America's Children and the Environment

A First View of Available Measures

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America's Children and the Environment:

A First View of Available Measures

Office of Children's Health Protection

NCEE
NATIONAL CENTER FOR ENVIRONMENTAL ECONOMICS

POLICY ECONOMICS INNOVATION

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Summary List of Measures

Name	Description of Measure	Year(s)
Environmental Contaminants		
Outdoor Air Pollution		
Common Air Pollutants	Percentage of children living in areas in which air quality standards were exceeded	1990 to 1998
	Percentage of children's days with good, moderate, or unhealthy air quality	1990 to 1998
Hazardous Air Pollutants	Percentage of children living in counties where at least one hazardous air pollutant concentration was greater than a health benchmark in 1990	1990
Indoor Air Pollution		
Environmental Tobacco Smoke	Percentage of homes with children under 7 where someone smokes regularly	1994 to 1999
Drinking Water Contaminants		
Drinking Water Standards	Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated treatment requirements	1993 to 1998
Nitrates and Nitrites	Percentage of children living in areas served by public water systems in which the nitrate/nitrite drinking water standard was exceeded	1993 to 1998
Monitoring and Reporting	Percentage of children living in areas with major violations of drinking water monitoring and reporting requirements	1993 to 1998
Pesticide Residues in Foods	Percentage of fruits, vegetables, grains, dairy, and processed foods with detectable pesticide residues	1994 to 1998
Land Contaminants		
Hazardous Waste Sites	Percentage of children living in counties with Superfund sites	1990 to 2000
	Percentage of children living in counties that had Superfund sites in 1990	1990 to 2000
Biomonitoring		
Concentrations of Lead in Blood	Average concentrations of lead in blood for children 5 and under	1976 to 1994
	Percentage of children aged 1-5 with concentrations of lead in blood greater than 10 µg/dl	1992 to 1994

Summary List of Measures

Name	Description of Measure	Year(s)
Childhood Diseases		
Respiratory Diseases	Percentage of children under 18 with asthma and chronic bronchitis	1990 to 1996
	Percentage of children under 18 with asthma, 1997-98	1997 to 1998
	Asthma hospitalization rate for children 0-14	1987 to 1998
Childhood Cancer	Cancer incidence and mortality for children under 20	1975 to 1995
	Cancer incidence for children under 20 by type	1973 to 1996

About This Report

America's Children and the Environment: A First View of Available Measures is the U.S. Environmental Protection Agency's (EPA) first report on trends in measures reflecting environmental factors that may affect the health and well-being of children in the United States. This report represents an initial step in the identification, development, and compilation of a set of measures that fully reflect environmental factors important for children.

Developed by EPA's Office of Children's Health Protection in collaboration with EPA's National Center for Environmental Economics in the Office of Policy, Economics and Innovation, *America's Children and the Environment* presents measures that reflect trends in levels of environmental contaminants in air, water, food, and soil; concentrations of lead measured in children's bodies; and childhood diseases that may be influenced by environmental factors.

As part of EPA's commitment to children's health, the Office of Children's Health Protection and the National Center for Environmental Economics will continue to work to obtain data needed for measures that more fully reflect how environmental contaminants affect children's health.

What are the purposes of this report?

This report has two principal objectives. First, *America's Children and the Environment* presents concrete, quantifiable measures for key factors relevant to the environment and children in the United States. This initial work offers a basis for a better understanding of time trends for some of these factors and for further investigation of others. The authors and sponsors hope it will contribute to the effort to integrate the environmental health needs of children into the nation's policy agenda.

The second purpose of this report is to provide a starting point for discussions among policymakers and the public about how to improve federal data on children and the environment.

The long-term purpose of *America's Children and the Environment* is to identify or develop measures that could be used by policymakers and the public to track and understand the environmental health experience of children and, ultimately, to identify and evaluate ways to improve it. The work involved in developing the measures for children and the environment will contribute to this long-term goal.

How is the report structured?

The report first presents a series of measures and then discusses the direction of future work.

The first section of the report presents measures reflecting trends in levels of environmental contaminants that are likely to affect children's health. These measures are intended to show the percentage of children exposed to critical concentrations of contaminants in air, water, food, and soil. When data on actual environmental concentrations of contaminants are not available, the report presents surrogate measures.

The second section presents measures that reflect trends in concentrations of key contaminants measured in children's bodies. Such data provide direct evidence of children's exposures and can be tracked to determine whether childhood exposures are changing over time.

The third section presents measures that reflect trends in certain childhood diseases, the frequency or severity of which may be related to environmental factors. Information is presented about changes in the frequency of occurrence of these diseases over time.

The sections presenting measures are followed by a discussion of future directions, including ways in which the existing measures could be improved, alternative data sources, and measures that might be included in future versions.

Appendix A provides tables that summarize the data on which the measures were based, and Appendix B describes the sources of the data used in this report and the construction of the measures. Appendix C has a list of health goals relevant to the topics in this report, developed by Healthy People 2010, a collaborative effort coordinated by the U.S. Department of Health and Human Services to establish national health objectives.

Why did EPA focus on measures for children?

Children may be affected by environmental contaminants quite differently than adults are, 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 in these media. Children's normal activities, such as putting their hands in their mouths or playing on the ground, create opportunities for exposures to contaminants that adults do not face. In addition, environmental contaminants may affect children disproportionately because their immune defenses are not fully developed or their growing organs are more easily harmed.

To fully integrate the needs of children into the work of EPA and other agencies, it will be helpful to define targets for research and for interventions to reduce contaminant exposures and improve health.

In preparing this report, we have begun to assess the completeness of existing information for each of the three major types of measures: levels of contaminants in the environment, concentrations of contaminants in children's bodies, and frequency of key childhood diseases. We also have assessed how well the data sources reflected the particular experience of children.

As would be expected in any first such endeavor, the analysis identified a number of areas in which better or more appropriate data are needed. The assessment of priorities for obtaining additional information is a continuing process that will be furthered by review and reaction to the initial presentation in this report.

How were the measures in this report selected?

Three principal criteria were used to select measures for the report: importance to the health of children, availability of data for much or all of the United States, and sufficient quality of data to generate a reliable measure.

For environmental contaminants, we first identified five important media for children's exposure: outdoor air, indoor air, drinking water, food, and soil. For each of these, we reviewed the data sources available from federal environmental and health agencies and selected the most informative sources that provided national coverage (or close to it) and a reasonable assurance of reliability. If data about concentrations of key contaminants

could be identified and were of adequate quality, we used that source. If not, we selected the best available surrogate.

For concentrations of contaminants in children's bodies, we selected lead, a pollutant long recognized as having major impacts on children's health, and obtained the best available information about lead concentrations in the blood of children.

For childhood diseases associated with environmental factors, we initially selected the two diseases identified as priorities by the Interagency Task Force on Environmental Health Risks and Safety to Children, organized by EPA and the U.S. Department of Health and Human Services: asthma and childhood cancer. We added an additional respiratory disease, chronic bronchitis, because it is associated with air pollution. We then identified the best available data to assess time trends for the frequency of these diseases in children.

For each data source and topic, we structured the measures primarily to portray changes over time. In future versions of this report, measures also may be designed to reflect regional differences and ethnic and racial differences in effects or exposures.

What are the sources for the data in this report?

For most measures, federal agencies provided the data.

The data on environmental contaminants are from data systems maintained by EPA and by state environmental agencies. The data on lead in blood and on respiratory diseases are from the National Center for Health Statistics in the Centers for Disease Control and Prevention. The data on cancer are from the National Cancer Institute. County-level population data from the Census Bureau are used to calculate how many children potentially were affected by environmental contaminants. Detailed descriptions of the data sources may be found in Appendix B.

What groups of children are included in this report?

Most of the measures include all children in the United States under the age of 18. Exceptions are noted in the descriptions of the measures.

What years are included in this report?

The report includes data for the 10 years from 1990 through 1999 whenever possible. In many cases, data were available for only some of these years. In other cases, data available before 1990 were included to provide an expanded depiction of trends.

What is the Office of Children's Health Protection at EPA?

The Office of Children's Health Protection (OCHP) supports and facilitates EPA's efforts to protect children from environmental threats. OCHP's mission is to make the protection of children's health a fundamental goal of public health and environmental protection in the United States. OCHP reviews EPA proposals for their impact on children and funds work designed to improve the protection of children from environmental hazards.

About This Report

What are the Office of Policy, Economics and Innovation and the National Center for Environmental Economics at EPA?

The Office of Policy, Economics and Innovation develops new approaches and provides analysis to enable EPA to better address emerging environmental challenges. The office addresses cross-cutting environmental management strategies, identifies emerging issues, and acts as a catalyst for testing and institutionalizing integrative approaches to environmental protection. Within the Office of Policy, Economics, and Innovation, EPA's National Center for Environmental Economics (NCEE) provides economic and health analysis of important environmental issues for the regulatory and policy process. NCEE also conducts research that will improve our current understanding of the impacts of environmental contaminants on public health. NCEE's staff includes specialists in air, water, solid waste, cross-media economics, and children's health risks. The center's health scientists emphasize new methods for assessing previously unidentified risks, assessing relationships between exposures and disease, and developing tools to communicate this information to the public.

Key Findings

Part I: Environmental Contaminants

Outdoor Air Pollution

- Between 1990 and 1998, the percentage of children living in counties where one or more of the six criteria air pollutants (ground-level ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide) exceeded national air quality standards decreased from 28 percent to 24 percent, although it fluctuated from a high of 32 percent to a low of 17 percent.
- The percentage of children's days with unhealthy air quality decreased between 1990 and 1998, dropping from 4 percent in 1990 to less than 2 percent in 1998.
- In 1990, 100 percent of America's children lived in counties in which a 1-in-100,000 benchmark for cancer risk was exceeded by at least one hazardous air pollutant. In the same year, 6 percent of children lived in counties in which a 1-in-10,000 cancer risk benchmark was exceeded by at least one hazardous air pollutant. Also in the same year, nearly 95 percent of children lived in counties in which a benchmark for non-cancer health effects was exceeded by at least one hazardous air pollutant.

Indoor Air Pollution

- The percentage of homes with children under 7 in which someone regularly smokes declined from 29 percent in 1994 to 19 percent in 1999.

Drinking Water Contaminants

- Between 1993 and 1998, the percentage of children living in areas served by public water systems in which a drinking water standard for chemicals, radiation, or microbial contaminants was exceeded, or treatment rules were violated, decreased from 19 to 8 percent.
- Between 1993 and 1998, the number of children served by a public water system in which the nitrate or nitrite drinking water standard was exceeded decreased by close to 20 percent.
- The percentage of children living in areas served by public water systems with at least one major monitoring or reporting violation dropped from 21 percent in 1993 to 10 percent in 1998.

Pesticide Residues in Foods

- Of the fruits, vegetables, grains, dairy, and processed foods tested by the U.S. Department of Agriculture's Pesticide Data Program, 62 percent showed detectable pesticide residues in 1994. This number decreased to 55 percent in 1998 but fluctuated in the interim years.

Part II: Biomonitoring

Concentrations of Lead in Blood

- Average concentrations of lead in the blood of children aged 5 and under dropped 78 percent from 16.5 micrograms per deciliter in 1976-80 to 3.6 in 1992-94. The decrease is largely attributed to the elimination of leaded gasoline between 1973 and 1995.
- Between 1992 and 1994, approximately 1.5 million children aged 17 and younger had elevated blood lead levels (higher than 10 micrograms per deciliter).

- Race and poverty affect a child's likelihood of having elevated concentrations of lead in his or her blood. Children living in families with incomes below the poverty line are more likely to have elevated blood lead levels. Black children are more likely to have elevated levels than white non-Hispanic and Hispanic children.

Part III: Childhood Diseases

Respiratory Diseases

- The prevalence of asthma among children in the United States increased 75 percent between 1980 and 1994. In 1990, 5.8 percent of children had asthma, increasing to 7.5 percent in 1995.
- In 1997-98, 8.3 percent of non-Hispanic Black children living in families with incomes below the poverty level had asthma, the highest for all racial groups and income levels.
- The frequency of asthma hospitalizations for children aged 0 to 14 fluctuated between 1987 and 1998. In 1987, the frequency was 284 hospitalizations per year per 100,000 children. The frequency increased to 369 per 100,000 in 1995 and then dropped to 277 per 100,000 in 1998.

Childhood Cancer

- The frequency of cancer in childhood increased from 130 cases per million children in 1975 to 150 cases per million in 1995, though this increase appears to have leveled off since 1990.
- While the frequency of childhood cancer has increased, the number of deaths from cancer in children has declined significantly since 1972. The decline in deaths is largely due to significant improvements in treatment for many forms of cancer in children.
- Between 1973 and 1996, leukemia was the cancer most commonly diagnosed among children and represented 25 percent of cases. The frequency of acute lymphoblastic leukemia increased moderately from 23 cases per million in 1973-1978 to approximately 27 cases per million in 1991-1996. The frequency of acute myeloid leukemia has remained stable.

PART I

Environmental Contaminants

Part I: Environmental Contaminants

This section of the report presents measures reflecting levels of contaminants of concern for children and how these levels have changed over time. Many different substances can affect the health of children. Children may come into contact with harmful pollutants in air, water, food, and soil. Tracking the levels of these pollutants is an important step toward ensuring that environmental policies protect children.

This section includes measures for contaminants in outdoor air, indoor air, drinking water, food, and soil. Most of the measures show the percentages of children who may be at risk from exposure to critical concentrations of pollutants.

Ideally, the report would include measures that reflect trends in concentrations of all important pollutants in all relevant exposure media. However, data of this type are not available for the most part, and the measures in this section are based largely on surrogates for such data.

The measures in this section do not account for some forms of environmental contaminants that also are important for children but are less amenable to measurement and data collection at a national scale. These include contaminants in dusts and soils in and near homes. Also, the measures do not include exposures through breast-feeding or exposures that occur prenatally.

The Future Directions section (see page 57) describes additional information that would be important to assess potential environmental threats to children fully, as well as ways in which existing data systems might be improved to provide better information for assessments.

Within Part I, the data used to develop measures of pollutants in outdoor air are the most complete. Information about the six most common outdoor air pollutants (often called the criteria pollutants) is available for nine of the 10 target years for this report. The data used are close surrogates for measured concentrations of pollutants, as they indicate whether air quality standards for pollutants were exceeded. Data for some pollutants are available for the vast majority of counties, though data for all six pollutants are available for relatively few counties due to limitations in monitoring networks. The criteria air pollutant measures thus represent all six of the relevant pollutants, provide very good coverage of the target time period, and offer fairly good but not complete coverage of the counties of the United States.

For hazardous outdoor air pollutants, the analysis includes data for one year, 1990. The data used to generate the measure are estimates of ambient concentrations of 148 pollutants—most of the pollutants identified as hazardous air pollutants under the Clean Air Act—for all counties in the contiguous United States.

For indoor air, this initial report includes one pollutant: environmental tobacco smoke. Many other important pollutants, including combustion products and volatile organic compounds, would be relevant to include if data could be identified. The measure used in this report is a surrogate for measured concentrations of environmental tobacco smoke in the home, as it is based on a survey that collected nationally representative data in 1994, 1996, and 1999 about the number of homes with young children in which people smoke.

For drinking water, the report uses surrogate measures for concentrations of contaminants in drinking water, relying on reported violations of drinking water standards for a wide variety of chemicals, physical agents such as radiation, and microbes such as bacteria and viruses. The measures also show trends for violations of rules for treatment of drinking water. The coverage of the measures in this section is fairly complete in terms of geographic areas, years of available data, and chemicals included. However, the reports of violations of standards are incomplete due to monitoring and reporting limitations.

For food, this report presents a measure of the frequency with which detectable levels of pesticides were found in fruits, vegetables, and other foods from 1994-1998. This measure is a surrogate for concentrations of pesticides in foods. The measure has fairly complete national coverage and is available for several years within the target range. However, it does not distinguish among different pesticides or among different foods with pesticide residues. Some pesticides may pose greater risks to children than others do, and residues on some foods may pose greater risks than residues on other foods. Moreover, the measure does not include many contaminants in food that are relevant to children, such as mercury.

For soil, little or no information about contaminants is available at a national scale. The report includes a surrogate measure based on the location of Superfund hazardous waste sites. This measure provides good coverage in that data are available for all counties for 1990-2000, but the measure is recognized to have significant limitations.

Outdoor Air Pollution

Common Air Pollutants

Air pollution contributes to a wide variety of health effects, though most of the evidence for health impacts is from studies on adults. The most common air pollutants—ground-level ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide—are regulated by EPA and the individual states. These pollutants often are called criteria pollutants.

Several of these pollutants, including ozone and particulate matter, have been associated with increases in respiratory-related diseases in children, including reduction of lung function, increases in respiratory symptoms, and increased severity or frequency of asthma attacks.[1-9] Lead damages the central nervous system in children. Higher concentrations of particulate matter increase mortality in the general population.[10-11]

EPA sets National Ambient Air Quality Standards for each of these pollutants to protect people from adverse health effects. The standards specify how much of each pollutant is allowed in the air. 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 periods of one hour and eight hours, while the current standard for nitrogen dioxide is for one year. The standards and the varying time periods for which they apply are shown in Appendix B as Table 1.

Air Quality Exceedances During a Year

State agencies that monitor air quality report their results to EPA, which then reports instances in which the measured concentration of a pollutant exceeds the standard for that pollutant. A description of the methods used to determine whether an exceedance has occurred is available in Appendix B.

