

Center
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Business



***Questioning the Emphasis on
Environmental Contaminants
as a Significant Threat to
Children's Health***

by Stephen Huebner with Kenneth Chilton

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This booklet is one in a series designed to enhance the understanding of the private enterprise system and the key forces affecting it. The series provides a forum for considering vital current issues in public policy and for communicating these views to a wide audience in the business, government, and academic communities.

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Introduction

Protecting children's health is essential to our nation's future. As parents and adults, we have an obligation to safeguard the health and welfare of our country's next generations. In most cases, we are willing to go to almost any lengths to protect our children. On the individual level, we ensure that our children eat healthful diets, receive medical care, and are reasonably protected from everyday risks such as drowning, electrical shock, and motor vehicle accidents. Collectively, we enact laws or regulations to address risks arising from the actions of others, such as drunk driving or pollution.

"Children's health" is a frequently cited justification for tighter environmental standards. Children's health and environmental advocates explain that current environmental standards and chemical tolerances are set to protect adults. They argue that these standards may not be sufficient to protect children, who have different exposures and responses to environmental contaminants. For example, children eat different foods, behave differently, and may lack the mature enzyme systems of adults. Environmentalists and some scientists suggest that environmental contaminants pose a major threat to children's health by increasing the risk of cancer, birth defects, developmental abnormalities, and other adverse health effects.

On the other hand, some experts argue that the risks posed by pollution are poorly defined and small relative to the other risks children face. Even if this is the case, we must not ignore these lesser risks; we should be watchful of them and do what we can to learn more.

It is important that we address the health risks children face, especially those that are large and well defined. Reducing these risks holds the potential to meaningfully improve children's health and welfare. This paper examines those issues purported to be threats to children's health, in order to put the risks posed by environmental contaminants into context.

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The Emphasis on Children's Health in Environmental Policy Making

In the last several years, "children's health" has played a important role in environmental policy making. A 1993 report by the National Academy of Sciences' National Research Council (NRC) focused attention on the potential risks to children's health created by one form of environmental contaminant, pesticide residues present in food and beverages. The report, titled *Pesticides in the Diets of Infants and Children*, addressed the question of whether the current approach to regulating pesticides in food adequately protects infants and children.¹ It did not, however, compare the risks of pesticides to the benefits of a varied and plentiful food supply, nor did it consider exposures to natural toxins.

The NRC report found that the toxicity of pesticides may differ between children and adults. Quantitative differences result from "age-related differences in absorption, metabolism, detoxification, and excretion of xenobiotic compounds," as well as physical and biological differences such as body size and the maturity of body systems. Qualitative differences result from "brief periods early in development when exposure to a toxicant can permanently alter the structure or function of an organ system."

The report also found that exposure to pesticides differs between children and adults. Compared to adults, children eat more food in proportion to their mass, have less variety in their diets, and may eat more of certain foods such as processed foods and juices. The report found that "differences in diet and thus in dietary exposure to pesticide residues account for most of the differences in pesticide-related health risks that were found to exist between children and adults."

The report recommended several reforms of the current approach to regulating pesticides. It recommended that exposure estimates reflect the unique diets of children and infants and that these estimates include nondietary exposure. It suggested that the Environmental Protection Agency (EPA) give health considerations a larger role than agricultural practices in setting "tolerances." It called for better data on food consumption and pesticide residues in the food consumed and for toxicity testing that focuses on infants and children.

The NRC report also recommended that EPA and the Food and Drug Administration (FDA) apply an additional tenfold uncertainty factor where there is evidence of postnatal developmental toxicity or where data are incomplete. (A hundredfold safety factor above

the “no-observed-effect level” found in animal tests is already applied to pesticide tolerances: a tenfold safety margin to account for differences between animals and humans, and another tenfold factor to account for variations within the human population. An additional tenfold uncertainty factor is applied for fetal, but not postnatal, developmental toxicity.)

The National Research Council report has had a substantial impact on policy, perhaps greater than its findings support. EPA, Congress, and the Clinton administration have taken a number of steps to address children’s health in response to the report. In June 1993, in anticipation of the report’s release, the administration announced its intention to reduce the amount of pesticides used in U.S. food production. In September 1993, the administration formally proposed tighter pesticide tolerances for foods that children tend to consume, citing the NRC report (which made no recommendation to reduce tolerances).²

The National Research Council report has had a substantial impact on policy, perhaps greater than its findings support.

On October 23, 1995, EPA Administrator Carol Browner announced EPA’s new national children’s health policy. The objective of the policy, which has been described as the “centerpiece” of EPA’s children’s health protection efforts, is to ensure that the agency’s risk assessments and public health standards take into account environmental threats to children and infants.³

Lawmakers have also addressed the children’s health issue. In the summer of 1996, Congress passed the Food Quality Protection Act (FQPA), which amends two statutes that regulate pesticides, the Federal Insecticide, Fungicide, and Rodenticide Act; and the Federal Food, Drug and Cosmetics Act.⁴ The FQPA explicitly provides for children’s health protection by requiring that pesticides be tested for their effects on children. Where data on children are not available or are uncertain, EPA may add a tenfold safety factor to a pesticide tolerance to protect children. The FPQA also requires EPA to consider the cumulative risk posed by exposure to all pesticides of similar classes. Before the FQPA, safe tolerances were determined for pesticides on an individual basis.

The FQPA allows no pesticide residue in food unless a “reasonable certainty of no harm” can be demonstrated. Before the FQPA, the Delaney Clause of the Food, Drug, and Cosmetics Act prohibited any level whatsoever of cancer-causing substances in processed foods. The FQPA replaces that “zero-risk” standard, but it goes beyond identifying chemicals that may cause cancer and calls for screening to determine whether pesticides may cause other harm, for example by disrupting the human endocrine, nervous, immune, or reproductive systems. According to EPA, the provisions of the 1996 Food Quality Protection Act are based on the recommendations of the NRC report.⁵

In September 1996, EPA released a report titled *Environmental Health Threats to Children*.⁶ The EPA report explains the reasons children are uniquely susceptible to environmental contaminants: their organ and immune systems are still developing; they eat, drink, and breathe proportionately more than adults; and they have different behavior patterns. The report includes a seven-step “national agenda to protect children’s health from environmental threats.” Several of the agenda’s notable steps are to do the following:

- Ensure that all standards set by EPA protect children from the potentially heightened risks they face.
- Expand research on child-specific susceptibility and exposure to environmental pollutants.
- Develop new, comprehensive policies to address cumulative and simultaneous exposures faced by children (as opposed to the chemical-by-chemical approach used in the past).

At the report’s announcement, Administrator Browner explained, “We must meet the challenge of protecting our children from toxins in the environment. An awareness of children’s unique susceptibility and exposure to toxic threats must guide every action we take to protect public health and the environment.”⁷

The EPA report and children’s health activists express legitimate concerns about children’s health. Children are physiologically different from adults and therefore face different, and in some cases greater, health risks. What is troubling is the agenda these advocates have put forward. EPA’s national agenda includes a commitment “to provide the necessary funding to address children’s environmental health issues *as a top priority among relative health risks* . . . substantial resources dedicated to these efforts are critical” (emphasis added). The problem, however, is that environmental health risks have not been established as one of the top risks to

children's health.

