does not add up values for more than one pollutant. Therefore, it does not reflect the possible effects of simultaneous exposure to high levels of multiple pollutants.

EPA has divided the AQI scale into categories. Air quality is considered "good" if the AQI is between 0 and 50, posing little or no risk. Air quality is considered "moderate" if the AQI is between 51 and 100. Some pollutants at this level may present a moderate health concern for a small number of individuals. Moreover, such a level may pose health risks if maintained over many days. Air quality is considered "unhealthy for sensitive groups" if the AQI is between 101 and 150. Members of sensitive groups such as children may experience health effects, but the general population is unlikely to be affected. Air quality is considered "unhealthy" if the AQI is between 151 and 200. The general population may begin to experience health effects, and members of sensitive groups may experience more serious health effects.
Figure 2.2 is based on the reported AQI for counties of the United States. (Not all counties have air quality monitoring stations.) This indicator was developed by reviewing the air quality designation for each day for each county and weighting the daily designations by the number of children living in each county. The overall indicator reports the percentage of children's days of exposure considered to be of good, moderate, or unhealthy air quality.

Figure 2.2: Percentage of Children's Days with Good, Moderate, or Unhealthy Air Quality, in the United States, 1990–1999



Source: US Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System

Key Observations

- The percentage of days that were designated as having "unhealthy" air quality (including days that were unhealthy for everyone as well as those that were unhealthy for sensitive groups) decreased from 3 percent in 1990 to less than 1 percent in 1999. The percentage of days with "moderate" air quality remained around 20 percent between 1990 and 1999, although an upward trend is suggested by the fact that the percentage of moderate air quality days was higher in 1999 than for any other year in this analysis. As the percentage of either unhealthy or good air days decreases, the percentage of moderate days would be expected to increase.
- The coverage of monitoring for this measure, in terms of area and percentage of days monitored, was largely unchanged between 1990 and 1999. Approximately 30 percent of children's days of exposure to air pollutants were not monitored. This percentage includes days for which no AQI was reported in counties where the AQI is sometimes reported, as well as counties in which the AQI is not reported at all. On days that were monitored, in many cases only one or a few pollutants were monitored.

Data Table 2.2: Percentage of Children's Days with Good, Moderate, or Unhealthy Air Quality

1990–1995						
Pollution Level	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Good	43.6%	44.2%	47.7%	46.9%	45.7%	47.2%
Moderate	20.6%	21.0%	18.4%	19.2%	20.5%	19.7%
Unhealthy	3.0%	3.0%	2.7%	2.3%	2.3%	2.2%
No Monitoring Data	32.8%	31.8%	31.2%	31.6%	31.5%	30.8%
1996–1999						
Pollution Level	**1996**	**1997**	**1998**	**1999**		
Good	48.9%	48.8%	47.1%	46.6%		
Moderate	19.1%	19.0%	20.7%	21.9%		
Unhealthy	1.7%	1.3%	1.3%	0.9%		
No Monitoring Data	30.3%	30.9%	30.9%	30.7%		

Limitations
Not all counties have air quality monitoring stations. The AQI is based on the single pollutant with the highest value for each day; it does not reflect any combined effect of multiple pollutants. It reflects only short-term, daily pollution burdens. It does not include lead. The approach is influenced by the frequency of measurements. Because the AQI is reported daily, pollutants that are measured daily—such as ozone—will appear to have more effect than those that are measured less frequently, such as PM_{10}, which typically is measured every six days. Also, the AQI is not well-suited for reporting concentrations of nitrogen dioxide, because this pollutant does not have a short-term standard.

Additional Indicators
In this report:

- Percentage of children living in counties in which air quality standards were exceeded in the United States, 1990–2003
- Percentage of children with asthma, in the United States, 1980 – 2003
- Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, in the United States, 1997–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Children's emergency room visits for asthma and other respiratory causes
- Children's hospital admissions for asthma and other respiratory causes
- Percentage of children's days with good, moderate, or unhealthy air quality
- Long-term trends in annual average concentrations of criteria pollutants
- Number of children living in counties with high annual averages of PM_{10}
-

Opportunities for Improvement
More frequent measurement of $PM_{2.5}$ and other pollutants to include in the Air Quality Index may more accurately reflect air quality. The combination of multiple pollutants as part of an overall air quality index might better replicate the health impacts of high pollution days and provide more useful information on potential air quality hazards to sensitive populations. In addition, consideration of the potential for health risks from long-term exposures to pollutants could be incorporated into an indicator as well as expansion of monitor locations to additional counties across the US to better reflect child population exposure.

Related Programs/Activities
Objective 8-01 of Healthy People 2010 aims to reduce the proportion of persons exposed to air that exceeds the levels of the US Environmental Protection Agency's health-based standards for harmful air pollutants.

AIRNow, is a government-backed program and through AIRNow, EPA, the National Oceanic and Atmospheric Administration (NOAA), National Air and Space Agency (NASA) Langley Laboratory, National Park Services (NPS) Air Resources and Environment Canada, and news media, tribal, state and local agencies work together to report conditions for ozone and particle pollution.
http://www.epa.gov/airnow/

2.2 Indoor Air Pollution

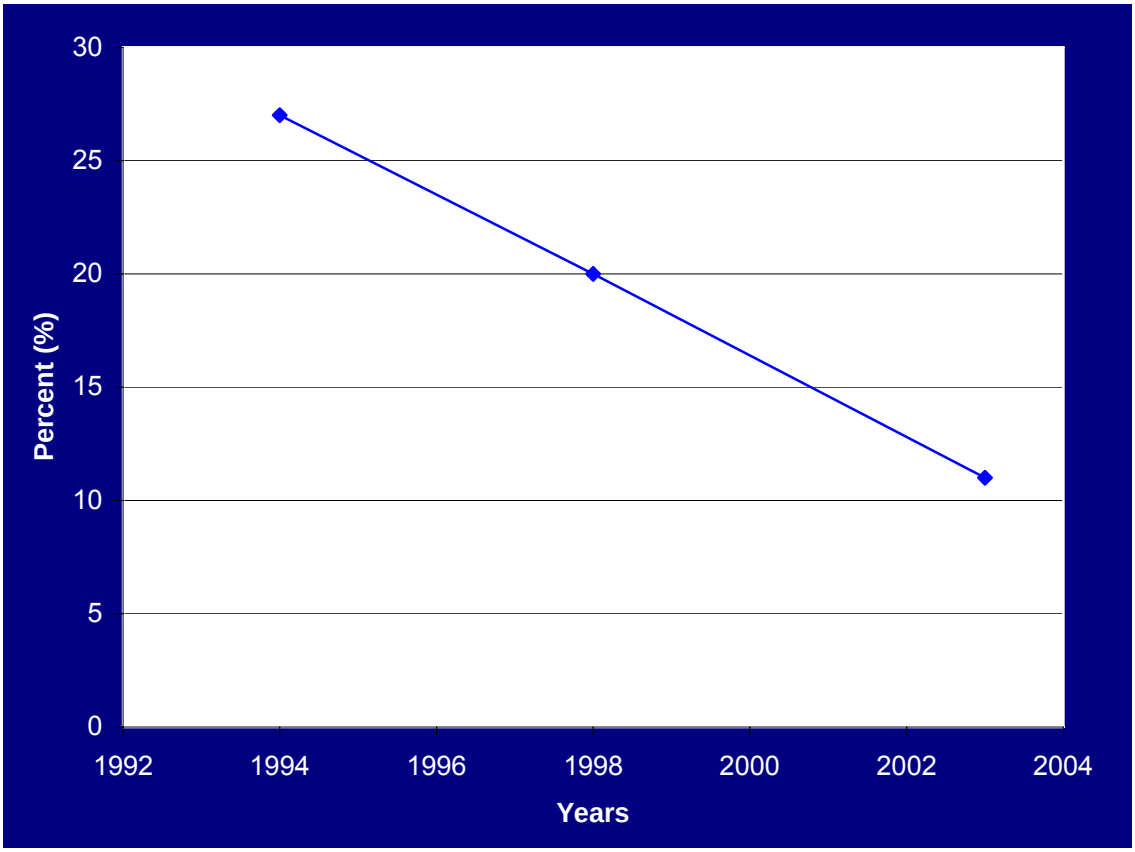
Children can be exposed to a number of air pollutants that come from sources inside homes, schools, and other buildings. Indoor sources include combustion sources such as gas stoves, fireplaces, and cigarettes; building materials such as treated wood and paints, furnishings, carpet, and fabrics; and consumer products such as sprays, pesticides, window cleaners, and laundry soap. Indoor air pollutants also can come from outside, as air pollution penetrates indoors. Information on the toxic effects of air pollutants from indoor sources indicates that they could pose health risks to children.[39,40]

Children who are exposed to environmental tobacco smoke, also known as secondhand smoke, are at increased risk for a number of adverse health effects, including lower respiratory tract infections, bronchitis, pneumonia, fluid in the middle ear, asthma symptoms, and sudden infant death syndrome (SIDS).[41-46] Exposure to environmental tobacco smoke also may be a risk factor contributing to the development of new cases of asthma.[46-48] Young children appear to be more susceptible to the effects of environmental tobacco smoke than older children are.[40,46]

Smoking in the home is an important source of exposure because young children spend most of their time at home and indoors. The measure for environmental tobacco smoke shows the percentage of homes with children ages 6 and under in which someone smokes regularly. Most often the smoker in the home is a parent.

This measure is a surrogate for the exposure of children to tobacco smoke. The data come from national surveys and are available for 1994, 1998, and 2003.

Figure 2.3: Percentage of Children Aged 6 and Under Regularly Exposed to Secondhand Smoke in US Homes, 1994–2003



Source: Data for 1994 and 1998: National Health Interview Survey. National Center for Health Statistics, Centers for Disease Control and Prevention. Data for 2003: National Survey on Environmental Management of Asthma and Children's Exposure to Tobacco Smoke. United States Environmental Protection Agency Indoor Environments Division.

Key Observations

- The percentage of children ages 6 and under who are regularly exposed to secondhand smoke in the home decreased from 27 percent in 1994 to 11 percent in 2003.

Data Table 2.3: Percentage of Children Aged 6 and Under Regularly Exposed to Secondhand Smoke in US homes, 1994–2003

1994	1998	2003
27%	20%	11%

SOURCE: 1994 and 1998: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey. 2003: US EPA, Indoor Environments Division, National Survey on Environmental Management of Asthma and Children's Exposure to Environmental Tobacco Smoke.

Limitations:

The data used for this indicator are gathered only periodically to assess progress toward Healthy People 2010 goals, and are not available on an annual basis.

Additional Indicators
In this report:

- Percentage of children aged 4-11 with detectable levels of blood cotinine by race and ethnicity, in the United States, 1988–94 and 1999–2000
- Percentage of children with asthma, in the United States, 1980 – 2003
- Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, in the United States, 1997–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Percentage of homes with children under 7 where someone smokes regularly
- Concentrations of cotinine in blood of children
- Children's emergency room visits for asthma and other respiratory causes
- Children's hospital admissions for asthma and other respiratory causes

Opportunities for Improvement
For indoor air quality in general, the most important improvement would be to add data about sources of other indoor air pollutants, such as consumer products, gas stoves, and furnishings, for both homes and schools.

For the indicator on the percentage of children ages 6 and under regularly exposed to secondhand smoke in the home, a possible improvement would be more regular reporting, such as annual or biannual instead of periodic reporting.

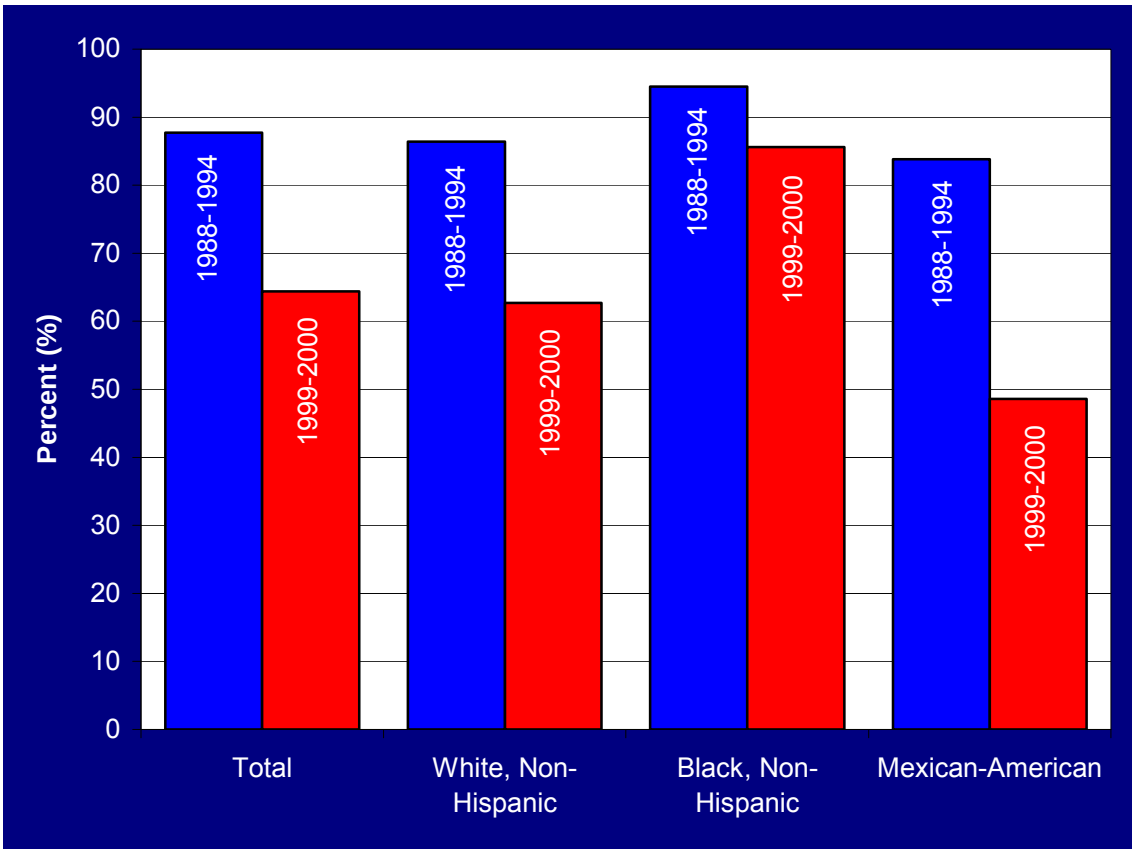
Related Programs/Activities
Objective 27-9 of the federal Healthy People 2010 initiative is to reduce the proportion of children who are regularly exposed to tobacco smoke at home.

EPA's Smoke-Free Homes initiative provides public education on the topic:
http://www.epa.gov/smokefree

Cotinine in the Blood of Children

Cotinine is a breakdown product of nicotine in blood. Measurements of cotinine in blood serum are a marker for exposure to environmental tobacco smoke in the previous 1 to 2 days.[49] Children can be exposed to ETS in their homes or in places where people are allowed to smoke, such as some restaurants. This measure presents cotinine levels for non-tobacco-users only. Children who smoke were excluded from these statistics.

Figure 2.4: Percentage of Children Aged 4-11 with Detectable Levels of Blood Cotinine by Race and Ethnicity, in the United States, 1988–94 and 1999–2000



Source: National Health and Nutrition Examination Survey. National Center for Health Statistics, Centers for Disease Control and Prevention.

Key Observations

- The percentage of children ages 4-11 exposed to environmental tobacco smoke, as indicated by detection of cotinine in their blood, decreased between 1988–94 and 1999–2000. Overall, 64 percent of children ages 4 to 11 had cotinine in their blood in 1999–2000, down from 88 percent in 1988–94.
- In 1999–2000, 86 percent of Black, non-Hispanic children ages 4 to 11 had cotinine in their blood compared with 63 percent of White, non-Hispanic children and 49 percent of Mexican American children.
- Despite the overall decrease, in 1999–2000 the median levels of cotinine in children ages 3–11 and 12-19 were more than twice as high as those of adults. (Data not shown; see the Centers for

Disease Control and Prevention, 2003, Second National Report on Human Exposure to Environmental Chemicals, http://www.cdc.gov/exposurereport/.)

Data Table 2.4: Percentage of Children aged 4–11 with Detectable Levels of Blood Cotinine by Race and Ethnicity in the United States, 1988–94 and 1999–2000

Race/Ethnicity and Cotinine Level	1988–94	1999–2000
Total		
Any detectable cotinine	87.7%	64.4%
White, non-Hispanic		
Any detectable cotinine	86.4%	62.7%
Black, non-Hispanic		
Any detectable cotinine	94.5%	85.6%
Mexican American		
Any detectable cotinine	83.8%	48.6%

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

Limitations:
Cotinine remains in the body for only a discrete period of time, and thus is only a short-term indicator of exposure to secondhand smoke. This indicator cannot isolate or differentiate home exposure from other sources (e.g., from a daily child care provider) without an additional interview screening component.

In addition, NHANES only tested children ages 4 and older during the periods shown in this indicator. No results are available for ages 0-3, when children are most vulnerable to adverse respiratory health consequences. NHANES recently began testing children down to age 3, and future indicators will include these data.

Additional Indicators
In this report:

- Percentage of children aged 6 and under regularly exposed to secondhand smoke in US homes, 1994 – 2003
- Percentage of children with asthma, in the United States, 1980 – 2003
- Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, in the United States, 1997–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Percentage of homes with children under 7 where someone smokes regularly
- Concentrations of cotinine in blood of children
- Children's emergency room visits for asthma and other respiratory causes
- Children's hospital admissions for asthma and other respiratory causes

Opportunities for Improvement
This indicator could be improved by finding a consistent and reliable method to measure exposure levels in infants and toddlers (ages 0–3).

Related Programs/Activities
Objective 27-9 of the federal Healthy People 2010 initiative is to reduce the proportion of children who are regularly exposed to tobacco smoke at home.

EPA's Smoke-Free Homes initiative provides public education on the topic:
http://www.epa.gov/smokefree

2.3 Asthma

Asthma is a disease of the lungs that can cause wheezing, difficulty in breathing, and chest pain. It is the most common chronic disease among children and is costly in both human and monetary terms.[40] Asthma is one of the leading causes of school absenteeism – 14 million school days are missed each year. In 1998, the cost of asthma to the US economy was 11.3 billion.[50]

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 use of medication. Some children with asthma may suffer serious attacks that greatly limit their activities, result in visits to emergency rooms or hospitals, or, in rare cases, cause death.

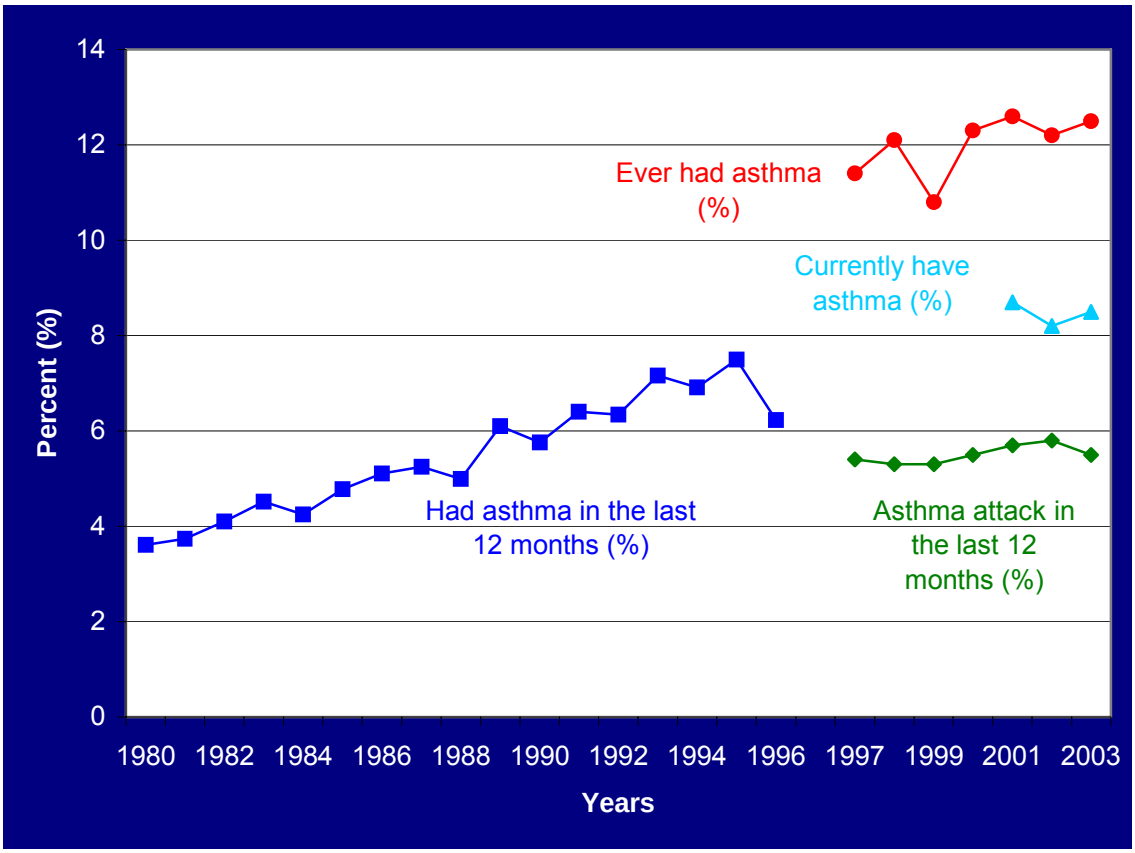
Asthma among children is increasing in the United States. Researchers do not understand completely why children develop asthma. The tendency to develop asthma can be inherited, but genetic factors alone are unlikely to explain the significant increases that have occurred in the last 20 years.[40]

Research on environmental factors that exacerbate or may contribute to causing asthma has focused on environmental agents found outdoors and indoors. The Institute of Medicine concluded that exposure to dust mites causes asthma in susceptible children.[15] Cockroaches and tobacco smoke are likely to cause asthma in young children.[40] Other studies have evaluated the role of indoor air pollutants such as nitrogen dioxide, pesticides, plasticizers, and volatile organic pollutants. Some of these pollutants may play a role in asthma.[40] One recent study suggests that chronic exposure to ozone may be associated with the development of asthma in children who exercise outside,[9] and two other studies suggest that chronic exposure to particulate matter may affect lung function and growth.[51,52]

Environmental factors may increase the severity or frequency of asthma attacks in children who have the disease. Children with asthma are particularly sensitive to outdoor air pollutants, including ozone, particulate matter, and sulfur dioxide.[11,29,31,38,53-61] These pollutants can exacerbate asthma, leading to difficulty in breathing, an increased use of medication, visits to doctors' offices, trips to emergency rooms, and admissions to the hospital. In addition, one study reported a relationship between exposure to hazardous air pollutants and increases in chronic respiratory symptoms that are characteristic of asthma.[62]

Data from the National Health Interview Survey were used to estimate the prevalence of childhood asthma. For 1980 to 1996, the percentage of children reported to have asthma in the preceding 12 months is shown. In 1997, the survey's method for measuring childhood asthma changed. For 1997 to 2001, the measure shows the percentage of children who had ever been told by a doctor or health professional that they have asthma, as well as the percentage of children who were ever diagnosed with asthma and who had an asthma attack in the preceding 12 months. Some children may have asthma when they are young and outgrow it as they get older, or their asthma may be well controlled through medication and by avoiding triggers of asthma attacks. In such cases, children may have asthma but may not have experienced any attacks in a long time. In 2001, the survey's method was changed to add an additional question to measure the percentage of children who currently have asthma.