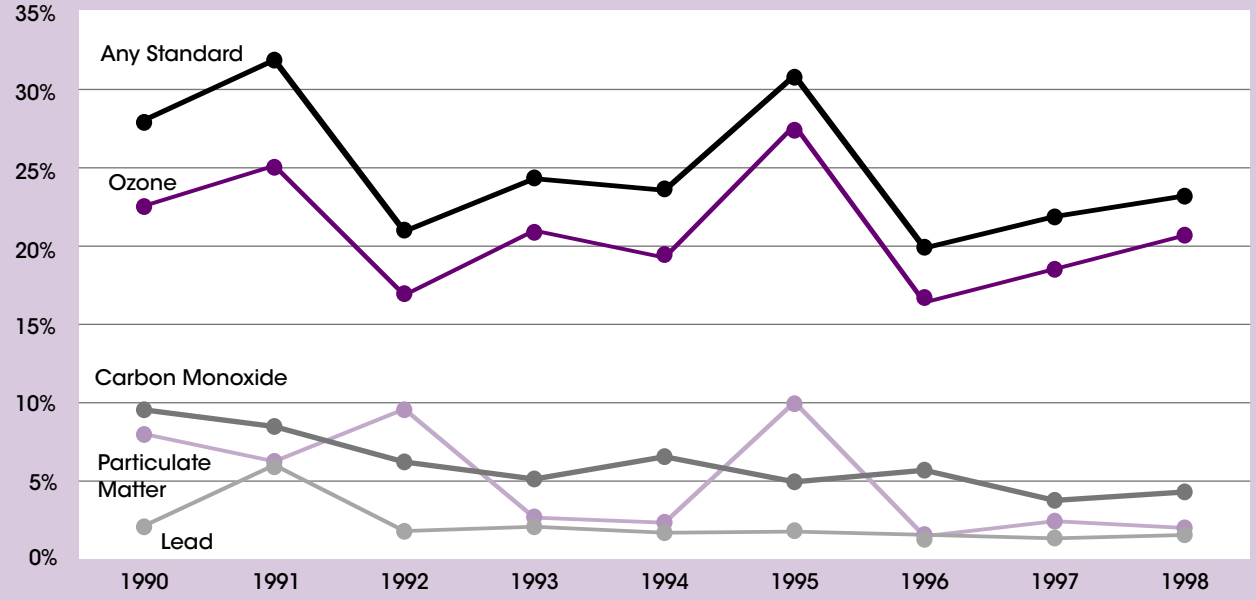
For this measure, we used EPA's results showing when air quality standards were exceeded in counties in the United States. We calculated the percentage of children living in areas with reported exceedances for the six criteria pollutants. This measure shows the percentage of children that may be exposed to poor air quality at some point during a year.

This measure does not differentiate between areas in which standards are exceeded frequently or by a large margin and areas in which standards are exceeded only rarely or by a small margin. Also, because the nature of health effects varies significantly and the averaging times associated with different standards vary widely, exceedances for different standards are not comparable. For example, the ozone standard considers measured levels of ozone within a one-hour period and health effects such as lung function decrements, respiratory symptoms, and hospital admissions. In contrast, the averaging time for the lead standard is three months and is based on health effects such as IQ decrements and hypertension.

Healthy People 2010: Objective 8-01 of the Healthy People 2010 initiative aims to reduce the number of people exposed to air that fails to meet EPA's health-based standards for criteria air pollutants. See Appendix C for more information.

Measure E1

Percentage of children living in counties in which air quality standards were exceeded



SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System.

- From 1990 through 1998, approximately 25 percent of children lived in a county in which at least one air quality standard was exceeded during the year.
- The highest number of exceedances was for ozone. In 1990, approximately 23 percent of children lived in counties in which the ozone standard was exceeded on at least one day. In 1998, approximately 21 percent of children lived in such counties.
- In 1990, approximately 10 percent of children lived in counties in which the carbon monoxide standard was exceeded. In 1998, approximately 4 percent of children lived in such counties.
- From 1990 to 1998, the percentage of children living in counties that exceeded the daily standard for particulate matter fluctuated, but was as high as 10 percent in 1992 and 1995.
- On average, 2 percent of children lived in counties that exceeded the standard for lead. The main sources of ambient concentrations of lead are metals processors, such as smelters, and battery manufacturers.[12]
- No exceedances of the nitrogen dioxide standard have occurred since 1991. However, the nitrogen dioxide standard is based on measurements over a full year and therefore is not comparable to the other standards included here. Also, few exceedances of the sulfur dioxide standard have occurred since 1993. Consequently, these two pollutants are not included on the graph.

Daily Air Quality

EPA provides an Air Quality Index (AQI) that offers useful information about air quality. The purpose of the AQI is to help individuals understand what local air quality means to their health. The AQI is like a yardstick: the higher the AQI value, the greater the level of air pollution and the greater the danger to health.

The AQI is based on measurements of up to five of the six air quality criteria pollutants (carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, and particulate matter). The AQI is a measure of air quality for each day. An AQI value of 100 for a given criteria pollutant generally corresponds to the national ambient air quality standard (NAAQS) for that pollutant and the level EPA has set to protect public health for that pollutant on a single day.

EPA has divided the AQI scale into categories. Air quality is considered "good" if the AQI is between 0 and 50. At this level, air quality is satisfactory and air pollution poses little or no risk over the short term. Air quality is considered "moderate" if the AQI is between 51 and 100. Air quality at this level is acceptable, but some pollutants may present a moderate health concern for a very 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 public is not likely 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.

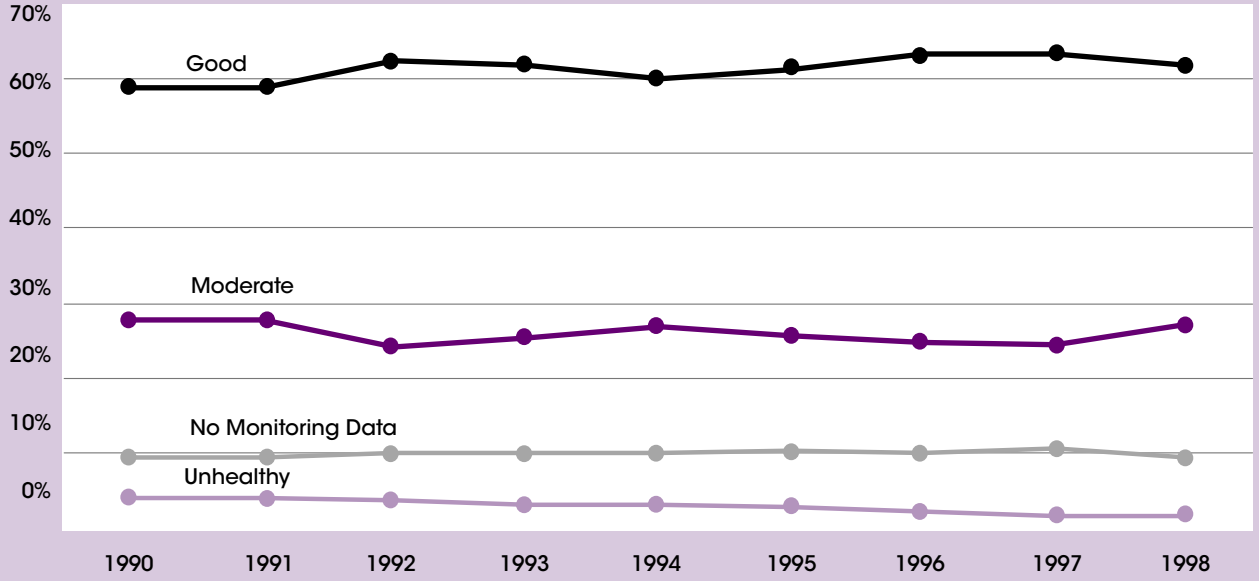
Measure E2 on the following page uses the reported AQI for the counties of the United States. This measure was developed by reviewing the air quality designation for each day for each county. The daily designations were weighted by the number of children living in each county. The resulting measure may be considered to be reported in "child-days," where the designation for each day for each child in a county is counted toward the total. This measure reflects the number of days that children live in a county with air quality in each category.

The advantage of this approach, compared with that used in measure E1 on the previous page, is that it 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 standards for these pollutants.

The limitation of this method is that 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 short-term, daily pollution burdens and is not well suited for reporting concentrations of lead and nitrogen dioxide because these pollutants do not have one-day standards. This 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 particulate matter.

Measure E2

Percentage of children's days with good, moderate, or unhealthy air quality



SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System.

- The percentage of children's days that were designated as having "unhealthy" air quality decreased between 1990 and 1998, dropping from 4 percent in 1990 to less than 2 percent in 1998. The percentage of children's days that were designated as having "moderate" air quality remained about the same between 1990 and 1998, at about 27 percent.
- The coverage of monitoring for this measure was largely unchanged between 1990 and 1998. Approximately 10 percent of children's days of exposure to air pollutants were not monitored at all. Even on days that were monitored, in many cases only one or a few pollutants were monitored. Areas that do not have monitors may be expected to have good air quality, but we do not have monitoring data to verify this.

Hazardous Air Pollutants

Hazardous air pollutants, also known as air toxics, have been associated with a number of adverse human health effects, including cancers, asthma and other respiratory ailments, and neurological problems such as learning disabilities and hyperactivity.[13-17] Examples of the 188 hazardous air pollutants listed in the Clean Air Act include benzene, trichloroethylene, mercury, chromium, and dioxins. Ambient concentrations result from emissions by local or regional sources such as chemical manufacturing plants, refineries, waste incinerators, electricity generating plants, dry cleaners, cars, trucks, and buses. For some hazardous air pollutants, ambient concentrations also result from emissions that occurred in past years or from natural sources.

Unlike the criteria air pollutants, there are no national air quality standards for hazardous air pollutants that can be used to construct a health-based measure. Instead, we have compared ambient concentrations of hazardous air pollutants with health benchmark concentrations derived from scientific assessments conducted by EPA and other environmental agencies.[13; 18-20]

Hazardous Air Pollutants and Health Benchmarks

For this analysis we used four different health benchmark concentrations. Three benchmarks reflect potential cancer risks, at levels of one-in-a-million risk, 1-in-100,000 risk, and 1-in-10,000 risk. If a particular hazardous air pollutant is present in ambient air at a one-in-a-million benchmark concentration, for example, one additional case of cancer would be expected in a population of one million people exposed for a lifetime. The fourth benchmark concentration corresponds to the level at which a hazardous air pollutant may be associated with human health effects other than cancer.

The four benchmarks generally reflect expected effects in adults, rather than potential risks to children or risks in adulthood stemming from childhood exposure. Benchmarks are not available to reflect these concerns.

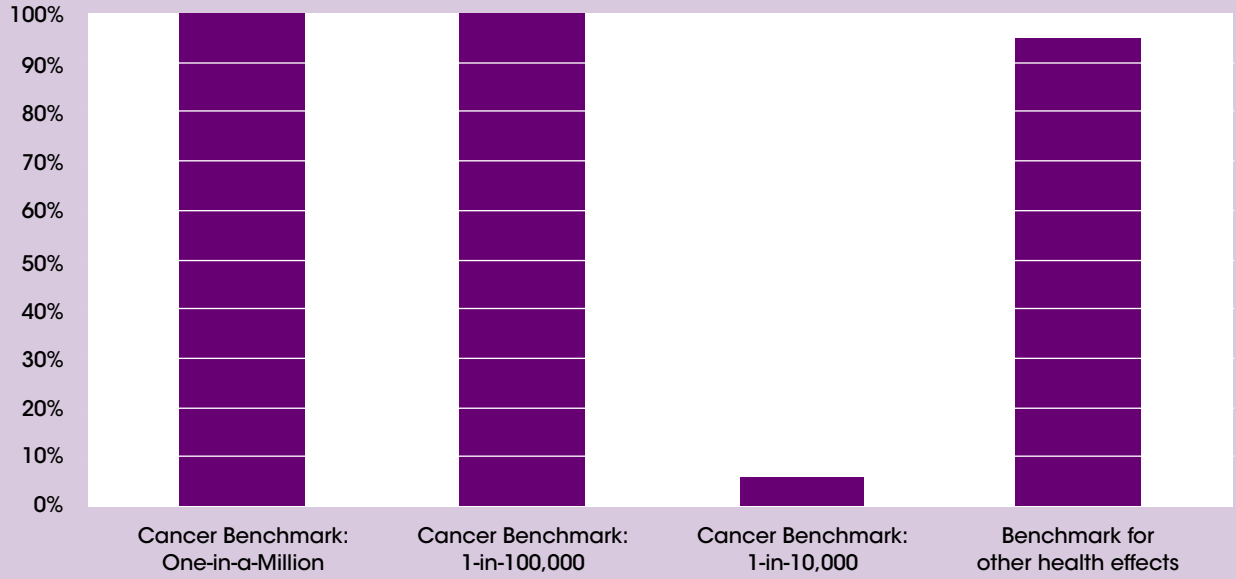
The estimates of ambient concentrations of air toxics for the year 1990 were computer-generated. The computer model provided estimates for every county in the continental United States. The computer estimates are consistent with the limited set of actual measurements of ambient air toxics concentrations available for 1990.

This measure only considers exposures to air toxics that occur by inhalation. An important additional pathway of exposure to many air toxics is through deposition of those pollutants to land and water, and subsequent accumulation in the food chain. For hazardous air pollutants that are persistent in the environment, exposures through food consumption typically are greater than inhalation exposures. Hazardous air pollutants for which these food chain exposures are important include mercury and other hazardous air pollutants that can damage a child's nervous system.[21-23]

Healthy People 2010: Objective 8-04 of the Healthy People 2010 initiative focuses on reducing emissions of hazardous air pollutants. See Appendix C for more information.

Measure E3

Percentage of children living in counties where at least one hazardous air pollutant concentration was greater than a health benchmark in 1990



SOURCE: U.S. Environmental Protection Agency, Cumulative Exposure Project.

- In 1990, all children lived in counties in which the one-in-a million and 1-in-100,000 cancer risk benchmarks were exceeded by at least one hazardous air pollutant. Six percent of children lived in counties in which at least one hazardous air pollutant exceeded the 1-in-10,000 benchmark.
- Approximately 95 percent of children lived in counties in which the benchmark for health effects other than cancer was exceeded by at least one hazardous air pollutant.
- Actual exposures may differ from ambient concentrations. Indoor concentrations of hazardous air pollutants from outdoor sources may be slightly lower than ambient concentrations, though they can be significantly higher if any indoor sources are present. Levels of some hazardous air pollutants may be substantially higher inside cars and school buses, and those higher levels would increase the risks.
- In the upcoming year, as part of its National Air Toxics Assessment (NATA) activities, EPA will finalize a national-scale assessment of hazardous air pollutant risks for the year 1996 (see ww.epa.gov/ttn/uatw/nata for a complete description). In the future, measures of hazardous air pollutant risks to children will be developed using information from NATA, which will be updated every three years.

Indoor Air Pollution

Environmental Tobacco Smoke

Children can be exposed to a number of air pollutants inside homes, schools, and other buildings. Some of these pollutants come from indoor sources, including emissions from combustion sources such as gas stoves, fireplaces, and secondhand tobacco smoke; off-gassing from building materials such as treated wood and paints, furnishings, carpet, and fabrics; and consumer products such as sprays, window cleaners, and laundry soap. Exposure to environmental tobacco smoke has been recognized as an important health risk for children and is included in this report. Information on the toxic effects of other important indoor pollutants indicates that they could pose health risks to children.[24] We will continue to explore data sources for other indoor air pollutants to include in future reports.

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).[25-28] Exposure to environmental tobacco smoke also may be a risk factor contributing to new cases of asthma.[25; 29-30] Young children appear to be more susceptible to the effects of environmental tobacco smoke than older children are.[25]

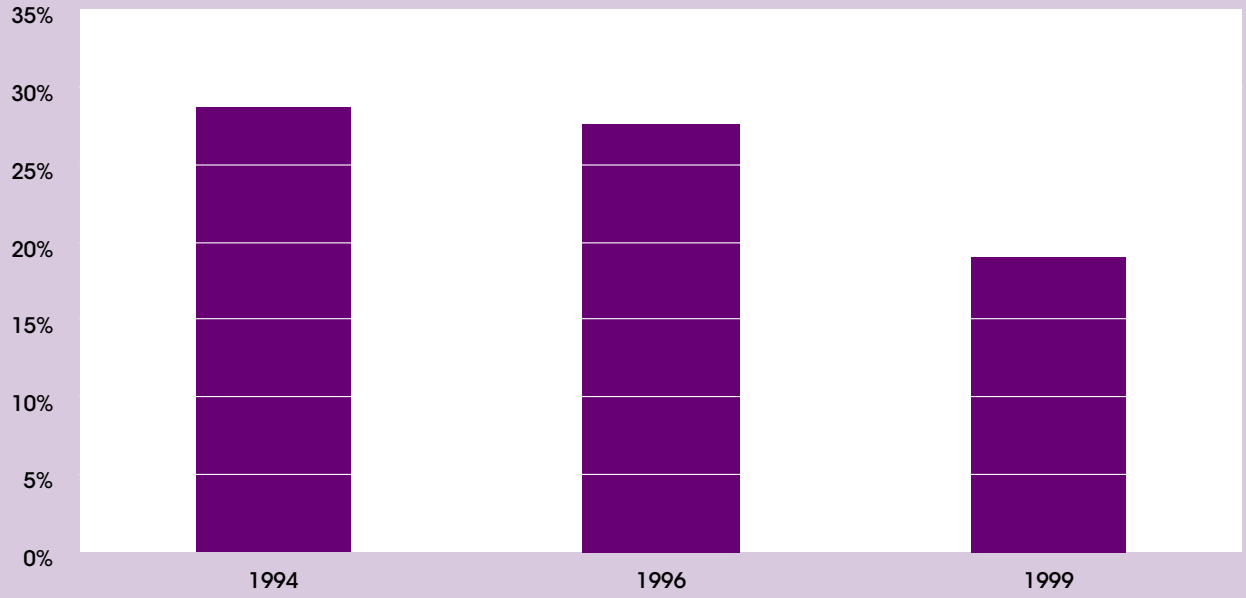
Smoking in the Home

Environmental tobacco smoke in the home is an important source of exposure because children spend most of their time at home and indoors. This report's measure for environmental tobacco smoke is the percentage of homes with children under 7 in which someone smokes regularly. This measure is a surrogate for the exposure of children to tobacco smoke, and the data are based on a national survey. Data are available for three of the 10 target years. The measure reflects the percentage of homes, rather than children, although it is expected that the two would track closely.

Healthy People 2010: Objective 27-09 of the Healthy People 2010 initiative seeks to reduce the percentage of children regularly exposed to secondhand smoke. See Appendix C for more information.

Measure E4

Percentage of homes with children under 7 where someone smokes regularly



SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division, Surveys on Radon Awareness and Environmental Tobacco Issues.

- The percentage of homes with children under 7 in which someone smokes on a regular basis decreased from 29 percent in 1994 to 19 percent in 1999.
- The percentage of homes with children under 7 in which someone is a smoker is greater than the percentage in which someone is allowed to smoke in the home.
- Most often the smoker in the home is one of the parents.
- The decline in the percentage of children exposed to environmental tobacco smoke in the home is similar to the decline in the percentage of adults who smoke.