On April 21, 1997, President Clinton signaled his commitment to protecting children's health when he issued Executive Order 13045, titled "Protection of Children from Environmental Health Risks and Safety Risks." The order directs each executive agency to "make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children" and "ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."⁸

The problem with the emphasis on environmental health risks is that they have not been established as one of the top risks to children's health.

In May 1997, EPA established the Office of Children's Health Protection to implement President Clinton's executive order as well as its own national agenda to protect children's health from environmental threats. In July 1997, the Children's Health Protection Advisory Committee was established to advise EPA on its development of regulations, guidance documents, and policies to address children's health. In March 1998, the committee's Regulatory Re-evaluation Work Group made a preliminary recommendation that EPA should reexamine its standards for six substances: particulate matter, sulfur dioxide, triazine pesticides, organophosphates and carbamates, mercury, and microbial contaminants in drinking water.⁹

In 1996 and 1997, Administrator Browner made frequent references to children to justify EPA's new air quality standards for ozone and particulate matter air pollution. For example, when the tighter standards were proposed in November 1996, she said, "The scientific evidence tells us that the current standards fail to provide adequate public health protection, especially for children."¹⁰

On September 15 and 16, 1997, EPA held a conference on Preventable Causes of Cancer in Children, which focused on the possible link between environmental contaminants and childhood cancer. On April 21, 1998, Vice President Al Gore announced an initiative to screen all high-production industrial chemicals in the

United States, with special attention given to their effects on children's health.¹¹

The Claims About Threats to Children's Health

It is evident that the children's health issue is a high priority for the EPA, Congress, and the Clinton administration. The urgency to address this issue is due in no small part to the claims of environmental activists, who warn that environmental contaminants may pose a grave danger to the health of infants and children in the United States. These activists hypothesize that environmental contaminants, including pesticides and other chemicals that humans may be exposed to, cause birth defects, childhood cancer, neurological damage, and other adverse health effects. This section analyzes some of the charges made against environmental contaminants and the threats they pose to children's health.

The Identified "Threats" to Children's Health

EPA's September 1996 report *Environmental Health Threats to Children* identifies nine environment-related children's health threats. Table 1 was developed from the EPA report.

In addition to familiar threats such as lead poisoning, asthma, and water pollution, the report identifies two environmental threats that are less understood: 1) the effects of pesticides and industrial chemicals on the endocrine system, and 2) the effects of particulate matter air pollution. EPA states that synthetic chemicals such as the pesticide DDT and polychlorinated biphenyls (PCBs) can disrupt the endocrine systems in wildlife and laboratory animals, and that low levels of these chemicals may mimic or block reproductive and thyroid hormones in developing humans. The agency says that, although little is known about the effects of endocrine disrupting chemicals, they theoretically could cause birth defects, alterations in children's growth and development, and reproductive cancers. According to the report, the adverse effects of particulate matter air pollution on children include restricted activity days, school absences, increased respiratory symptoms, and decreased lung function.¹²

Environmental groups also make claims about the harmful effects of environmental contaminants on children's health. In 1997, the Natural Resources Defense Council (NRDC) released *Our Children At Risk: The 5 Worst Environmental Threats To Their Health*.¹³ The report indicted lead, air pollution, pesticides, environmental

Table 1

**Top Environmental Threats to Children’s Health
Identified by the EPA**

<i>Threat</i>	<i>EPA Comment</i>
Lead poisoning	Affects up to 1.7 million children age five and younger.
Pesticides	Children eat more fresh produce than adults. Some pesticides can cause cancer, nervous system damage, or respiratory illness. More than 100,000 children accidentally ingest pesticides each year.
Asthma	Deaths due to asthma in children and young people increased 118 percent from 1980 to 1993.
Drinking water contaminants	In 1995, 30 million Americans drank water from systems that violated at least one public health standard.
Polluted water	Mercury contamination in fish is a major threat.
Toxic waste dumps	Ten million children younger than age 12 live within four miles of a toxic waste dump.
Polychlorinated biphenyls (PCBs)	PCBs were banned by EPA in 1976 but are still present in the environment. PCB exposure during pregnancy is reported to cause learning disabilities.
Secondhand tobacco smoke	Can cause acute and chronic respiratory conditions in children.
Overexposure to ultraviolet light	Sunburns during childhood increases the risk of developing malignant melanoma. In the United States in 1995, there were an estimated one million new cases of skin cancer.

Developed from: U.S. Environmental Protection Agency, *Environmental Health Threats to Children*, (September 1996; EPA 175-F-96-001).

tobacco smoke, and drinking water contamination as the greatest environmental threats to children's health. The report states that pesticide exposure is associated with childhood cancer, birth defects, and immune system effects:

Case reports and epidemiological studies indicate an association between pesticide exposure and the development of certain cancers in children including leukemia, sarcomas, and brain tumors. Most major classes of pesticides have been shown to adversely affect the developing nervous system of experimental animals, impairing both mental and motor development. Parental exposure to pesticides, particularly in agricultural areas, has been associated with the development of certain cancers and birth defects in offspring. And some studies suggest that exposure to pesticides may compromise the immune system of infants and children and exacerbate their risk of infection and disease.¹⁴

The NRDC report identifies several types of cancer that have been associated with pesticide exposure: leukemia, brain tumors, sarcomas, lymphomas, and Wilm's tumors. The environmental group's report also says that pesticides may cause acute and chronic nervous system damage in children. NRDC states that, although the causes of birth defects are unknown, "environmental agents" are an important risk factor.¹⁵

The NRDC report, however, is not useful for evaluating the relative importance of environmental pollution risks; it does not provide information about how they compare to other risks. Furthermore, it implies that a causal association between some environmental contaminants and health effects has been established with greater certainty than it actually has. Examples are the association between pesticides and cancer and birth defects, or the link between air pollution and asthma.

A January 1998 Environmental Working Group (EWG) report also argues that pesticide use poses a grave danger to children's health. The report, *Overexposed: Organophosphate Insecticides in Children's Food*, examines data on organophosphate insecticide residues and children's food consumption patterns. It claims that every day one out of 20 children age five and under consumes an unsafe dose of organophosphates, a class of widely-used insecticides.¹⁶

The EWG report claims that foods commonly consumed by infants and children—apples, peaches, applesauce, popcorn, grapes, and others—contain dangerous levels of these pesticides, which it

speculates may cause long term brain and nervous system damage. EWG warns, “There is mounting evidence, however, that OPs [organophosphates] are toxic to the developing brain and nervous system at very low levels of exposure. Again, both current studies and the regulations they support do not account for these toxic effects.”¹⁷

The Natural Resources Defense Council report is not useful for evaluating the relative importance of environmental pollution risks; it does not provide information about how they compare to other risks.