Figure 2.5: Percentage of Children with Asthma, in the United States, 1980–2003



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

Note: The survey questions for asthma changed in 1997; data before 1997 cannot be directly compared to data in 1997 or later.

Key Observations

- Between 1980 and 1995, the percentage of children with asthma (as measured by "children with asthma in past twelve months") doubled, from 3.6 percent in 1980 to 7.5 percent in 1995. A decrease in the percentage of children occurred between 1995 and 1996, but it is difficult to interpret single-year changes.
- In 2003, about 9 percent of children were reported to currently have asthma. These include children with active asthma symptoms and those whose asthma is well-controlled.
- In 2003, about 13 percent of children had been diagnosed with asthma at some time in their lives, though some of those children may no longer have asthma.
- Prior to 1997, the percentage of children with asthma was measured by asking parents if a child in their family had asthma during the previous 12 months. In 1997–2001, a parent was asked if his or her child had ever been diagnosed with asthma by a health professional. If the parent answered yes, then he or she was asked if the child had an asthma attack or episode in the last 12 months. The percentage of children with an asthma attack in the last 12 months measures the population with incomplete control of asthma. For 1997–2000, available data do not distinguish between those children who may no longer have active asthma and those whose asthma is well controlled.

- Approximately 6 percent of all children had one or more asthma attacks in the previous twelve months. These children have ongoing asthma symptoms that could put them at risk for poorer outcomes, including hospitalizations and death. About two-thirds of children who currently have asthma have on-going asthma symptoms (2001–2003).
- Emergency room visits for asthma and other respiratory causes were 369 per 10,000 children in 1992 and 379 per 10,000 children in 1999. Hospital admissions for asthma and other respiratory causes were 55 per 10,000 children in 1980 and 66 per 10,000 children in 1999.

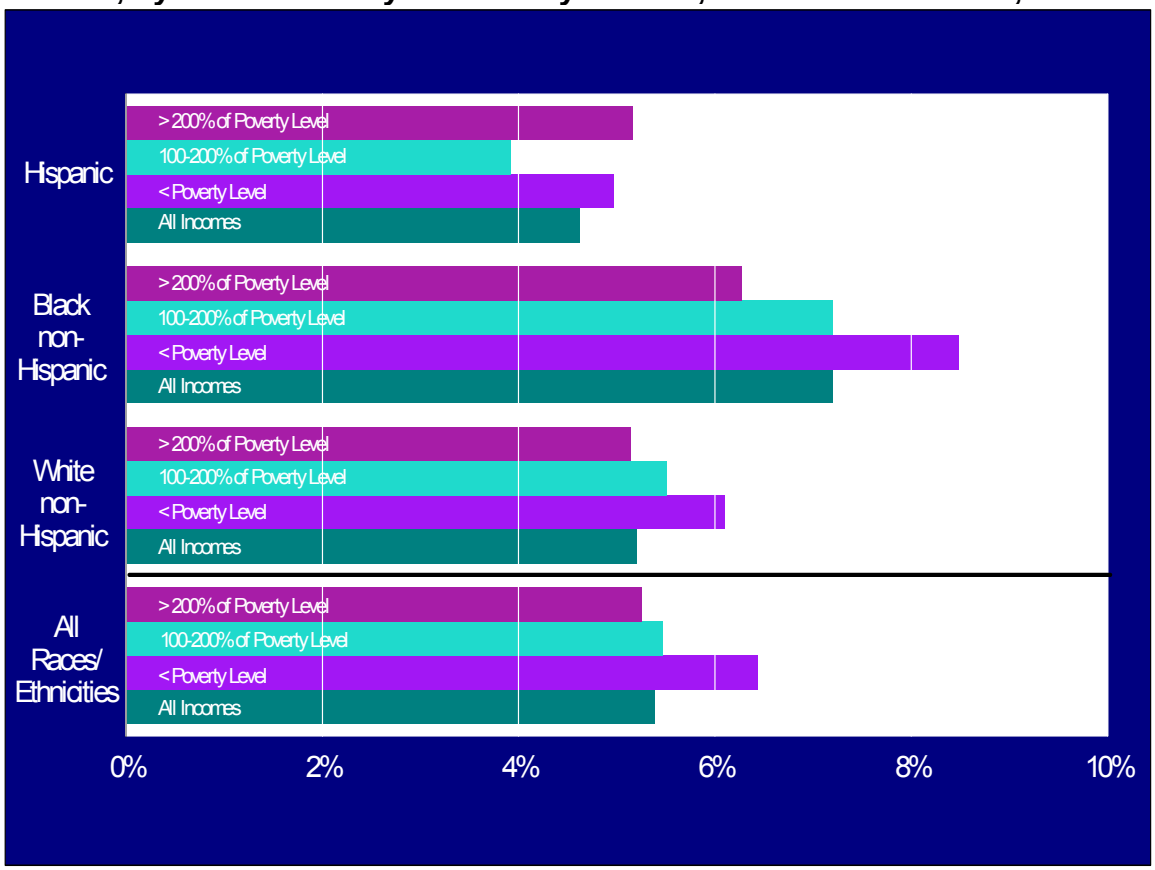
Data Table 2.5: Percentage of Children with Asthma in the United States, 1980–2003

1980–1985						
	1980	**1981**	**1982**	**1983**	**1984**	**1985**
Percentage of children with asthma in the past 12 months	3.6%	3.7%	4.1%	4.5%	4.3%	4.8%
1986–1991						
	1986	**1987**	**1988**	**1989**	**1990**	**1991**
Percentage of children with asthma in the past 12 months	5.1%	5.3%	5.0%	6.1%	5.8%	6.4%
1992–1996						
	1992	**1993**	**1994**	**1995**	**1996**	**1997**
Percentage of children with asthma in the past 12 months	6.3%	7.2%	6.9%	7.5%	6.2%	
1997–2001*						
	1997	**1998**	**1999**	**2000**	**2001**	
Children ever diagnosed with asthma and having an asthma attack in the past 12 months	5.4%	5.3%	5.3%	5.5%	5.7%	
Children ever diagnosed with asthma	11.4%	12.1%	10.8%	12.3%	12.6%	
Children who currently have asthma					8.7%	
2002–2003						
	2002	**2003**				
Children ever diagnosed with asthma and having an asthma attack in the past 12 months	5.8%	5.5%				
Children ever diagnosed with asthma	12.2%	12.5%				
Children who currently have asthma	8.2%	8.5%				

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

Note: *The survey questions for asthma changed in 1997; data before 1997 cannot be directly compared to data in 1997 and later.

Figure 2.6: Percentage of Children Having an Asthma Attack in the Previous 12 Months, by Race/Ethnicity and Family Income, in the United States, 1997–2000



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

Key Observations

- The percentage of children with asthma differs by race/ethnicity and family income. In 1997–2000, more than 8 percent of Black non-Hispanic children living in families with incomes below the poverty level had an asthma attack in the previous 12 months. Approximately 6 percent of White non-Hispanic children and 5 percent of Hispanic children living in families with incomes below the poverty level had an asthma attack in the previous 12 months.
- More than 6 percent of children living in families with incomes below the poverty level had an asthma attack in the previous 12 months. About 5 percent of children living in families with incomes at the poverty level and higher had an asthma attack in the previous 12 months.

Data Table 2.6: Percentage of Children Having an Asthma Attack in the Previous 12 months, by Race/Ethnicity and Family Income in the United States, 1997–2000.

	All Incomes	< Poverty Level	100–200% of Poverty Level	> 200% of Poverty Level	Unknown Income
All races/ethnicities	5.4%	6.4%	5.5%	5.3%	4.9%
White non-Hispanic	5.2%	6.1%	5.5%	5.1%	4.7%
Black non-Hispanic	7.2%	8.5%	7.2%	6.3%	6.5%
Hispanic	4.6%	5.0%	3.9%	5.2%	4.3%

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

Limitations
It is difficult to obtain an accurate measurement of how many children have asthma, because asthma is a complex disease that can be difficult to differentiate from other wheezing disorders, especially in children under the age of 6 years.

Additional Indicators
In this report:

- Percentage of children living in counties in which air quality standards were exceeded, in the United States, 1990–2003
- Percentage of children's days with good, moderate, or unhealthy air quality
- Percentage of children aged 6 and under regularly exposed to secondhand smoke in US homes, 1994 – 2003
- Percentage of children ages 4–11 with detectable blood cotinine by race and ethnicity, 1988–94 and 1999–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Children's emergency room visits for asthma and other respiratory causes
- Children's hospital admissions for asthma and other respiratory causes
- Percentage of homes with children under 7 where someone smokes regularly
- Concentrations of cotinine in blood of children
- Long-term trends in annual average concentrations of criteria pollutants
- Number of children living in counties with high annual averages of PM10
- Percentage of children living in counties in which air quality standards were exceeded
- Percentage of children's days with good, moderate, or unhealthy air quality

Opportunities for Improvement
Continuing refinements in the National Health Interview Survey questions may help reduce any false self-reporting of asthma. The questions now ask whether a health professional has diagnosed a child with asthma. Additional research could be conducted to document the role of environmental factors in the prevalence of asthma.

Related Programs/Activities
Objective 1-9 of Healthy People 2010 aims to reduce hospitalization rates for three ambulatory-care-sensitive conditions—pediatric asthma, uncontrolled diabetes, and immunization-preventable pneumonia and influenza. Objective 24-1 is to reduce asthma deaths, Objective 24-2 is to reduce hospitalizations for asthma, Objective 24-3 is to reduce hospital emergency department visits for asthma, and Objective 24-5 is to reduce the number of school or work days missed by people with asthma due to asthma.

The US National Institutes of Health coordinates the National Asthma Education and Prevention Program to address the growing problem of asthma in the United States. http://www.nhlbi.nih.gov/about/naepp/

EPA's Indoor Environments Division has launched a national public education and prevention program to raise awareness of indoor asthma triggers. http://www.epa.gov/iaq/asthma/iedasthmaprog.html

3 Lead and Other Chemicals, Including Pesticides

Lead, along with other chemicals, can be important environmental hazards for young children both inside and outside their homes.

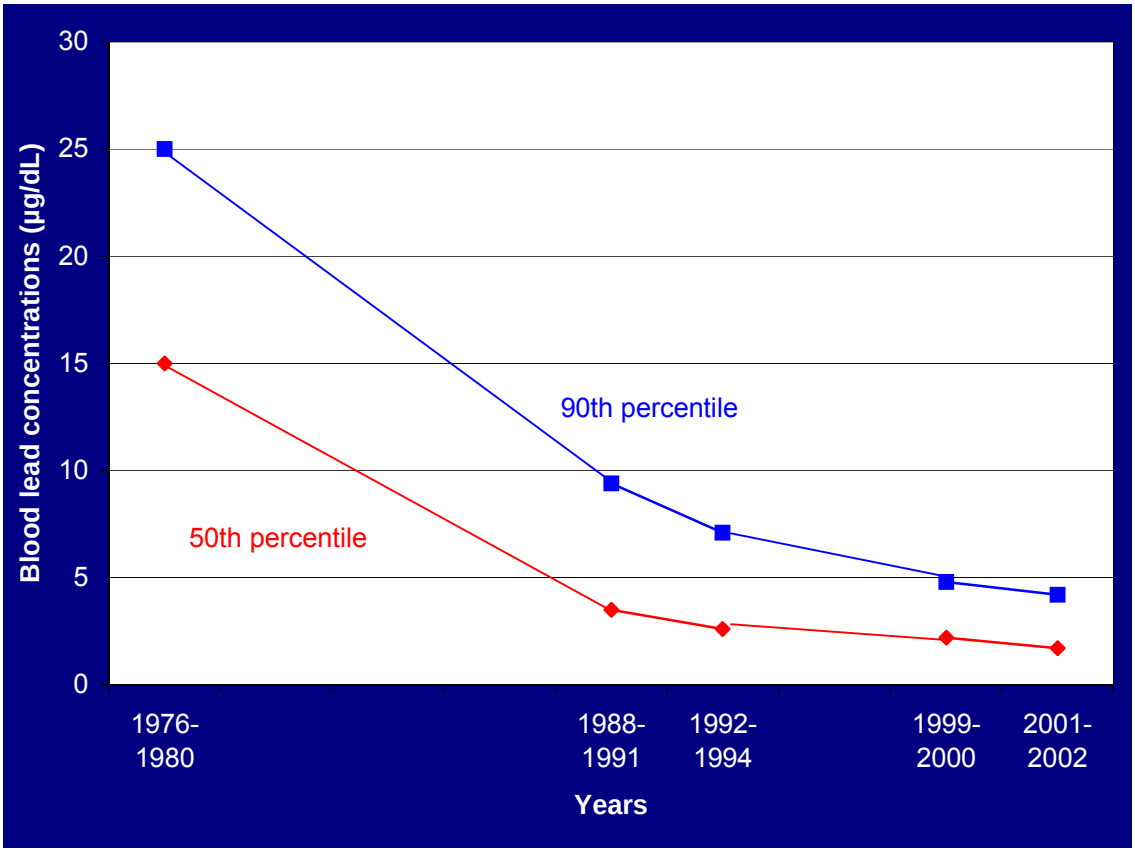
3.1 Blood Lead Levels

Lead is a serious environmental health hazard for young children. A child's brain and nervous system are vulnerable to adverse impacts from lead because they go through a long developmental process beginning shortly after conception and continuing through adolescence.[63,64] Studies have found that lead can damage children's developing brain and nervous system. Lead contributes to learning problems such as reduced intelligence and cognitive development.[20-22] Childhood exposure to lead contributes to attention-deficit/hyperactivity disorder[23] and hyperactivity and distractibility;[24-26] increases the likelihood of dropping out of high school, having a reading disability, lower vocabulary, and lower class standing in high school;[27] and increases the risk for antisocial and delinquent behavior.[28] A blood lead level of 10 micrograms per deciliter (µg/dL) or greater is considered elevated,[65,66] but there is no demonstrated safe concentration of lead in blood.[67] Adverse health effects can occur at lower concentrations.[21,22,68]

In the past, ambient concentrations of lead from leaded gasoline were a major contributor to blood lead levels in children.[68] Today, elevated blood lead levels are due mostly to ingestion of contaminated dust, paint and soil.[65] Soil and dust that are contaminated with lead are important sources of exposure because children play outside, and very small children frequently put their hands in their mouths.[69,70] Deterioration of lead-based paint can generate contaminated dust and soil, and past emissions of lead in gasoline that subsequently were deposited in the soil also contribute to lead-contaminated soil and house dust.[69-71] As of 1998–2000, lead-based paint was present in 40 percent of US homes.[72] Sixteen percent of homes had dust lead hazards, and 7 percent of homes had soil lead hazards.[72] Some small fraction of children also are exposed through direct ingestion of lead-containing paint chips and lead contaminated non-food items, as commonly found among children with pica.[73,74]

Although the concentration of lead in blood is an important indicator of risk, it reflects only current exposures. Lead also accumulates in bone and teeth. Recent research suggests that concentrations of lead in bone may be more related to adverse health outcomes in children than are concentrations in blood, as this would reflect exposure over a longer timeframe .[75] This finding suggests that concentrations in bone may better reflect the net burden of exposure. However, methods for measuring lead in bone are more time-consuming and expensive than those for measuring lead in blood, and nationally representative data are not available.

Figure 3.1: Concentration of Lead in the Blood of Children Five and Under, in the United States, 1976–2002



Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens and Illness. www.epa.gov/envirohealth/children

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

Note: 10 µg of blood has been identified by CDC as elevated, which indicated need for intervention. There is no demonstrated safe concentration of lead in blood. Adverse effects may occur at lower concentrations.

Key Observations

- The median concentration of lead in the blood of children 5 years old and under dropped from 15 micrograms per deciliter (µg/dL) in 1976-1980 to 1.7 µg/dL in 2001–2002, a decline of 89 percent.
- The concentration of lead in blood at the 90th percentile in children 5 years old and under dropped from 25 µg/dL in 1976-1980 to 4.2 µg/dL in 2001–2002. This means that 10 percent of children had blood lead levels above 4.2 µg/dL and 90 percent had blood lead levels below 4.2 µg/dL.
- The decline in blood lead levels is due largely to the phasing out of lead in gasoline between 1973 and 1995 [76] and some to the reduction in the number of homes with lead-based paint from 64 million in 1990 to 38 million in 2000.[72] Some decline also was a result of EPA regulations reducing lead levels in drinking water, as well as legislation banning lead from paint and restricting the content of lead in solder, faucets, pipes, and plumbing. Lead also has been eliminated or reduced in food and beverage containers and ceramic ware, and in products such as toys, mini-blinds, and playground equipment.

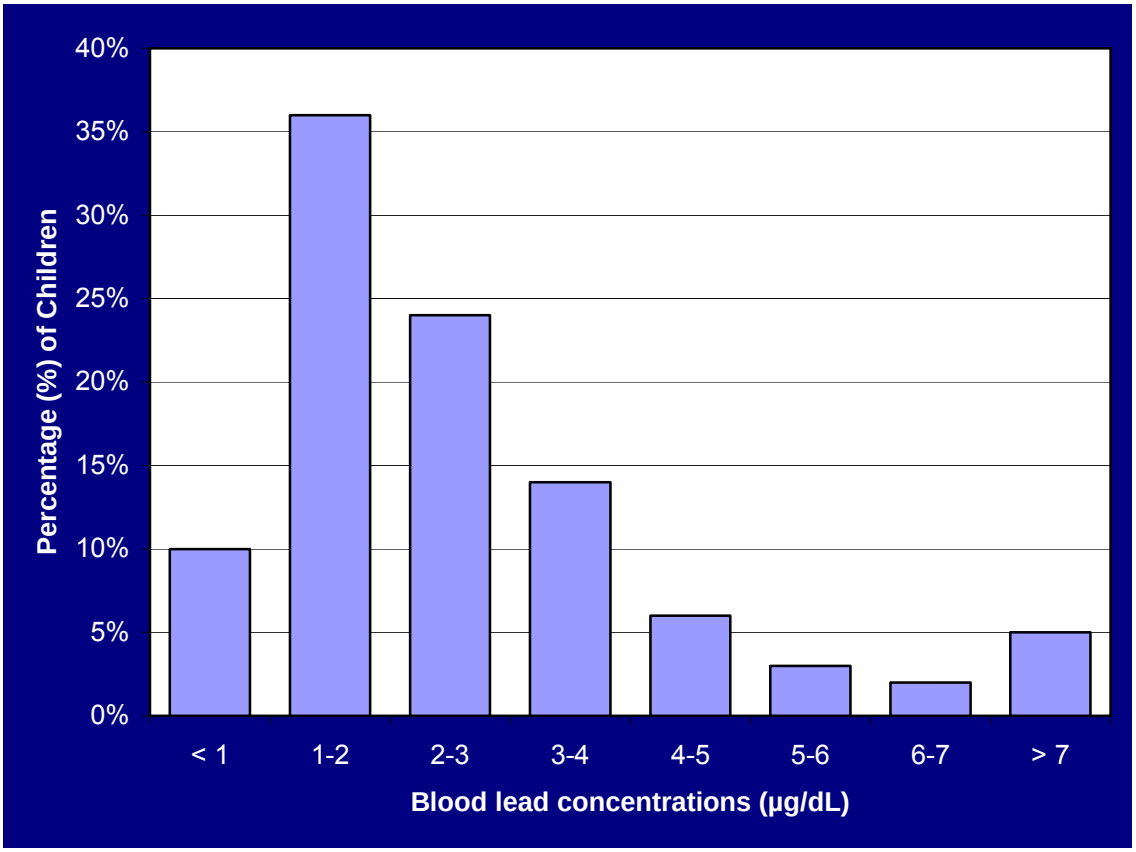
Data Table 3.1: Concentration of Lead in the Blood of Children Five and Under in the United States, 1976–2002

	Blood lead concentrations (µg/dL)				
	1976–80	**1988–91**	**1992–94**	**1999–2000**	**2001–2002**
50th percentile	15.0	3.5	2.6	2.2	1.7
90th percentile	25.0	9.4	7.1	4.8	4.2

Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens and Illness. www.epa.gov/envirohealth/children

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

Figure 3.2: Distribution of Concentrations of Lead in Blood of Children Aged One to Five, in the United States, 1999–2000



Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens and Illness. www.epa.gov/envirohealth/children.