Drinking Water Contaminants

The contaminants in drinking water are quite varied and can cause a range of diseases in children, including cancer, developmental effects such as learning disorders, and acute diseases such as gastrointestinal illness. Children are particularly sensitive to microbial contaminants because their immune systems may be less well developed than those of most adults. Children are sensitive to lead, which affects brain development, and to nitrates, which can cause methemoglobinemia (blue baby syndrome).

EPA sets drinking water standards for public water systems, referred to as Maximum Contaminant Levels (MCLs). These standards are designed to protect against adverse health effects from contaminants in drinking water while taking into account technical feasibility of meeting the standard. MCLs have been adopted for more than 80 microbial contaminants, chemicals, and radionuclides. EPA also adopts standards for the protection of drinking water sources and for the treatment of drinking water to increase its safety. An important treatment-related standard, the Surface Water Treatment Rule, requires treatment of surface water by filtration to remove contaminants.

In 1998, EPA established more stringent filter performance requirements to further strengthen microbial protection. In the same year, EPA also established new drinking water standards for disinfection byproducts, exposure to which has been associated with long-term bladder cancer and possible reproductive effects. Most recently, EPA finalized standards protecting against radionuclides in drinking water. Because these standards have been promulgated only recently, this report does not reflect the increased public health protection achieved through their implementation.

Exceedances of Drinking Water Standards

One way to measure children's risk of exposure to contaminated drinking water is to identify public water systems that contain contaminants at levels greater than those allowed by the drinking water standards. Ideally, we would look at data on concentrations of all of the chemical and microbial contaminants in all public drinking water systems and identify any areas of risk for children. This is not currently possible, for two reasons. First, the national data systems for drinking water do not track concentrations of contaminants in drinking water, but rather the frequency with which standards are exceeded. Second, the information on violations is incomplete because not all public water systems fully monitor contaminants or report their monitoring results. (We do, however, have some data that identify the public water systems that do not monitor or report their results.)

We can use information about violations as a surrogate for exposure to unacceptably high levels of drinking water contaminants. We also need to consider information about water systems that do not monitor or report results, because we do not know with certainty whether populations served by these systems are at risk.

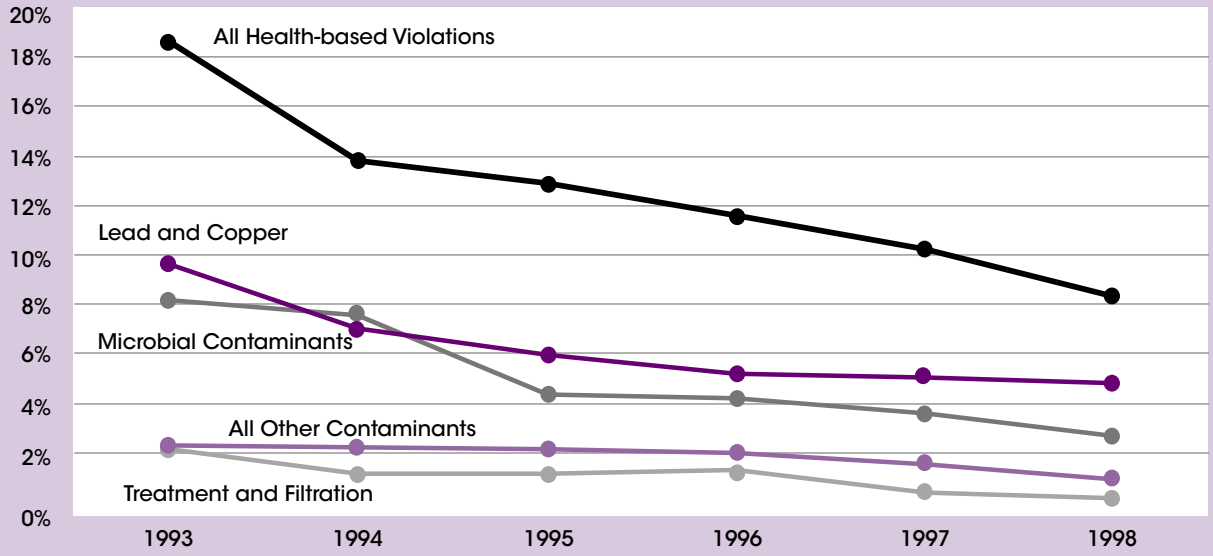
Data are available only for public water systems. Approximately 42 million people are served by private drinking water systems, which are not required to monitor and report the quality of drinking water. We do not have information to indicate whether these people are at risk.

Healthy People 2010: Objective 8-05 of the 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. See Appendix C for more information.

Drinking Water Contaminants

Measure E5

Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated treatment requirements



SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

- The percentage of children served by public water systems that exceeded a Maximum Contaminant Level or violated a treatment standard decreased from 19 percent in 1993 to 8 percent in 1998.
- Every category of violation decreased between 1993 and 1998. The largest decline was for violations of the microbial contaminants standards.
- A violation of "treatment and filtration" is defined as any failure in the treatment process, or in operation and maintenance activities, or both, that may affect water quality. EPA has a rule that specifies the type of treatment and maintenance activities that systems must use to prevent microbial contamination of drinking water.
- Data on violations reported to the federal government are of generally high quality. However, many public water systems fail to report all violations. A recent review of the data concluded that 68 percent of the microbial contaminant violations are reported, 19 percent of the violations for other contaminants are reported, and 11 percent of the treatment and filtration violations are reported.[31]

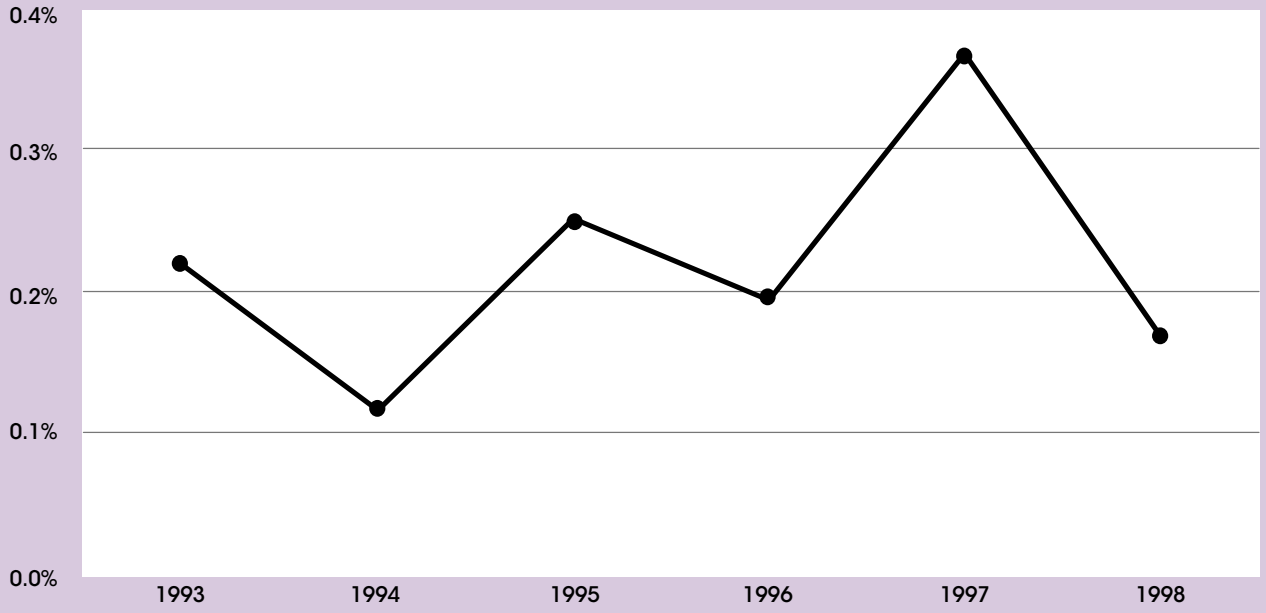
Nitrates and Nitrites

High levels of nitrites or nitrates in the water supply can interfere with infants' ability to absorb oxygen and can lead to "blue-baby" syndrome (methemoglobinemia), which can result in death. EPA has set drinking water standards for nitrates and nitrites.

The percentage of children living in areas served by public water systems that violate these standards can be used as a measure of risk of exposure to nitrates and nitrites. However, some families are served by water supplies, such as wells, that are not included in this measure because they are not part of public water systems and are not subject to monitoring. Many people served by private water supplies live in rural and agricultural areas, and may be at particular risk. Fertilizer and livestock manures are significant contributors of nitrates and nitrites in groundwater supplies of drinking water.

Measure E6

Percentage of children living in areas served by public water systems in which the nitrate/nitrite standard was exceeded



SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

- In 1993, approximately 147,000 children were served by public water systems that violated the nitrate or nitrite standard. In 1998, 117,000 children were served by systems that violated the nitrate or nitrite standard.
- The primary sources of nitrates include livestock manure (especially from feedlots), fertilizers, and human sewage.

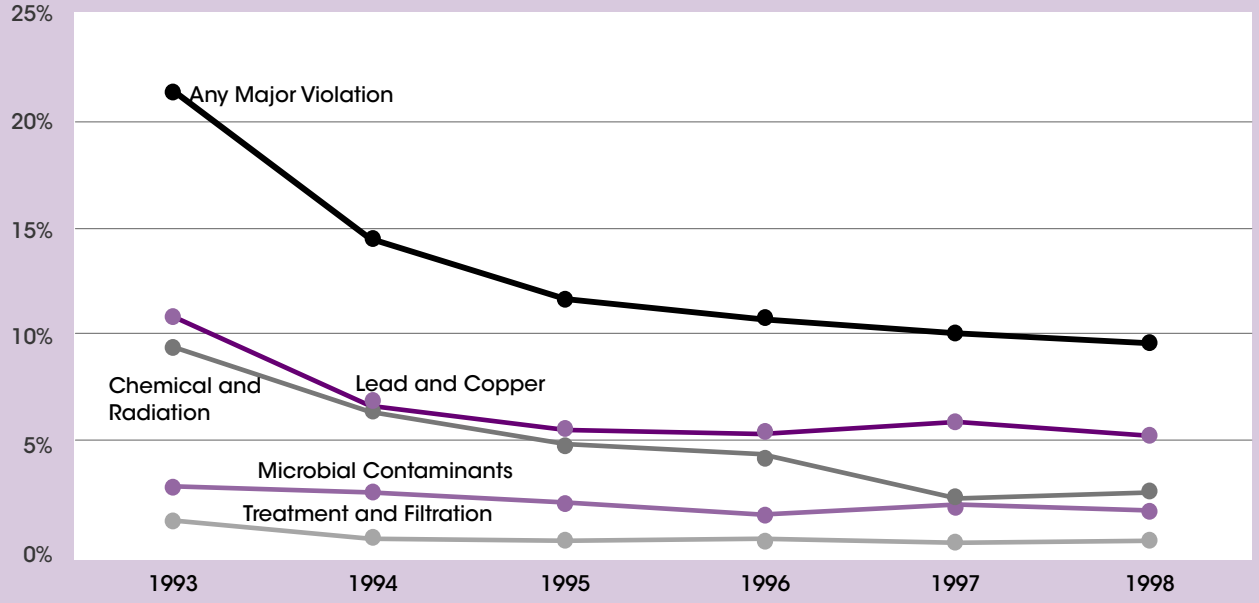
Monitoring and Reporting

Public water systems are required to monitor for contaminants and report violations of drinking water standards to EPA. However, not all public water systems conduct all required monitoring and report violations. Such water systems violate monitoring and reporting requirements.

Some monitoring and reporting violations, such as late reporting, are minor. But some water systems have major violations, such as failing to collect any water samples during a specified monitoring period. Children that live in areas that are not adequately monitoring for water contaminants may be at risk, but the extent of the risk is unknown.

Measure E7

Percentage of children living in areas with major violations of drinking water monitoring and reporting requirements



SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

- In 1993, approximately 21 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 1998.
- 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 constant since then.
- The percentage of children who live in areas with a major chemical and radiation monitoring violation declined from approximately 9 percent in 1993 to about 2 percent in 1998.

Pesticide Residues in Foods

Most of the food produced for human consumption is grown using pesticides. Chemical control of weeds, insects, fungi, and rodents has enabled agricultural productivity and intensity to increase. However, these economic benefits are not without their risks to human and environmental health. Small amounts of some pesticides may remain as residues on fruits, vegetables, grains, and other foods. If exposures are great enough, many pesticides may cause harmful health effects, including delayed or altered development, cancer, acute and chronic injury to the nervous systems, lung damage, reproductive dysfunction, and possibly dysfunction of the endocrine (hormone) and immune systems.[32-33]

Children's exposures to pesticide residues may be relatively higher than those 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.[34] For instance, children typically consume larger quantities of applesauce, milk, and orange juice per pound of body weight.

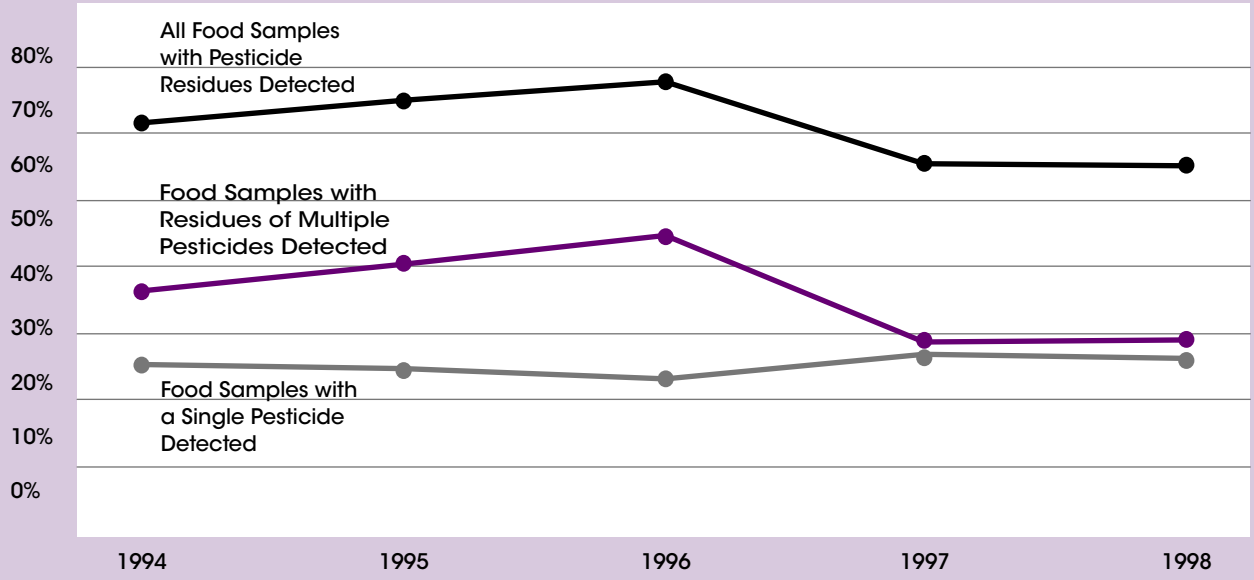
Protecting the food supply from harmful levels of pesticide residues requires the ongoing attention of government agencies, pesticide producers, and pesticide users. The U.S. Department of Agriculture (USDA) collects annual data on pesticide residues in food. Among the foods sampled by the USDA's Pesticide 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. EPA evaluates the safety of all new and existing pesticides and restricts pesticide use to those applications that do not pose unacceptable human health or ecological risks.

Pesticides are not the only contaminants in food that may affect children's health adversely. Industrial contaminants (such as dioxins, PCBs, and mercury), microbial contaminants (such as E. coli), and natural contaminants (such as aflatoxin) also can be found in foods. The Pesticide Data Program does not analyze foods for the presence of these types of contaminants, although other government programs monitor for some of them.

The chart on the following page displays the percentage of foods with detectable pesticide residues reported by the PDP from 1994 to 1998.[35-36] 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 pesticides may pose greater risks to children than others do; residues on some foods may pose greater risks than residues on other foods due to differences in amounts consumed. For some pesticides, residues at levels below detection limits may pose important risks, while for other pesticides detectable levels of residues may not pose a significant health concern. 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.

Measure E8

Percentage of fruits, vegetables, grains, dairy, and processed foods with detectable pesticide residues



SOURCE: U.S. Department of Agriculture, Agricultural Marketing Service, Pesticide Data Program Annual Summary (Calendar Years 1993-1998).

- In 1994, 62 percent of all food samples tested by the U.S. Department of Agriculture's Pesticide Data Program (PDP) had detectable levels of at least one pesticide. The proportion of samples with detections increased to 68 percent in 1996, then declined to 55 percent in 1998.
- In 1998, 29 percent of samples had detectable levels of multiple pesticides, compared with 36 percent in 1994. During the same period, the proportion of samples with detectable levels of a single pesticide remained relatively constant.
- PDP data from 1994-96 were further evaluated for the presence of pesticides in 19 foods frequently eaten by children. This analysis focused on detections of carcinogenic and neurotoxic pesticides. Twenty-five percent of the samples had detectable levels of carcinogenic pesticides, and 34 percent had detectable levels of neurotoxic pesticides (not shown).
- Each year, less than 0.2 percent of all sampled foods had residues that violated established tolerances. A tolerance is the amount of pesticide residue legally allowed to remain on a food commodity.

Hazardous Waste Sites

Abandoned and uncontrolled hazardous waste sites may pose risks to children who play in or near them, and the sites also may cause pollution of drinking water, ambient air, and foods. Superfund is the federal government's program to clean up these sites. EPA's principal mechanism for placing sites on Superfund's National Priorities List (NPL) is a scoring system that uses information from initial, limited investigations to assess the relative potential of sites to pose a threat to human health or the environment.