Like the Natural Resources Defense Council report, the EWG report does not provide evidence that the risks posed by pesticide exposure rank high relative to other children’s health risks including, among others, the risk associated with low fruit and vegetable consumption.

Is Children’s Health Worsening?

Environmental and children’s health advocates point to downward trends in several indicators of children’s health to make the case that children’s health is endangered by environmental contaminants. For example, some children’s health advocates attribute the increased incidence of some types of childhood cancer, birth defects, and asthma to environmental factors.

Cancer. At EPA’s September 1997 “Conference on Preventable Causes of Children’s Cancer,” Administrator Browner said that, although the death rate from childhood cancer has declined, the incidence of cancer in children has increased. Browner said that many leading health experts suspect environmental contaminants may be responsible for the rise in childhood cancer. She also noted that in the last several decades, tens of thousands of new chemicals have been introduced into our air, water, food, and homes.¹⁸

According to EPA, nearly 9,000 new cases of cancer are diagnosed in children younger than 14 each year; a child has a 1 in 600 probability of developing cancer before age 10; and the incidence of cancer rose by about 1 percent each year from 1974 to 1991. The agency cites alarming trends for specific cancers in 0-14 year olds from 1973-1994 based on National Cancer Institute data: Wilm’s

tumor (a kidney tumor) rose by 46 percent, brain cancers rose by 40 percent, and testicular cancer rose by 37 percent.¹⁹

These statistics may be accurate, but they are very misleading. Take, for example, the incidence of Wilm's tumor. The National Cancer Institute data for 1973-74 to 1993-94 show a rise in the annual incidence of kidney and renal pelvis cancers from 0.7 to 1.0 case per 100,000 children, an increase of 45.6 percent, according to the National Cancer Institute. The most recent data (for 1973-74 to 1994-95) show an annual increase from 0.7 to 0.8 cases per 100,000 children, just a 14 percent increase.²⁰ Although small changes in the incidence rate appear dramatic when expressed as percentages of the small baseline rate, the overall increase in childhood cancer has been modest. Another way of characterizing the incidence of kidney and renal pelvis cancers in children over this period is that it rose by one in one million.

Similarly, while the National Cancer Institute data show an increase in the incidence of all cancers in children over the last two decades, this increase is more modest than EPA's presentation of the data implies. From 1973-74 to 1994-95, the annual rate for all cancers per 100,000 persons in the 0 to 14 age group increased from 12.8 to 13.6 cases.²¹

Moreover, cancer in children is a relatively rare event. In 1995, the estimated number of incident cases for the 0-14 age group was 8,300. For comparison, the total number of cancer cases for all ages in 1995 was approximately 1.3 million.²²

Figure 1 shows the annual incidence of several cancers in children in 1973-74 and 1994-95.

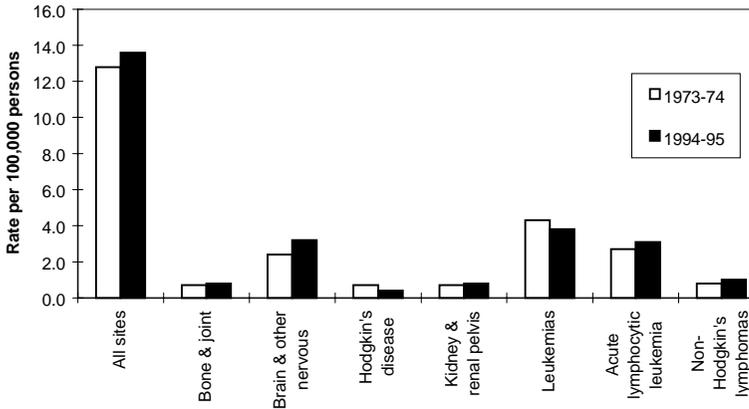
The Journal of the National Cancer Institute quotes Dr. Martha Linet, of the Institute's Radiation Epidemiology Branch, on the incidence of childhood cancer:

Many epidemiologists believe that total childhood cancer is not an etiologically meaningful entity. Each of the 12 major internationally recognized categories of childhood cancer has its own very clear descriptive epidemiology; they differ by age, by gender, by race, and many other factors. There's not a totally consistent picture, and the only [childhood cancer] that appears to be continuing to go up is brain tumors, where there was a big increase in the mid-1980s, followed by a much slower increase since then.²³

Perhaps more important than the slight rise in the incidence rate of childhood cancer is the decline in the death rate. The annual cancer mortality rate for 0 to 14 year olds fell from 5.4 per 100,000 in 1973-1974 period to 2.8 per 100,000 in the 1994-95 pe-

Figure 1

Incidence of Cancers in 0-14 Year Olds, 1973-74 and 1994-95



Source: Ries, LAG, Kosary, CL, Hankey, BF, Miller, BA, Edwards, BK (eds.), *SEER Cancer Statistics Review, 1973-1995* (Bethesda, Maryland: National Cancer Institute, 1998), Table XXVII-1.

riod.²⁴ This favorable statistic reflects improvements in the detection and treatment of childhood cancer.

Birth Defects. At EPA's 1997 conference, Dr. Philip Landrigan of EPA's Office of Children's Health Protection and Mount Sinai School of Medicine observed that certain birth defects are increasing. He cited a near doubling in the rate of hypospadias (a urinary tract birth defect found in boys) from 1970 to 1994. Dr. Landrigan noted that children have greater exposure to environmental toxins than adults, are biologically more vulnerable, and are less protected by chemical tolerances. As a result, he said, environmental factors may play a role in the increase in these children's diseases.²⁵

In fact, a 1997 study did find an apparent doubling of the hypospadias rate during the 1970s and 1980s, but the authors cautioned against concluding that their data confirms an actual increase:

Better identification of mild cases by physicians, therefore, cannot be ruled out as at least a partial cause of the increase in the hypospadias rate. Although these results are not sufficient in themselves to prove that the rate of hypospadias is increasing, the possibility of such an increase merits further investigation...²⁶

Asthma. Approximately 15 million Americans have asthma, including 5 million children.²⁷ According to Dr. Landrigan, asthma

rates have doubled in the past decade, and death rates from asthma have increased in recent years.²⁸ EPA statistics indicate that 14 Americans die each day from asthma, triple the rate of 20 years ago.²⁹

Some environmental and children's health advocates imply that air pollution may be responsible for the increase in the incidence of asthma. EPA's September 1996 report *Environmental Health Threats to Children* states:

Many of the most common air pollutants can cause or contribute to respiratory illnesses, including asthma, which is now the leading cause of hospital admissions for our nation's children. More than 25% of the nation's children live in areas that don't meet national ambient air quality standards.³⁰

In promoting EPA's new National Ambient Air Quality Standards for ozone and particulate matter air pollution, which the agency issued in July 1997, Administrator Browner made frequent references to children and asthmatics. EPA considers these groups to be at increased risk, since high ozone concentrations may cause more frequent and more severe attacks.