Key Observations

- Based on the 1999–2000 survey, 2.2 percent of US children aged 1-5 years have a blood lead level greater than or equal to 10 µg/dL. In the 1976–1980 survey, 88.2 percent of children had a blood lead level above or equal to 10 µg/dL.
- In the 1999–2000 survey, 434,000 US children aged 1-5 years were estimated to have a blood lead level of 10 µg/dL or more. The most current estimate of the number of children in the US

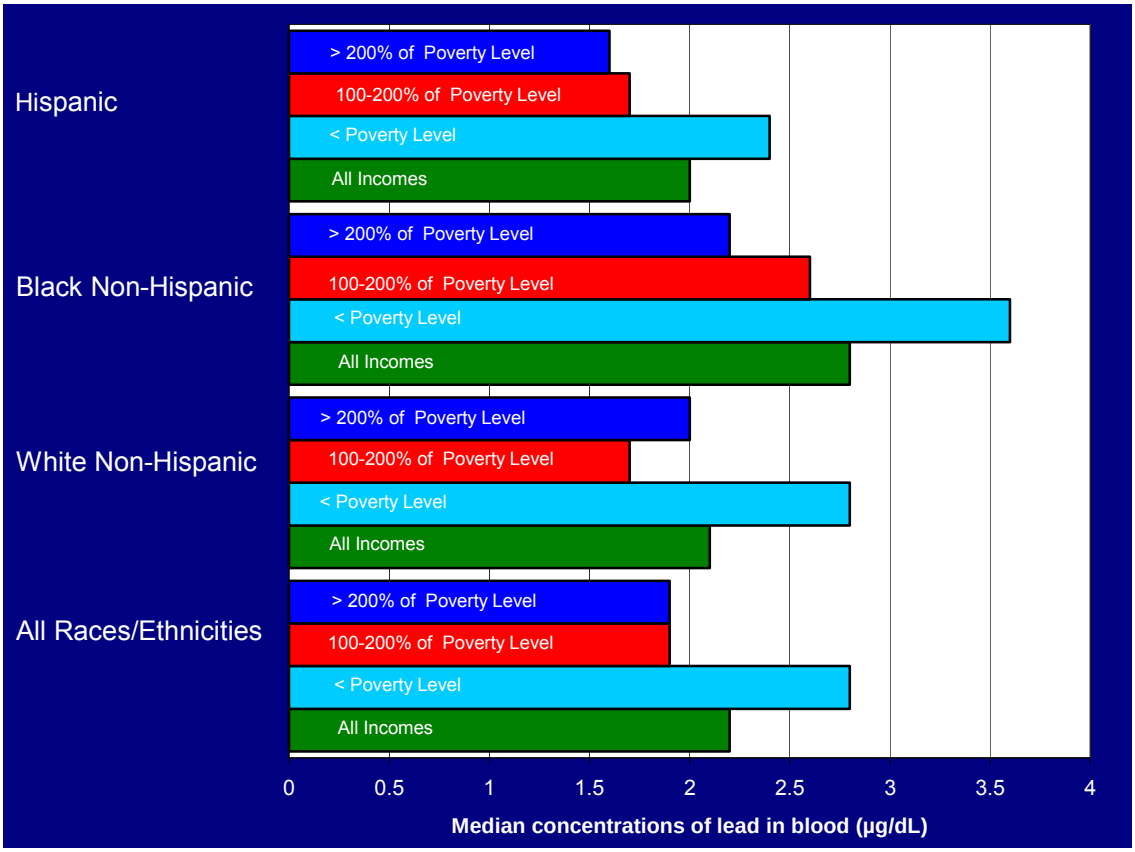
with an elevated blood lead level is 310,000 for the period 1999-2002 (data not shown). This contrasts with the 1976-1980 survey, the comparable estimate was 13,500,000 children.

Data Table 3.2: Distribution of Concentrations of Lead in Blood of Children Aged 1 to 5 in the United States, 1999–2000

Blood lead concentrations (µg/dL)							
< 1	1-2	2-3	3-4	4-5	5-6	6-7	> 7
10%	36%	24%	14%	6%	3%	2%	5%

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

Figure 3.3: Median Concentrations of Lead in Blood of Children Aged One to Five, by Race/Ethnicity and Family Income, in the United States, 1999–2000



Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens and Illness. www.epa.gov/envirohealth/children.

Key Observations

- In 1999–2000 the median blood lead level in children ages 1–5 was 2.2 µg/dL. The median blood lead level for children living in families with incomes below the poverty level was 2.8 µg/dL and for children living in families above the poverty level it was 1.9 µg/dL.
- In 1999–2000, White non-Hispanic children ages 1-5 had a median blood lead level of about 2 µg/dL, unchanged from the level in 1992–94.

- In 1992–94, Black non-Hispanic children ages 1-5 had a median blood lead level of 3.9 µg/dL and in 1999–2000 they had a median blood lead level of 2.8 µg/dL.
- In 1992–94, Hispanic children ages 1–5 had a median blood lead level of 2.6 µg/dL and in 1999–2000 they had a median blood lead level of 2.0 µg/dL.

Data Table 3.3: Median Concentrations of Lead in Blood of Children aged 1 to 5, by Race/Ethnicity and Family Income, 1999–2000

	Blood lead concentrations (µg/dL)				
	All Incomes	**< Poverty Level**	**100–200% of Poverty Level**	**> 200% of Poverty Level**	**Unknown Income**
All Races/Ethnicities	2.2	2.8	1.9	1.9	2.9
White non-Hispanic	2.1	2.8	1.7	2.0	3.2
Black non-Hispanic	2.8	3.6	2.6	2.2	2.7
Hispanic	2.0	2.4	1.7	1.6	2.3

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

Limitations

The percentage of children with blood lead levels greater than 10 µg/dL is influenced by the proportion of nonresponses within each category. Families with incomes below the poverty level had a lower response rate than families with incomes at or above the poverty level. The percentages are thus the best estimates available, but may be biased by the variation of nonresponses by family income. These data only represent national averages. They do not adequately represent very high exposures that could occur because of local sources, such as high concentrations of housing with deteriorated lead paint.

Additional Indicators

In this report:

- Lead in US housing, 1998–2000
- Lead-based paint and year of housing unit construction
- On- and off-site releases of lead (and its compounds) in the United States, 1995–2000 from industrial facilities

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Concentrations of lead in blood of children ages 5 and under
- Median concentrations of lead in blood of children ages 1–5, by race/ethnicity and family income
- Distribution of concentrations of lead in blood of children ages 1–5
- Children reported to have mental retardation, by race/ethnicity and family income
- Percentage of California public elementary schools with lead paint and some deterioration of paint
- Percentage of California public elementary schools with lead in soils
- Percentage of California public elementary schools with lead in drinking water

Opportunities for Improvement

Enhanced monitoring at the state level could improve the availability of geographically specified data and could provide more information about existence of higher end exposures.

Related Programs/Activities

The US Department of Health and Human Services' Healthy People 2010 initiative has set a national goal of eliminating blood lead levels equal to or greater than 10 µg/dL among children aged 1–5 years by 2010.

The US Department of Housing and Urban Development (HUD) and EPA also are implementing targeted strategies to prevent lead exposure through addressing lead hazards in the nation's public and private housing stock, certifying building professions in safe lead paint management and in providing education and outreach to homebuyers, tenants and the general public regarding lead hazards and their management. See http://www.epa.gov/lead/index.html and http://www.hud.gov/offices/lead/index.cfm.

The National Lead Information Center at http://www.epa.gov/opptintr/lead/nlic.htm provides public information and outreach on the risks of lead exposure.

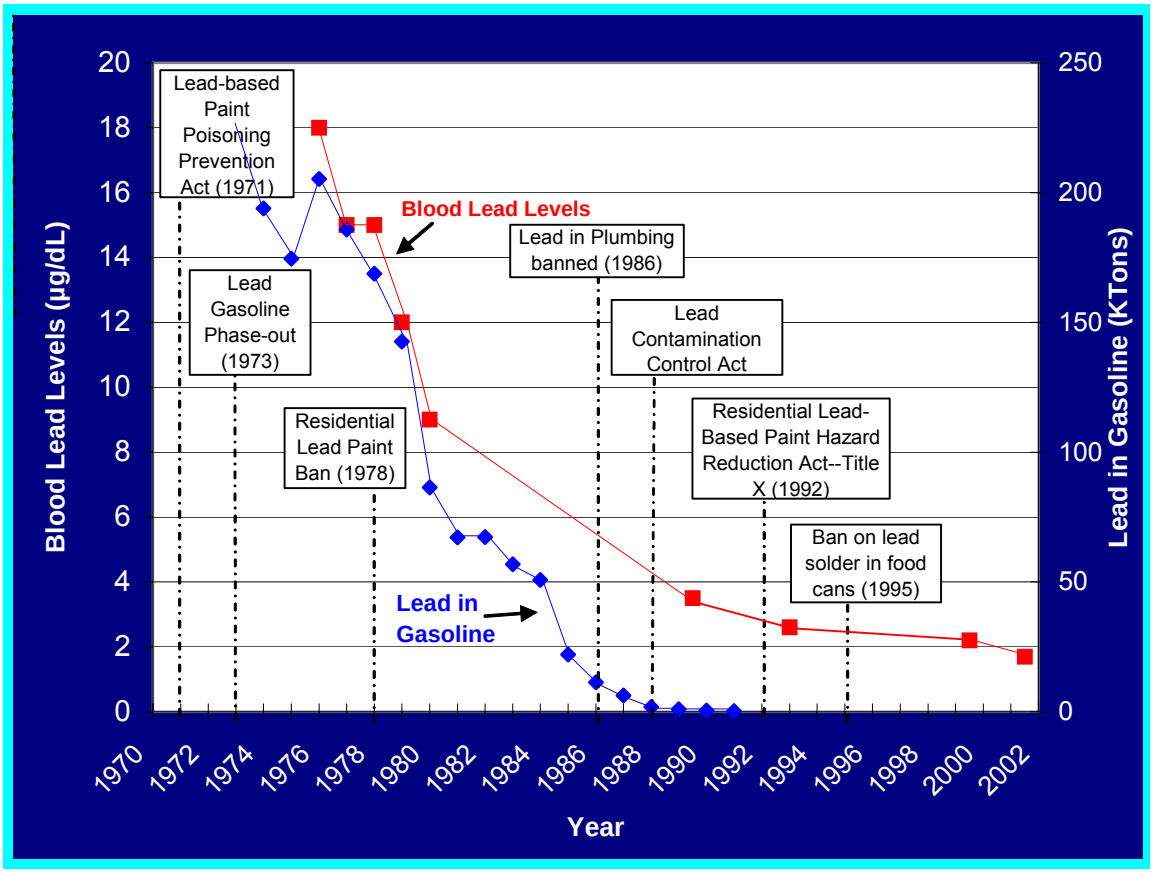
EPA also operates a Lead Awareness Program, at http://www.epa.gov/opptintr/lead/, which works to raise awareness of lead in paint, dust, and soil.

CASE STUDY

Blood Lead Levels in Response to Restrictions on Lead in Gasoline and other Products

The decline in blood lead levels is due largely to the phasing out of lead in gasoline between 1973 and 1995 [76] and some to the reduction in the number of homes with lead-based paint from 64 million in 1990 to 38 million in 2000.[72] Some decline also was a result of EPA regulations reducing lead levels in drinking water, as well as legislation banning lead from paint and restricting the content of lead in solder, faucets, pipes, and plumbing. Lead also has been eliminated or reduced in food and beverage containers and ceramic ware, and in products such as toys, mini-blinds, and playground equipment. As a result of these past and ongoing efforts, children's blood-lead levels have declined by 89 percent since the mid 1970s.

Figure 3.4: Impact of Lead Poisoning Prevention Policy on Reducing Children's Blood Lead Levels, in the United States, 1971–2001



Source: Blood lead levels: National Health and Nutrition Examination Survey. National Center for Health Statistics, Centers for Disease Control and Prevention. Lead in gasoline: 1967-1975: Unpublished data from industry, provided by US EPA. 1976-1991: Unpublished data from refiner reports to US EPA.

Key Observations:

- The median concentration of lead in the blood of children five years old and under dropped from 15 micrograms per deciliter (µg/dL) in 1976–80 to 1.7µg/dL in 2001–2002, a decline of 89 percent.

Data Table 3.4: Impact of Lead Poisoning Prevention Policy on Reducing Children's Blood Lead Levels in the United States, 1971–2001

Year	Blood Lead Levels (µg/dL)	Lead in Gasoline (Ktons)
1972		226
1973		226
1974		194
1975		175
1976	18	205
1977	15	186
1978	15	169
1979	12	143
1980	9	86
1981		67
1982		67
1983		57
1984		51
1985		22
1986		11
1987		6.2
1988		1. 9
1989		1.01
1990		0.47
1991		0.28
1993	2.6	
Data with "mid-year" lead blood lead levels		
1989.5	3.5	
1999.5	2.2	
2001.5	1.7	

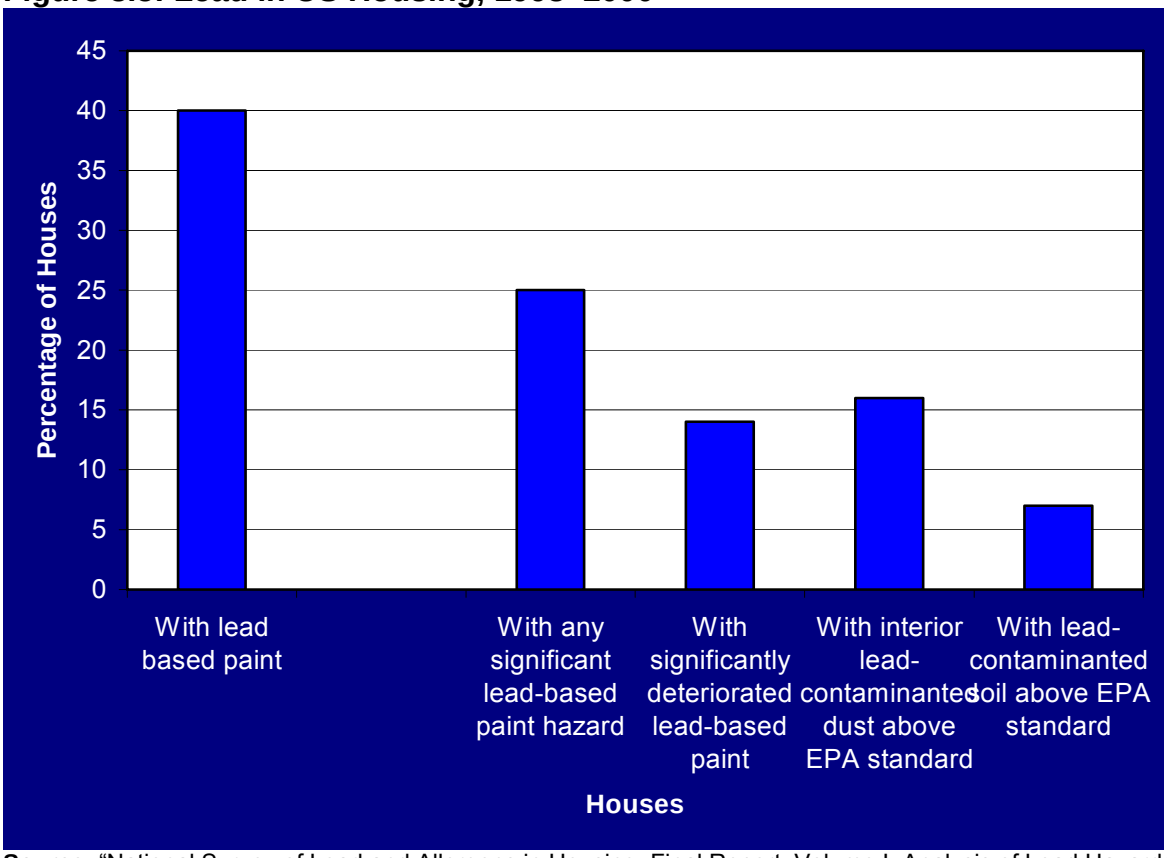
Source: Blood lead levels from Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Lead in Gasoline data from industry data (1967-1975 and refiner reports to US EPA (for 1976-1991).

3.2 Lead in the Home

Today, elevated blood lead levels in the United States are due mostly to ingestion of contaminated dust, paint and soil.[65] Soil and dust that are contaminated with lead are important sources of exposure because children play outside, and very small children frequently put their hands in their mouths.[69-71] Deterioration of lead-based paint can generate contaminated dust and soil, and past emissions of lead in gasoline that subsequently were deposited in the soil also contribute to lead-contaminated soil and house dust.[69-71]

The National Survey of Lead and Allergens in Housing, conducted under the sponsorship of the Department of Housing and Urban Development (HUD) and the National Institute of Environmental Health Sciences (NIEHS), provides national estimates of children's potential household exposure to lead and allergens.

Figure 3.5: Lead in US Housing, 1998–2000



Source: "National Survey of Lead and Allergens in Housing, Final Report, Volume I, Analysis of Lead Hazards, Revision 6.0", April 18, 2001.

Key Observations

- In 1998–2000, 40 percent of houses in the United States had paint that had some lead in it. Twenty-five percent of houses had a significant lead based paint hazard, which could be from deteriorating paint, contaminated dust, or contaminated soil outside the house.
- In 1998–2000, 14 percent of houses had significantly deteriorated lead based paint and 16 percent of houses in the United States had lead in dust above EPA standards. Seven percent of houses had lead in soil outside the house greater than the EPA standard.

- An estimated 38 million homes have lead-based paint somewhere in the building, however most have relatively small surfaces; the average home has an estimated 259 square feet of interior lead-based paint and 996 square feet of exterior lead-based paint.[77]

Data Table 3.5: Lead in US Housing, 1998–2000

	Percent
With lead based paint	40
Any significant lead-based paint hazard	25
Significantly deteriorated lead-based paint	14
Interior lead-contaminated dust above EPA standard	16
Lead-contaminated soil above EPA standard	7

Source: "National Survey of Lead and Allergens in Housing, Final Report, Volume I, Analysis of Lead Hazards, Revision 6.0", April 18, 2001.

Note: "Lead-based paint" is defined as a paint or coating with a lead content $\geq$ 1 mg/cm^2 or 0.5% by weight. "Significant lead-based paint hazard" is defined as an area of deteriorated lead-based paint above the *de minimis* levels specified by the US Department of Housing and Urban Development, which are ≤ 20 ft^2 (exterior) or ≤ 2 ft^2 (interior) of lead-based paint on large surface area components (walls, doors), or damage to ≤ 10% of the total surface area of interior small surface area component types (windowsills, baseboards, trim).

Limitations

The national survey identified lead hazards to include deteriorated lead based paint, lead contaminated dust and soil within the context of individual housing. This does not reflect the hazards that children may encounter in schools or day care centers or in areas in the community, such as parks or lots, where housing or other structures painted with lead based paint may be been demolished unsafely and lead contaminated soil remains.

Additional Indicators

In this report:

- Concentrations of lead in the blood of children five and under in the United States, 1976–2000
- Distribution of concentrations of lead in blood of children ages 1–5 in the United States, 1999–2000
- On- and off-site releases of lead (and its compounds) in the United States, 1995–2000 from industrial facilities

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Concentrations of lead in blood of children ages 5 and under
- Median concentrations of lead in blood of children ages 1–5, by race/ethnicity and family income
- Distribution of concentrations of lead in blood of children ages 1–5
- Children reported to have mental retardation, by race/ethnicity and family income
- Percentage of California public elementary schools with lead paint and some deterioration of paint
- Percentage of California public elementary schools with lead in soils
- Percentage of California public elementary schools with lead in drinking water

Opportunities for Improvement

As lead has been used in paint as well as gasoline and many industries and is a common hazardous contaminant, it may be appropriate to expand this indicator to look at the proximity of children to older industry sectors known to use lead such as historic or abandoned smelters, foundries and other industrial facilities now considered Brownfields.

Data on lead in paint at schools and day care facilities would also be an additional important area for coverage.

Develop methodology to link state and local surveillance study to provide robust national risk information.

Related Programs/Activities
Objective 8-11 of Healthy People 2010 aims to totally eliminate elevated blood lead levels (target level is 0 µg/dL) in children by the year 2010.