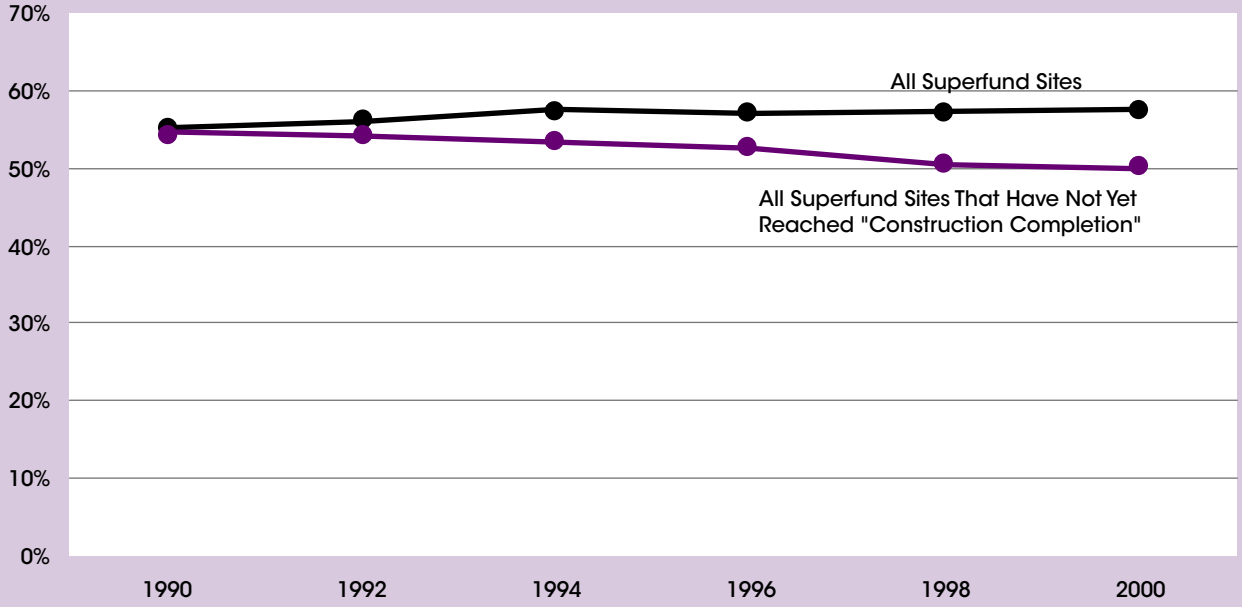
Sites with scores indicating a high risk potential are proposed for addition to the NPL. EPA then accepts public comments on the sites, responds to the comments, and finalizes the listing for those sites that continue to meet the requirements for addition to the list. Sites on the NPL are studied in detail and cleaned up as necessary. Sites are deleted from the list when EPA determines that no further response is required to protect human health or the environment.

Sites at which substantial cleanup work has been completed may be designated as having reached "Construction Completion." This means that any physical construction necessary to reduce potential exposures has been completed, and other controls are in place to prevent exposure while final cleanup levels are being achieved. Construction Completion represents a level of site remediation at which potential exposures have been significantly reduced, although additional cleanup work remains.

Residence in a county where a Superfund site is located is a surrogate measure for potential exposure to contaminants found at these sites. This measure has complete national coverage and includes data for multiple years. The limitations of this measure are that some children living in counties with Superfund sites may live many miles away from those sites, in which case the potential for exposure could be low. Also, the hazards posed to children may vary significantly across the different Superfund sites.

Healthy People 2010: Objective 8-12 of the Healthy People 2010 initiative addresses the mitigation of hazardous waste sites on the National Priority List. See Appendix C for more information.

Measure E9 **Percentage of children living in counties with Superfund sites**



SOURCE: Environmental Protection Agency, Superfund NPL Assessment Program (SNAP) Database.

- About 58 percent of children lived in counties with Superfund sites as of August 2000. This figure represents an increase from approximately 55 percent in 1990. The increase is due to the addition of sites to the list through the 1990s as initial evaluations were completed. The soil at these newly listed sites probably has been contaminated for many years, so the increase in the percentage of children living in counties with Superfund sites does not necessarily reflect an increase in hazards to children in recent years.
- Sites that have reached "Construction Completion" are expected to pose a substantially reduced hazard. When only the Superfund sites that have not reached this milestone are considered, the percentage of children living in counties with hazardous waste sites has declined from 55 percent in 1990 to 50 percent in 2000.
- More than 750 out of the 1,500 sites on Superfund's National Priorities List (NPL) have reached Construction Completion. Of these, cleanup has been completed at more than 200 sites and they have been removed from the NPL.

Hazardous Waste Sites Listed as of 1990

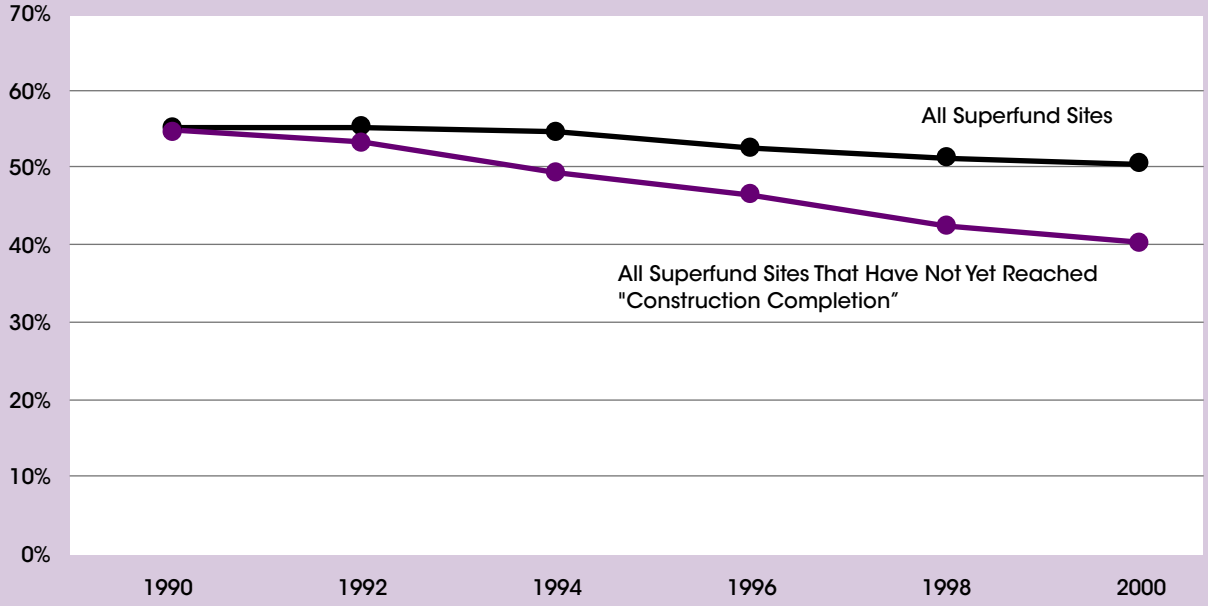
Another way to look at trends in children potentially affected by Superfund sites is to focus only on changes in those sites that were on Superfund's National Priorities List (NPL) at the end of fiscal year 1990. As noted above, the analysis based on the entire NPL may be misleading, because the addition of sites to the NPL in recent years does not necessarily mean that risks have increased. Most of the newly listed sites have been contaminated for many years, and their addition to the NPL in the 1990s means only that EPA has recognized the contamination and that the administrative processes required for listing have been completed.

For this alternative analysis, we disregard sites added to the NPL since 1990 and consider only those sites that were listed by September 30, 1990. We then track the sites that remain on the NPL in subsequent years—i.e., the sites at which remediation was not complete as of 1992, 1994, etc. Both final remediation and cleanup (which results in deletion from the NPL) and "Construction Completion" (which indicates significant reductions in potential exposures) are considered.

This analysis provides an indication of progress in remediation at those sites that were included on the NPL in 1990. The limitation of this measure is similar to that of the previous Superfund measure in that both measures only present the number of children living in counties with Superfund sites. The hazards posed by any Superfund site may be localized and therefore may not affect many residents of the county in which it is located.

Measure E10

Percentage of children living in counties that had Superfund sites in 1990



SOURCE: Environmental Protection Agency, Superfund NPL Assessment Program (SNAP) Database.

- In 1990, 55 percent of children lived in counties that had Superfund sites. By 2000, many of those counties no longer had sites on Superfund's National Priorities List (NPL), because final remediation and cleanup of their sites had been achieved. Fifty percent of children live in counties that had Superfund sites in 1990 and still have Superfund sites in 2000.
- Many of the sites that were on the NPL in 1990 and remain on the list today have been substantially remediated and are described as having reached "Construction Completion." Forty percent of children currently live in counties that had Superfund sites in 1990 and still have Superfund sites that have not reached Construction Completion, a reduction from 55 percent in 1990.

PART II

Biomonitoring

Part II: Biomonitoring

This section of the report presents measures reflecting levels of contaminants in children.

Data on the levels of pollutants in children's bodies provide direct information about exposures to environmental contaminants that may harm children. These measurements most often are taken from blood samples, but also can come from sources such as urine or hair. The disadvantage of these measurements is that it is difficult to determine the source of the exposures. For example, lead may occur in children's blood when they inhale airborne lead, eat contaminated food, or when they play in contaminated soil or dust and then put their hands in their mouths.

Also, it is invasive to obtain samples and can be expensive to obtain enough samples to estimate the distribution of contaminants in children for the nation or for groups that may have higher exposures such as the poor.

The measures in this report for biomonitoring present data on concentrations of lead in blood. Blood lead is an important measure because it is directly related to neurological and developmental effects in children, and national data are available for a number of years. Many other pollutants for which biomonitoring data are not currently available on a national level are important to children's health. However, the federal government currently is collecting and analyzing biomonitoring data for a number of other compounds important to children, including pesticides, heavy metals such as mercury and cadmium, and compounds that indicate exposure to environmental tobacco smoke. This work will be incorporated into future editions of this report.

Concentrations of Lead in Blood

Lead is a major environmental health hazard for young children. Research shows that blood lead levels of 10 micrograms per deciliter of blood (µg/dL) in young children can result in lowered intelligence, reading and learning disabilities, impaired hearing, reduced attention span, hyperactivity, and antisocial behavior.[37] However, there currently is no demonstrated safe concentration of lead in blood, and adverse health effects can occur at lower concentrations.

Lead in the Blood of Young Children

Today, high blood lead levels are due mostly to deteriorated lead paint in older homes and contaminated dust and soil.[37] Soil that is contaminated with lead is an important source of lead exposure because children play outside and very small children frequently put their hands in their mouths. Research shows that pulverized leaded paint and past emissions of lead in gasoline that subsequently were deposited in the soil contribute to lead-contaminated soil and house dust.[38]

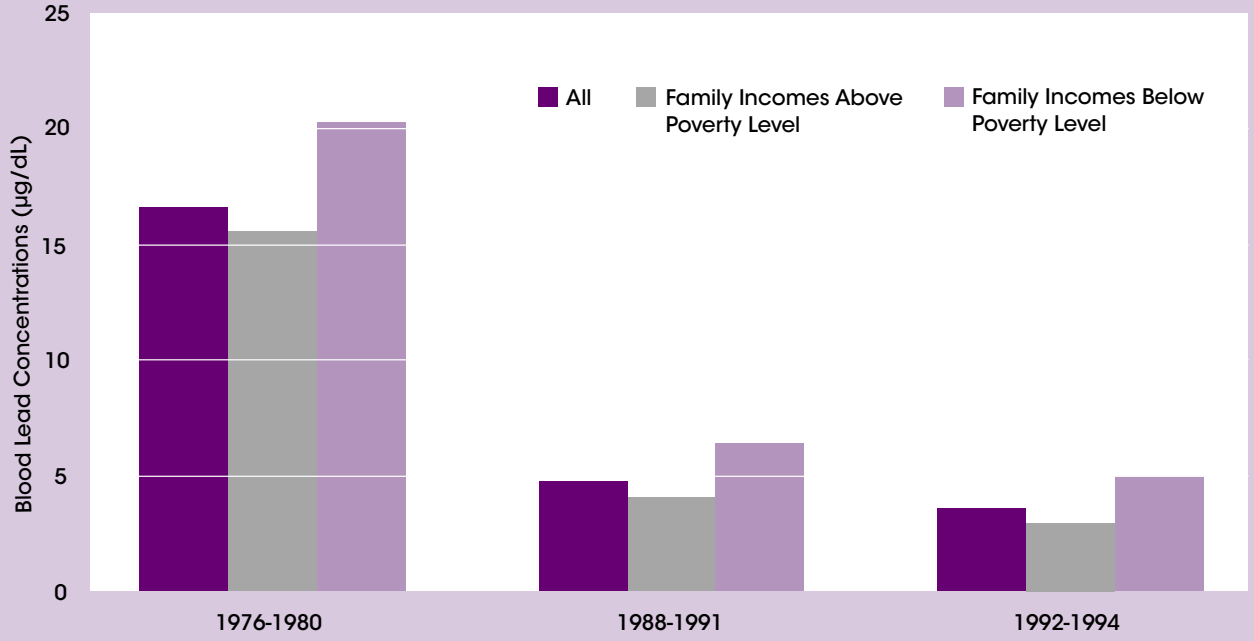
Children also may be exposed to lead through drinking water contaminated by pipes and fixtures containing lead. In the past, ambient concentrations of lead from leaded gasoline were a major contributor to childhood blood lead levels.

Healthy People 2010: Objective 8-11 of the Healthy People 2010 initiative aims to totally eliminate elevated blood levels in children. See Appendix C for more information.

Concentrations of Lead in Blood

Measure B1

Average concentrations of lead in blood for children 5 and under



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

- Average blood lead levels in children 5 years old and under dropped from 16.5 micrograms per deciliter (µg/dL) between 1976 and 1980 to 3.6 µg/dL between 1992 and 1994, a decline of 78 percent.
- The decline in average blood lead levels is due largely to the phasing out of lead in gasoline between 1973 and 1995.[12] Some decline also was due to legislation banning lead from paint and plumbing supplies.
- In 1976-1980 the average child, regardless of family income, had an elevated blood lead level (i.e. concentrations greater than 10 µg/dL). However, children living in families with incomes below the poverty line had higher average blood lead concentrations than those living in families with incomes at or above the poverty line. This disparity continued through the 1990s.
- Although the concentration of lead in blood is an important indicator for risk, it reflects only current exposures. Lead also accumulates in bone. Recent research suggests that concentrations of lead in bone may be more related to adverse health outcomes in children than concentrations in blood are.[39] This 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.
- Concentrations of lead in air remain greater than the National Ambient Air Quality Standards in some areas in the United States. The main sources of ambient concentrations of lead are metals processors such as smelters and battery manufacturers.

Blood Lead by Race and Income

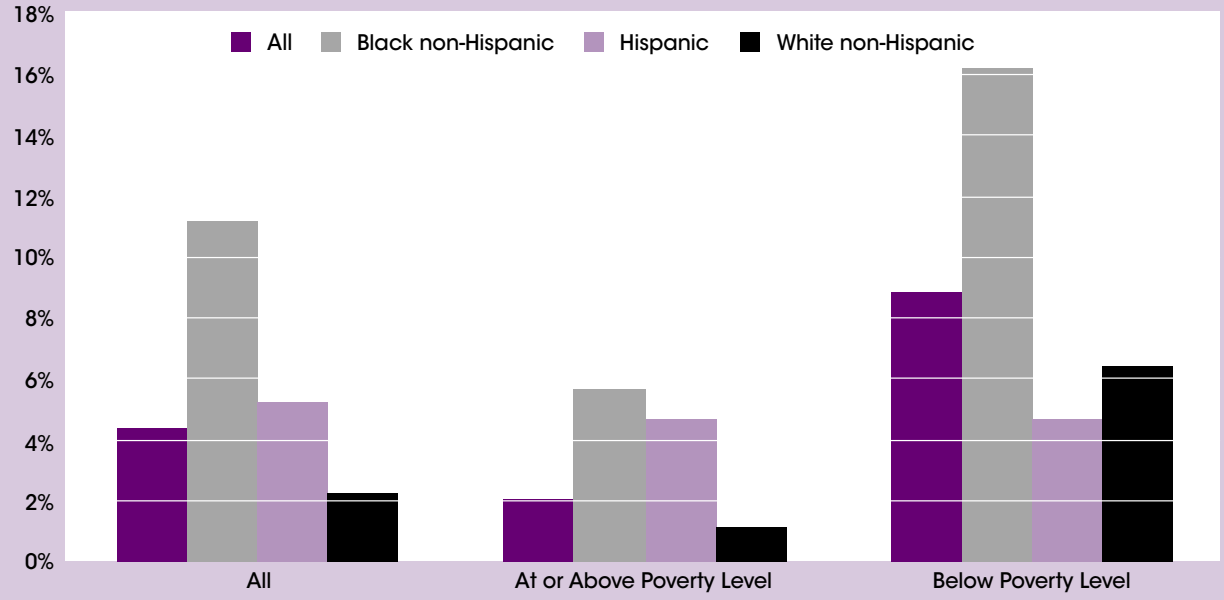
Many children still have elevated blood lead levels (levels above 10 µg/dL). Race and poverty affect the likelihood that a child has an elevated blood lead level. Blood lead levels are highest for younger children, because their exposure per pound of body weight is greater due to their smaller body weight.

The youngest age group for which data are available, ages 1-5, are presented here. Measures of blood lead by race and income can help identify the groups that are at greatest risk.

Concentrations of Lead in Blood

Measure B2

Percentage of children ages 1-5 with concentrations of lead in blood greater than 10 micrograms per deciliter, 1992-1994



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

- In 1992-1994, approximately 1.5 million children (2.3 percent) 17 and younger had elevated blood lead levels (concentrations greater than 10 µg/dL). Four percent of children between the ages of 1 and 5 (890,000) had elevated blood lead levels.
- Children who lived in families with incomes below the poverty line had a greater risk of elevated blood lead levels than those who lived in families with incomes at or above the poverty line.
- For all income levels, non-Hispanic Black children had a greater risk of elevated blood lead levels than white children. However, the disparity is greater for Black children who live in families with incomes below the poverty line.
- Approximately 73,000 children had blood lead levels greater than 20 µg/dL between 1992 and 1994. This is twice the level considered to be elevated.
- Currently, there is no demonstrated safe concentration of lead in blood. Recent research on a national sample of children measured effects down to the lowest detectable concentrations of lead in blood, and the results suggest that health effects can occur at blood lead levels as low as 2.5 µg/dL.[40] Approximately 11 million children between the ages of 1 and 5, about 54 percent of that age group, had blood lead levels of 2.5 µg/dL or greater between 1992 and 1994.