Urban air pollution is unlikely to be responsible for the recent increase in asthma, however. U.S. air quality has improved dramatically over the last several decades: from 1970 to 1996; aggregate emissions of the six major urban air pollutants decreased 32 percent.³¹

Urban air pollution is unlikely to be responsible for the recent increase in asthma—U.S. air quality has improved dramatically over the last several decades.

Table 2 shows emissions and concentration changes of these "criteria" pollutants for 1977-1996 and 1970-1996, respectively. Ozone concentrations have declined 30 percent and direct emissions of particulates have decreased by 73 percent.

A hypothesized cause of the rise in asthma incidence is indoor air pollution, including tobacco smoke, molds, mites, and cockroach dust. A 1997 *New England Journal of Medicine* study found that exposure to elevated levels of cockroach allergen was associated with increased hospitalizations and unscheduled medical visits among inner city children.³² Energy conservation measures

Table 2

Change in U.S. Air Quality—Concentrations (1977-1996) and Emissions (1970-1996)

Criteria Pollutant	Concentration % Change 1977-1996	Emissions % Change 1970-1996
Carbon monoxide	-61%	-31%
Lead	-97%	-98%
Nitrogen dioxide	-27%	+8% (NO _x)
Ozone	-30%	-38% (VOC)
PM ₁₀ *	Data not available	-73% **
Sulfur dioxide	-58%	-39%

Notes: * Particulate matter measuring 10 micrometers or less in diameter.
** Includes only directly emitted particles. Secondary PM formed from SO_x, NO_x, and other gases comprise a significant fraction of ambient PM.

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *National Air Quality and Emissions Trends Report, 1996* (Research Triangle Park, N.C., January 1998), Table 1-2.

enacted during and after the 1970s to reduce excessive ventilation have had the effect of raising levels of indoor air contaminants. Thus, an increase in indoor air pollution is another possible explanation for the increase in asthma.³³

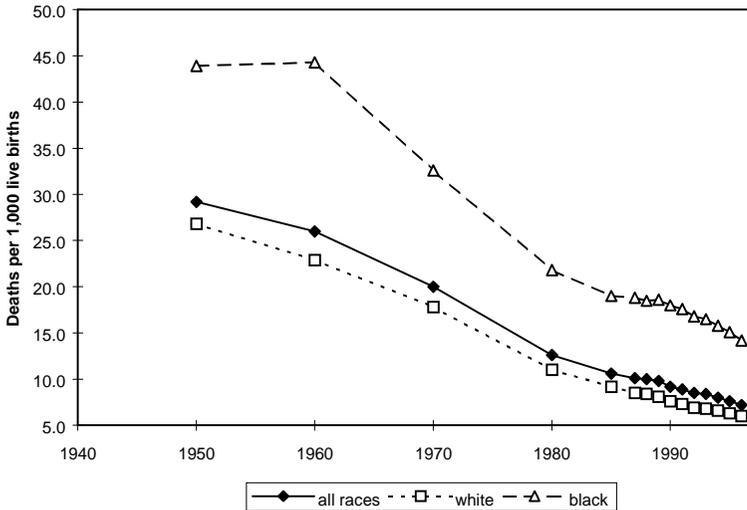
A January 1997 *Science* essay offers another hypothesis: the increased incidence of asthma could be related to a decrease in respiratory and other infections in children. These childhood infections may protect against developing asthma. The article also explains that some individuals are genetically predisposed to asthma and that, although air pollution may exacerbate the disease, it is not the likely cause of its recent increase.³⁴

Risks to Children's Health in Perspective

Despite the increased incidence of certain childhood diseases, the overall trend in children's health is unmistakably favorable. Children living in the United States today enjoy an unprecedented level of health relative to both historical standards and to children living elsewhere in the world. Several statistics indicate that, overall, children's health has improved consistently over the last half

Figure 2

Infant Mortality Rate, 1950-1996



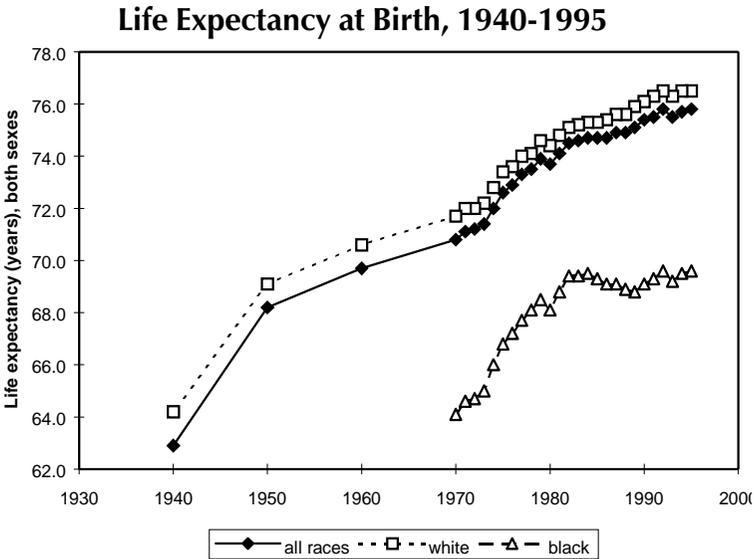
Source: Centers for Disease Control and Prevention, National Center for Health Statistics, “Infant Mortality Rates, Fetal Death Rates, and Perinatal Mortality Rates, According to Race: United States, Selected Years 1950-95,” available on the world wide web at <<http://www.cdc.gov/nchswww/datawh/statab/pubd/hus97t23.htm>>, and Center for Disease Control and Prevention, National Center for Health Statistics, Monthly Vital Statistics Report, Vol. 46, No. 1, Supplement 2 (September 11, 1997), p. 28.

century—coincident with the widespread presence of “environmental contaminants.” These data show that today, children are living longer, healthier lives than ever before.

Although environmentalists claim that environmental contaminants are an important source of birth defects and the increased incidence of children’s cancer, these risks have not been well-quantified. For all cancers, the vast majority of which occur in adults, the largest risk factors appear to be unrelated to environmental pollution. Significant risk factors include tobacco use, chronic infection and inflammation, diet, hormones, and endogenous damage.³⁵

Even if the risks posed by environmental contaminants were quantifiable, these risks would need to be evaluated *relative* to other risks. The data on children’s health risks suggest that reduction of other risks such as accidents, lack of prenatal care, fast-food diets, smoking, drug use, and gunshot wounds may offer a greater

Figure 3



Source: Anderson, Robert N., Kenneth D. Kochanek, and Sherry L. Murphy (1997), "Report of Final Mortality Statistics, 1995," Monthly Vital Statistics Report, Vol. 45, No. 11, Supp. 2 (Centers for Disease Control and Prevention, National Center for Health Statistics, June 12), p. 19.

potential to improve children's health than addressing the uncertain risks posed by environmental contaminants.