EPA's school program is developing a comprehensive tool to assist school managers in managing potential hazards, such as lead-based paint, as part of their maintenance and repair programs. http://cfpub.epa.gov/schools/index.cfm

HUD Office of Healthy Homes and Lead Hazard Control. http://www.hud.gov/offices/lead/

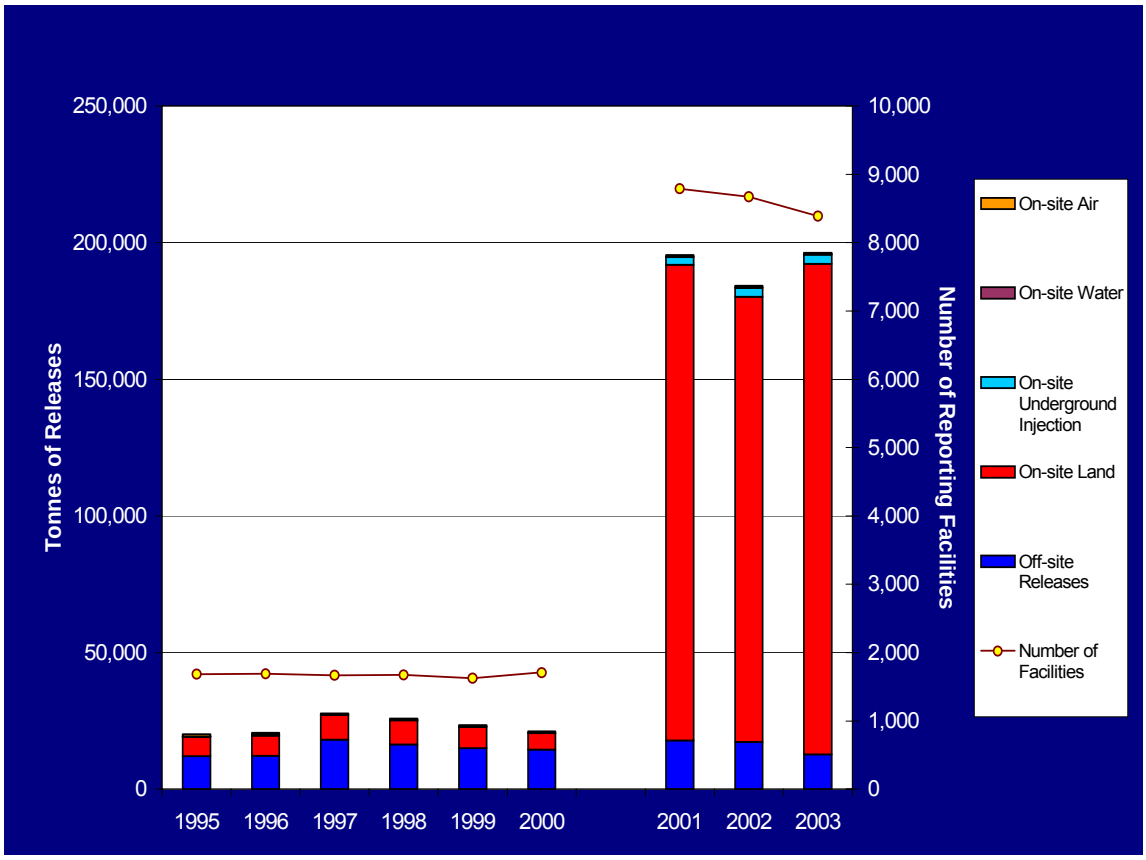
US EPA Lead Awareness Program - http://www.epa.gov/lead/

3.3 Industrial Releases of Lead

In the United States, certain industries and facilities are required to report their annual releases of certain chemical substances, and how they are managed as waste, to the US EPA, state, local, and tribal governments. Facilities that operate within certain industry sectors; have 10 or more employees; and manufacture, process, or use certain chemicals over defined quantities are required to report. This information is made available to the public in the Toxics Release Inventory (TRI), a database maintained by the US EPA. Lead is one of the compounds required for reporting. The requirements for chemicals that persist or bioaccumulate were changed in 2001, so that releases over 0.1 gram for dioxin and dioxin-like compounds, and 10 or 100 pounds for lead and for other persistent and bioaccumulative chemicals, have to be reported.

Figure 3.6 below illustrates the environmental releases (expressed in tonnes) of lead from lead and lead compounds from major industrial facilities as reported to EPA's Toxics Release Inventory Program for reporting years 1995 through 2003.

Figure 3.6: On- and Off-site Industrial Releases of Lead (and its compounds) in the United States, 1995–2003



Source: Toxics Release Inventory, Environmental Protection Agency.

Key Observations

- The amount of industrial releases of lead was about 23,500 tonnes (metric tons) in 1995 and 23,100 tonnes in 2000. There was an increase in the total industrial releases of lead seen in 1997 with reductions in each subsequent reporting year up to 2000. Most of the increase was due to a 45 percent increase in the amount of lead released off-site (off-site releases are primarily transfers to landfills) between 1996 and 1997. The decrease in later years was not enough to offset the earlier increase so that the change for the period 1995–2000 was an increase of 5 percent.
- The largest decrease in lead emissions over the 1995–2000 period occurred for releases to on-site land by an overall decrease of 20 percent. Air releases of lead decreased by about 390 tonnes or 28 percent over the reporting period.
- For the 2001 reporting year, the quantities of lead reported as being released or otherwise managed as waste within the United States increased sharply because more facilities were required to report to the Toxics Release Inventory. This increase does not mean that the release of lead has increased from industrial facilities, but rather that more industrial facilities are required to report their releases of lead.

Data Table 3.6: On- and Off-site Industrial Releases of Lead (and its compounds) in the United States, 1995–2003

	Tonnes						
	On-site Air	On-site Water	On-site Underground Injection	On-site Land	Off-site Releases	Total On- and Off-site Releases	Number of Facilities
1995	1,384	48	83	7,919	14,034	23,469	1,817
1996	1,332	35	303	8,192	14,478	24,340	1,820
1997	1,116	29	120	9,812	20,943	32,021	1,800
1998	1,041	36	82	9,555	18,480	29,193	1,808
1999	963	26	83	8,402	16,337	25,811	1,765
2000	992	28	98	6,365	15,627	23,110	1,848
2001	697	72	2,833	173,971	17,909	195,482	8,793
2002	644	64	3,263	162,938	17,322	184,230	8,676
2003	577	63	3,443	179,537	12,736	196,357	8,388

Source: Toxics Release Inventory, Environmental Protection Agency.

Limitations

These data for lead from industry and facility sources are subject to the reporting requirements of the Emergency Planning and Community Right-to-Know Act of 1986. These reporting requirements do not cover all industry sectors or facilities that may release lead into the environment, nor do they cover all anthropogenic sources or natural sources of environmental releases of lead.

Additional Indicators

The Centers for Disease Control and Prevention (CDC) has established five environmental health indicators that pertain to lead including: two core indicators; blood lead level in children and lead poisoning in children; and three indicators that are optional or under development; lead contamination in the environment, residence near metal processing industries, and lead elimination programs. For additional information, go to the http://www.cdc.gov/ and follow the link to environmental health tracking.

Opportunities for Improvement

TRI lead and lead compound emission data could be used as well as State and local surveillance and prevalence studies to assist in better characterizing and managing lead hazards in communities. For additional information on surveillance and prevalence programs, go to the http://www.cdc.gov/ and follow the link to lead poisoning prevention programs.

Related Programs/Activities

The US EPA is working with CDC and other partners to link environmental indicators and state and local surveillance activities. For additional information, go to the http://www.cdc.gov/ and follow the link to lead poisoning prevention.

The US EPA does not have the authority to regulated leaded gasoline used in racing and the Federal Aviation Administration regulates aircraft fuels. In 2002, however, the US EPA chose to release the PBT National Action Plan for Alkyl-lead as a voluntary effort to phase out the continued use of alkyl-lead in leaded gasoline fuels predominantly used in aviation (piston engine) industry, but also in non-road competition race vehicles (cars, boats, etc). For additional information on leaded gasoline phase out activities, see http://www.epa.gov/opptintr/pbt/pubs/Alkyl_lead_action_plan_final.pdf.

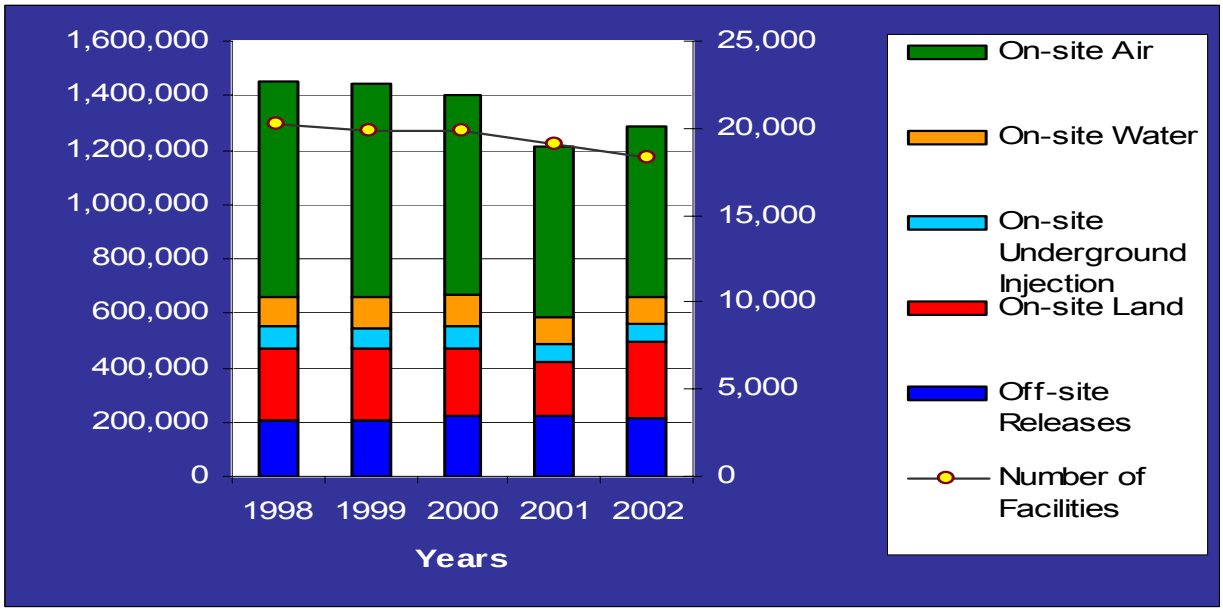
3.4 Industrial Releases of Selected Chemicals

The Toxics Release Inventory (TRI) is a publicly available database maintained by the US EPA that contains information on toxic chemical releases and other waste management activities for more than 650 chemicals reported annually by certain covered industries as well as by federal facilities. A federal law called the Emergency Planning and Community Right to Know Act gives the public the right to know about toxic chemicals being released into the environment. The law requires facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals, to report annually on their releases and other waste management of these chemicals. The reports contain information about the types and amounts of toxic chemicals that are released each year to the air, water and land as well as information on the quantities of toxic chemicals sent to other facilities for further waste management.

Figure 3.7 and Figure 3.8 as well as Data Table 3.7 and Data Table 3.8 contain US data from a "matched" data set compiled by the CEC in which only chemicals and industrial sectors for which comparable data are available from both the US and Canadian PRTR systems. Therefore these figures and data tables present a subset of U.S. data that is comparable to the Canadian data. For a more detailed explanation on the specific steps needed to create the comparable, "matched" data set, see Chapter 2 of *Taking Stock: North American Pollutant Releases and Transfers 2002* at <http://www.cec.org/pubs_docs/documents/index.cfm?ID=1753&varlan=english>.

Figure 3.9 and Data Table 3.9 contain information from the US using the complete US data set available, covering nearly 650 chemicals and chemical categories from industries including manufacturing, metal and coal mining, electric utilities, commercial hazardous waste treatment, and other industrial sectors. Thus, the data in this figure and data table are not comparable to the data in Figure 3.7 and Figure 3.8 or Data Table 3.7 and Data Table 3.8. For a more detailed explanation of the coverage of the US data, see *US EPA Toxics Release Inventory - Reporting Year 2003 Public Data Release, Summary of Key Findings* at <http://www.epa.gov/tri/tridata/tri03/KeyFind.pdf>.

Figure 3.7: On- and Off-site Releases of Matched Chemicals From Major Industrial Sources, in the United States, 1998–2002



Source: Data compiled by the CEC from a subset of original Pollutant Release Transfer Register data from the Toxics Release Inventory (TRI, 2004), US EPA. The data shown are from a "matched" data set compiled by the CEC, in which only data are comparable between the Canadian NPRI and the US TRI are included. For information

on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/.

Key Observations

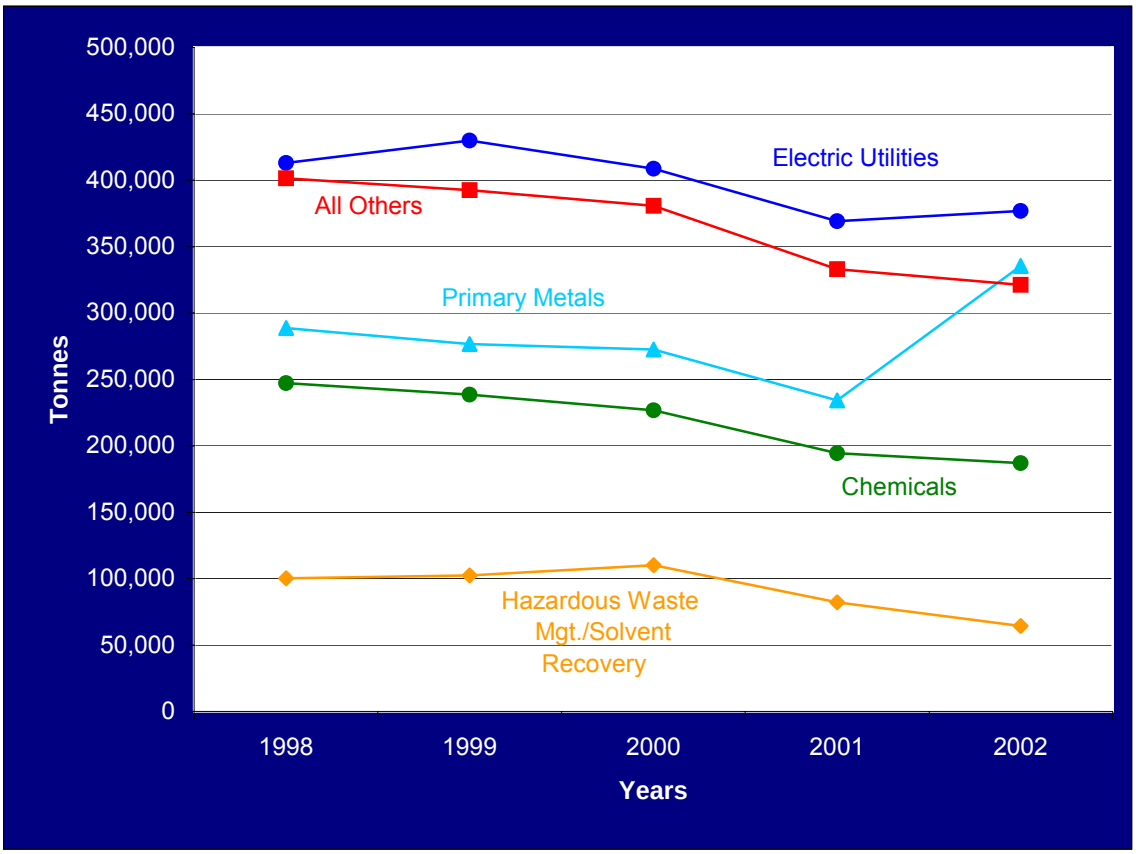
- The total facilities reporting releases of the 153 matched chemicals decreased over the reporting period 1998 to 2002, as did the total releases, which went from a high of 1,45 million tonnes in 1998 to a low of 1,21 million tonnes in 2001 but then increased to 1,28 million tonnes in 2002, for an overall decrease of 11 percent from 1998 to 2002. There were reductions in releases to on-site air, water and underground injection, with on-site land and off-site releases (primarily transfers to landfills) showing an increase.

Data Table 3.7: On- and Off-site Releases of Matched Chemicals From Major Industrial Sources in the United States, 1998–2002

	Tonnes						
	On-site Air	On-site Water	On-site Underground Injection	On-site Land	Off-site Releases (adjusted)	Total On- and Off-site Releases	Number of Facilities
1998	790,315	109,091	81,493	266,898	202,819	1,450,616	20,223
1999	778,295	115,817	76,927	259,579	209,737	1,440,354	19,899
2000	730,476	115,278	84,929	247,610	220,514	1,398,807	19,854
2001	628,394	97,890	67,992	192,057	226,535	1,212,869	19,053
2002	622,804	98,395	71,603	279,104	212,8	1,284,757	18,245

Source Data compiled by the CEC from a subset of original Pollutant Release Transfer Register data from the Toxics Release Inventory (TRI, 2004), US EPA. The data shown are from a "matched" data set compiled by the CEC, in which only data are comparable between the Canadian NPRI and the US TRI are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/.

Figure 3.8: Total On- and Off-site Releases of Matched Chemicals, by Industry Sector, in the United States, 1998–2002



Source: Data compiled by the CEC from a subset of original Pollutant Release Transfer Register data from the Toxics Release Inventory (TRI), US EPA. The data shown are from a "matched" data set compiled by the CEC, in which only data are comparable between the Canadian NPRI and the US TRI are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/.

Note: This chart depicts the top five industry sectors based on largest total release on- and off-site releases in 1998 and the continued release trends.

Key Observations

- The electric utilities sector reported the largest total releases and showed a decrease of 9 percent from 1998 to 2002. The primary metals sector, the second largest sector, reported an increase of 16 percent in releases over the same time period. The chemical manufacturing sector and the hazardous waste management sectors reported the third and fourth largest total releases, with overall decreases of 24 percent and 36 percent respectively. The other industry sectors combined, the "all others" category (which includes, among others, the food, paper, transportation equipment and plastics manufacturing industries), had about 401,000 tonnes of releases in 1998 and about 321,000 tonnes in 2002.

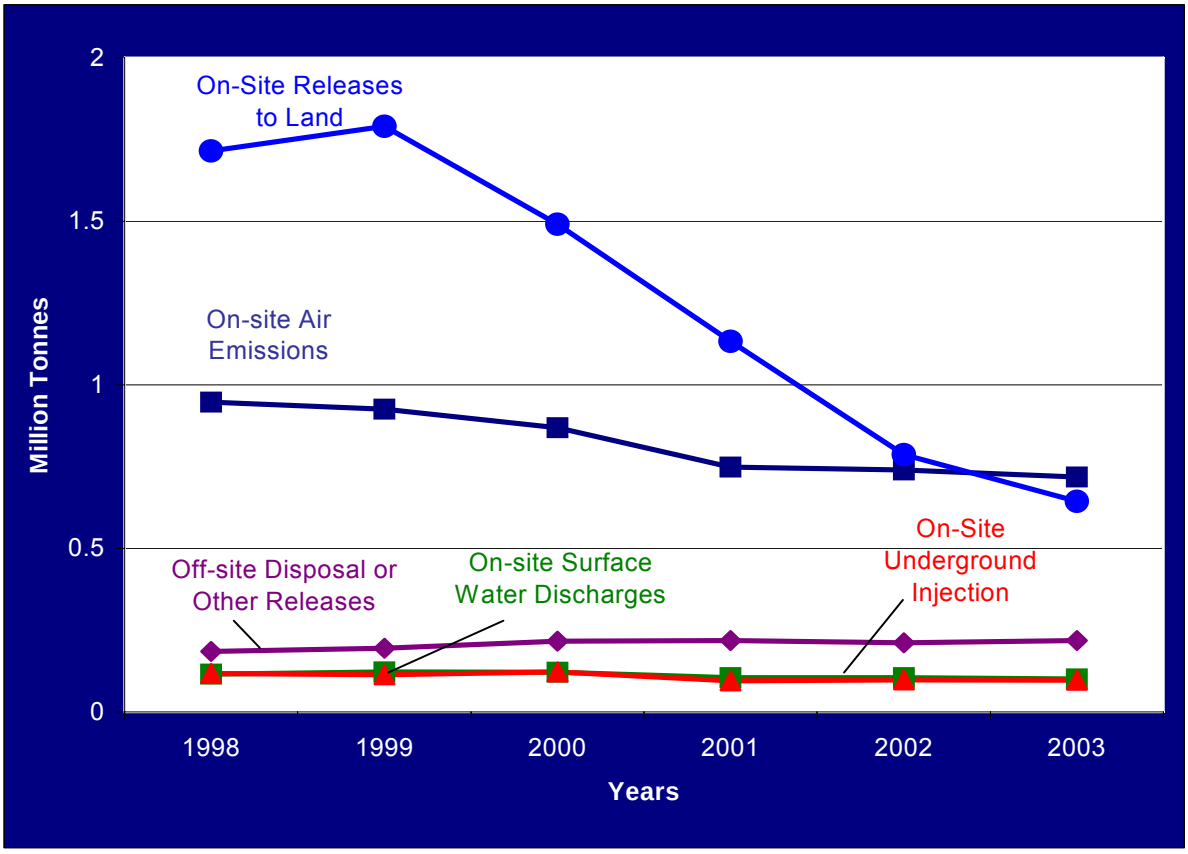
Data Table 3.8: Total On- and Off-site Releases of Matched Chemicals by Major Industrial Sectors in the United States, 1998–2002

	1998	1999	2000	2001	2002
	Tonnes				
Electric Utilities	413,112	429,991	408,654	369,090	376,769

Primary Metals	288,704	276,723	272,497	234,133	335,450
Chemicals	247,142	238,658	226,805	194,506	187,060
Hazardous Wastes Mgt/Solvent Recovery	100,148	102,517	110,206	82,151	64,340
All Others	401,510	392,465	380,644	332,989	321,138

Source Data compiled by the CEC from a subset of original Pollutant Release Transfer Register data from the Toxics Release Inventory (TRI), US EPA. The data shown are from a "matched" data set compiled by the CEC, in which only data are comparable between the Canadian NPRI and the US TRI are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/.