PART III

Childhood Diseases

Part III: Childhood Diseases

This section of the report presents measures of adverse health effects in children that may be influenced by exposures to environmental contaminants.

There are many important diseases that affect children, some in which environmental contaminants are known to play a role and others for which the role is unclear. This report focuses on important childhood diseases for which we have nationally representative and readily available data, and for which some evidence exists to indicate or suggest that the disease is partially influenced by environmental contaminants. The diseases selected for this report are asthma, chronic bronchitis, and childhood cancer. The Interagency Task Force on Environmental Health Risks and Safety to Children, organized by EPA and the Department of Health and Human Services, has identified asthma and childhood cancer as priorities.

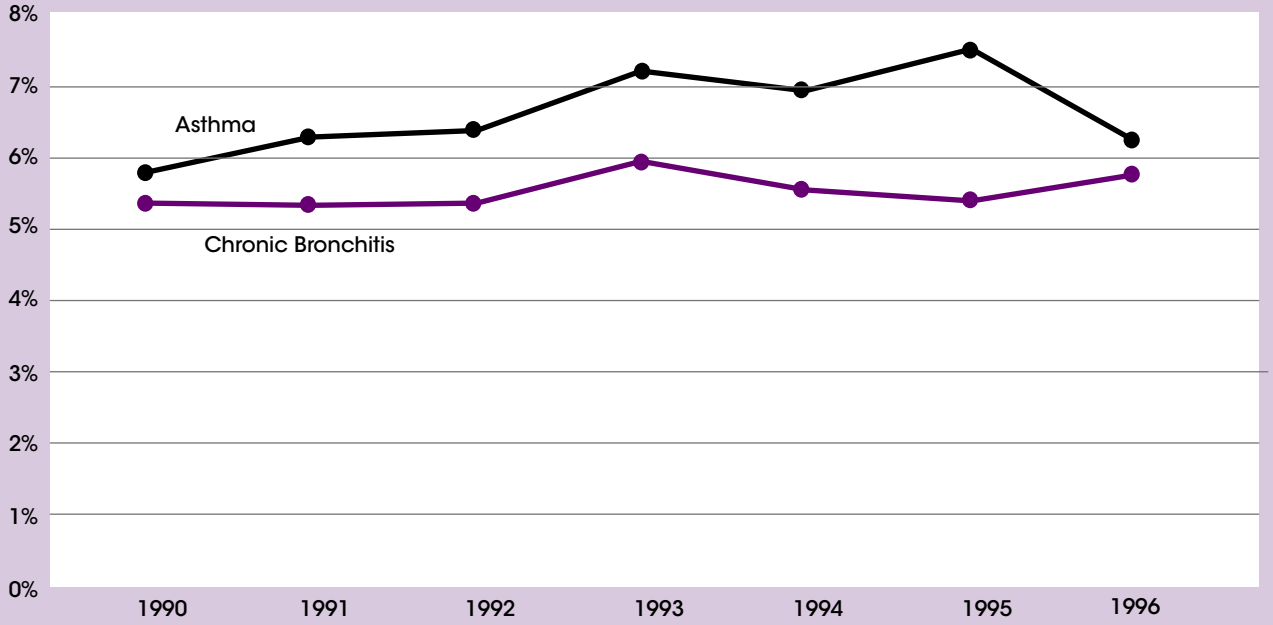
Additional diseases that may be partially influenced by environmental contaminants include other respiratory diseases, waterborne diseases, methemoglobinemia, birth defects, developmental defects, and learning disorders. Diseases that may result from childhood exposures to environmental contaminants, but that do not manifest themselves until adulthood, are not addressed in this report.

Respiratory Outcomes in Children: Asthma and Chronic Bronchitis

Asthma is the most common chronic disease among children and is a costly disease in both human and monetary terms.[41] Children with asthma may need to limit daily activities to control or prevent asthma attacks and often require long-term use of medications. Extreme exacerbation of asthma can lead to emergency room visits, hospitalizations, and sometimes death. The tendency to develop asthma can be inherited, but not all children with asthma have a family history of the disease. Exposures to indoor and outdoor sources of biological and chemical environmental contaminants have been shown to cause asthma or exacerbate existing asthma. Exposures to outdoor air pollutants, such as particulate matter, have been shown to exacerbate asthma. Chronic bronchitis also is a condition in children that has been associated with exposure to air pollutants, including particulate matter and ozone.[42-43]

Measure D1

Percentage of children under 18 with asthma and chronic bronchitis



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

- Between 1990 and 1995, the number of children with asthma increased by about 30 percent, from 5.8 percent in 1990 to 7.5 percent in 1995. The number of children with asthma in the United States increased by 75 percent from 1980 to 1994. A slight decrease in asthma rates occurred between 1995 and 1996.
- The number of children with chronic bronchitis increased slightly from 5.4 percent in 1990 to 5.7 percent in 1996.
- Some environmental factors may cause children to develop asthma, but the causes of asthma are not completely understood. In a recent report, the Institute of Medicine identified house dust mites as an agent known to cause asthma, and cockroaches and tobacco smoke as other indoor sources suspected to cause asthma.[41]
- Other environmental factors may increase the severity or frequency of asthma in children who have the disease. Children with asthma are particularly sensitive to outdoor air pollution such as ozone, particulate matter, and sulfur dioxide. These pollutants can exacerbate asthma, possibly leading to an increased use of medication, visits to doctors' offices, and trips to emergency rooms. In severe cases asthma can lead to hospital admissions and even death.

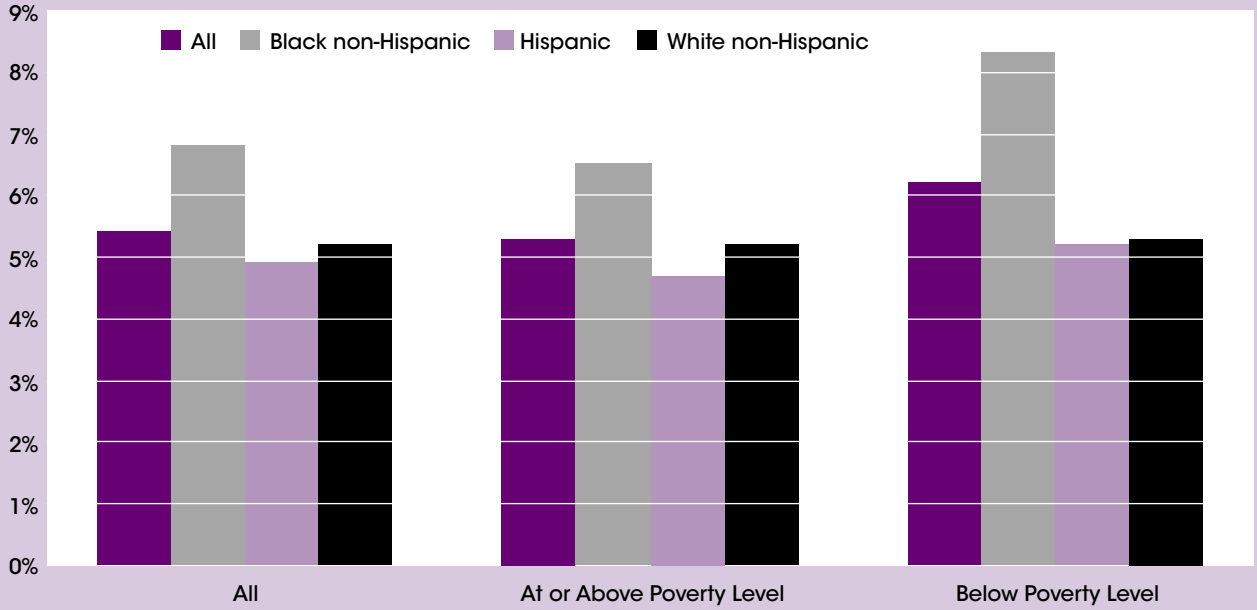
Prevalence of Asthma by Race and Income

Children of lower-income families and children of color are more likely to have asthma. These children often have less access to medical care, which can increase the severity and impact of their illness. Data for 1997-1998 show that the percentage of children with asthma differs by racial and ethnic groups, and by poverty level.

In 1997, the method for measuring asthma among children was changed. Estimates for the percentage of children with asthma are lower in 1997-1998 than in 1996, but it is not clear whether this is due to an actual decrease in the percentage of children with asthma or the change in how asthma is measured.

Measure D2

Percentage of children under 18 with asthma, 1997-98



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

- In 1997-98, 5.4 percent of all children had asthma.
- Non-Hispanic Black children living in families with incomes below the poverty level have the highest rates of asthma of any group: 8.3 percent of children.
- Approximately 5 percent of both White non-Hispanic children and Hispanic children have asthma.
- Children living in families with incomes below the poverty level had higher rates of asthma, 6.2 percent, than those children living in families at or above the poverty level, 5.3 percent.

Asthma Hospitalizations

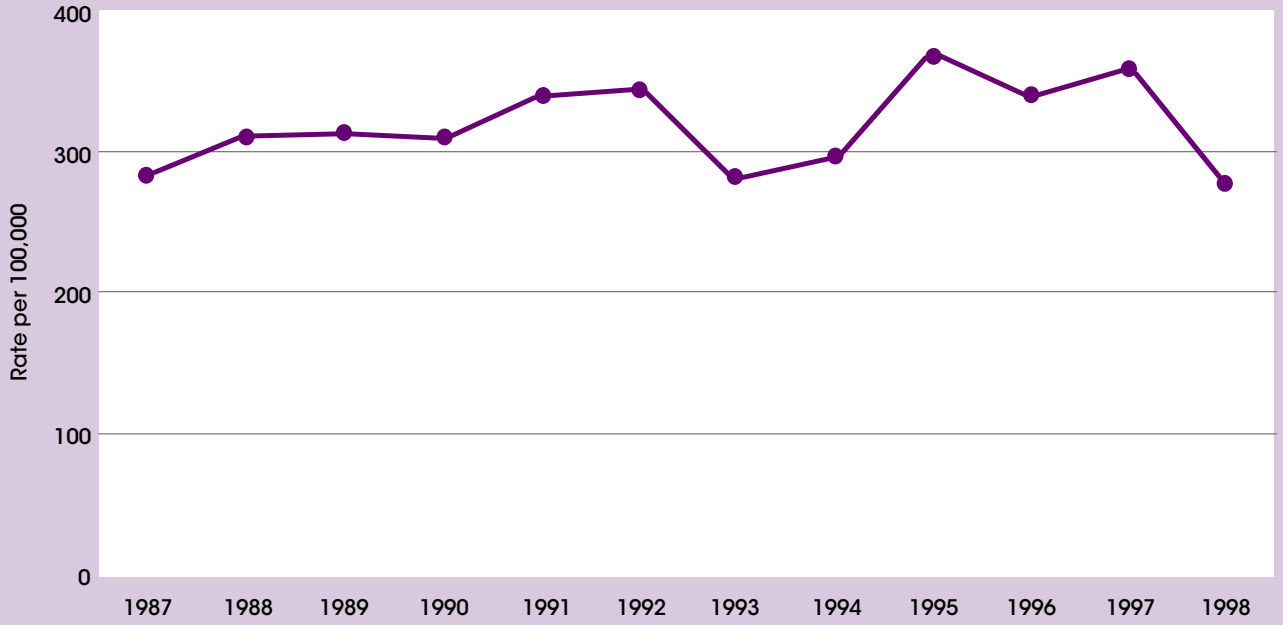
The rate of children hospitalized for asthma is another important measure because it represents the most severe cases—those in which asthma could not be controlled on an outpatient or emergency department basis.

Only a fraction of children with asthma are admitted to the hospital. Hospitalization for asthma can be related to a number of factors, including air pollution and lack of access to primary health care. Studies conducted in the northeastern United States indicate that air pollution during the summer was associated with approximately 6-24 percent of all hospital admissions for asthma.[44]

Healthy People 2010: Objective 24-02a of the Healthy People 2010 initiative seeks to reduce asthma-related hospitalizations of children under 5. See Appendix C for more information.

Measure D3

Asthma hospitalization rate for children 0-14



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

- The asthma hospitalization rate for children aged 0-14 increased from 284 per 100,000 in 1987 to 369 per 100,000 in 1995, and then dropped to 277 per 100,000 in 1998.
- Children aged 0-14 represent 38 percent of asthma hospitalizations for all ages (children and adults) during 1998.[45]
- Asthma hospitalizations accounted for 7 percent of all hospitalizations for children aged 0-14 in 1998, and asthma was the fourth leading cause of non-injury-related hospital admissions.[45]
- Outdoor air pollutants such as particulate matter and ozone are associated with increased emergency room visits and hospital admissions.[42-43]
- Exposure to two other important air pollutants, nitrogen dioxide and sulfur dioxide, has been shown to decrease lung function in asthmatics.[46]

Childhood Cancer

Cancer in childhood is quite rare compared with cancer in adults, but it still causes the most deaths, other than injuries and accidents, among children 0-19 years of age.[47]

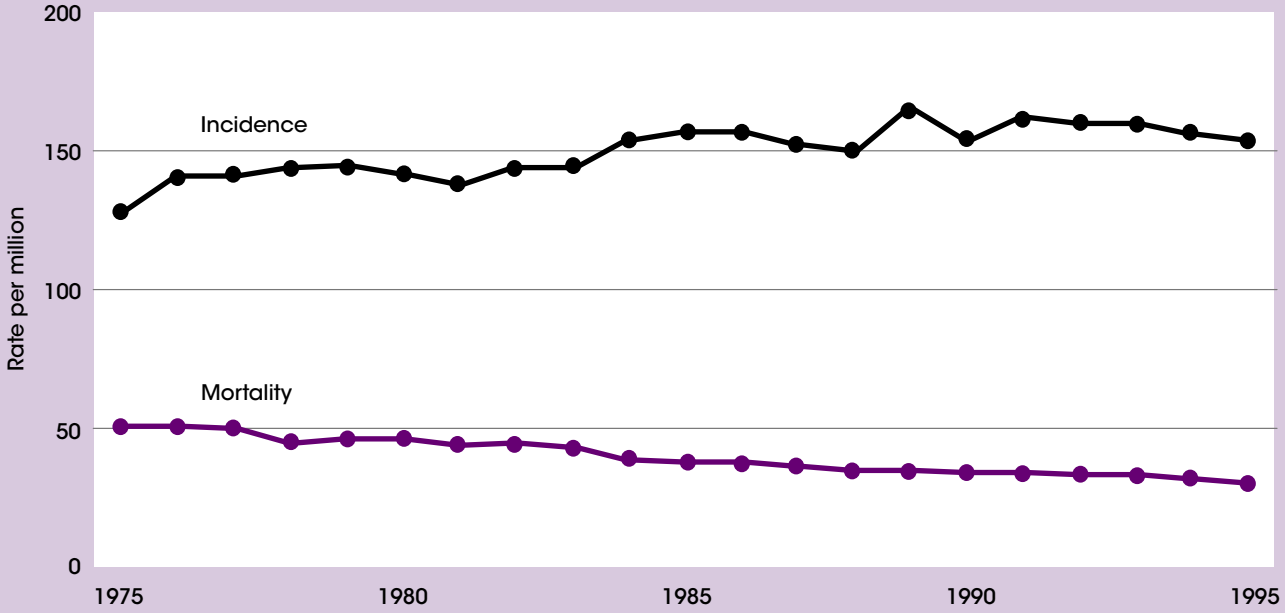
Childhood cancer is not a single disease, as it includes a variety of malignancies. The forms of childhood cancer that are most common vary at different ages.

Cancer Incidence and Mortality

The incidence of childhood cancer increased from 1975 until about 1990. The frequency of the disease appears to have become fairly stable overall since 1990. Mortality has declined substantially during the last 25 years, due largely to improvements in treatment.

The causes of cancer in children are poorly understood, though in general it is thought that different forms of cancer have different causes. Established risk factors for the development of childhood cancer include family history, genetic defects, radiation, and certain pharmaceutical agents used in chemotherapy.[47] Evidence from epidemiological studies suggests that environmental contaminants such as pesticides and certain chemicals, in addition to radiation, may contribute to an increased frequency of some childhood cancers.[32] Some studies have found that children born to parents who work with or use such chemicals are more likely to have cancer in childhood.[48] It may be that the chemicals cause mutations in parents' germ cells that may increase the risk of their children developing certain cancers, or perhaps the parental exposure is passed on to the child while in utero, affecting the child directly. Children's direct exposures to such chemicals also may contribute to cancer.

Measure D4 **Cancer incidence and mortality for children under 20**



SOURCE: Incidence data are from the National Cancer Institute, Surveillance, Epidemiology and End Results Program. Mortality data are from Centers for Disease Control and Prevention, National Center for Health Statistics.

- Age-adjusted annual incidence of cancer in children increased from 130 to 150 cases per million children between 1975 and 1995. The incidence appears to have leveled off after 1990. Mortality decreased from 50 to 30 deaths per million children during the same period.
- Rates of cancer incidence vary by age. Rates are highest among infants, decline until age 9, and then rise again with increasing age. Between 1986 and 1995, children under 5 and those aged 15-19 experienced the highest incidence rates of cancer at approximately 200 cases per million. Children aged 5-9 and 10-14 had lower incidence rates at approximately 110 and 120 cases per million respectively.
- Between 1992 and 1996, incidence rates of cancer were highest among whites at 160 per million. Hispanics were next highest at 150 per million. Asians and Pacific Islanders had an incidence rate of 140 per million, Black children had a rate of 120 per million, and Native Americans and Alaska Natives had the lowest at 80 per million. Data on the incidence of childhood cancer by race and ethnicity are shown in the data tables in Appendix A.