The State of Children's Health Today

One important indicator of children's health and welfare is infant mortality. This statistic measures the number of deaths within the first year of life for each 1,000 live births. The infant mortality rate has fallen consistently since 1950 for both white and black children. For whites, the rate fell from 26.8 in 1950 to 6.0 in 1996, and for blacks from 43.9 to 14.2. (See Figure 2.)

Life expectancy at birth is another important indicator of health and welfare. From 1970 to 1995, life expectancy at birth increased from 64.1 years to 69.6 years for African Americans and from 1940 to 1995, it increased from 64.2 years to 76.5 years for Caucasians. (See Figure 3.)

Numerous factors have contributed to the upward trends in indicators of health and welfare of children in the United States. Among them are the cure or prevention of infectious diseases such as smallpox, polio, measles, rubella, and diphtheria; earlier detection and improved treatment of diseases such as cancer; improvements in sanitation and drinking water; increased availability of fruits and vegetables; and numerous other advances in science, medicine, and public health.

Another important factor is the steady rise in real per-capita income since World War II. Higher incomes allow people to eat healthier foods, buy more health care (or health insurance), and drive safer cars. Empirically, per capita income is positively associated with life expectancy and is negatively associated with infant mortality; as countries become richer, their children live longer, healthier lives.³⁶

"There's no doubt that the benefits of fruits, vegetables and grains far outweigh the risks of residues of pesticides on these products."

— David Kessler, Former F.D.A. Commissioner

Income is positively associated with an improved diet and increased consumption of fruit and vegetables. Diet, in turn, is one of the largest controllable risk factors for cancer. High fruit and vegetable consumption is consistently associated with reduced risk of degenerative diseases including cancer, cardiovascular disease, and brain dysfunction. The rate of most types of cancer (lung, larynx, oral cavity, esophageal, stomach, colorectal, bladder, pancreatic, cervical, and ovarian) is roughly twice as high in the quarter of the population with the lowest intake of fruits and vegetables as in the quarter with the highest.³⁷

The availability of an abundant and low-cost supply of fruits and vegetables can be attributed to advances in agricultural practices and technology and transportation. From the early 1960s to the end of the 1980s, the productivity of agricultural land in the United States increased 58 percent.³⁸ Ironically, one of the most important advances has been the introduction of synthetic pesticides, the very chemicals that environmentalists claim endanger our children.

A 1993 study by researchers at Texas A&M University underscores the importance of pesticide use in providing an abundant supply of fruits and vegetables. The study found that a 50 percent reduction in pesticide use on crops of nine fruits and vegetables (apples, grapes, lettuce, onions, oranges, peaches, potatoes, sweet corn, and tomatoes) would reduce average yields by 37 percent, and a complete elimination of pesticide use would reduce yields by 70 percent. In addition, the appearance and quality of fruits and vegetables would decline so that consumers would be likely to purchase fewer of them.³⁹

A 1995 study by C. Robert Taylor of Auburn University estimated the effect of eliminating U.S. pesticide use on fruit and vegetable prices and domestic consumption. He found that production costs would increase by 75 percent, wholesale prices would increase by 45 percent, and retail prices would increase by 27 percent. As a result, domestic consumption would fall by 11 percent. Taylor also explains that reducing pesticide use would lead to an increase in *natural* toxins and carcinogens in produce.⁴⁰

David A. Kessler, former Food and Drug Administration Commissioner, recognized the importance of pesticides even as the Clinton Administration announced its 1993 plan to reduce pesticide use. At the June 25, 1993 announcement he stated:

We are not saying that food is unsafe. What we're saying is that we can do better. There is no reason for a scare, and there is no reason for alarm. . . . There's no doubt that the benefits of fruits, vegetables and grains far outweigh the risks of residues of pesticides on these products.⁴¹

The trend in the overall indicators of children's health is unmistakably favorable. Although some indicators, such as the incidence of asthma and specific cancers, are on the rise, there is little reason to believe that these will overtake the historical and present gains in children's health.

How Do Environmental Contaminants Compare to Other Risks?

The fact that each generation of American children is healthier than ever does not mean that there is no room for improvement. Indeed, there are several areas in which large reductions in risks to children's health can be made.

Data on the causes of childhood deaths shed some light on the question of which risks pose the greatest threats to children's

health. The National Center for Health Statistics reports the 10 leading causes of death for ages 1-4 and 5-14 in the United States in 1995. (See Table 3.)

Accidents are by far the leading cause of death for children age 1-14, accounting for 36 percent of deaths in the 1-4 age group and 41 percent of deaths in the 5-14 age group. Leading causes of accidental death include suffocation, drowning, motor vehicle occupant injury, fire and burns, and pedestrian and bicycle injury. Accidents also cause approximately 246,000 hospitalizations, 8,700,000 emergency room visits, and 11,000,000 visits to physicians every year.⁴²

The good news is that many of the deaths and injuries caused by accidents are relatively easy to prevent. Dr. C. Everett Koop, former U.S. Surgeon General, told a recent Senate Labor and Human Resources Committee hearing on unintentional childhood injuries and death that 90 percent of all childhood injuries are preventable.⁴³

In fact, substantial progress has been made toward reducing the rate of children's deaths due to accidents. According to the National Safe Kids Campaign, deaths due to accidents for the 14 and under age group declined 18 percent from 1987 to 1995, from 8,069 to 6,611 per year.⁴⁴ This progress may be the result of efforts to increase the use of seat belts, bicycle safety helmets, smoke detectors, child safety seats, and similar safety measures.

Children's health and environmental activists hypothesize that environmental contaminants are associated with birth defects and cancer, both of which are in the top four categories of childhood deaths. To assess the relative importance of environmental contaminants as a threat to children's health, we need some idea of what proportion of children's cancers and birth defects they are responsible for.

Cancer. Cancer is the third leading cause of death in the 1 to 4 age group, accounting for about 8 percent of all deaths. It is the second leading cause for the 5 to 14 age group, accounting for about 12 percent of all deaths.

The causes of childhood cancer are not well understood, in part because it is a relatively rare phenomenon and, therefore, difficult to study. This is especially true for cancers other than leukemias and brain cancers.⁴⁵ These two types of cancer account for about half the cancers in children under age 14.⁴⁶

Hypothesized causes of leukemia include random or inherited genetic abnormalities; exposure to common infections at unusual times; childhood, fetal, or parental exposure to environmental contaminants such as pesticides; and parental exposure to certain chemicals during or before pregnancy (including breakdown prod-