Figure 3.9: Location of Releases or Transfers of Chemicals from Major Industrial Sources, in the United States, 1998–2003



Source: Toxics Release Inventory, Environmental Protection Agency.

Key Observations

- This Table shows additional chemicals and industrial sectors not reflected in the "matched data set" depicted in earlier figures and data sets. The "matched data set" is a subset of 153 chemicals which represents a fraction of the nearly 650 chemicals reported to the US TRI.
- In 2001, total on- and off-site releases for all Toxics Release Inventory facilities were 6.16 billion pounds. Of these releases, 56 percent were to land, 27 percent were to air, 4 percent were to water, 3.5 percent were to underground injection wells, and 9 percent were chemicals disposed of off-site to land or underground injection.

- Between 1998 and 2001, total on- and off-site releases of TRI chemicals decreased by 22 percent, a net decrease of 1.58 billion pounds. On-site releases decreased by 25 percent, but off-site releases (transfers off-site to disposal) increased by 26 percent.
- For the core set of chemicals from industries that have reported consistently since 1998, total on- and off-site releases decreased by 54.5 percent between 1998 and 2001, a reduction of 1.72 billion pounds.
- Between 2001 and 2003, total on- and off-site releases of TRI chemicals further decreased by 23 percent. Between 2001 and 2003, decreases were seen in on-site air and water discharges and land releases while increases were seen in on-site underground injection and off-site disposal or other releases.

Data Table 3.9: Location of Releases or Transfers of Chemicals from Major Industrial Sources in the United States, 1998–2003

Year	Emissions (tonnes)					
	On-site Air Emissions	On-site Surface Water Discharges	On-Site Underground Injection	On-Site Releases to Land	Off-site Disposal or Other Releases	Total On- and Off-site Disposal or Other Releases
1998	947,113	115,250	117,216	1,715,458	184,755	3,079,793
1999	925,834	121,884	113,732	1,790,445	194,591	3,146,486
2000	868,418	121,090	122,187	1,490,949	216,698	2,819,341
2001	748,734	104,472	94,463	1,133,253	217,830	2,298,752
2002	739,834	105,006	97,563	786,940	211,815	1,941,158
2003	718,032	100,526	96,931	644,087	218,436	1,778,012

Source: Toxics Release Inventory, Environmental Protection Agency.

Limitations:

These data are subject to the reporting requirements of the Emergency Planning and Community Right-to-Know Act of 1986. These reporting requirements do not cover all industry sectors or facilities that may release lead into the environment, nor do they cover all anthropogenic sources or natural sources of environmental releases of lead.

TRI data are an input to determine exposure or calculate potential risks to human health and the environment, but by themselves do not represent risk. The determination of potential risk depends on many factors, including toxicity, chemical fate after release, release location, and population concentrations. In addition, although the US EPA has expanded the TRI program, it does not cover all sources of releases and other waste management activities, such as vehicle emissions, nor does it cover all toxic chemicals or industry sectors. Also, while many facilities base their TRI data on monitoring data, others report estimated data to TRI as the program does not mandate release monitoring. Finally, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report.

In general, the Toxics Release Inventory (TRI) only includes data from facilities that exceed certain threshold requirements and are required to report releases and transfers to TRI. The threshold criteria include:

- Operations within certain industry sectors;
- Operations that employ more than 10 people;
- Operations that manufacture or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. These reporting triggers do not include persistent, bioaccumulative, and toxic (PBT) chemicals, such as lead, where the thresholds are 0.1 gram for dioxin and dioxin-like compounds, 10 pounds for other highly

persistent and highly bioaccumulative compounds, and 100 pounds for lead and other PBT chemicals. These lower limits were established in 2001.

Additional Indicators
In this report:

- None

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- None

EPA has also prepared a report on trends in Toxics Release Inventory waste minimization priority chemicals (a subset of the TRI chemicals) from 1991–2000, available online at http://www.epa.gov/epaoswer/hazwaste/minimize/trends.htm.

Opportunities for Improvement
Canada, Mexico, and the United States are working to enhance the comparability of the North American Pollutant Release and Transfer Registers (PRTRs) through CEC's PRTR project. The three nations developed *An Action Plan to Enhance the Comparability of PRTRs in North America* that was adopted by the CEC Council in June 2002. This action plan currently is being updated.

PRTR data could be analyzed using particular subsets of chemicals that are most important to children's health (e.g., PBTs, mercury, carcinogens). This information could be examined at a regional, geographic, facility, or industry sector level to identify areas or facilities to work with to set priorities, measure progress, and target areas of special and immediate concern.

Related Programs/Activities
A federal law called the Emergency Planning and Community Right to Know Act gives the public the right to know about toxic chemicals being released into the environment. The law requires facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals, to report annually on their releases of these chemicals. The reports contain information about the types and amounts of toxic chemicals that are released each year to the air, water, and land as well as information on the quantities of toxic chemicals sent to other facilities for further waste management. EPA compiles the TRI data each year and makes them available through several data access tools, including the TRI Explorer (http://www.epa.gov/triexplorer) and Envirofacts (http://www.epa.gov/enviro). Additional TRI information, including EPA's annual Public Data Release, also is available on the TRI Web site at http://www.epa.gov/tri.

3.5 Pesticides

Children may be exposed to pesticides and other contaminants in their food and through day-to-day activities around the home. EPA regulates the amounts of pesticides in food, termed "residues," through standards called "food tolerances." A tolerance is a legal limit on the amount of pesticide residue in a particular food. Children's exposures to pesticides may be higher than the exposures of most adults. Pound for pound, children generally eat more than adults, and they may be exposed more heavily to certain pesticides because they consume a diet different from that of adults.[78] Among the agricultural commodities that are consumed by children in large amounts are apples, corn, oranges, rice, and wheat.

Organophosphate pesticides frequently are applied to many of the foods important in children's diets, and certain organophosphate pesticide residues can be detected in small quantities. When exposure to organophosphate pesticides is sufficiently high, they interfere with the proper functioning of the nervous system.[79] There are approximately 40 organophosphates, and as a group they account for approximately

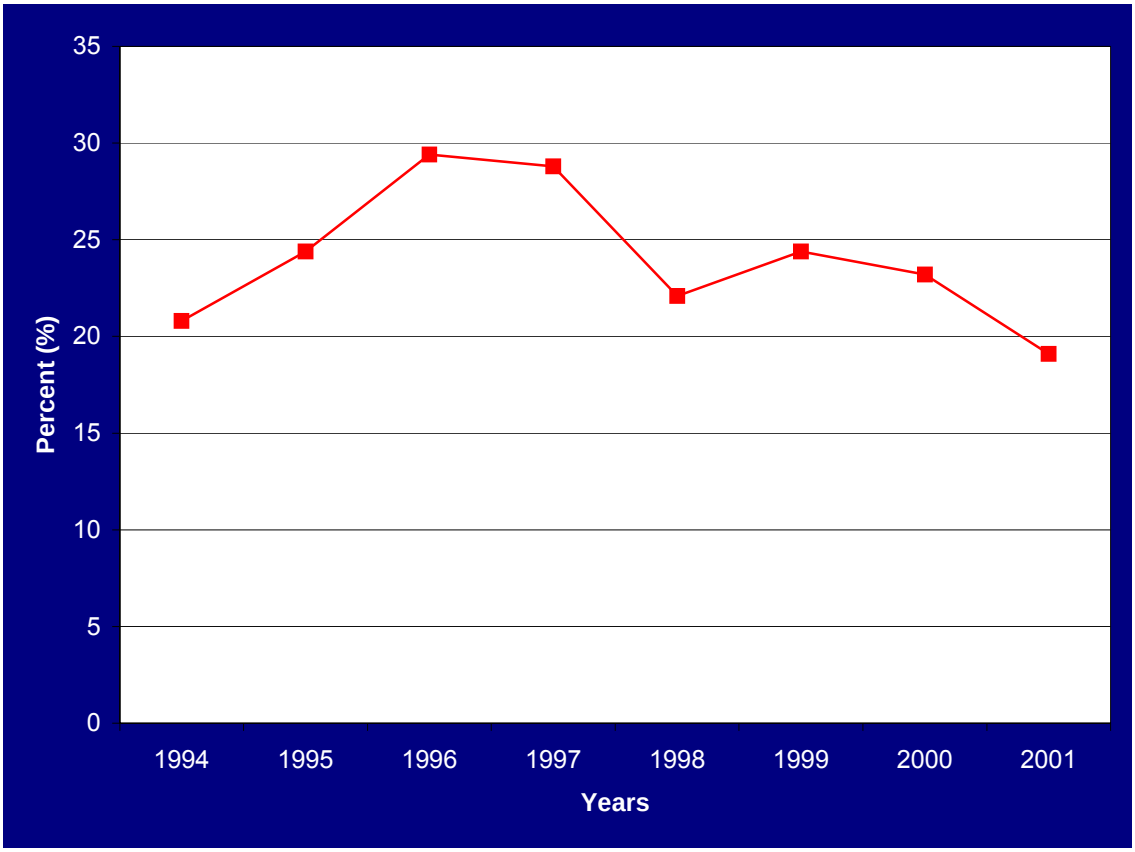
half of the insecticide use in the United States. The majority of organophosphate use is on food crops—including corn, fruits, vegetables, and nuts. In addition, organophosphate pesticides often have been used in and around the home. Examples of organophosphate pesticides include chlorpyrifos, azinphos methyl, methyl parathion, and phosmet.

The US Department of Agriculture (USDA) collects annual data on pesticide residues in food. Among the foods sampled by the USDA's Pesticide Data Program in recent years are several that are important parts of children's diets, including apples, apple juice, bananas, carrots, green beans, orange juice, peaches, pears, potatoes, and tomatoes.

The chart below displays the percentage of food samples with detectable organophosphate pesticide residues reported by the Pesticide Data Program from 1994 to 2001. The 34 organophosphates that were sampled in each of these years are included; other organophosphates that have been added to the program in recent years are excluded so that the chart represents a consistent set of pesticides for all years shown. This measure is a surrogate for children's exposure to pesticides in foods: If the frequency of detectable levels of pesticides in foods decreases, it is likely that exposures will decrease. However, this measure does not account for many additional factors that affect the risk to children. For example, some organophosphates pose greater risks to children than others do, and residues on some foods may pose greater risks than residues on other foods due to differences in amounts consumed. In addition, year-to-year changes in the percentage of samples with detectable pesticide residues may be affected by changes in the selection of foods that are sampled each year.

In accordance with the Food Quality Protection Act (FQPA) of 1996, EPA currently is reassessing all food tolerances to assure that they comply with the FQPA's "reasonable certainty of no harm" standard, with a particular focus on protecting children's health. EPA has concluded that a substantial portion of the existing tolerances for organophosphate pesticides meet the stringent safety standards of the FQPA and that a significant portion of the potential exposure to organophosphate pesticides is associated with only a small number of uses of these compounds.

Figure 3.10: Percentage of Fruits, Vegetables and Grains with Detectable Residues of Organophosphate Pesticides, in the United States, 1994–2001



Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens and Illnesses.<www.epa.gov/envirohealth/children>.

Key Observations

- Between 1994 and 2001, the percentage of food samples with detectable organophosphate pesticide residues ranged between 19 percent and 29 percent. The highest detection rates were observed during 1996 and 1997, while the lowest detection rate was observed in 2001.
- Between 1993 and 2001, the amount of organophosphate pesticides used on foods most frequently consumed by children declined from 25 million pounds to 14 million pounds.
- In 1999–2000, EPA imposed new restrictions on the use of the organophosphate pesticides azinphos methyl, chlorpyrifos, and methyl parathion on certain food crops and around the home, due largely to concerns about potential exposures of children.

Data Table 3.10: Percentage of Fruits, Vegetables, and Grains with Detectable Residues of Organophosphate Pesticides in the United States, 1994–2001

1994	1995	1996	1997	1998	1999	2000	2001
20.8%	24.4%	29.4%	28.8%	22.1%	24.4%	23.2%	19.1%

SOURCE: US Department of Agriculture, Pesticide Data Program

Limitations

This indicator is a surrogate for children's exposure to pesticides in foods: If the frequency of detectable levels of pesticides in foods decreases, it is likely that exposures will decrease. However, this indicator does not account for many additional factors that affect the risk to children. For example, some organophosphates pose greater risks to children than others do, and residues on some foods may pose greater risks than residues on other foods due to differences in amounts consumed. In addition, year-to-year changes in the percentage of samples with detectable pesticide residues may be affected by changes in the selection of foods that are sampled each year. This indicator does not represent all pesticides that may be present as residues on food, nor does it represent all pesticides to which children may be exposed. Such exposures may occur in a variety of settings, including in and around the home, day care facilities, play areas, or in agricultural areas, for example.

Additional Indicators
In this report:

- None

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Percentage of fruits, vegetables, and grains with detectable residues of organophosphate pesticides
- Frequency of application of pesticides in Minnesota K–12 schools, 1999
-

Opportunities for Improvement
As required by the Food Quality Protection Act, EPA currently is conducting a cumulative risk assessment for the organophosphate pesticides. For the first time ever, this scientific assessment evaluates the potential risks to children from the combined estimates of all contributing organophosphate residues in food and drinking water consumption, and from activities around the home. EPA already has imposed various restrictions on many individual uses of organophosphates, particularly those that may pose greater risk to children from dietary and residential sources. These restrictions, and others that may be imposed as a result of the cumulative assessment, are expected to lower children's potential exposure to these pesticides and thereby reduce potential health risks. EPA will evaluate the outputs from the cumulative risk assessments to determine how they may be used in developing measures that better reflect increases or decreases in pesticide exposure or risk. In addition, national data could be added on body burdens for certain pesticides, and will be considered in the future.

Related Programs/Activities
Objective 8-13 of Healthy People 2010 aims to reduce pesticide exposures that result in visits to a health care facility, and Objective 8-24 aims to reduce exposure to pesticides as measured by urine concentrations of metabolites.

EPA is conducting research to develop and implement an approach to examine the cumulative risks and possible health effects from persistent exposure to pesticides via multiple sources and pathways in children living along the US-Mexico Border. For more information, see http://www.epa.gov/orsearth/projects_publications/urincary_biomarker_data_analysis_and_study_design_for_children.html.

EPA also helps support the "For Healthy Kids" project, which focuses on preventing children's exposure to pesticides by educating agricultural workers on preventing "the take home pathway" for pesticide residue. More information is available at: http://www.epa.prosser.wsu.edu/kids.html.

4 Waterborne Diseases

4.1 Drinking Water

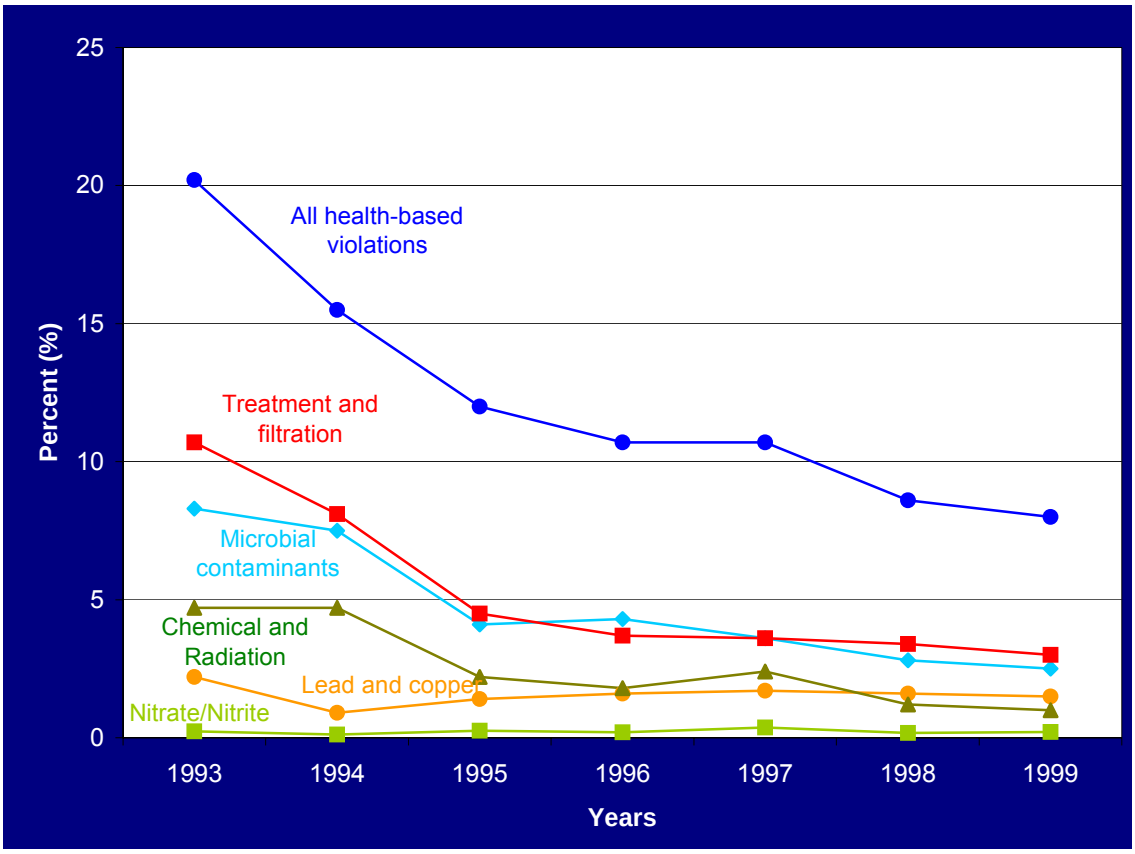
The contaminants in drinking water are quite varied and may cause a range of diseases in children, including acute diseases such as gastrointestinal illness, developmental effects such as learning disorders, and cancer.[80] Children are particularly sensitive to microbial contaminants because their immune systems are less developed than those of most adults.[80] Children are sensitive to lead, which affects brain development,[20,23-28,81] and to nitrates and nitrites, which can cause methemoglobinemia (blue baby syndrome).[82-84] Fertilizer, livestock manures, and human sewage are significant contributors of nitrates and nitrites in groundwater sources used for drinking water.[85-87]

Public water systems regulated by EPA, and delegated states and tribes, provide drinking water to an estimated 90 percent of Americans. Through the Public Water System Supervision program, EPA sets and enforces drinking water standards, referred to as Maximum Contaminant Levels (MCLs).[88] These standards are designed to protect people against adverse health effects from contaminants in drinking water while taking into account the technical feasibility of meeting the standard and balancing costs and benefits. EPA has set MCLs for more than 80 microbial contaminants, chemicals, and radionuclides. EPA also has developed regulations to protect drinking water sources and to require treatment of drinking water. An important treatment-related regulation, the Surface Water Treatment Rule, requires treatment of surface waters used for drinking water by filtration to remove microbial contaminants.

Drinking water rules often are added or modified. For example, EPA established more stringent filter performance requirements in 1998 to further strengthen protection against microbial contaminants. In the same year, EPA also established new drinking water standards for disinfection byproducts, exposure to which has been associated with bladder cancer[89] and possible reproductive effects.[90] In 2000, EPA finalized standards protecting against radionuclides in drinking water.[91] In addition, EPA strengthened the existing standard for arsenic in 2001. Changes in regulatory requirements may affect the outcome of the measures presented in this report, as the resulting trends sometimes may be related to changes in standards rather than changes in exposures.

Unlike public water systems, EPA does not have the authority to regulate private drinking water wells. An estimated 28 million people or nearly 10 percent of Americans have their own sources of drinking water, such as wells, cisterns, and springs.[92] Unlike public drinking water systems serving many people, they do not have experts regularly checking the water's source and its quality before it is sent through pipes to the community.

Figure 4.1: Percentage of Children Living in Areas Served by Public Water Systems that Exceeded a Drinking Water Standard or Violated a Treatment Requirement, in the United States, 1993–1999



Source: United States Environmental Protection Agency. 2003. America's Children and the Environment: Measures of Contaminants, Body Burdens, and Illnesses. <www.epa.gov/envirohealth/children>.

Data Source: Safe Drinking Water Information System. Office of Water, US Environmental Protection Agency.