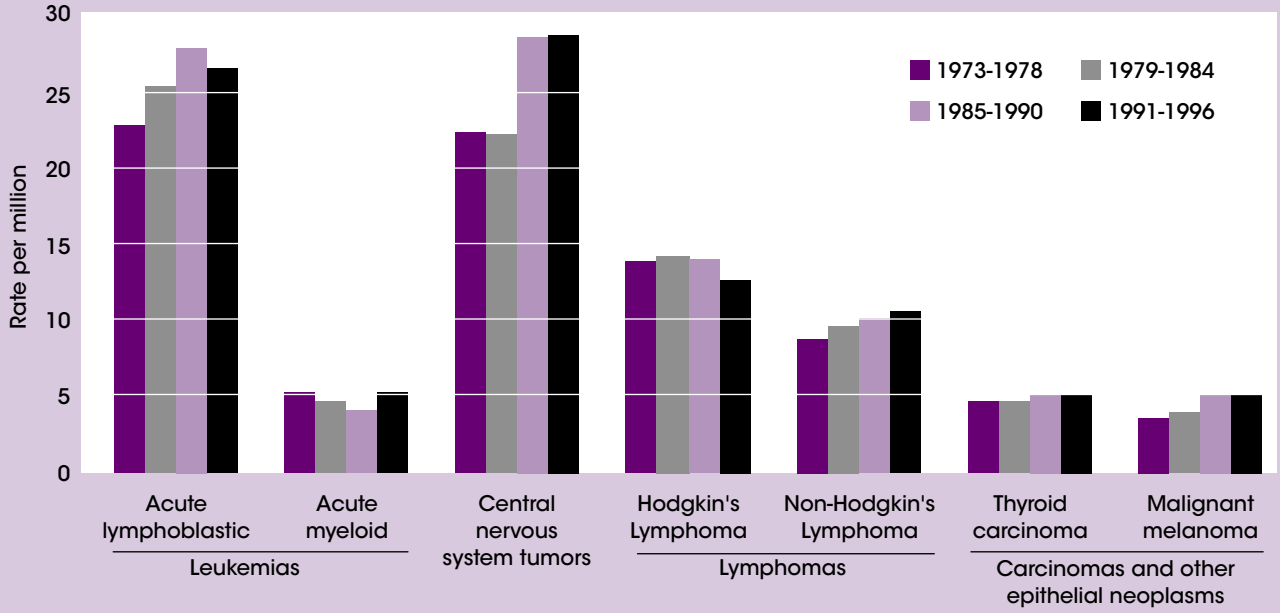
Childhood Cancer by Type

Trends in the total incidence of childhood cancer are useful indicators for assessing the overall burden of cancer among children. However, broad trends mask changes in frequency of individual cancers. Individual cancers often have patterns that diverge from the overall trend. Moreover, environmental factors may be more likely to contribute to some childhood cancers than to others.

Ionizing radiation, such as from x-rays, is a known cause of leukemia and brain tumors.[49-50] There is suggestive–but not conclusive–evidence that parental exposures to certain chemicals may be a cause of leukemia, brain cancer, non-Hodgkin's lymphoma, and Wilms' tumor in children.[51]

A number of studies have evaluated the relationship between pesticide exposure and certain types of childhood cancer, and while the evidence is suggestive of a link, it is still not conclusive.[47] Most studies of the relationship between pesticide exposure and leukemia and brain cancer show increased risks for children whose parents used pesticides at home or work, and for children who may be exposed to pesticides in the home.[52-53] Evidence is limited but suggestive that non-Hodgkin's lymphoma in children may be linked to parental pesticide exposure and exposure to pesticides in the home.[52] There is some evidence linking pesticide use to Wilms' tumor and Ewing's sarcoma.[52]

Measure D5a **Cancer incidence for children under 20 by type**

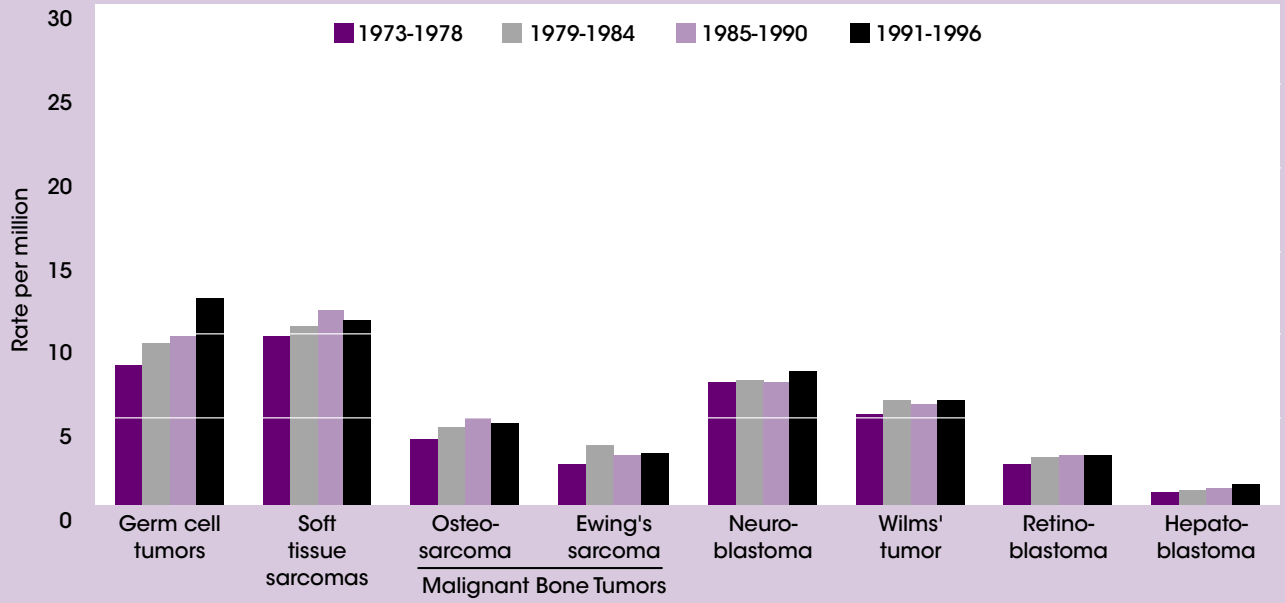


SOURCE: Surveillance, Epidemiology, and End Results Program 1973-1996, Division of Cancer Control and Population Sciences, National Cancer Institute.

- Leukemia was the most common cancer diagnosis for children from 1973-1996, representing 25 percent of the total cancer cases. Incidence of acute lymphoblastic leukemia has increased moderately from 23 cases per million between 1973-1978 to approximately 27 cases per million between 1991-1996. Rates of acute myeloid leukemia have remained stable.
- Central nervous system tumors represented 17 percent of childhood cancers. The incidence of central nervous system tumors increased from approximately 23 per million in 1973-1978 to 29 per million in 1991-1996.
- Lymphomas, which include Hodgkin's disease and non-Hodgkin's lymphoma, represent approximately 16 percent of childhood cancers. Hodgkin's disease declined slightly from roughly 14 per million in 1973-1978 to approximately 13 per million in 1991-1996. Non-Hodgkin's lymphomas increased from 8.9 per million in 1973-1978 to approximately 11 per million in 1991-1996.

Measure D5b

Cancer incidence for children under 20 by type



SOURCE: Surveillance, Epidemiology, and End Results Program 1973-1996, Division of Cancer Control and Population Sciences, National Cancer Institute.

- Different types of cancer affect children at different ages. Neuroblastomas, Wilms' tumor (tumors of the kidney), and retinoblastoma (tumors in the eye) usually are found only in very young children. Leukemias and nervous system cancers are most common through age 14; lymphomas, carcinomas, and germ cell and other gonadal tumors are more common in those 15-19 years old.[47]

Future Directions

In the process of developing this report, we identified a number of limitations to the most readily available data and the methods used to collect and present them. This section discusses recommended improvements to the measures in the report and improvements to the data sources used to calculate the measures. We also include a discussion of tracking systems for childhood diseases.

There are many important measures that we would like to include in future reports; our discussion here is focused on those of greatest importance, which were identified through discussion with experts in the field.

Characteristics of Ideal Measures

Ideally, measures would be available to reflect all important factors in each of the three parts of this report.

For environmental contaminants, ideal measures would reflect concentrations in the environment of all of the chemical and biological agents that are important for children. The measures would reflect the potential for children to be exposed to these pollutants.

For concentrations of contaminants measured in children, ideal measures would reflect concentrations of the key pollutants that tend to accumulate in children and that pose high risks of health effects.

For childhood diseases, ideal measures would reflect all the important childhood diseases that may be caused by or exacerbated in part by environmental factors.

Ideally, for measures in all three parts of the report, data sources would provide information for all of the nation's children. Data also would be available for 10 years or more to provide information about changes over time. Information would be available on differences among geographic areas, differences among racial-ethnic groups, and differences by various social and economic status factors.

Data for Existing and New Measures

In the sections below, we outline potential improvements to the existing measures and describe other data that we would like to include in future reports. As future editions of this report are developed, we will continue to review and assess data sources that are available. This review and assessment will be an ongoing process as new sources of data are identified and, we hope, existing sources of data are improved.

Environmental Contaminants

Our goal is to have nationally representative measurements of concentrations of environmental contaminants that could affect children's health in air, water, food, and soil.

Common Air Pollutants

The measures used for criteria air pollutants are based on two kinds of data: exceedances of national standards and the reports of daily air quality generated through the Air Quality Index.

To further develop measures in this area, the first priority is to obtain data on measured concentrations of air pollutants in all counties. These data would allow for a more detailed assessment of the severity of pollution, both in terms of the numbers of days in

which standards are exceeded and the actual concentrations of pollutants. The data also would allow better assessment of the measure's completeness.

As noted in Part I of the report, the information about exceedances of standards shows only whether air quality, at any point during a year, exceeds a standard. It does not allow any analysis of how often such exceedances occur. On the other hand, it does provide disaggregation of the data separately for each pollutant.

Measures based on actual concentrations may better capture the potential health risks to children. Such measures could portray the combined pollution burden from multiple pollutants on any single day as well as the full duration of concentrations at various levels.

Hazardous Air Pollutants

The measures in this report for hazardous air pollutants (air toxics) are based on data from the year 1990 only. Work is underway to produce measures that will reflect trends over time in ambient concentrations of hazardous air pollutants. Estimates of ambient concentrations in 1996 are expected to be completed within the coming year and will be incorporated into next year's report. Estimates will be updated every three years thereafter.

Data from air toxics monitoring programs also could be considered for inclusion in future editions of this report. Currently, national data on air toxics monitoring are limited and much of the monitoring and data collection are performed at the state level.

The air toxics measures presented in this report do not distinguish between situations in which many hazardous air pollutants exceed health benchmarks and those in which only one exceeds the benchmarks. Measures accounting for the number of hazardous air pollutants exceeding health benchmarks may provide a fuller picture of the potential risks to children. To develop these measures further, the authors will consider monitoring information and updated modeling data.

The hazardous air pollutants measures in this report are further limited because they represents only the presence of these pollutants in ambient air. For certain hazardous air pollutants that are persistent in the environment, greater exposures occur in food. These pollutants settle out of the air onto land and into bodies of water, and then are taken up in the food chain. Future work on measures of food contaminants will consider this pathway of exposure (see the section on food contaminants below).

Indoor Air Pollutants

Indoor air contaminants are represented by a surrogate measure reflecting the percentage of homes where people smoke. The most important improvement to this measure would be to add data for other sources of indoor air pollutants, such as consumer products, gas stoves, and furnishings, for both homes and schools. We have not identified any nationally representative data on air contaminants for homes, schools, and other indoor environments in which children may spend large amounts of time, but we will continue to explore possible measures in this area.

Drinking Water Contaminants

The measures for contaminants in drinking water reflect violations of national standards. These measures share the limitations of the criteria air pollutant measures, as described above, in that they do not distinguish among the impacts of various concentrations of contaminants. The data on drinking water contaminants are less complete than those used for the air measures because less reporting of water contaminants occurs at the national level. In addition, the drinking water contaminant measures in this report rely on the Maximum Contaminant Level (MCL) standards, which are based partly on health considerations but also take into account technical feasibility. Each MCL also has a corresponding Maximum Contaminant Level Goal (MCLG), which is based only on health considerations. The MCLG 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 are collected at the state level; information from the states would need to be compiled nationally to improve the measures for drinking water. Another problem with the data on drinking water is that many water systems do not adequately monitor for contaminants, so we have no information about potential risks to children in those areas. Future reports will consider data collected at the state level.

Since 1999, EPA has required water suppliers to send annual reports on drinking water quality to their customers. These reports contain information on the drinking water source and the level, or range of levels, of contaminants found in local drinking water. These data also will be considered along with state data in future reports.

Information on sources of contamination to ground water and surface water sources that supply water to public water systems is important for identifying the key contributors to drinking water contamination. EPA now requires states to assess all the ground water and surface water sources that supply water to public water systems. These assessments will identify the major potential sources of contamination to drinking water supplies, and will help officials determine the water systems' susceptibility to contamination. Information from state assessments will be considered for future reports.

Surface Water Contaminants

In future reports we hope to characterize the risks to children posed by the consumption of fish contaminated with mercury, PCBs, and other toxicants that affect neurological development. Many states target their warnings on the consumption of fish from contaminated water to pregnant women and children. We also would like to characterize the risks posed to children by swimming in waters with bacterial contamination. Children are at greater risk of illness while swimming than adults are because of their longer exposure times and more frequent accidental ingestion of water.

On October 10, 2000 the Beaches Environmental Assessment and Coastal Health Act was signed into law. This new amendment to the Clean Water Act requires nationally consistent bacterial standards for recreational waters in all coastal and Great Lakes beaches, and provides grants for states and tribes to conduct beach monitoring and notification programs. Data generated under this provision, when available, may be useful for constructing measures for future reports.

Pesticide Residues and Other Food Contaminants

Contaminants in food are represented in this report by a measure of the frequency with which pesticides are detected in tested samples of produce. This measure does not distinguish among differing levels of contamination. Furthermore, the detection limits do not provide a health-based point of comparison, as they are not equivalent to levels of concern for children's health.

For future reports we will consider improved measures for pesticides that incorporate the actual measured levels of pesticide residues, along with children's food consumption rates that are available from surveys conducted by the U.S. Department of Agriculture.

The Food Quality Protection Act (FQPA) of 1996 established a single, health-based safety standard for new and existing pesticides and their residues in raw and processed food. EPA now routinely considers the combined effects of pesticide exposure from food, drinking water, and other non-work related uses, as well as the effects of pesticides that act in the same way in the body. We will consider new data, standards and analytical techniques developed in the implementation of FQPA in developing measures for future versions of this report.

We also will examine the available data on the presence of other types of contaminants in foods. As noted above, some hazardous air pollutants find their way into the food chain after being deposited from the atmosphere, and their presence in food can pose more of a risk to children than their presence in the air. In addition, children are exposed in utero and nursing infants may be exposed to persistent contaminants in breast milk. We will explore the feasibility of preparing measures of these other food contaminants for future reports.

Finally, some children may be exposed to particularly elevated levels of contaminants in food, including children in homes where much of the diet comes from subsistence fishing or subsistence farming. We will explore the availability of suitable data regarding such differential exposures for future reports.

Land Contaminants

For contaminants in soil, this report includes a measure of the percentage of children living in counties that have a Superfund site. This measure will be refined for future reports by considering whether children live in close proximity to one of these sites (e.g., within one mile), rather than whether they live anywhere in the same county. A measure of children living in proximity to brownfield sites also will be considered for future reports. We are not aware of nationally representative databases of contaminants in soil. Measures for soil contaminants will focus on proximity to sites found to have high levels of contamination or other surrogates.

Other Contaminated Media

Key additional data needs focus on exposure pathways and environments that are particularly important for children. A number of contaminants may gather on household surfaces, including those found in indoor air, contaminants in soil that are tracked into the home, and those from the workplace that inadvertently are brought into the home on the parents' clothes or body. Young children may be frequently exposed to environmental contaminants that gather on floors and other surfaces in the home through hand-to-mouth and object-to-mouth contact. Data available for these exposure scenarios are limited.

Future Directions

Biomonitoring

Currently, nationally representative biomonitoring data are available for concentrations of lead in blood. Data are needed on concentrations of other contaminants in children's bodies.

The Centers for Disease Control and Prevention (CDC) currently are collecting additional biomonitoring data for an annual National Exposure Report Card. The report card is intended to provide concentrations of toxic substances present in the U.S. population, from measurements in samples of blood and urine. CDC's sampling process will provide some measurements for children. The 25 substances to be included in the first report card will include heavy metals, cotinine, nonpersistent pesticides, and phthalates. We will develop new biomonitoring measures for future versions of this report as the CDC data become available.

Childhood Diseases and Tracking

The childhood diseases in this report were selected using several criteria: The data had to be nationally representative and readily available; some proportion of the observed effects should be caused, or suspected to be caused, by environmental contaminants; and the diseases must be important to children. The current report includes measures for respiratory related diseases, with an emphasis on asthma, and measures for childhood cancer. Other measures of severity for respiratory effects will be considered for future reports, including emergency room visits and deaths. Several additional respiratory conditions, such as lung function, are influenced by environmental factors but are not included in this report. Future work will focus on identifying appropriate data sources for these measures.

A number of additional types of childhood diseases, such as birth defects and waterborne diseases, may be environmentally mediated, but we do not have consistent nationally representative data for them. For other important effects, such as learning and neurological disorders, identifying appropriate data sources may be difficult. Future work will focus on identifying important childhood diseases for which existing data sources may be used for tracking.

Tracking systems are important for following trends in diseases that may be important in children. These systems can help researchers and health officials identify progress toward reducing diseases and areas that require research and interventions. Some childhood diseases are tracked at the state level. Examples of tracking systems include cancer registries in some states, which collect data on all the reported cancers in those states. Measures of the extent to which we track these important diseases could be added to future editions of this report. For example, the percentage of states that have tracking systems for certain types of important childhood diseases could be included as a measure in next year's report. Suggested topics include birth defects, asthma, and learning disorders.

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Glossary of Terms

Air Toxics:
Synonym for "hazardous air pollutants." (See below).

Ambient Air:
Any unconfined portion of the atmosphere: open air, surrounding air.

Benzene:
A colorless, volatile, flammable, toxic liquid aromatic hydrocarbon (C_6H_6) used in organic synthesis, as a solvent, and as a component of motor fuel.

Biomonitoring:
Analysis of blood, urine, tissues, etc., to measure chemical exposure in humans.

Carcinoma:
Cancer that begins in the tissues lining or covering an organ.

Carbon Monoxide (CO):
A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

Chromium:
A heavy metal that is an important hazardous air pollutant. (See "heavy metals.")

Contaminant:
Any physical, chemical, biological, or radiological substance or matter in air, water, or soil that can have adverse health effects.