Table 3

Ten Leading Causes of Death in 1995 for Children Aged 1-4 and 5-14

<i>Ages 1-4</i>	<i>Annual Deaths</i>	<i>%</i>	<i>Ages 5-14</i>	<i>Annual Deaths</i>	<i>%</i>
1. Accidents and adverse effects	2,280	35.7 %	1. Accidents and adverse effects	3,544	41.2 %
2. Congenital anomalies (birth defects)	695	10.9	2. Malignant neoplasms (cancers)	1,026	11.9
3. Malignant neoplasms (cancers)	488	7.6	3. Homicide	562	6.5
4. Homicide	452	7.1	4. Congenital anomalies (birth defects)	449	5.2
5. Heart disease	251	3.9	5. Suicide	337	3.9
6. Human Immunodeficiency Virus	210	3.3	6. Heart disease	294	3.4
7. Pneumonia and influenza	156	2.4	7. Human Immunodeficiency Virus	189	2.2
8. Conditions originating in perinatal period	87	1.4	8. Chronic Obstructive Pulmonary Disease	143	1.7
9. Septicemia	80	1.3	9. Pneumonia and influenza	128	1.5
10. Cerebrovascular diseases	57	0.9	10. Benign neoplasms	105	1.2
Other causes	<u>1,637</u>	25.6	Other causes	<u>1,819</u>	21.2
<i>All causes</i>	6,393		<i>All causes</i>	8,596	

Source: Anderson, R.N., Kochanek, K.D., Murphy, S.L., Report on Final Mortality Statistics, 1995, Monthly Vital Statistics Report, Vol. 45, No. 11, supp. 2, table 7 (Hyattsville, Maryland: National Center for Health Statistics, 1997).

ucts of benzene, quinoline antibiotics, resins used to treat genital warts, Chinese herbal medicines, metabolites of alcohol, and flavonoids found in foods such as onions and red wine).⁴⁷

Another hypothesis is that smoking by fathers may increase the risk of childhood cancer and birth defects (acute lymphocytic leukemia, lymphoma, and brain tumors) because smoking causes oxidative damage to sperm DNA. A 1997 study by Ji et al., published in the Journal of the National Cancer Institute, found an association between preconception smoking by fathers and an increased risk of acute leukemia and lymphoma in their offspring.⁴⁸

[F]ocusing our efforts and resources to eliminate the small and uncertain risks caused by environmental contaminants may do more harm than good. Resources spent to eliminate these risks cannot be applied to the larger and well-quantified risks.

Hereditary factors may play a large role in causing childhood cancer. Biochemist Bruce Ames and his co-authors explain: "Inherited factors clearly contribute to cancer, particularly in childhood cancer and cancer in early adulthood. Overall cancer rates increase exponentially with age except for a blip on the curve for childhood cancer, which is thought to be mainly due to inheriting a mutant cancer gene."⁴⁹

In contrast with childhood cancer, the major risk factors for all cancers are better understood. In a widely-cited 1981 article, Richard Doll and Richard Peto, of Oxford University, estimated the percentages of cancer deaths in the United States attributable to various factors. They found that most causes of cancer are avoidable, and therefore that most cancers are probably preventable. They found that diet and tobacco are likely to account for a majority of cancer deaths, with best estimates of 30 percent (range 25%-40%) and 35 percent (range 10%-70%), respectively. Their estimate for pollution is 2 percent (range 1%-5%), and their estimate for industrial products is less than 1 percent (range <1%-2%).⁵⁰

In a 1996 article, Doll writes that little reduction in cancer rates can be expected from further reducing the small risks caused by pollution:

Two categories of cause remain for which I see little possibility of material benefit from their further control, namely the hazards of occupation and pollution. . . . Pollution, which is popularly thought to be a major hazard, must cause some cases, but the risks that can be quantified—those of polycyclic aromatic hydrocarbons, trace metals and benzene from the use and combustion of fossil fuels in industry and transport, dioxins from the combustion of waste, pesticide residues in food and discharges from the nuclear industry—all appear to be so minute that the social cost of trying to reduce them further may well outweigh any benefit from reduction in the incidence of cancer.⁵¹

Doll makes an important point: focusing our efforts and resources to eliminate the small and uncertain risks caused by environmental contaminants may do more harm than good. Resources spent to eliminate these risks cannot be applied to the larger and well-quantified risks.

Ames, et al., agree that synthetic chemicals are unlikely to be a major cause of cancer:

The idea that there is an epidemic of human cancer caused by synthetic industrial chemicals is not supported by either toxicology or epidemiology. Though some epidemiologic studies have found an association between cancer and low levels of industrial pollutants, the studies did not correct for diet, which is a potentially large confounding factor; moreover, the levels of pollutants are low and rarely seem plausible as a causal factor when compared with the background of natural chemicals that are rodent carcinogens.⁵²

Walter Willett, of the Harvard School of Public Health, estimated in a 1995 article that about 32 percent of cancer could be avoided by dietary changes, consistent with Doll and Peto's estimate. He finds that fruit and vegetable consumption is an important means of cancer prevention: "Whereas earlier thinking about nutrition and cancer emphasized the adverse effects of fat and other components in the diet, the most compelling evidence of the last decade has indicated the importance of protective factors, largely unidentified, in fruits and vegetables."⁵³

Other important probable causes of cancer include reproductive hormones, responsible for up to 20 percent of cancers; and chronic infection and inflammation, responsible for an estimated

9 percent of cancers in developed countries.⁵⁴

Birth Defects. Birth defects are the second leading cause of death for the 1 to 4 age group, accounting for about 11 percent of all deaths, and the fourth leading cause of death for the 5 to 14 age group, accounting for about 5 percent of all deaths. The good news is that many birth defects are preventable.

About 1 in 1,000 infants in the United States are born with either spina bifida (incomplete closure of the spinal column) or anencephaly (incomplete development of the skull bones and an incomplete brain). About 4,000 pregnancies are affected by these birth defects each year. The Centers for Disease Control and Prevention estimates that as many as 3,000 of these cases could be prevented if women consumed an adequate daily dose of folic acid before and during early pregnancy (which easily can be accomplished by taking a multivitamin).⁵⁵ For this reason, the U.S. Food and Drug Administration announced regulations in 1996 to require U.S. food manufacturers to add folic acid to enriched breads, flours, pastas, and other grain products beginning in 1998.⁵⁶

Fetal alcohol syndrome is another leading cause of birth defects and mental retardation, causing approximately 2,000 cases of preventable birth defects every year. An additional 4,000 children may not meet the definition of fetal alcohol syndrome, but suffer cognitive and behavioral impairment from fetal alcohol exposure. The Centers for Disease Control and Prevention reports an unfortunate statistic: the rate of frequent drinking among pregnant women rose fourfold from 1991 to 1995.⁵⁷ Since fetal alcohol syndrome is known to be the direct result of alcohol consumption during pregnancy, most of its occurrences are probably preventable.

Unanswered Questions

The possibility that environmental contaminants adversely affect the health of our nation's children has led to widespread concern. Exposure to pesticides and other synthetic chemicals at the levels present in our environment and food supply is a hypothesized risk factor for childhood diseases including cancer, birth defects, and developmental abnormalities.

Yet many questions remain unanswered, and the extent to which environmental contaminants may adversely affect the health of our nation's children is not clear.

For example, it is not at all evident that the health risks posed to children by environmental contaminants are comparable to, or

greater in magnitude than, the other risks children face. There are no data to support this contention, and in many cases, the risks posed by environmental contaminants appear to be small relative to others. Cancers and birth defects are both important threats to children's health, but environmental contaminants have not been established as a major risk factor for these diseases.