Key Observations

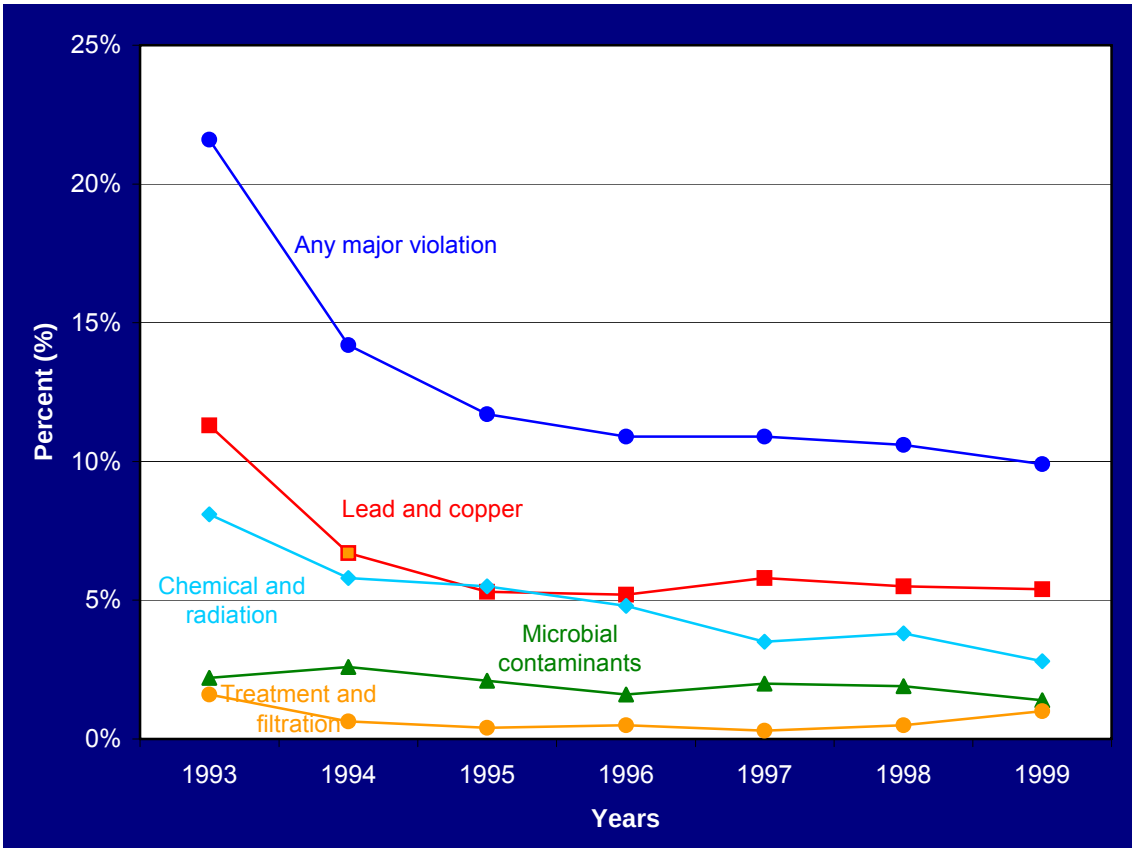
- The percentage of children served by public water systems that reported exceeding a Maximum Contaminant Level (MCL) or violated a treatment standard decreased from 20 percent in 1993 to 8 percent in 1999.
- Every category of reported violation decreased between 1993 and 1999 except for nitrates and nitrites, which remained steady. The largest decline was for violations of the treatment and filtration standards.
- From 1993-1999, approximately 0.2 percent of the children served by public water systems were served by systems that reported violations of the nitrate or nitrite standard.

Data Table 4.1: Percentage of Children Living in Areas Served by Public Water Systems that Exceeded a Drinking Water Standard or Violated a Treatment Requirement in the United States, 1993–1999

1993-1997					
Type of standard violated	**1993**	**1994**	**1995**	**1996**	**1997**
Lead and copper*	2.2%	0.9%	1.4%	1.6%	1.7%
Microbial contaminants	8.3%	7.5%	4.1%	4.3%	3.6%
Chemical and radiation	4.7%	4.7%	2.2%	1.8%	2.4%
Nitrate/nitrite	0.23%	0.12%	0.25%	0.20%	0.37%
Treatment and filtration	10.7%	8.1%	4.5%	3.7%	3.6%
Any health-based violations	20.2%	15.5%	12.0%	10.7%	10.7%
1998-1999					
Type of standard violated	**1998**	**1999**			
Lead and copper*	1.6%	1.5%			
Microbial contaminants	2.8%	2.5%			
Chemical and radiation	1.2%	1.0%			
Nitrate/nitrite	0.17%	0.21%			
Treatment and filtration	3.4%	3.0%			
Any health-based violations	8.6%	8.0%			

Source: US Environmental Protection Agency, Office of Water, Safe Drinking Water Information System

Figure 4.2: Percentage of Children Living in Areas Served by Public Water Systems with Major Violations of Drinking Water Monitoring and Reporting Requirements, in the United States, 1993–1999



Source: US Environmental Protection Agency. 2003. America's Children and the Environment: Measure of Contaminants, Body Burdens, and Illness. www.epa.gov/envirohealth/children

Data: US Environmental Protection Agency. Office of Water. Safe Drinking Water Information Systems (percentages are estimated)

Key Observations

- In 1993, approximately 22 percent of children lived in an area served by a public water system that had at least one major monitoring and reporting violation. This figure decreased to about 10 percent in 1999.
- The largest number of monitoring and reporting violations occurred for the lead and copper standards. Approximately 11 percent of children in 1993 were served by public water systems with monitoring and reporting violations for lead and copper, decreasing to about 5 percent in 1995. The number has remained relatively constant since then.

Table 4.2: Percentage of Children Living in Areas Served by Public Water Systems with Major Violations of Drinking Water Monitoring and Reporting Requirements in the United States, 1993–1999

1993-1997					
Type of standard violated	**1993**	**1994**	**1995**	**1996**	**1997**
Lead and copper	11.3%	6.7%	5.3%	5.2%	5.8%
Microbial contaminants	2.2%	2.6%	2.1%	1.6%	2.0%
Chemical and radiation	8.1%	5.8%	5.5%	4.8%	3.5%
Treatment and filtration	1.6%	0.6%	0.4%	0.5%	0.3%
Any major violation	21.6%	14.2%	11.7%	10.9%	10.9%
1998-1999					
Type of standard violated	**1998**	**1999**			
Lead and copper	5.5%	5.4%			
Microbial contaminants	1.9%	1.4%			
Chemical and radiation	3.8%	2.8%			
Treatment and filtration	0.5%	1.0%			
Any major violation	10.6%	9.9%			

Source: US Environmental Protection Agency, Office of Water, Safe Drinking Water Information System

Limitations

The Safe Drinking Water Information System (SDWIS) does not track concentrations of contaminants in drinking water, but instead tracks the frequency with which standards are exceeded. SDWIS also does not collect data on the number of children served by public water systems, but only on the total population served. EPA has estimated the number of children affected based on county-level census data. Data are available only for public water systems. Approximately 28 million people are served by private water systems that are not required to monitor and report the quality of drinking water.[92] Many people served by private water supplies live in rural and agricultural areas, which may be at increased risk for nitrate and nitrite contamination. Conversely, many children served by public water systems may not drink the tap water or may use a water filtration device to further purify the water. Thus, the indicator may overestimate the percentage of children exposed to contaminated drinking water. In addition, the drinking water contaminant measures in this report rely on the MCL standards, which are based partly on health considerations but also take into account technical feasibility and cost-benefit considerations. The reported violations received by the federal government are highly accurate, but violations may be under-reported in some cases because some public water systems fail to fully monitor contaminants or report their monitoring results.

Additional Indicators

In this report:

- Waterborne Disease Outbreaks by Year and Type of Water System, in the United States, 1971–2000

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated treatment requirements
- Percentage of children living in areas with major violations of drinking water monitoring and reporting requirements

Opportunities for Improvement
Each Maximum Contaminant Level in the drinking water standards also has a corresponding Maximum Contaminant Level Goal (MCLG), which is based only on health considerations. The MCLGs could be considered for measures in future reports. Actual measured contaminant concentrations would provide the most relevant measures of potential risks to children. The most complete data on contaminants in drinking water are collected at the state level; information from the states would have to be compiled nationally to improve the indicators for drinking water. Another limitation of the data on drinking water is that many water systems do not adequately monitor for contaminants, so no information about potential risks to children in those areas is available.

Related Programs/Activities
Objective 8-05 of the federal Healthy People 2010 initiative seeks to increase the number of people served by community water systems that meet the regulations of the Safe Drinking Water Act.

EPA's "Drinking Water for Kids" site provides information for parents and children about safe drinking water: http://www.epa.gov/safewater/kids/index.html.

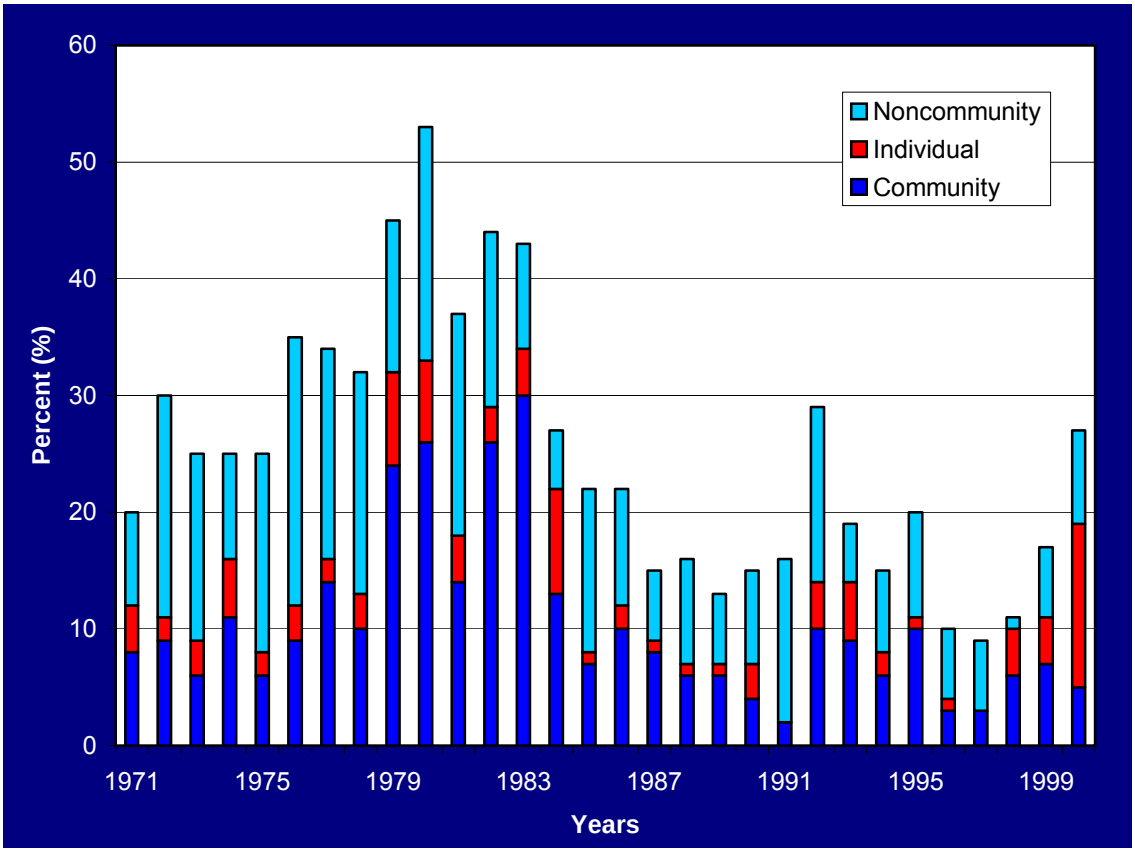
4.2 Sanitation

Canada and the United States have elected not to report on this indicator due to the high percentage of coverage for sewage collection and treatment in both urban and rural environments in both countries. Most urban and rural communities are served with sewerage and sanitation services or have septic systems to collect and treat sewage. Canada has presented this indicator in their country report (see Volume II).

4.3 Waterborne Diseases

The United States does not collect waterborne disease outbreak information focused exclusively on children. However, data are available to present an indicator of waterborne disease outbreaks by year and type of water system for the whole population. The data are based on a voluntary reporting system and are for outbreaks, not individual cases. The outbreaks are reported based on illness after either ingestion of drinking water or exposure to water either at work or recreationally.

Figure 4.3: Waterborne Disease Outbreaks by Year and Type of Water System, in the United States, 1971–2000



Source: Based on data presented in Craun, G.F. and R.L. Calderon. "Waterborne Outbreaks in the United States, 1971–2000". In Frederick W. Pontius (ed.), Drinking Water Regulations and Health, New York, NY: John Wiley & Sons: 2003, 40-56.

Note: A waterborne disease outbreak is defined as an event which 1) more than two persons have experienced an illness after either the ingestion or drinking water or exposure to water encountered in recreational or occupational settings, and 2) epidemiologic evidence implicates water as the probable source of illness.

Key Observations

- Between 1971 and 2000, there were 751 reported waterborne disease outbreaks associated with drinking water from individual, non-community systems, and community water systems.
- During 1999–2000, a total of 44 outbreaks (18 from private wells, 14 from non-community systems, and 12 from community systems) associated with drinking water were reported by 25 states.
- *Non-community water systems* are systems that either 1) regularly supply water to at least 25 of the same people at least 6 months per year but not year round (e.g., schools, factories, office buildings, and hospitals that have their own water systems), or 2) provide water in a place where people do not remain for long periods of time (e.g., a gas station or campground). *Individual water systems* are not regulated by the Safe Drinking Water Act and serve fewer than 25 persons or 15 service connections, including many private wells. *Community water systems* provide water to at least 25 of the same people or service connections year round.

Data Table 4.3: Waterborne Disease Outbreaks by Year and Type of Water System in the United States, 1971–2000 (n=751)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Community water systems	8	9	6	11	6	9	14	10	24	26
Individual water systems	4	2	3	5	2	3	2	3	8	7
Non-community water systems	8	19	16	9	17	23	18	19	13	20

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Community water systems	14	26	30	13	7	10	8	6	6	4
Individual water systems	4	3	4	9	1	2	1	1	1	3
Non-community water systems	19	15	9	5	14	10	6	9	6	8

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Community water systems	2	10	9	6	10	3	3	6	7	5
Individual water systems	0	4	5	2	1	1	0	4	4	14
Non-community water systems	14	15	5	7	9	6	6	1	6	8

Source: Based on data presented in Craun, G.F. and R.L. Calderon. "Waterborne Outbreaks in the United States, 1971–2000." In: Frederick W. Pontius (ed.), Drinking Water Regulations and Health, New York, NY: John Wiley & Sons, 2003, 40–56.

In 2002, giardiasis became a nationally notifiable disease to the Centers for Disease Control and Prevention (CDC). From 1998 through 2002, the total number of reported cases of giardiasis decreased from 24,226 for 1998 to 19,708 for 2001 and then increased to 21,300 for 2002. The number of states reporting giardiasis cases increased from 42 to 46; however, the number of states reporting more than 15 cases per 100,000 people decreased from 10 to five. A greater number of case reports were received for children aged 1–9 years and for adults aged 30–39 years compared with other age groups. Incidence of giardiasis was highest in northern states. Peak onset of illness occurred annually during early summer through early fall. The seasonal peak in age-specific case reports coincides with the summer recreational water season and might reflect increased use of communal swimming venues (e.g., lakes, rivers, swimming pools, and water parks) by young children (data now shown). For additional information, see the US Centers for Disease Control and Prevention website: http://www.cdc.gov.

Limitations

Many factors can influence whether a water-borne disease outbreak (WBDO) is recognized and investigated by local, territorial, and state public health agencies. For example, the size of the outbreak, severity of the disease caused by the outbreak, public awareness of the outbreak, whether people seek medical care or report to a local health authority, reporting requirements, routine laboratory testing for organisms, and resources for investigation can all influence the identification and investigation of a WBDO. In addition, this system is a voluntary reporting system, so not every state or relevant public health agency may be reporting information to the system. This system underreports the true number of outbreaks because of the multiple steps required before an outbreak is identified and investigated. Thus, an increase in the number of outbreaks reported could either reflect an actual increase or improved surveillance and reporting at the local and state level. This indicator provides data only on microbial

outbreaks and does not include other contaminants that are relevant to children's health, such as lead. Furthermore, the indicator provides data on the entire population, not just children.

Additional Indicators
In this report:

- Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated a treatment requirement, in the United States, 1993–1999
- Percentage of children living in areas served by public water systems with major violations of drinking water monitoring and reporting requirements, in the United States, 1993–1999

In EPA's *America's Children and the Environment* report, available at www.epa.gov/envirohealth/children:

- Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated treatment requirements
- Percentage of children living in areas with major violations of drinking water monitoring and reporting requirements

Opportunities for Improvement
Standardized surveillance and collection of data could be implemented to provide reliable estimates of waterborne disease outbreaks. In addition, this data is not specific to children, so additional information could be collected on the age of the population affected.

Related Programs/Activities
Objective 8-05 of the federal Healthy People 2010 initiative seeks to increase the number of people served by community water systems that meet the regulations of the Safe Drinking Water Act.

The Centers for Disease Control and Prevention and EPA are collaborating on a series of epidemiology studies to assess the magnitude of non-outbreak waterborne illness associated with consumption of municipal drinking water.

EPA's "Drinking Water for Kids" site provides information for parents and children about safe drinking water: http://www.epa.gov/safewater/kids/index.html.

5 Opportunities for Improvement

Ideally, data sources for all indicators would provide information collected in a consistent manner for all of the nation's children. Data also would be available for 10 years or more to provide information about changes over time, and to show whether the changes were statistically significant. Information would be available on differences among geographic areas, by race/ethnicity, and by economic status.

5.1 Indicators Related to Asthma and Respiratory Disease

15.1.1 Outdoor Air Pollution

The indicators could provided additional information to reflect the number, margin, and duration of exceedances to help distinguish among exceedances. More frequent measurement of PM_{10} and other pollutants to include in the Air Quality Index may more accurately reflect air quality. The combination of multiple pollutants as part of an overall air quality index might better replicate the health impacts of high pollution days and provide more useful information on potential air quality hazards to sensitive populations. In addition, consideration of the potential for health risks from long-term exposures to pollutants could be incorporated into an indicator.

15.1.2 Indoor Air Pollution

For indoor air quality in general, the most important improvement would be to add data about sources of other indoor air pollutants, such as consumer products, gas stoves, and furnishings, for both homes and schools.

For the indicator on the percentage of children ages 6 and under regularly exposed to secondhand smoke in the home, it would be ideal if data were available on an annual rather than periodic basis.

The indicators on cotinine could be improved by finding a consistent and reliable method to measure exposure levels in infants and toddlers (ages 0–3).

15.1.3 Asthma

Continuing refinements in the National Health Interview Survey questions may help reduce any false self-reporting of asthma. The questions now ask whether a health professional has diagnosed a child with asthma. Additional research could be conducted to document the role of environmental factors in the prevalence of asthma

5.2 Indicators Related to the Effects of Lead and Chemicals, Including Pesticides

5.2.1 Blood Lead Levels

Enhanced monitoring at the state level could improve the availability of geographically specified data and could provide more information about existence of higher end exposures.

5.2.2 Lead in the Home

As lead has been used in paint as well as gasoline and many industries and is a common hazardous contaminant, it may be appropriate to expand this indicator to look at the proximity of children to older industry sectors known to use lead such as historic or abandoned smelters, foundries and other industrial facilities now considered Brownfields.

Data on lead in paint at schools and day cares would also be an additional important area for coverage.

5.2.3 Industrial Releases of Lead

Improved coordination between state and local health agencies conducting surveillance in areas where industrial emissions may pose health risks to communities.

5.2.4 Industrial Releases of Certain Toxic Chemicals

Canada, Mexico, and the United States are working to enhance the comparability of the North American Pollutant Release and Transfer Registers (PRTRs) through CEC's PRTR project. The three nations developed *An Action Plan to Enhance the Comparability of PRTRs in North America* that was adopted by the CEC Council in June 2002. This action plan currently is being updated.

PRTR data could be analyzed using particular subsets of chemicals that are most important to children's health (e.g., PBTs, mercury, carcinogens). This information could be examined at a regional, geographic, facility, or industry sector level to identify areas or facilities to work with to set priorities, measure progress, and target areas of special and immediate concern.

5.2.5 Pesticide

As required by the Food Quality Protection Act, EPA currently is conducting a cumulative risk assessment for the organophosphate pesticides. For the first time ever, this scientific assessment evaluates the potential risks to children from the combined estimates of all contributing organophosphate residues in food and drinking water consumption, and from activities around the home. EPA will evaluate the outputs from the cumulative risk assessments to determine how they may be used in developing measures that better reflect increases or decreases in pesticide exposure or risk. In addition, the Agency expects to add indicators of pesticide exposures to the body burdens section of future editions of the America's Children and the Environment report.

5.3 Indicators Related to Waterborne Diseases

5.3.1 Drinking Water Systems in Violation of Standards

Each Maximum Contaminant Level in the drinking water standards also has a corresponding Maximum Contaminant Level Goal (MCLG), which is based only on health considerations. The MCLGs could be considered for measures in future reports.

Actual measured contaminant concentrations would provide the most relevant measures of potential risks to children. The most complete data on contaminants in drinking water are collected at the state level; information from the states would have to be compiled nationally to improve the indicators for drinking water.

Another limitation of the data on drinking water is that many water systems do not adequately monitor for contaminants, so no information about potential risks to children in those areas is available.