Criteria Pollutants:
The 1970 amendments to the Clean Air Act required EPA to set National Ambient Air Quality Standards for certain pollutants known to be hazardous to human health. EPA has set standards to protect human health and welfare for six pollutants: ozone, carbon monoxide, total suspended particulates, sulfur dioxide, lead, and nitrogen oxides. The term "criteria pollutants" derives from the requirement that EPA must describe the criteria—characteristics and potential health and welfare effects of these pollutants—for setting or revising standards.

Deciliter:
One-tenth of a liter (0.1 liter).

Exposure:
Human contact with environmental contaminants or concentrations of contaminants in media.

Media:
Specific environments–air, water, soil–that are the subject of regulatory concern and activities because of potential for human exposure.

Environmental Tobacco Smoke:
Mixture of smoke exhaled by a smoker and the smoke from the burning end of the smoker's cigarette, pipe, or cigar.

Germ Cell Tumor:
A type of tumor found in the ovaries or testicles.

Gonadal Tumor:
Tumor specific to the gonads.

Hazardous Air Pollutants:
Air pollutants that are not covered by ambient air quality standards but which, as defined in the Clean Air Act, may reasonably be expected to cause or contribute to irreversible illness or death. Such pollutants include asbestos, beryllium, mercury, benzene, coke oven emissions, radionuclides, and vinyl chloride. A total of 188 hazardous air pollutants are listed in section 112(b) of the Clean Air Act, as amended in 1990.

Heavy Metals:
Metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead; can damage living things at low concentrations.

Immunodeficiency:
Inability to produce a normal complement of antibodies or immunologically sensitized T cells, especially in response to specific antigens.

Ionizing Radiation:
Radiation that can strip electrons from atoms, i.e., alpha, beta, and gamma radiation.

Lymphoma:
Lymphomas are tumors in the lymph system, which is responsible for fighting diseases in the body and is part of the immune system. Lymphomas are the third most common form of cancer in children.

Glossary of Terms

Mercury:
A heavy metal that can bioaccumulate in the environment and is highly toxic if breathed or swallowed.

Methemoglobinemia:
The presence of excess methemoglobin in the blood, which replaces hemoglobin and results in loss of the ability to transport oxygen in the blood. A small amount of methemoglobin is present in the blood normally, but injury or toxic agents, such as nitrites, convert a larger proportion of hemoglobin into methemoglobin.

Microgram (μg):
One-millionth of a gram.

Microorganisms:
Tiny living organisms that can be seen only with the aid of a microscope. Some microorganisms can cause acute health problems when consumed in drinking water. Also known as microbes.

Mortality:
Death rate.

National Ambient Air Quality Standards (NAAQS):
Standards established by EPA to protect human health and the environment from criteria pollutants, which apply for outside air throughout the nation.

Nitrogen Dioxide (NO_2):
A chemical that results from nitric oxide combining with oxygen in the atmosphere; a major component of photochemical smog.

Ozone:
A gas that results from complex chemical reactions between nitrogen dioxide and volatile organic compounds; the major component of smog.

Particulate Matter:
Particles in the air, such as dust, dirt, soot, smoke, and liquid droplets; may have significant effects on human health.

Polychlorinated Biphenyls (PCBs):
A group of toxic, persistent chemicals used in electrical transformers and capacitors for insulating purposes, and in gas pipeline systems as a lubricant. The sale and new use of PCBs were banned by law in 1979.

Prenatal:
Occurring, existing, or performed before birth.

Radionuclides:
Radioactive isotopes or unstable forms of elements.

Retinoblastomas:
Tumors of the eye.

Sulfur Dioxide (SO_2):
A pungent, colorless, gaseous pollutant formed primarily by the combustion of fossil fuels.

Superfund:
The program operated under the legislative authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) that funds and carries out EPA solid waste emergency and long-term removal and remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority, and conducting and/or supervising cleanup and other remedial actions.

Trichloroethylene (TCE):
A stable, low boiling-point colorless liquid, toxic if inhaled. Used as a solvent or metal decreasing agent, and in other industrial applications.

APPENDIX A

Data Tables

Table E1

Percentage of children living in counties in which air quality standards were exceeded

1990-1995

	1990	1991	1992	1993	1994	1995
Ozone	22.6%	25.1%	16.9%	21.0%	19.0%	27.7%
Particulate matter	8.0%	6.3%	9.6%	2.7%	2.3%	10.0%
Carbon monoxide	9.5%	8.5%	6.2%	5.1%	6.6%	5.0%
Lead	2.2%	6.0%	1.8%	2.1%	1.7%	1.8%
Sulfur dioxide	0.5%	2.1%	0.1%	0.5%	0.1%	0.1%
Nitrogen dioxide	3.7%	3.7%	0.0%	0.0%	0.0%	0.0%
Any Standard	28.0%	31.9%	20.9%	24.3%	23.6%	30.9%

1996-1998

	1996	1997	1998
Ozone	16.4%	18.5%	20.7%
Particulate matter	1.5%	2.4%	2.0%
Carbon monoxide	5.7%	3.8%	4.3%
Lead	1.6%	1.4%	1.6%
Sulfur dioxide	0.1%	0.1%	0.1%
Nitrogen dioxide	0.0%	0.0%	0.0%
Any Standard	19.9%	21.9%	23.2%

SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System.

Table E2

Percentage of children's days with good, moderate, or unhealthy air quality

1990-1994

Pollution Level	1990	1991	1992	1993	1994
Good	58.8%	58.9%	62.6%	61.9%	60.1%
Moderate	27.7%	27.7%	24.1%	25.3%	26.9%
Unhealthy	4.0%	3.9%	3.5%	3.0%	3.0%
No Monitoring Data	9.5%	9.4%	9.8%	9.8%	10.0%

1995-1998

Pollution Level	1995	1996	1997	1998
Good	61.3%	63.3%	63.3%	61.9%
Moderate	25.5%	24.6%	24.5%	27.1%
Unhealthy	2.8%	2.2%	1.6%	1.6%
No Monitoring Data	10.3%	10.0%	10.6%	9.4%

SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Aerometric Information Retrieval System.

Table E3

Percentage of children living in counties where at least one hazardous air pollutant concentration was greater than a health benchmark in 1990

Benchmark	Cancer, one-in-a-Million	Cancer, 1-in-100,000	Cancer, 1-in-10,000	Other Health Effects
Percentage of Children	100.0%	100.0%	6.0%	95.0%

SOURCE: U.S. Environmental Protection Agency, Cumulative Exposure Project.

Table E4

Percentage of homes with children under 7 where someone smokes regularly

	1994	1996	1999
Percentage of Homes	28.7%	27.6%	19.0%

SOURCE: U.S. Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division, Survey on Radon Awareness and Environmental Tobacco Issues.

Table E5

Percentage of children living in areas served by public water systems that exceeded a drinking water standard or violated treatment requirements

Type of standard violated	1993	1994	1995	1996	1997	1998
Lead and copper	9.6%	7.0%	5.9%	5.2%	5.0%	4.8%
Microbial contaminants	8.2%	7.6%	4.4%	4.2%	3.6%	2.7%
All other contaminants	2.3%	2.2%	2.2%	2.0%	1.5%	0.9%
Treatment and filtration	2.1%	1.1%	1.2%	1.3%	0.4%	0.2%
All health-based violations	18.6%	13.8%	12.9%	11.6%	10.2%	8.3%

SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System..

Table E6

Percentage of children living in areas served by public water systems in which the nitrate/nitrite standard was exceeded

	1993	1994	1995	1996	1997	1998
Percentage of children	0.2%	0.1%	0.3%	0.2%	0.4%	0.2%

SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

Table E7

Percentage of children living in areas with major violations of drinking water monitoring and reporting requirements

	1993	1994	1995	1996	1997	1998
Lead and copper	10.8%	6.6%	5.5%	5.3%	5.8%	5.2%
Microbial contaminants	2.9%	2.5%	2.0%	1.6%	2.0%	1.7%
Chemical and radiation	9.4%	6.4%	4.8%	4.4%	2.3%	2.5%
Treatment and filtration	1.2%	0.4%	0.3%	0.4%	0.2%	0.3%
Any major violation	21.4%	14.5%	11.6%	10.7%	10.0%	9.6%

SOURCE: U.S. Environmental Protection Agency, Office of Water, Safe Drinking Water Information System.

Table E8

Percentage of fruits, vegetables, grains, dairy, and processed foods with detectable pesticide residues

	1994	1995	1996	1997	1998
Food samples with a single pesticide detected	25.2%	24.7%	23.0%	26.9%	26.3%
Food samples with multiple pesticides detected	36.3%	40.3%	44.6%	28.6%	28.8%
All food samples with pesticide residues detected	61.5%	65.0%	67.6%	55.5%	55.1%

SOURCE: U.S. Department of Agriculture, Agricultural Marketing Service. Pesticide Data Program: Annual Summary (Calendar Years 1993-1998).

Table E9

Percentage of children living in counties with Superfund sites

	1990	1992	1994	1996	1998	2000
All Superfund sites	55%	56%	58%	57%	57%	58%
All Superfund sites that have not reached Construction Completion	55%	54%	53%	53%	51%	50%

SOURCE: U.S. Environmental Protection Agency, Superfund NPL Assessment Program (SNAP) Database.

Table E10

Percentage of children living in counties that had Superfund sites in 1990

	1990	1992	1994	1996	1998	2000
All Superfund sites	55%	55%	55%	52%	51%	50%
All Superfund sites that have not reached Construction Completion	55%	53%	49%	46%	42%	40%

SOURCE: U.S. Environmental Protection Agency, Superfund NPL Assessment Program (SNAP) Database.

Data Tables

Table B1

Average concentration of lead in blood for children 5 and under

	Blood lead levels in micrograms per deciliter		
	1976-1980	1988-1991	1992-1994
All	16.5	4.7	3.6
Above poverty level	15.5	4.0	2.9
Below poverty level	20.2	6.3	5.0

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

Table B2

Percentage of children ages 1-5 with concentrations of lead in blood greater than 10 micrograms per deciliter, 1992-1994

	All	Black Non-Hispanic	Hispanic	White Non-Hispanic
All	4.4%	11.2%	5.2%	2.3%
Above poverty level	2.1%	5.6%	4.7%	1.1%
Below poverty level	8.9%	16.2%	4.7%	6.4%

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

Table D1

Percentage of children under 18 with asthma and chronic bronchitis

	1990	1991	1992	1993	1994	1995	1996
Percentage of children with asthma	5.8%	6.2%	6.3%	7.2%	6.9%	7.5%	6.2%
Percentage of children with chronic bronchitis	5.3%	5.3%	5.4%	5.9%	5.5%	5.4%	5.7%

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

Addendum to D1

Estimated average percentage of children under 18 with asthma during the previous 12 months, by selected years

Characteristic				
Race/Ethnicity	**1980-81**	**1985-86**	**1990-91**	**1995-1996**
White, non-Hispanic	3.6%	5.1%	6.0%	6.5%
Black, non-Hispanic	4.2%	6.0%	7.3%	8.2%
Hispanic	NA	3.2%	5.1%	7.6%
Age (years)				
0-4	2.9%	3.2%	4.3%	5.0%
5-10	4.9%	5.5%	6.3%	7.4%
11-17	3.2%	5.8%	7.1%	7.7%
Overall prevalence	**3.7%**	**4.9%**	**6.0%**	**6.9%**

NOTE: There are insufficient samples for each year by demographic group to include annual prevalence by age and race and ethnicity. We have provided prevalence estimates by two-year groupings for each of the age, race, and ethnicity categories covered in the National Health Interview Survey.

SOURCE: National Health Interview Survey, 1980-1986, presented in Morbidity and Mortality Weekly Report, Oct. 13, 2000. 49(40): 908-911.

Table D2

Percentage of children under 18 with asthma, 1997-98

	All	Black Non-Hispanic	Hispanic	White Non-Hispanic
All	5.4%	6.8%	4.9%	5.2%
Above poverty level	5.3%	6.5%	4.7%	5.2%
Below poverty level	6.2%	8.3%	5.2%	5.3%

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

Table D3

Asthma hospitalization rate for children 0-14 (rate per 100,000)

1987-1994	1987	1988	1989	1990	1991	1992	1993	1994
Asthma hospitalizations per 100,000	284	310	312	308	339	344	280	295

1995-1998	1995	1996	1997	1998
Asthma hospitalizations per 100,000	369	338	358	277

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, National Hospital Discharge Survey.

Table D4

Age-adjusted cancer incidence and mortality rates for children under 20 (rate per million)

1975-1980	1975	1976	1977	1978	1979	1980
Incidence	128	141	141	144	145	142
Mortality	51	51	50	45	46	46

1981-1985	1981	1982	1983	1984	1985
Incidence	138	144	144	154	157
Mortality	44	45	43	39	38

1986-1990	1986	1987	1988	1989	1990
Incidence	157	152	150	165	154
Mortality	38	36	35	35	34

1991-1995	1991	1992	1993	1994	1995
Incidence	162	160	160	156	154
Mortality	34	33	33	32	30

SOURCE: Incidence data from National Cancer Institute, Surveillance, Epidemiology and End Results Program. Mortality data from Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System.

Table D5

Cancer incidence for children under 20 by type (rate per million)

	1973-78	1979-84	1985-90	1991-96
Acute lymphoblastic leukemia	23.1	25.6	28.2	26.8
Acute myeloid leukemia	5.4	4.7	4.1	5.4
Hodgkin's disease	14	14.4	14.1	12.8
Non-Hodgkin's lymphoma	8.9	9.7	10.2	10.7
CNS tumors	22.6	22.5	28.9	29
Neuroblastoma	7.4	7.5	7.4	7.9
Retinoblastoma	2.4	2.8	2.9	3
Wilms' tumor	5.4	6.3	6	6.2
Hepatoblastoma	0.7	0.9	1	1.2
Osteosarcoma	3.9	4.7	5.2	4.9
Ewing's sarcoma	2.5	3.6	3	3.1
Soft tissue sarcomas	10	10.6	11.6	11
Germ cell tumors	8.3	9.7	10.1	12.4
Thyroid carcinoma	4.8	4.7	5.3	5.2
Malignant melanoma	3.6	4	5.3	5.2

SOURCE: Surveillance, Epidemiology, and End Results Program 1973-1996. Division of Cancer Control and Population Sciences, National Cancer Institute.

Addendum to D5

Cancer incidence for children under 20 by race/ethnicity and gender, 1992-1996 (rate per million)

	Male	Female
All Races	163.0	148.0
White	170.0	152.0
Black	129.0	122.0
American Indian/Alaska Native	80.0	70.0
Asian/Pacific Islander	150.0	137.0
Hispanic	155.0	136.0

SOURCE: SEER Stat Software, Surveillance, Epidemiology, and End Results Program 1973-1996. Division of Cancer Control Population Sciences, National Cancer Institute. American Cancer Society, Surveillance Research.

Addendum to D5

Childhood cancer incidence by age, 1991-1995 (rate per million)

	0-4	5-9	10-14	15-19
Lymphocytic leukemia	59.0	30.9	18.9	15.1
Acute non-lymphocytic leukemia	9.6	4.5	6.5	8.5
Hodgkin's disease	0.6	3.6	12.4	33.0
Non-Hodgkin's lymphoma	3.9	5.8	7.4	12.1
Central nervous system	34.8	30.3	26.0	19.5
Neuroblastoma	27.0	2.8	0.8	0.6
Retinoblastoma	12.4	0.5	0.0	0.0
Wilms' tumor	18.1	5.1	0.8	0.4
Hepatic tumors	4.7	0.6	0.4	1.3
Osteosarcoma	0.4	2.9	7.6	9.4
Ewing's sarcoma	0.7	2.0	4.6	4.1
Soft tissue sarcomas	10.7	7.9	10.4	14.8
Germ cell, trophoblastic, other gonadal neoplasms	6.7	2.2	7.6	29.1
Epithelial and unspecified	3.8	3.3	11.8	39.0

SOURCE: Cancer in North America, 1991-1995. North American Association of Central Cancer Registries. American Cancer Society, Surveillance Research.

APPENDIX B

Data Source Descriptions

Common Air Pollutants

Air Quality Exceedances

EPA's Office of Air Quality Planning and Standards has set health-based National Ambient Air Quality Standards (NAAQS) for six common pollutants, often referred to as criteria pollutants. These standards are shown in Table 1 below.

State and local environmental agencies conduct air monitoring programs to measure concentrations of these pollutants. The individual measurements are submitted to EPA for inclusion in a national database called the Aerometric Information Retrieval System.

EPA, as part of its data management system, identifies instances in which levels of air pollutants measured in the air are greater than the air quality standards. Each of these events is called an "exceedance." An exceedance occurs when a measured concentration exceeds a target value that is actually higher than the air quality standard. Concentrations measured in the air must be averaged over a time period set in accordance with the standard for that pollutant. The target values used to identify exceedances are shown in Table 1 below.

Table 1

National Ambient Air Quality Standards (NAAQS) and the Values Used to Define Exceedances by EPA

Pollutant	Duration of Standard	Standard	Target value to define exceedance
Carbon monoxide	Eight-hour average	9 ppm	9.5 ppm
	One-hour average	35 ppm	Not applicable
Nitrogen dioxide	One year average	0.053 ppm	0.0535 ppm
Ozone	One-hour average[a]	0.12 ppm	0.125 ppm
	Eight-hour average	0.08	Not applicable
Lead	Three-month average	1.5 $\mu g/m^3$	1.55 $\mu g/m^3$
Particulate matter under 10 microns	One-day (24 hour) average	150 $\mu g/m^3$	155
	One year average	50 $\mu g/m^3$	Not applicable
Sulfur dioxide	One-day (24 hour) average	0.14 ppm	0.145 ppm
	One year average	0.03 ppm	Not applicable

[a] The ozone 1-hour standard applies only to areas that were designated non-attainment when the ozone 8-hour standard was adopted in July 1997.

To use these data in measure E1, for carbon monoxide and ozone, we identified counties in which air quality exceeded the one-hour standards at any time during the year. For particulate matter and sulfur dioxide we identified counties in which the one-day standards were exceeded at any time during the year. For nitrogen dioxide, we identified counties in which air quality exceeded the standard for the year, and for lead we identified counties in which air quality exceeded the lead standard for a three-month period.