[M]any questions remain unanswered, and the extent to which environmental contaminants may adversely affect the health of our nation's children is not clear.

Although environmental contaminants cannot be ruled out as risks to children's health, the lack of scientific evidence makes it difficult to reach conclusions about which risks are the most important and which policy solutions are the most prudent. More data on the causes of cancers, birth defects, and other childhood diseases would go a long way to resolve many of the unanswered questions.

Conclusion

Protecting children's health should be a high priority for policymakers. In many cases, children's health is used as a justification for more restrictive environmental standards. One of the driving forces behind these policies is the concern that environmental contaminants are responsible for unfavorable movements in indicators of children's health, such as the rise in specific types of cancer and the incidence of asthma.

Children's health has led some to put forward an agenda that focuses limited public health resources on the poorly quantified risks posed by environmental contaminants to the neglect of other known risks. It is imperative that we exercise caution when dealing with lesser risks, because policies that target small threats may distract our attention and divert resources away from the larger and better-defined risks that children face.

The largest threats to children's health appear to be preventable, including accidents and behavioral factors. Therefore, ad-

addressing these risks holds a large potential to improve children's health. Accidents pose the largest risk of death to children by far, accounting for close to 40 percent of deaths in the 1 to 14 age group. To the extent that many birth defects and cancers may be the result of behavioral, rather than environmental, factors, these diseases are probably preventable, as well.

Policies that target the risks to children's health posed by environmental contaminants such as pesticides and urban air pollution may result in small improvements in the health of our nation's children. They may also result in no improvement, on balance, if they have the unintended consequence of increasing other risks such as the risks posed by insufficient fruit and vegetable consumption or by poverty. Because public health resources are limited and we all want what is best for our nation's children, we would be wise to question the emphasis on environmental contaminants as a leading risk to their health.

Notes

1. National Research Council, *Pesticides in the Diets of Infants and Children* (Washington, D.C.: National Academy Press, 1993).
2. Gary Lee, "Administration Urges Overhaul of Food Safety Laws," *Washington Post*, 22 September 1993, p. A1.
3. U.S. Environmental Protection Agency, *Environmental Health Threats to Children*, (September; EPA 175-F-96-001, 1996).
4. *Food Quality Protection Act of 1996*, Public law 104-170, 104th Cong., 2nd Sess. (3 August 1996).
5. Lynn R. Goldman, Assistant Administrator, Office of Prevention, Pesticides and Toxic Substances, U.S. Environmental Protection Agency, "Food Quality Protection Act of 1996: New Directions in Public Health Protection," (symposium sponsored by The American Crop Protection Association and McKenna & Cuneo, Washington, D.C., 10 September 1996), available on world wide web at <<http://www.epa.gov/oppfead1/fqpa/sphgold1.htm>>.
6. U.S. Environmental Protection Agency, *Environmental Health Threats to Children*.

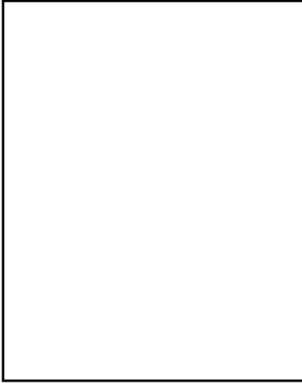
7. Josh Greenberg, "Administration to Launch New Toxin Rules," *Los Angeles Times*, 12 September 1996, p. A20.
8. Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," *Federal Register* 62, no. 78, 23 April 1997.
9. Patricia Ware, "Particulates, SO₂, Triazines, Microbials Top List for Children's Health Initiative," *Environment Reporter* (Washington, D.C.: Bureau of National Affairs, 13 March 1998), pp. 2404-2405.
10. John H. Cushman, "Administration Issues Its Proposal for Tightening Air Standards," *New York Times* (28 November 1996), p. A1.
11. Sara Thurin Rollin, "Gore Calls for Basic Studies on Chemicals, With Special Focus on Children's Health," *BNA Environment Reporter* 28, no. 50 (24 April 1998), pp. 2745-2746.
12. U.S. Environmental Protection Agency, *Environmental Health Threats to Children*.
13. Lawrie Mott, *Our Children at Risk: The 5 Worst Threats to Their Health* (New York: Natural Resources Defense Council, November 1997).
14. Mott, pp. 50-51.
15. Mott, pp. 54-58.
16. Richard Wiles, Kert Davies, and Christopher Campbell, *Overexposed: Organophosphate Insecticides in Children's Food* (Washington, D.C.: Environmental Working Group, January 1998).
17. *Ibid.*, pp. 19-20.
18. Carol Browner, "Children's Health and the Environment: The EPA Commitment," (U.S. EPA Conference on Preventable Causes of Cancer in Children, 15-16 September 1997), available on the world wide web at <<http://www.epa.gov/children/document/minutes.htm>>.
19. U.S. Environmental Protection Agency, Office of Children's Health Protection, *Some Facts on Children's Cancers*, fact sheet, December 1997, available on the world wide web at <http://www.epa.gov/children/document/app_d.htm>.
20. L.A.G. Ries, C.L. Kosary, B.F. Hankey, B.A. Miller, and B.K. Edwards (eds.), *SEER Cancer Statistics Review, 1973-1995* (Bethesda, Maryland: National Cancer Institute, 1998), Table XXVII-1; L.A.G. Ries, C.L. Kosary, B.F. Hankey, B.A. Miller, and B.K. Edwards (eds.), *SEER Cancer Statistics Review, 1973-1994* (Bethesda, Maryland: National Cancer Institute, 1997), Table XXVII-1.
21. L.A.G. Ries, et al. (eds.), *SEER Cancer Statistics Review, 1973-1995*, Table II-15.
22. *Ibid.*, Table I-3.
23. Tom Reynolds, "Researchers Hunt for Elusive Environmental Causes of Leukemia," *Journal of the National Cancer Institute* 90, no.

2 (21 January 1998), p. 90.