5.3.2 Waterborne Diseases

Standardized surveillance and collection of data could be implemented to provide reliable estimates of waterborne disease outbreaks. In addition, this data is not specific to children, so additional information could be collected on the age of the population affected.

6 References

Many of the indicators presented here were originally developed for the following two reports:

America's Children and the Environment, US EPA, 2003.
Web site: http://www.epa.gov/envirohealth/children

Draft Report on the Environment, US EPA, 2003.
Web site: http://www.epa.gov/indicators/roe/

Specific information sources used to develop the indicators are listed below.

Air Quality Standards
US Environmental Protection Agency, Office of Air Quality Planning and Standards, Aerometric Information Retrieval System (now the Air Quality System)
Web site: http://www.epa.gov/ttn/airs/airsaqs/

Indoor Air Quality
Data from US Centers for Disease Control, National Center for Health Statistics.

National Health Interview Survey.
Web site: http://www.cdc.gov/nchs/nhis.htm

National Health and Nutrition Examination Survey.
Web site: http://www.cdc.gov/nchs/nhanes.htm

Asthma Prevalence
US Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.
Web site: http://www.cdc.gov/nchs/nhis.htm

Blood Lead Levels
Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey.
Web site: http://www.cdc.gov/nchs/nhanes.htm

Pesticide Residues
US Department of Agriculture, Pesticide Data Program.
Web site: http://www.ams.usda.gov/science/pdp/

US Environmental Protection Agency, Office of Pesticide Programs.
Web site: http://www.epa.gov/pesticides

Pollutant Release and Transfer Registers Data
EPA Office of Environmental Information, *2001 Toxics Release Inventory (TRI) Public Data Release Report*, June 2003
Web site: http://www.epa.gov/tri

Drinking Water Standards and Treated Water
US Environmental Protection Agency, Safe Drinking Water Information System
Web site at http://www.epa.gov/safewater/sdwisfed/sdwis.htm

Waterborne Disease Outbreaks

Craun, G.F. and R.L. Calderon. "Waterborne Outbreaks in the United States, 1971–2000." In: Frederick W. Pontius (ed.), Drinking Water Regulations and Health, New York, NY: John Wiley & Sons, 2003, 40–56.

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Appendix 1 US Metadata for the Indicators

Percentage of children living in counties in which air quality standards were exceeded in the United States, 1990–2003	**Type of indicator: Exposure surrogate**
INDICATOR Description	
Definition	The percentage of US children living in counties in which national air quality standards were exceeded.
Rationale and role	Air pollution contributes to a wide variety of adverse health effects. The US Environmental Protection Agency has set National Ambient Air Quality Standards that specify allowable concentrations of the most common air pollutants. The standards are set at a level that protects public health with an adequate margin of safety. The indicator shows the percentage of children living in counties in which these air quality standards were exceeded.
Data Range	Dates: 1990–2003. Ages: 0–18.
Data sources, availability and quality	State and local environmental agencies conduct air monitoring programs to measure concentrations of common air pollutants. The individual measurements are submitted to EPA for inclusion in a national database called the Air Quality System. EPA identifies instances in which levels of air pollutants measured in the air are greater than the air quality standards. Data quality is considered high, but not all counties measure all air pollutants and some do not measure any. Agency Contact: David Mintz (mintz.david@epa.gov) or James Hemby (hemby.james@epa.gov), US EPA, Office of Air Quality Planning and Standards. Details on the Census data used are available in America's Children and the Environment, at <http://www.epa.gov/envirohealth/children>.
Units of measurement	Air quality standards use various units of measurement depending on the pollutant. The values representing an exceedance for the pollutants presented here are shown in Table 1 at http://www.epa.gov/envirohealth/children/contaminants/data.htm.
Computation	EPA's Air Quality System reports counties that exceeded the various standards. Census data were used to determine the number of children living in these counties. The percentage of children living in counties that exceeded the various standards was then calculated by dividing the number of children living in these counties by the total number of children in the United States.
Sources of further information	Data are from the Aerometric Information Retrieval System (now the Air Quality System), at http://www.epa.gov/ttn/airs/airsaqs/, US Environmental Protection Agency, Office of Air Quality Planning and Standards.
Scale of application	National. This indicator aggregates county-level data for all counties in the United States that monitor common air pollutants. Note that many counties monitor only some air pollutants and some counties do not monitor any.
Useful references	US Environmental Protection Agency, Office of Air Quality Planning and Standards, Aerometric Information Retrieval System (now the Air Quality System), at <http://www.epa.gov/ttn/airs/airsaqs/>. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	The indicator provides national-scale data on the percentage of children living in counties in which air quality concentrations were above the level of the standard.

Percentage of children's days with good, moderate, or unhealthy air quality	**Type of indicator: Exposure surrogate**
INDICATOR Description	
Definition	The percentage of US children's days with good, moderate, or unhealthy air quality, as defined by the US Environmental Protection Agency's Air Quality Index.
Rationale and role	Air pollution contributes to a wide variety of adverse health effects. The US Environmental Protection Agency has set National Ambient Air Quality Standards that specify allowable concentrations of the most common air pollutants. The standards are set at a level that protects public health with an adequate margin of safety. The indicator shows the percentage of children's days of exposure considered to be of good, moderate, or unhealthy air quality .
Data Range	Dates: 1990–1999. Ages: 0–18.
Data sources, availability and quality	State and local environmental agencies conduct air monitoring programs to measure concentrations of common air pollutants. The individual measurements are submitted to EPA for inclusion in a national database called the Air Quality System. EPA provides an Air Quality Index (AQI) that represents air quality for specific days and is widely reported in newspapers and other media outlets in metropolitan areas. Data quality is considered high, but not all counties measure all air pollutants and some do not measure any. Agency Contact: David Mintz (mintz.david@epa.gov) or James Hemby (hemby.james@epa.gov), US EPA, Office of Air Quality Planning and Standards.
Units of measurement	Air quality standards use various units of measurement depending on the pollutant.
Computation	The AQI is based on measurements of up to five of the six air quality criteria pollutants (carbon monoxide, ground-level ozone, nitrogen dioxide, particulate matter, and sulfur dioxide). Lead is not included in the AQI. An AQI value of 100 for a criteria pollutant generally corresponds to the short-term National Ambient Air Quality Standard for that pollutant, and is the level EPA has set to protect public health for a single day. Above this level, pollutant-specific health advisories are issued. EPA has divided the AQI scale into categories. Air quality is considered "good" if the AQI is between 0 and 50, posing little or no risk. Air quality is considered "moderate" if the AQI is between 51 and 100. Some pollutants at this level may present a moderate health concern for a small number of individuals. Moreover, such a level may pose health risks if maintained over many days. Air quality is considered "unhealthy for sensitive groups" if the AQI is between 101 and 150. Members of sensitive groups such as children may experience health effects, but the general population is unlikely to be affected. Air quality is considered "unhealthy" if the AQI is between 151 and 200. This indicator was developed by reviewing the air quality designation for each day for each county and weighting the daily designations by the number of children living in each county. The overall measure reports the percentage of children's days of exposure considered to be of good, moderate, or unhealthy air quality.
Sources of further information	Data are from the Aerometric Information Retrieval System (now the Air Quality System), at http://www.epa.gov/ttn/airs/airsaqs/, US Environmental Protection Agency, Office of Air Quality Planning and Standards
Scale of application	National. This indicator aggregates county-level data for all counties in the United States that monitor common air pollutants. Note that many counties monitor only some air pollutants and some counties do not monitor any.
Useful references	US Environmental Protection Agency, Office of Air Quality Planning and Standards, Aerometric Information Retrieval System (now the Air Quality System), at http://www.epa.gov/ttn/airs/airsaqs/. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	The indicator provides a sense of the intensity of pollution over the course of a year. This method provides data on the air quality category for each day, rather than simply reporting whether a county ever exceeds any standard for any pollutant. Counties in which air quality concentrations were above the level of the standard.

Percentage of children ages 6 and under regularly exposed to secondhand smoke in US homes, 1994–2003	**Type of indicator: Measure of exposure**
INDICATOR Description	
Definition	The percentage of children ages 6 and under regularly exposed to secondhand smoke in the home.
Rationale and role	Children who are exposed to secondhand smoke are at increased risk for a number of adverse health effects, including lower respiratory tract infections, bronchitis, pneumonia, fluid in the middle ear, asthma symptoms, and sudden infant death syndrome. Exposure to secondhand smoke also may be a risk factor contributing to the development of new cases of asthma. Smoking in the home is an important source of exposure because young children spend most of their time at home and indoors.
Data Range	Dates: 1994–2003. Ages: 0–6 years old.
Data sources, availability and quality	For 1994 and 1998, exposure in the home was measured by data from the National Health Interview Survey (NHIS), administered by the Centers for Disease Control and Prevention's National Center for Health Statistics. Specifically, the measure indicates the percentage of children 6 years and under who are exposed regularly (4 or more days per week) to secondhand smoke in the home. For 2003, data are from US EPA Indoor Environments Division, National Survey on Environmental Management of Asthma and Children's Exposure to Tobacco Smoke.
Units of measurement	Simple percentage, based on survey results.
Computation	Results are calculated from responses to the survey questions
Sources of further information	NHIS Web site: http://www.cdc.gov/nchs/nhis.htm *Respiratory Health Effects of Passive Smoking* (EPA, 1992): http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=2835 *Health Effects of Exposure to Environmental Tobacco Smoke* (California EPA, 1997): http://www.oehha.org/air/environmental_tobacco/finalets.html
Scale of application	National.
Useful references	NHIS Web site: http://www.cdc.gov/nchs/nhis.htm EPA Smoke-free Homes site: http://www.epa.gov/smokefree/. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	This indicator is a measure of the exposure of children to tobacco smoke, an important indoor pollutant. The measure is based on nationally representative survey data.

Percentage of children ages 4-11 with detectable blood cotinine by race and ethnicity, 1988–94 and 1999–2000	Type of indicator: Body burden
INDICATOR Description	
Definition	The percentage of US nonsmoking children ages 4–11 with specified levels of serum cotinine, by race and ethnicity.
Rationale and role	Children who are exposed to secondhand smoke are at increased risk for a number of adverse health effects, including lower respiratory tract infections, bronchitis, pneumonia, fluid in the middle ear, asthma symptoms, and sudden infant death syndrome. Exposure to secondhand smoke also may be a risk factor contributing to the development of new cases of asthma. Smoking in the home is an important source of exposure because young children spend most of their time at home and indoors.
Data Range	Dates: 1988–94, 1999–2000. Ages: 4–11
Data sources, availability and quality	Data on children's cotinine levels were obtained from the National Health and Nutrition Examination Surveys (NHANES) III, and NHANES 1999–2000, conducted by the National Center for Health Statistics. The survey is designed to assess the health and nutritional status of the non-institutionalized civilian population with direct physical examinations and interviews, using a complex multi-stage, stratified, clustered sampling design. Interviewers obtain information on personal and demographic characteristics, including age, household income, and race and ethnicity by self-reporting or as reported by an informant. NHANES III covers the period 1988–1994. Starting in 1999, NHANES changed to a continuous survey visiting 15 US locations per year and surveying and reporting for approximately 5,000 people annually.
Units of measurement	Simple percentage, based on survey results.
Computation	Exposure is measured by analyzing the cotinine levels in the blood. Data presented for nonsmokers only, defined as those with less than 11 ng/mL serum cotinine. Detectable cotinine levels are at or above 0.05 ng/mL.
Sources of further information	Clifford Johnson, National Center for Health Statistics, clj1@cdc.gov
Scale of application	National.
Useful references	National Health and Nutrition Examination Survey web site: www.cdc.gov/nchs/nhanes.htm Centers for Disease Control and Prevention: Second National Report on Human Exposure to Environmental Chemicals: http://www.cdc.gov/exposurereport/ The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	Cotinine, one of the major metabolites of nicotine, is considered a very good biomarker of recent exposure to secondhand smoke. The indicator is based on nationally representative survey data.

Percentage of children with asthma in the United States, 1980–2003	**Type of indicator: Effect**
INDICATOR Description	
Definition	The percentage of children in the United States with asthma, from 1980–2003.
Rationale and role	Asthma is the most common chronic disease among children and is costly in both human and monetary terms. Environmental factors may increase the severity or frequency of asthma attacks in children who have the disease. Children with asthma are particularly sensitive to outdoor air pollutants, including ozone, particulate matter, and sulfur dioxide. These pollutants can exacerbate asthma.
Data Range	Dates: 1980–2003. Ages: 0–18.
Data sources, availability and quality	Data are from the US Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey. Data are collected through personal household interviews.
Units of measurement	Simple percentage of children reported or diagnosed as having asthma.
Computation	Simple tabulation of children reported as having asthma or having been diagnosed as having asthma. Prior to 1997, the National Health Interview Survey asked parents if their child had asthma in the past 12 months. From 1997–2000, the survey asked parents the following two questions: “Has a doctor or other health professional ever told you that [child’s name] had asthma?” and if yes, “During the past 12 months, has [child’s name] had an episode of asthma or an asthma attack?” In 2001, the NHIS added the following new question: “Does [child’s name] still have asthma?” This question was used to estimate the percentage of children who currently have asthma.
Sources of further information	Laura Montgomery, National Center for Health Statistics, lem3@cdc.gov. National Health Interview Survey Web site: http://www.cdc.gov/nchs/nhis.htm
Scale of application	National.
Useful references	National Health Interview Survey Web site: http://www.cdc.gov/nchs/nhis.htm. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	A national-scale indicator of the prevalence of asthma, based on direct interviews.

Percentage of children having an asthma attack in the previous 12 months, by race/ethnicity and family income, 1997–2000	**Type of indicator: Effect**
INDICATOR Description	
Definition	The percentage of children in the United States having an asthma attack in the previous 12 months, by race/ethnicity and family income, 1997–2000.
Rationale and role	Asthma is the most common chronic disease among children and is costly in both human and monetary terms. Environmental factors may increase the severity or frequency of asthma attacks in children who have the disease. Children with asthma are particularly sensitive to outdoor air pollutants, including ozone, particulate matter, and sulfur dioxide. These pollutants can exacerbate asthma. Risk for asthma may differ by race/ethnicity and socioeconomic status.
Data Range	Dates: 1997–2000. Ages: 0–18.
Data sources, availability and quality	Data are from the US Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey. Data are collected through personal household interviews.
Units of measurement	Simple percentage of children reported or diagnosed as having asthma.
Computation	From 1997–2000, the survey asked parents the following two questions: “Has a doctor or other health professional ever told you that [child’s name] had asthma?” and if yes, “During the past 12 months, has [child’s name] had an episode of asthma or an asthma attack?”
Sources of further information	Laura Montgomery, National Center for Health Statistics, lem3@cdc.gov. National Health Interview Survey Web site: http://www.cdc.gov/nchs/nhis.htm
Scale of application	National.
Useful references	National Health Interview Survey Web site: http://www.cdc.gov/nchs/nhis.htm. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	A national-scale indicator of the prevalence of asthma, based on direct interviews.

Concentrations of lead in the blood of children five and under in the United States, 1976–2002	**Type of indicator: Exposure**
INDICATOR Description	
Definition	The distribution of blood lead levels among children for the years 1999–2000.
Rationale and role	Lead is an important environmental health hazard for young children. Lead contributes to learning problems such as reduced intelligence and cognitive development. Studies also have found that childhood exposure to lead contributes to attention-deficit/hyperactivity disorder and hyperactivity and distractibility; increases the likelihood of dropping out of high school, having a reading disability, lower vocabulary, and lower class standing in high school; and increases the risk for antisocial and delinquent behavior. A blood lead level of 10 micrograms per deciliter (µg/dL) or greater is considered elevated, but there is no demonstrated safe concentration of lead in blood. Adverse health effects can occur at lower concentrations.
Data Range	Dates: 1976–2001 Ages: 0–5
Data sources, availability and quality	Data are from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Body burden data from NHANES 1999–2000 are presented in: Second National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Environmental Health, January 2003. http://www.cdc.gov/nchs/nhanes.htm. Contact: Clifford Johnson (clj1@cdc.gov)
Units of measurement	Blood lead concentrations are measured in micrograms per deciliter of blood.
Computation	Data on children's blood lead levels were obtained from the National Health and Nutrition Examination Surveys (NHANES) II and III, and NHANES 1999–2000, conducted by the National Center for Health Statistics. The survey is designed to assess the health and nutritional status of the non-institutionalized civilian population with direct physical examinations and interviews, using a complex multi-stage, stratified, clustered sampling design. Interviewers obtain information on personal and demographic characteristics, including age, household income, and race and ethnicity by self-reporting or as reported by an informant. The first survey, NHANES I, was conducted during the periods 1971–1974 and 1974–1975; NHANES II covered the period 1976–1980; and NHANES III covered the period 1988–1994. Only NHANES II and III, however, contain data on blood lead levels. NHANES II provided blood lead data for children ages 6 months to 5 years; NHANES III provided data on children ages 1–5 years. Starting in 1999, NHANES changed to a continuous survey visiting 15 US locations per year and surveying and reporting for approximately 5,000 people annually. The percentage of children with blood lead levels greater than 10 µg/dL is influenced by the proportion of nonresponses within each category. Families with incomes below the poverty level had a lower response rate than families with incomes at or above the poverty level. The percentages are thus the best estimates available, but may be biased by the variation of nonresponses by family income.
Sources of further information	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm.
Scale of application	National.
Useful references	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	Provides representative national data on blood lead levels of children ages 5 and under.

Distribution of concentrations of lead in blood of children ages 1-5 in the United States, 1999–2000	**Type of indicator: Exposure**
INDICATOR Description	
Definition	The distribution of blood lead levels among children for the years 1999–2000.
Rationale and role	A blood lead level of 10 micrograms per deciliter or greater is considered elevated, but there is no demonstrated safe concentration of lead in blood. Adverse health effects can occur at lower concentrations. A growing body of research has found measurable adverse neurological effects in children at blood lead concentrations as low as 1 microgram per deciliter. EPA believes that effects may occur at blood lead levels so low that there is essentially no "safe" level of lead.
Data Range	Dates: 1999–2000. Ages: 1–5.
Data sources, availability and quality	Data are from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Body burden data from NHANES 1999–2000 are presented in: Second National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Environmental Health, January 2003. http://www.cdc.gov/nchs/nhanes.htm. Contact: Clifford Johnson (clj1@cdc.gov)
Units of measurement	Percentage of children; blood lead concentrations are measured in micrograms per deciliter of blood.
Computation	Simple distribution (histogram) of percentage of children with various ranges of blood concentrations (0–1, 1–2, 2–3, 3–4, 4–5, 5–6, 6–7, and greater than 7 micrograms per deciliter).
Sources of further information	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm.
Scale of application	National.
Useful references	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	Provides representative national data on blood lead levels of children ages 5 and under.

Median concentrations of lead in blood of children ages 1–5, by race/ethnicity and family income, 1999–2000	**Type of indicator: Exposure**
INDICATOR Description	
Definition	Median concentrations of lead in the blood of children for the years 1999–2000.
Rationale and role	A blood lead level of 10 micrograms per deciliter or greater is considered elevated, but there is no demonstrated safe concentration of lead in blood. Adverse health effects can occur at lower concentrations. A growing body of research has found measurable adverse neurological effects in children at blood lead concentrations as low as 1 microgram per deciliter. EPA believes that effects may occur at blood lead levels so low that there is essentially no "safe" level of lead.
Data Range	Dates: 1999–2000. Ages: 1–5.
Data sources, availability and quality	Data are from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Body burden data from NHANES 1999–2000 are presented in: Second National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Environmental Health, January 2003. http://www.cdc.gov/nchs/nhanes.htm. Contact: Clifford Johnson (clj1@cdc.gov)
Units of measurement	Percentage of children; blood lead concentrations are measured in micrograms per deciliter of blood.
Computation	Percentage calculated from survey results.
Sources of further information	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm.
Scale of application	National.
Useful references	Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. http://www.cdc.gov/nchs/nhanes.htm. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	Provides representative national data on median blood lead levels of children ages 5 and under by race/ethnicity and family income.

Lead in US housing, 1998–2000	Type of indicator: Exposure
INDICATOR Description	
Definition	Percentage of US homes with paint that had some lead in it, and percent of housing units with significant lead-based paint, significantly deteriorated lead-based paint, interior lead-contaminated dust above EPA standard and lead contaminated soil above EPA standard, 1998–2000.
Rationale and role	Today, elevated blood lead levels in the United States are due mostly to ingestion of contaminated dust, paint, and soil.
Data Range	Dates: 1998–2000.
Data sources, availability and quality	Data are from the National Survey of Lead and Allergens in Housing, under sponsorship of the Department of Housing and Urban Development and the National Institute of Environmental Health Sciences.
Units of measurement	Percentage of houses.
Computation	Percentage calculated from survey results.
Sources of further information	National Survey of Lead and Allergens in Housing, under sponsorship of the Department of Housing and Urban Development and the National Institute of Environmental Health Sciences. http://www.hud.gov/utilities/intercept.cfm?/offices/lead/hhi/HUD_NSLAH_Vol1.pdf.
Scale of application	National.
Useful references	National Survey of Lead and Allergens in Housing, under sponsorship of the Department of Housing and Urban Development and the National Institute of Environmental Health Sciences. http://www.hud.gov/utilities/intercept.cfm?/offices/lead/hhi/HUD_NSLAH_Vol1.pdf.
Strengths of the Indicator	Provides representative national data on lead-based paint in homes.