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Air Quality Index

EPA uses the Air Quality Index (AQI) to evaluate daily air quality for five major pollutants for which it has established NAAQS under the Clean Air Act. The AQI is an update of the Pollutant Standards Index (PSI). Both indices convert the measured pollutant concentration in a community's air to a number on a scale of 0 to 500. The most important number on this scale is 100, which corresponds to the NAAQS for each pollutant established under the Clean Air Act. A PSI or AQI level in excess of 100 means that a pollutant is in the unhealthy range on a given day; a PSI or AQI level at or below 100 means that a pollutant reading is in the satisfactory range. Once these levels are measured, the PSI or AQI figures are reported in all metropolitan areas of the United States with populations exceeding 200,000. Data on the PSI are used in this report, since we have historical data for the PSI. New data for the AQI will be incorporated as the data become available. Information on the AQI can be found at http://www.epa.gov/airnow/aqibroch/.

Detailed information on the PSI data is presented in the following:

- The Pollutant Standards Index. EPA 451/K-94-001. February 1994, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. (Portions of this document are available on the web at http://www.epa.gov/airprogm/oar/oaqps/psihold.html).

Agency Contact:
AIRS Hotline
U.S. EPA, Office of Air Quality
Planning and Standards (OAQPS)
Tel: (800) 334-2405

Hazardous Air Pollutants

Hazardous Air Pollutants

The Cumulative Exposure Project, conducted by EPA's Office of Policy, Economics and Innovation, estimated outdoor concentrations of 148 hazardous air pollutants for 1990. EPA used a computer dispersion model, the Assessment System for Population Exposure Nationwide (ASPEN), to estimate concentrations. ASPEN was developed as part of the Cumulative Exposure Project and expands on standard EPA models by including the capability to model a large number of pollutants across the entire continental United States. EPA combined ASPEN with an inventory of estimated 1990 hazardous air pollutant emissions, from both mobile and stationary sources, to produce the 1990 ambient concentration estimates. The model's estimates were generally consistent with the limited monitoring data available for hazardous air pollutants from 1990. More information is available at http://www.epa.gov/CumulativeExposure.

To create the measures in this report, we started by calculating an average ambient concentration for each hazardous air pollutant in each county in 1990. This county-level value was calculated by averaging together the ASPEN estimates for each of the census tracts within each county. Then we compared the ambient concentration of each pollutant in each county with health benchmark values. Benchmark values are drawn from the toxicological literature and represent varying levels of potential concern for public health. We then identified counties in which the estimated 1990 ambient concentration of any hazardous air pollutant was greater than the health benchmarks, and calculated the total number of children living in those counties.

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Indoor Air Pollution

Surveys on Radon Awareness and Environmental Tobacco Smoke Issues

In 1994 and 1996, EPA's Indoor Environments Division commissioned a commercial contractor, Survey Communications, Inc., to conduct surveys on radon awareness and environmental tobacco smoke issues. Approximately 31,000 households in the 50 states were contacted in 1994 and 1996. All interviews were conducted by telephone using a random digit dialing sampling methodology. Both the 1994 and the 1996 surveys asked whether the household included any children under the age of 6. In addition, they asked the following:

- Does anyone in your household smoke cigarettes, cigars, or a pipe?
- Do you allow anyone to smoke in your home on a regular basis?

In the 1994 survey, 6,411 households had children under the age of 6. In the 1996 survey, 6,851 households had children under the age of 6. The percentages of homes with children under the age of six in which someone smokes, or in which someone smokes regularly, were obtained by crossing the question on children with the appropriate question on smoking in the household.

In 1999, EPA commissioned the Center for Survey Research and Analysis at the University of Connecticut to conduct a similar but much smaller survey. The results of this survey were based on 1,005 telephone interviews with respondents located in the contiguous 48 states, using a random digit dialing sampling methodology. The survey questions regarding smoking in the home were similar to the questions in the 1994 and 1996 surveys. In the 1999 there were 225 households with children 6 years of age or younger survey. Although the 1999 survey was substantially smaller than the 1994 and 1996 surveys, all three surveys were designed to produce nationally representative samples.

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Drinking Water Contaminants

Safe Drinking Water Information System (SDWIS)

The Safe Drinking Water Information System (SDWIS) is the national regulatory compliance database for EPA's drinking water program. SDWIS includes information on the nation's 170,000 public water systems and data submitted by states and EPA regions in conformance with reporting requirements established by statute, regulation, and guidance.

EPA sets national standards for drinking water. These requirements take three forms: maximum contaminant levels (MCLs, the maximum level of a specific contaminant that can occur in drinking water), treatment techniques (specific methods that facilities must follow to remove certain contaminants), and monitoring and reporting requirements

(schedules that utilities must follow to report testing results). States report any violations of these three types of standards to EPA.

Water systems must monitor for contaminant levels on fixed schedules and report to EPA when a maximum contaminant level has been exceeded. States also must report when systems fail to meet specified treatment techniques. More information about the maximum contaminant levels can be found online at http://www.epa.gov/OGWDW/mcl.html.

EPA sets minimum monitoring schedules that drinking water systems must follow. These minimum reporting schedules (systems may monitor more frequently) vary by the size of the water system as well as by contaminant. Some contaminants are monitored daily, others need to be checked far less frequently (every nine years is the longest monitoring cycle). For example, at a minimum, drinking water systems will monitor continuously for turbidity, monthly for bacteria, and once every four years for radionuclides. A monitoring and reporting violation occurs when the system did not perform the required testing, take adequate samples, or report a violation as required. Only major monitoring and reporting violations are used in this report.

SDWIS includes the total population served by each public water system and the state in which the public water system resides. However, SDWIS does not include the number of children served. The numbers of children served by the public water systems were estimated by determining the ratio of children in the state in which the public water system resides and multiplying the ratio by the number of people served by that public water system.

For additional information see the EPA's SDWIS website at http://www.epa.gov/safewater/sdwisfed/sdwis.htm.

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Pesticide Residues in Foods

Pesticide Data Program

In 1991, the U.S. Department of Agriculture (USDA) was charged with implementing a program to collect data on pesticide residues in food. The Pesticide Data Program (PDP) has been in operation since 1991 and has published its findings for calendar years 1991 through 1998. PDP continues to focus on the National Academy of Sciences' 1993 recommendation that pesticide residue monitoring programs target foods that are highly consumed by children, and that the analytical testing methods used in these monitoring efforts should be standardized, validated, and subject to strict quality control and quality assurance programs. Consequently, since 1994 PDP has modified its commodity testing profile to include not only fresh fruits and vegetables, but also canned and frozen fruits and vegetables, fruit juices, whole milk, wheat, soybeans, oats, corn syrup, peanut butter, and poultry. In 1998, PDP collected and analyzed a total of 8,500 food samples, including approximately 7,000 samples of fruits and vegetables. More information is available at http://www.ams.usda.gov:80/science/pdp/index.htm

Each sample of food tested in the PDP is analyzed to determine whether the residues of a variety of different pesticides are present. For the pesticide measure in this report, we

assigned each sample to one of three groups: (1) no pesticides present at detectable levels; (2) one pesticide present at detectable levels; and (3) two or more pesticides present at detectable levels. The numbers of samples with one pesticide and the numbers with multiple pesticides were totaled for each year 1994-98 and calculated as a percentage of the total number of samples in each year.

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Land Contaminants

Superfund NPL Assessment Program Database

The Superfund NPL Assessment Program (SNAP) is a relational database system containing data for proposed, final, and deleted National Priorities List (NPL) sites. The majority of the information contained in SNAP is the data that support the NPL listing of sites; e.g., Hazard Ranking System (HRS) scoring factors, site narratives, site characteristics, contaminants, locational information, proposed and final Federal Register dates and citations, etc. For the most part, the data contained in SNAP are a snapshot at the time of NPL proposal and listing, although SNAP also contains a minimal amount of data (date and status) on Construction Completions, partial deletions, and deletions. This information allows SNAP to give an accurate overall picture of the status of the NPL on a real-time basis. All of the data contained in SNAP are publicly available information.

The measures presented in this report made use of SNAP's information on each county in which an NPL site is found and on the status of the NPL site—i.e., date proposed for the NPL, date of final listing, date of Construction Completion, and date of deletion. We then assembled data snapshots of the sites that were on the NPL on September 30 of 1990, 1992, 1994, 1996, and 1998. In addition, a snapshot for August 2000 (when information was obtained from SNAP for the purpose of assembling these measures) was assembled. We developed two measures for each of these dates. The first measure was based on all sites with either proposed or final listing on the NPL as of the target date, but excluding those sites deleted from the NPL on or before the target date. The second measure differed from the first in that sites that had reached Construction Completion (but were not yet deleted from the NPL) also were excluded. The counties with Superfund sites then were identified using the site location information in SNAP.

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Concentrations of Lead in Blood

National Health and Nutrition Examination Survey

Data on children's blood lead levels were obtained from the National Health and Nutrition Examination Surveys (NHANES) II and III, 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 of the United States, aged 2 months and older. NHANES collects data through both 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. Descriptions of the survey design, the methods used in estimation, and the general qualifications of the data are presented in the following:

- Plan and Operation of the Second National Health and Nutrition Examination Survey, 1976-80: Programs and Collection Procedures, Series 1, No. 15. Vital and Health Statistics, Hyattsville, MD: National Center for Health Statistics.
- Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-94: Series 1: Programs and Collection Procedures, No. 32. Vital and Health Statistics, Hyattsville, MD: National Center for Health Statistics.

The percentage of children with blood lead levels greater than 10µg/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 contain some error.

NHANES Website: www.cdc.gov/nchs/nhanes.htm

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Asthma and Chronic Bronchitis

National Health Interview Survey

Data on the prevalence of asthma and bronchitis are from the National Health Interview Survey (NHIS), a continuing nationwide sample survey of the civilian non-institutionalized population in which data are collected by personal household interviews. Interviewers obtain information on personal and demographic characteristics, including race and ethnicity, by self-reporting or as reported by an informant. Investigators also collect data about illnesses, injuries, impairments, chronic conditions, activity limitation caused by chronic conditions, utilization of health services, and other health topics. For most health topics, the survey collects data over an entire year.

The NHIS sample includes an over-sample of Black and Hispanic persons and is designed to allow the development of national estimates of health conditions, health service utilization, and health problems of the U.S. civilian non-institutionalized population. Over the years, the response rate for the ongoing part of the survey has run between 94 and 98 percent. In 1997, interviewers collected information on 36,116 persons, including 14,290 children.

Descriptions of the survey design, the methods used in estimation, and the general qualifications of the data are presented in the following:

- Massey, J.T., T.F. Moore, V.L. Parsons, and W. Tadros 1989. Design and estimation for the National Health Interview Survey, 1985-1994. Vital and Health Statistics 2 (110). Hyattsville, MD: National Center for Health Statistics.
- Benson, V. and M. Marano (1998). Current estimates from the National Health Interview Survey, 1995. Vital and Health Statistics 10 (199). Hyattsville, MD: National Center for Health Statistics.

NHIS Website: http://www.cdc.gov/nchs/nhis.htm

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National Hospital Discharge Survey

Data on asthma hospitalizations were obtained from the National Hospital Discharge Survey (NHDS). The NHDS is a national probability survey designed to meet the need for information on characteristics of in-patients discharged from non-federal short-stay hospitals in the United States. The NHDS collects data from a sample of approximately 270,000 in-patient records acquired from a national sample of approximately 500 hospitals. Only hospitals with an average length of stay of fewer than 30 days for all patients, general hospitals, or children's general hospitals are included in the survey. Federal, military, and Department of Veterans Affairs hospitals, as well as hospital units of institutions (such as prison hospitals), and hospitals with fewer than six beds staffed for patient use, are excluded. Data from the NHDS are available annually.

NHDS Website: http://www.cdc.gov/nchs/about/major/hdasd/nhdsdes.htm

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Childhood Cancer

Surveillance, Epidemiology and End Results Program

The population-based data used for incidence of cancer are from the Surveillance, Epidemiology and End Results (SEER) Program of the National Cancer Institute (NCI). Information from five states (Connecticut, Hawaii, Iowa, New Mexico, and Utah) and five metropolitan areas (Atlanta, Georgia; Detroit, Michigan; Los Angeles, California; San Francisco-Oakland, California; and Seattle-Puget Sound, Washington) accounting for approximately 14 percent of the United States' population are included. The participating regions were selected primarily for their ability to operate and maintain a population-based cancer reporting system and for their epidemiologically significant population subgroups. With respect to selected demographic and epidemiologic factors, they are, when combined, a reasonably representative subset of the U.S. population.

The mortality data for all cancer deaths among children in the United States are from data based on underlying cause of death from the National Vital Statistics System, administered by the National Center for Health Statistics. Mortality data are obtained by NCI and provided for all causes of cancer.

All rates are age-adjusted to the 1970 U.S. standard population.

SEER Website: http://seer.cancer.gov

Agency Contact:
Surveillance, Epidemiology, and End Results Program
National Cancer Institute

Child Population Data

U.S. Census County-Level Data

County population estimates are created by the U.S. Census Bureau starting with the most recent decennial census figure (April 1, 1990) and updating that figure with information on births, deaths, domestic migration (in/out flows with other counties in the United States), and international migration (in/out flows with other countries) that have occurred between the census date and the date of the population estimate.

The U.S. Census Bureau Population by Race and Age data are estimates of the resident population of the counties in the United States, by age (ages 0 to 84, 85 and over), sex (male, female), race (White; Black; American Indian, Eskimo and Aleut; Asian and Pacific Islander) for July 1 of each year from 1990 to 1998. A complete description of the population estimation methodology can be found on the Census Bureau's Methodology for Estimates of State and County Total Population website at http://www.census.gov/population/methods/stco99.txt and on the Census Bureau's Methodology for Estimating County Population by Age and Race website at http://www.census.gov/population/estimates/county/casrh_doc.txt.

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APPENDIX C

Environmental Health Objectives in *Healthy People 2010*

Environmental Health Objectives in *Healthy People 2010*

Healthy People 2010, an initiative coordinated by the U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, establishes national health objectives for the first decade of the new millennium. Launched in January 2000, Healthy People 2010 seeks to increase the quality and number of years of healthy life and to eliminate health disparities among Americans.

Healthy People 2010 includes a number of goals and objectives that relate to the children's environmental health risks considered in *America's Children and the Environment*.

Objective 8-1 of Healthy People 2010 aims to reduce the proportion of persons exposed to air that fails to meet EPA's health-based standards for criteria air pollutants. The goal is to reduce the number of exceedances of the standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead from their present levels to zero by 2010. Exceedances for ozone would be reduced to zero by 2012, and particulate matter (10mm or less in diameter) by 2018.

Objective 8-4 focuses on reducing emissions of hazardous air pollutants. Healthy People 2010's goal is a 75 reduction in hazardous air pollutant releases by 2010, from 8.1 million tons nationally in 1993 to 2 million tons in 2010.

Objective 8-5 aims to increase the proportion of persons served by community water systems with drinking water that meets the regulations of the Safe Drinking Water Act to 95 percent by 2010, compared with 85 percent in 1995.

Objective 8-11 aims to eliminate elevated blood lead levels in children by 2010. Lead poisoning remains a preventable environmental problem in the United States.

Objective 8-12 addresses health risks associated with exposure to hazardous waste sites. This objective seeks to remediate 98 percent of the hazardous waste sites listed as National Priority List (Superfund) sites, Resource Conservation and Recovery Act facilities, leaking underground storage facilities, and brownfield properties.

Objective 24-2a seeks to reduce asthma-related hospitalizations of children under 5 from 45.6 hospitalizations per 10,000 children in 1998 to 25 per 10,000 in 2010.

Objective 27-9 aims to reduce the percentage of children regularly exposed to secondhand smoke from the 27 percent reported in 1994 to 10 percent by 2010.

Healthy People 2010 is available at www.health.gov/healthypeople or by calling 1(800)367-4725.

Tips to Protect Children from Environmental Hazards

Help children breathe easier

- Don't smoke or let others smoke in your home or car.
- Keep your home as clean as possible. Dust, mold, certain household pests, secondhand smoke, and pet dander can trigger asthma attacks and allergies.
- Limit outdoor activity when air pollution is bad, such as on ozone alert days.

Protect children from lead poisoning

- Wash children's hands before they eat, and wash bottles, pacifiers, and toys often.
- Wash floors and window sills to protect kids from dust and peeling paint contaminated with lead—especially in older homes.
- Run the cold water for 30 seconds to flush lead from pipes before drawing water to drink.
- Get kids tested for lead—check with your doctor.
- Test your home for lead paint hazards if it was built before 1978.

Protect children from carbon monoxide (CO) poisoning

- Have fuel-burning appliances, furnace flues, and chimneys checked once a year.
- Never use gas ovens or burners for heat and never use barbeques/grills indoors or in the garage.
- Never sleep in rooms with unvented gas or kerosene space heaters.
- Don't run cars or lawnmowers in the garage.
- Install a UL approved CO detector in sleeping areas.

Keep pesticides and other toxic chemicals away from children

- Put food and trash away in closed containers to keep pests from coming into your home.
- Don't use pesticides if you don't have to—look for alternatives.
- Read product labels and follow directions.
- Use bait and traps instead of bug sprays when you can, and place the bait and traps where kids can't get them.
- Store chemicals where kids can't reach them and never put them in other containers that kids can mistake for food or drink.
- Keep children, toys, and pets away when using pesticides and don't let kids play in fields, orchards and gardens after pesticides have been used.
- Wash fruits and vegetables under running water before eating—peel them when possible.

Protect children from too much sun

- Have them wear hats, sunglasses, and protective clothing.
- Use sunscreen on kids older than 6 months and keep infants out of the sun.
- Keep children out of the mid-day sun—the sun is most intense between 10 and 2.

Safeguard them from high levels of radon

- Test your home for radon with a home test kit.
- Fix your home if your radon level is 4 pCi/L or higher. If you need help, call your state radon office or 1-800-644-6999.

Protect children from contaminated fish and polluted water

- Call the local or state health department to learn about any beach closings or local advisories limiting the amount of fish to be eaten.
- Take used motor oil to a recycling center and properly dispose of toxic household chemicals.
- Find out what's in your local drinking water—call your local water system for your annual drinking water quality report, or if you have a private home drinking water well, test it every year.

For more information call:

1 877 590 KIDS
www.epa.gov/children
EPA Office of Children's Health Protection