24. L.A.G. Ries, et al. (eds.), *SEER Cancer Statistics Review, 1973-1995*, Table II-16
25. Philip Landrigan, "The Special Vulnerability of Children to Environmental Toxins," (U.S. EPA Conference on Preventable Causes of Cancer in Children, 15-16 September 1997), available on the world wide web at <<http://www.epa.gov/children/document/minutes.htm>>.
26. L.J. Paulozzi, J.D. Erickson, and R.J. Jackson, "Hypospadias Trends in Two US Surveillance Systems," *Pediatrics* 100, no. 5 (November 1997), pp. 831-834.
27. Centers For Disease Control and Prevention, National Center for Environmental Health, "CDC's Asthma Prevention Program," April 1997, available on the world wide web at <<http://www.cdc.gov/nceh/pubcatns/97fsheet/asthma/asthma.htm>>.
28. Landrigan, "The Special Vulnerability of Children to Environmental Toxins."
29. U.S. Environmental Protection Agency, Office of Air & Radiation, Office of Air Quality Planning & Standards, *Fact Sheet: Health and Environmental Effects of Ground-Level Ozone*, 17 July 1997, available on the world wide web at: <<http://ttnwww.rtpnc.epa.gov/naaqsfm/o3health.htm>>.
30. U.S. Environmental Protection Agency, *Environmental Health Threats to Children*.
31. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *National Air Quality and Emissions Trends Report, 1996* (Research Triangle Park, North Carolina, January 1998), Table 1-1.
32. D.L. Rosenstreich, P. Eggleston, M. Kattan, D. Baker, R. G. Slavin, P. Gergen, H. Mitchell, K. McNiff-Mortimer, H. Lynn, D. Ownby, F. Malveaux, "The Role of Cockroach Allergy and Exposure to Cockroach Allergen in Causing Morbidity Among Inner-City Children With Asthma," *New England Journal of Medicine* 336, no. 19, 8 May 1997.
33. Ben Lieberman, "Federal Regulators Worsen Problems for Asthma Victims," *Detroit News*, 18 July 1997, p. A10.
34. William O.C.M. Cookson and Miriam F. Moffatt, "Asthma: An Epidemic in the Absence of Infection?" *Science*, Vol. 275 (3 January 1997), pp. 41-42.
35. Bruce N. Ames, Lois Swirsky Gold, and Walter C. Willett, "The Causes and Prevention of Cancer," *Proc. Natl. Acad. Sci. USA* 92 (June 1995), pp. 5258-5265.
36. John C. Shanahan and Adam D. Thierer, *How To Talk About Risk: How Well-Intentioned Regulations Can Kill* (Washington: Heritage Foundation, Talking Points no. 13, 23 April 1996).
37. Bruce Ames and Lois Swirsky Gold, *Misconceptions About Environ-*

- mental Pollution, Pesticides and the Causes of Cancer* (Dallas, Texas: National Center for Policy Analysis, Policy Report no. 214, March 1998), pp. 3, 4.
38. Steve Hayward, Laura Jones, Boris DeWiel, Nicole Goranko, Rosemary Herbut-Fikus, Dana C. Joel, Erin Schiller, and M. Danielle Smith, *Index of Leading Environmental Indicators* (San Francisco: Pacific Research Institute for Public Policy, April 1998), p. 49.
 39. Ron Knutson, Charles Hall, Edward Smith, Samuel Cotner, and John Miller, *Economic Impacts of Reduced Pesticide Use on Fruits and Vegetables*, (Texas A&M University, September 1993).
 40. C. Robert Taylor, *Economic Impacts and Environmental Safety Tradeoffs of Pesticide Use Reduction on Fruit and Vegetables*, (Auburn University, June 1995).
 41. Tom Kenworthy, and John Schwartz, "3 U.S. Agencies Announce Joint Commitment to Cut Pesticide Use," *Washington Post*, 26 June 1993.
 42. National Safe Kids Campaign, "The National Safe Kids Campaign Injury Fact Sheet," September 1997, available at <<http://www.safekids.org/fact97/ci97.html>>.
 43. Senate Labor and Human Resources Committee, *Hearing on unintentional childhood injuries and death*, 105th Cong. 2nd Sess., 5 May 1998.
 44. National Safe Kids Campaign, *The National Safe Kids Campaign Trends in Unintentional Childhood Injury Prevention Since the Launch of the National Safe Kids Campaign*, fact sheet, September 1997, available on the world wide web at <<http://www.safekids.org/fact97/trends97.html>>.
 45. Seymour Grufferman, "Methodologic Approaches to Studying Environmental Factors in Childhood Cancer," *Environmental Health Perspectives* 106, supp. 3 (June 1998), pp. 881-886.
 46. Sheila Hoar Zahm and Susan S. Devesa, "Childhood Cancer: Overview of Incidence Trends and Environmental Carcinogens," *Environmental Health Perspectives* 103, supp. 6 (September 1995), pp. 177-184.
 47. Tom Reynolds, "Researchers Hunt for Elusive Environmental Causes of Leukemia," *Journal of the National Cancer Institute* 90, no. 2 (21 January 1998), p. 90; Tom Reynolds, "Causes of Childhood Leukemia Beginning to Emerge," *Journal of the National Cancer Institute*, Vol. 90, No. 1 (7 January 1998), p. 2.
 48. Bu-Tian Ji, Xiao-ou Shu, Martha S. Linet, Wei Zheng, Sholom Wacholder, Ying Gao Yu-Tang, Da-Ming Ying, and Fan Jin, "Paternal Cigarette Smoking and the Risk of Childhood Cancer Among Offspring of Nonsmoking Mothers," *Journal of the National Cancer Institute* 89, no. 3 (5 February 1997), pp. 238-244.
 49. Bruce Ames, Lois Swirsky Gold, and Walter C. Willett, "The Causes and Prevention of Cancer."

50. Richard Doll and Richard Peto, "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today," *Journal of the National Cancer Institute* 66, no. 6 (June 1981), pp. 1191-1308.
51. Richard Doll, "Nature and Nurture: Possibilities for Cancer Control," *Carcinogenesis* 17, no. 2 (1996), pp. 177-184.
52. Bruce Ames, Lois Swirsky Gold, and Walter C. Willett, "The Causes and Prevention of Cancer."
53. Walter C. Willett, "Diet, Nutrition, and Avoidable Cancer," *Environmental Health Perspectives* 103, supp. 8 (November 1995), pp. 165-170.
54. Bruce Ames and Lois Swirsky Gold, *Misconceptions About Environmental Pollution, Pesticides and the Causes of Cancer*, p. 3.
55. Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Birth Defects and Developmental Disabilities, *Frequently Asked Questions About Spina and Bifida and Anencephaly (Neural Tube Birth Defects)*, (20 December 1996), available on the world wide web at <http://www.cdc.gov/hceh/programs/infants/brthdfct/prevent/ntd_faq.htm>; and Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Birth Defects and Developmental Disabilities, *Birth Defects Prevention: An Urgent Need for Folic Acid to Prevent Birth Defects!* (5 January 1998), available on the world wide web at <http://www.cdc.gov/nceh/programs/infants/brthdfct/prevent/bd_prev.htm>.
56. U.S. Food and Drug Administration, press release, "Folic Acid to Fortify U.S. Food Products to Prevent Birth Defects," 29 February 1996.
57. Centers for Disease Control and Prevention, National Center for Environmental Health, *Prevention of Fetal Alcohol Syndrome*, (September 1997), available on the world wide web at <<http://www.cdc.gov/nceh/pubcatns/97fsheet/fas/fas.htm>> and Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Birth Defects and Developmental Disabilities, *What CDC is Doing to Prevent Fetal Alcohol Syndrome and Other Alcohol-Related Developmental Disabilities*, (20 December 1996), available on the world wide web at <http://www.cdc.gov/nceh/programs/infants/brthdfct/prevent/fas_prev.htm>.



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