On- and off-site releases of lead (and its compounds) in the United States, 1995–2003	**Type of indicator: Exposure**
INDICATOR Description	
Definition	Releases of lead and its compounds from manufacturing facilities between 1995 and 2003.
Rationale and role	Today, elevated blood lead levels in the United States are due mostly to ingestion of contaminated dust, paint, and soil.
Data Range	Dates: 1995–2003.
Data sources, availability and quality	Data are from the US Toxics Release Inventory (TRI) are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/. For the TRI, facilities in all parts of the United States report their releases of over 650 toxic chemicals and chemical compounds to EPA and state agencies. Facilities indicate whether the releases were to land, air, water, underground injection well, or offsite disposal facilities. TRI includes a large amount of information on more than 600 chemicals and 30 chemical categories, including arsenic, cyanide, dioxin, lead, mercury, and nitrate compounds, and provides information on the amount and trends in releases and other waste management of chemicals, including recycling, energy recovery, and treatment. Under the Emergency Planning and Community Right to Know Act of 1986 and the Pollution Prevention Act of 1990, EPA's Office of Environmental Information makes these data available to the public annually via the *Toxics Release Inventory (TRI) Public Data Release Report*, as well as through several data access tools, including TRI Explorer (http://www.epa.gov/triexplorer) and Envirofacts (http://www.epa.gov/enviro). The Toxics Release Inventory (TRI) is a publicly available database that contains information on toxic chemical releases and other waste management activities for more than 600 chemicals reported annually by certain covered industries as well as by federal facilities. TRI data are an input to determine exposure or calculate potential risks to human health and the environment, but by themselves do not represent risk. The determination of potential risk depends on many factors, including toxicity, chemical fate after release, release location, and population concentrations. In addition, although EPA has expanded the TRI program, it does not cover all sources of releases and other waste management activities, such as vehicle emissions, nor does it cover all toxic chemicals or industry sectors. Also, while many facilities base their TRI data on monitoring data, others report estimated date to TRI as the program does not mandate release monitoring. Finally, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report.
Units of measurement	Metric tons. One metric ton (tonne) equals 1.1 short tons.
Computation	The US facility TRI lead emissions reporting industries expanded as a result of a US program change during the timeframe reflected in this report. Though new facility reporting requirements and reporting thresholds were introduced in 2001 resulting in a change in trend baselines, these additional facilities are included as reflected in reporting from 2002, as reported to the US EPA TRI program.
Sources of further information	US EPA, Toxics Release Inventory <http://www.epa.gov/tri/>.
Scale of application	National.
Useful references	US EPA, Toxics Release Inventory <http://www.epa.gov/tri/>.
Strengths of the Indicator	Provides national data on releases of lead from manufacturing facilities.

On- and off-site releases of matched chemicals in the United States, 1998–2002	Type of indicator: Exposure
INDICATOR Description	
Definition	Releases of toxic chemical in the United States between 1998 and 2002.
Rationale and role	Toxic chemicals, including some pesticides, can lead to a variety of acute or chronic health problems. The US Environmental Protection Agency (EPA) collects data using the Toxics Release Inventory (TRI), which represents a part of a broader universe of the chemicals that are used and released into the environment.
Data Range	Dates: 1998–2002.
Data sources, availability and quality	Data are from a 'matched' data set compiled by the CEC in which only chemicals that are reported by both Canada NPRI and the US Toxics Release Inventory (TRI) are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at www.cec.org/takingstock/. For the TRI, facilities in all parts of the United States report their releases of over 650 toxic chemicals and chemical compounds to EPA and state agencies. Facilities indicate whether the releases were to land, air, water, underground injection well, or offsite disposal facilities. TRI includes a large amount of information on more than 600 chemicals and 30 chemical categories, including arsenic, cyanide, dioxin, lead, mercury, and nitrate compounds, and provides information on the amount and trends in releases and other waste management of chemicals, including recycling, energy recovery, and treatment. Under the Emergency Planning and Community Right to Know Act of 1986 and the Pollution Prevention Act of 1990, EPA Office of Environmental Information makes these data available to the public annually via the *Toxics Release Inventory (TRI) Public Data Release Report*, as well as through several data access tools, including TRI Explorer (http://www.epa.gov/triexplorer) and Envirofacts (http://www.epa.gov/enviro). The Toxics Release Inventory (TRI) is a publicly available database that contains information on toxic chemical releases and other waste management activities for more than 600 chemicals reported annually by certain covered industries as well as by federal facilities. TRI data are an input to determine exposure or calculate potential risks to human health and the environment, but by themselves do not represent risk. The determination of potential risk depends on many factors, including toxicity, chemical fate after release, release location, and population concentrations. In addition, although EPA has expanded the TRI program, it does not cover all sources of releases and other waste management activities, such as vehicle emissions, nor does it cover all toxic chemicals or industry sectors. Also, while many facilities base their TRI data on monitoring data, others report estimated date to TRI as the program does not mandate release monitoring. Finally, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report.
Units of measurement	Metric tons. One metric ton (tonne) equals 1.1 short tons.
Computation	The 'Matched set' is derived by CEC contractors based on a subset of US TRI data and Canadian NPRI data based on matched industries and reporting thresholds. As the reporting facilities and reporting levels are matched, this represents a subset of US TRI reported emissions.
Sources of further information	US EPA, Toxics Release Inventory <http://www.epa.gov/tri/>. CEC's annual *Taking Stock* report, available at <www.cec.org/takingstock/>.
Scale of application	National.
Useful references	US Toxics Release Inventory <http://www.epa.gov/tri/>.
Strengths of the Indicator	Provides information about the releases of 153 matched chemicals to on-site air, land, water, and underground injections, as well as off-site releases.

On- and off-site releases of matched chemicals by sector in the United States, 1998–2002	Type of indicator: Exposure
INDICATOR Description	
Definition	Releases of toxic chemical in the United States by sector between 1998 and 2002.
Rationale and role	Toxic chemicals, including some pesticides, can lead to a variety of acute or chronic health problems. The US Environmental Protection Agency (EPA) collects data using the Toxics Release Inventory (TRI), which represents a part of a broader universe of the chemicals that are used and released into the environment.
Data Range	Dates: 1998–2002.
Data sources, availability and quality	Data are from a 'matched' data set compiled by the CEC in which only chemicals that are reported by both Canada NPRI and the US Toxics Release Inventory (TRI) are included. For information on the methods used to compile the matched data sets used for these analyses, please refer to the CEC's annual *Taking Stock* report, available at <www.cec.org/takingstock/>. For the TRI, facilities in all parts of the United States report their releases of over 650 toxic chemicals and chemical compounds to EPA and state agencies. Facilities indicate whether the releases were to land, air, water, underground injection well, or offsite disposal facilities. TRI includes a large amount of information on more than 600 chemicals and 30 chemical categories, including arsenic, cyanide, dioxin, lead, mercury, and nitrate compounds, and provides information on the amount and trends in releases and other waste management of chemicals, including recycling, energy recovery, and treatment. Under the Emergency Planning and Community Right to Know Act of 1986 and the Pollution Prevention Act of 1990, EPA Office of Environmental Information makes these data available to the public annually via the *Toxics Release Inventory (TRI) Public Data Release Report*, as well as through several data access tools, including TRI Explorer <http://www.epa.gov/triexplorer> and Envirofacts <http://www.epa.gov/enviro>. The Toxics Release Inventory (TRI) is a publicly available database that contains information on toxic chemical releases and other waste management activities for more than 600 chemicals reported annually by certain covered industries as well as by federal facilities. TRI data are an input to determine exposure or calculate potential risks to human health and the environment, but by themselves do not represent risk. The determination of potential risk depends on many factors, including toxicity, chemical fate after release, release location, and population concentrations. In addition, although EPA has expanded the TRI program, it does not cover all sources of releases and other waste management activities, such as vehicle emissions, nor does it cover all toxic chemicals or industry sectors. Also, while many facilities base their TRI data on monitoring data, others report estimated date to TRI as the program does not mandate release monitoring. Finally, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report.
Units of measurement	Metric tons. One metric ton (tonne) equals 1.1 short tons.
Computation	The 'Matched set' is derived by CEC contractors based on a subset of US TRI data and Canadian NPRI data based on matched industries and reporting thresholds. As the reporting facilities and reporting levels are matched, this represents a subset of US TRI reported emissions.
Sources of further information	US EPA, Toxics Release Inventory <http://www.epa.gov/tri/>. CEC's annual *Taking Stock* report, available at <www.cec.org/takingstock/>.
Scale of application	National.
Useful references	US Toxics Release Inventory <http://www.epa.gov/tri/>.
Strengths of the Indicator	Provides information about the releases of 153 matched chemicals to on-site air, land, water, and underground injections, as well as off-site releases.

Distribution of TRI on-site and off-site disposal or other releases, 1998–2003	**Type of indicator: Exposure**
INDICATOR Description	
Definition	Distribution of US Toxics Release Inventory on-site and off-site disposal or other releases of toxic chemical in the United States between 1998 and 2003.
Rationale and role	Toxic chemicals, including some pesticides, can lead to a variety of acute or chronic health problems. The US Environmental Protection Agency (EPA) collects data using the Toxics Release Inventory (TRI), which represents a part of a broader universe of the chemicals that are used and released into the environment.
Data Range	Dates: 1998–2003.
Data sources, availability and quality	For the Toxics Release Inventory (TRI), facilities in all parts of the United States report their releases of over 650 toxic chemicals and chemical compounds to EPA and state agencies. Facilities indicate whether the releases were to land, air, water, underground injection well, or offsite disposal facilities. TRI includes a large amount of information on more than 600 chemicals and 30 chemical categories, including arsenic, cyanide, dioxin, lead, mercury, and nitrate compounds, and provides information on the amount and trends in releases and other waste management of chemicals, including recycling, energy recovery, and treatment. Under the Emergency Planning and Community Right to Know Act of 1986 and the Pollution Prevention Act of 1990, EPA Office of Environmental Information makes these data available to the public annually via the *Toxics Release Inventory (TRI) Public Data Release Report*, as well as through several data access tools, including TRI Explorer <http://www.epa.gov/triexplorer> and Envirofacts <http://www.epa.gov/enviro>. The Toxics Release Inventory (TRI) is a publicly available database that contains information on toxic chemical releases and other waste management activities for more than 600 chemicals reported annually by certain covered industries as well as by federal facilities. TRI data are an input to determine exposure or calculate potential risks to human health and the environment, but by themselves do not represent risk. The determination of potential risk depends on many factors, including toxicity, chemical fate after release, release location, and population concentrations. In addition, although EPA has expanded the TRI program, it does not cover all sources of releases and other waste management activities, such as vehicle emissions, nor does it cover all toxic chemicals or industry sectors. Also, while many facilities base their TRI data on monitoring data, others report estimated date to TRI as the program does not mandate release monitoring. Finally, facilities that do not meet the TRI threshold levels (those with fewer than 10 full-time employees or those not meeting TRI quantity thresholds) are not required to report.
Units of measurement	Metric tons. One metric ton (tonne) equals 1.1 short tons.
Computation	While many facilities base their TRI data on monitoring data, others report estimated data to TRI as the program does not mandate additional release monitoring. Various estimation techniques are used when monitoring data are not available, and EPA has published estimation guidance for the regulated community. Variations between facilities can result from the use of different estimation methodologies. Facilities report information about the estimation methods when they report their release and waste management information. These factors should be taken into account when considering data accuracy and comparability.
Sources of further information	US EPA, Toxics Release Inventory <http://www.epa.gov/tri/>.
Scale of application	National.
Useful references	US Toxics Release Inventory <http://www.epa.gov/tri/>.
Strengths of the Indicator	Provides information about the disposal or other releases to land, water, air, on-site underground injection, or off-site disposal.

Percentage of fruits, vegetables, and grains with detectable residues of organophosphate pesticides	**Type of indicator: Exposure surrogate**
INDICATOR Description	
Definition	The percentage of food samples with detectable organophosphate pesticide residues reported by the US Department of Agriculture's Pesticide Data Program from 1994–2001.
Rationale and role	Children may be exposed to pesticides and other contaminants in their food and through day-to-day activities around the home. Children's exposures to pesticides may be higher than the exposures of most adults. Pound for pound, children generally eat more than adults, and they may be exposed more heavily to certain pesticides because they consume a diet different from that of adults. The US Department of Agriculture's Pesticide Data Program (PDP) concentrates its efforts on providing better pesticide residue data on foods most consumed by children. This PDP policy is guided by the requirements of the 1996 Food Quality Protection Act and by recommendations made in 1993 by the National Academy of Sciences in its report, *Pesticides in the Diets of Infants and Children*. Details on the commodities and pesticides tested by the PDP are available at http://www.ams.usda.gov/science/pdp/Overview.htm
Data Range	Dates: 1994–2001. Ages: 0-18 years old.
Data sources, availability and quality	Data from US Department of Agriculture's Pesticide Data Program. The program samples foods for pesticide residues. The analytical testing methods used in the monitoring efforts are standardized, validated, and subject to strict quality control and quality assurance programs The program Web site is http://www.ams.usda.gov/science/pdp/
Units of measurement	Simple percentage, based on reported results.
Computation	Each sample of food tested in the Pesticide Data Program is analyzed to determine whether the residues of a variety of different pesticides are present. The number of organophosphate pesticides and metabolites analyzed by PDP has increased from 34 in 1994 to 77 in 2001, and measurement techniques have become more sensitive during that time. In order to maintain comparability across the years 1994–2001, the organophosphate detection rates reported here include only detection of the original 34 pesticides included in the PDP at or above the original limits of detection available in 1994.
Sources of further information	For PDP information (PDP survey data): http://www.ams.usda.gov/science/pdp For EPA Office of Pesticide Programs information (risk assessment): http://www.epa.gov/pesticides
Scale of application	National.
Useful references	Data are from U.SDA, Pesticide Data Program. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	The indicator shows pesticide residues on foods that are frequently consumed by children. The measure is based on nationally representative data.

Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated a treatment requirement, 1993–1999	**Type of indicator: Exposure**
INDICATOR Description	
Definition	The percentage of children served by public water systems that reported exceeding a Maximum Contaminant Level (MCL) or violated a treatment standard.
Rationale and role	Microbiological, chemical, and radiological contaminants can enter water supplies as a result of human activity and from natural sources. Disinfection of drinking water is a critical public health measure as it provides a barrier against harmful contaminants. Under the Safe Drinking Water Act, all public water systems must monitor the quality of their drinking water and report the monitoring results to the states, who in turn reports violations to EPA quarterly. National health-based standards exist for about 90 regulated contaminants. The Safe Drinking Water Act, as amended in 1996, mandates that EPA, states, and water systems implement multiple barriers to protect consumers from the risks of unsafe drinking water.
Data Range	Dates: 1993–1999.
Data sources, availability and quality	Community water systems report monitoring violations quarterly to the states and data are compiled by EPA. The Safe Drinking Water Information System, Federal version (SDWIS/FED) contains information about public water systems and their violations of EPA's drinking water regulations, as reported to EPA by states and EPA Regions in conformance with reporting requirements. The SDWIS includes information on the nation's 170,000 public water systems and violations of drinking water regulations. Data are available at http://www.epa.gov/OGWD/datagbases.html for each year since 1993. The overall quality of the violations data is high for the Total Coliform Rule standard, but is very low for other health-based standards and for monitoring and reporting. Source: EPA *2000 National Public Water Systems Compliance Report, National Summary*, July 2002.
Units of measurement	Percentage of children.
Computation	States report the following information to EPA on a quarterly basis: • Basic information including name, ID number, number of people served, type of system (year round or seasonal), and source (groundwater or surface water); • Violation information for each water system, including whether it has followed established monitoring and reporting schedules, complied with mandated treatment techniques, or violated any MCLs; • Enforcement information: Actions taken by states to ensure drinking water systems return to compliance if they are in violation of a regulation; and • Sampling results for unregulated contaminants and for regulated contaminants when the monitoring results exceed the MCL.
Sources of further information	Data were obtained from EPA, Office of Water, *Safe Drinking Water Information Systems/Federal version, (SDWIS/FED)*, 2003. http://www.epa.gov/safewater/sdwisfed/sdwis.htm
Scale of application	National.
Useful references	EPA *2000 National Public Water Systems Compliance Report, National Summary*, July 2002. Document located at: http://www.epa.gov/safewater/annual/sdwcom2002.pdf. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	The indicator provides a national-scale measure of the percentage of children served by public water systems who may be exposed to poor water quality.

Percentage of children living in areas served by public water systems with major violations of drinking water monitoring and reporting requirements in the United States, 1993–1997	**Type of indicator: Exposure**
INDICATOR Description	
Definition	The percentage of children served by public water systems that had at least one major monitoring and reporting violations.
Rationale and role	Microbiological, chemical, and radiological contaminants can enter water supplies as a result of human activity and from natural sources. Disinfection of drinking water is a critical public health measure as it provides a barrier against harmful contaminants. Under the Safe Drinking Water Act, all public water systems must monitor the quality of their drinking water and report the monitoring results to the states, who in turn reports violations to EPA quarterly. National health-based standards exist for about 90 regulated contaminants. The Safe Drinking Water Act, as amended in 1996, mandates that EPA, states, and water systems implement multiple barriers to protect consumers from the risks of unsafe drinking water.
Data Range	Dates: 1993–1997.
Data sources, availability and quality	Community water systems report monitoring violations quarterly to the states and data are compiled by EPA. The Safe Drinking Water Information System, Federal version (SDWIS/FED) contains information about public water systems and their violations of EPA's drinking water regulations, as reported to EPA by states and EPA Regions in conformance with reporting requirements. The SDWIS includes information on the nation's 170,000 public water systems and violations of drinking water regulations. Data are available at http://www.epa.gov/OGWD/datagbases.html for each year since 1993. The overall quality of the violations data is high for the Total Coliform Rule standard, but is very low for other health-based standards and for monitoring and reporting. Source: EPA *2000 National Public Water Systems Compliance Report, National Summary*, July 2002.
Units of measurement	Percentage of children.
Computation	States report the following information to EPA on a quarterly basis: • Basic information including name, ID number, number of people served, type of system (year round or seasonal), and source (groundwater or surface water); • Violation information for each water system, including whether it has followed established monitoring and reporting schedules, complied with mandated treatment techniques, or violated any MCLs; • Enforcement information: Actions taken by states to ensure drinking water systems return to compliance if they are in violation of a regulation; and • Sampling results for unregulated contaminants and for regulated contaminants when the monitoring results exceed the MCL.
Sources of further information	Data were obtained from EPA, Office of Water, *Safe Drinking Water Information Systems/Federal version, (SDWIS/FED)*, 2003. http://www.epa.gov/safewater/sdwisfed/sdwis.htm
Scale of application	National.
Useful references	EPA *2000 National Public Water Systems Compliance Report, National Summary*, July 2002. Document located at: http://www.epa.gov/safewater/annual/sdwcom2002.pdf. The indicator was developed for EPA's report, America's Children and the Environment. Additional information is available at www.epa.gov/envirohealth/children.
Strengths of the Indicator	The indicator provides a national-scale measure of the percentage of children served by public water systems who may be exposed to poor water quality.

Waterborne disease outbreaks by year and type of water system in the United States, 1971–2000	Type of indicator: Effect
INDICATOR Description	
Definition	The number of voluntarily reported waterborne disease outbreaks (WBDOs) associated with drinking water (e.g., typhoid, cholera, hepatitis, and gastrointestinal illness) in the United States.
Rationale and role	The potential health effects of consuming contaminated drinking water range from minor to fatal. A system for reporting food and waterborne disease outbreaks has been in place since 1971 in the United States. The system allows public health officials to investigate and determine the role of food and water in contributing to intestinal illness, and identify actions that may be needed to protect public health.
Data Range	Dates: 1971–2000. All ages
Data sources, availability and quality	The Centers for Disease Control and Prevention and the Council of State and Territorial Epidemiologists maintain a collaborative surveillance system for the occurrences and causes of WBDOs. The data identify types of water systems, their deficiencies, and the etiologic agents associated with the outbreaks. The system reports outbreaks and the estimated numbers of people who become ill. Many factors can influence whether a water-borne disease outbreak (WBDO) is recognized and investigated by local, territorial, and state public health agencies. For example, the size of the outbreak, severity of the disease caused by the outbreak, public awareness of the outbreak, whether people seek medical care or report to a local health authority, reporting requirements, routine laboratory testing for organisms, and resources for investigation can all influence the identification and investigation of a WBDO. In addition, this system is a voluntary reporting system, so not every state or relevant public health agency may be reporting information to the system. This system underreports the true number of outbreaks because of the multiple steps required before an outbreak is identified and investigated.
Units of measurement	Number of outbreaks per year.
Computation	State, territorial, and local public health agencies are primarily responsible for detecting and investigating WBDOs and voluntarily reporting them to CDC.
Sources of further information	Craun, G.F. and R.L. Calderon. "Waterborne Outbreaks in the United States, 1971–2000." In: Frederick W. Pontius (ed.), Drinking Water Regulations and Health, New York, NY: John Wiley & Sons, 2003, 40-56.
Scale of application	National.
Useful references	Prevalence of 7 waterborne diseases can be found at: Morbidity and Mortality Weekly Report: http://www.cdc.gov/mmwr and Summary of Notifiable Diseases: http://www.cdc.gov/epo/dphsi/annsum.
Strengths of the Indicator	Data are used to evaluate current technologies for providing safe drinking water and safe recreational waters.

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