Maryland Children's Environmental Health Report Card

MaryPIRG Foundation

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December 2005

Acknowledgments

MaryPIRG Foundation thanks the Abell Foundation, the Zanvyl & Isabelle Krieger Fund, the Aaron & Lillie Straus Foundation and the Jacob & Hilda Blaustein Foundation for their generous support of this report.

The authors gratefully acknowledge Ruth Berlin of the Maryland Pesticides Network and Terry Harris of the Cleanup Coalition for peer review of this project. Thanks also to Tony Dutzik and Brad Heavner for editorial support.

The authors alone bear responsibility for any factual errors. The recommendations are those of the MaryPIRG Foundation. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

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Design: Kathleen Krushas, To the Point Publications

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Executive Summary

Air pollution, mercury-tainted fish, peeling lead paint, pesticides and other commonly used toxic chemicals threaten the health of Maryland's children. Though there are many powerful policies available for the state to use in reducing pollution, Maryland has adopted only a few of them. In this report, we examine the most common environmental threats to children's health and evaluate and grade the state's response to these problems.

Environmental pollution causes health problems for all Maryland residents, but children are especially hard hit. Children's smaller bodies make them vulnerable to lower amounts of pollution. In addition, they breathe more air per pound of body weight than do adults, magnifying the impacts of air pollution. Injuries—received in utero or in childhood—to their developing bodies may cause permanent damage by interfering with normal development.

Children across Maryland are exposed to serious pollution on a daily basis. As a result, thousands of children have developed chronic, pollution-related illnesses.

- **Mercury:** Mercury is a neurotoxin that can delay a child's ability to walk and talk, impair motor function and decrease attention spans. Though fish are a good protein source and regular fish consumption has heart benefits for adults, children in Maryland can safely consume only limited amounts of bass, bluegill and yellow perch from streams and lakes across the state because the fish contain mercury.
- **Lead:** Children who live in older homes with deteriorating paint may be exposed to lead, which can cause learning disorders, behavior problems, hearing problems and delayed growth. More than 200,000 Maryland children under age 6 are at risk of lead poisoning. Of the fraction of these at-risk children who were tested in 2002, 3% had elevated blood lead levels.
- **Pesticides:** Children are exposed to pesticides in food, water, and air. Pesticides are used in homes, schools, playgrounds and antimicro-

bial and disinfectant products and are found everywhere children go. Studies have linked cancer, birth and neurological defects, sterility and asthma to pesticides.

- **Air pollution:** Concentrations of ground-level ozone, also known as smog, exceed federal health-protective standards in the summer in fourteen Maryland counties and Baltimore City. Smog causes asthma, triggers asthma attacks, increases emergency room visits, hospitalizations and missed school days, impairs lung growth and increases infant deaths. More than 150,000 children in Maryland have a history of asthma and one-third of them have missed school because of it.

Exposure to other pollutants such as flame retardants and phthalates is equally common and children in Maryland are put at risk as a result.

Maryland must do a more effective job of protecting children's health. The state's efforts to date to reduce pollution have been inconsistent. For example, the state has established relatively strong policies to cut air pollution from school buses but

Table 1. Maryland's Grades on Protecting Children from Environmental Pollution

	Grade
Reduce Mercury Exposure:	**C-**
Cut emissions from power plants	F
Advocate for strong federal standards on power plants	D-
Reduce mercury from other sources	C
Issue adequate fish consumption advisories	B
Reduce Lead Poisoning:	**D+**
Register all rental properties that might contain lead	C
Regularly inspect registered homes to ensure landlords perform maintenance	D
Test all at-risk children	D
Reduce Pesticide Exposure:	**C**
Completely implement IPM in schools	C
Reduce Air Pollution:	**D+**
Tighten emission standards for cars and trucks	F
Cut emissions from power plants	F
Reduce emissions from diesel school buses	B
Reduce emissions from other diesel vehicles	F
Seek strong federal standards	C+
Reduce Exposure to Other Chemicals:	**D-**
Ban phthalates, bisphenol-A and toxic flame retardants	D-
Establish a 1 ppb drinking water standard for rocket fuel	F
Overall:	**C-**

has not adopted some of the most effective policy options available to reduce emissions from more significant sources of air pollution.

- Maryland's current lead abatement programs are inadequate to the size of the problem. For example, Baltimore City joined with the state to provide $3 million to remediate lead paint problems in older homes, but in two years the program treated only 1.2% of the city's most dangerous homes. Statewide, too few vulnerable children are tested for lead poisoning and therefore do not receive treatment.
- Maryland has made limited progress on reducing children's exposure to pesticides. In 1998, the state adopted an integrated pest control program to reduce pesticide use in schools. But a recent survey found that though some schools have reduced their pesticide use dramatically and a few schools have ceased using pesticides altogether, at least 10% of schools continue to use pesticides freely. One source of the problem is that the program implementation manuals published by the state are not in compliance with the law.
- The state has not yet established lower emission standards for cars and light trucks and for power plants—steps that would reduce ozone levels, particulate matter pollution and mercury contamination.

Overall, the state and local governments receive a barely passing grade for their efforts to protect children from environmental health threats. (See Table 1.)

To protect the health of the state's children, Maryland should do more to reduce pollution. Among other recommendations in this report, the state should:

- Increase funding for lead abatement programs, ensure all children who are at risk for lead poisoning are tested and provide assistance to children who have elevated blood lead levels.
- Implement required integrated pest control methods in schools so that pesticides are used as a last resort and only when the problem poses a serious health hazard and reduce unnecessary exposure to pesticides used for mosquito control.
- Ban a set of chemicals that mimic sex hormones and that interfere with brain development and, at minimum, establish drinking water standards that will protect the health of infants, the most vulnerable members of the population.
- Adopt more protective emission standards for cars and light trucks.
- Enact limits on smog-forming emissions, particulate matter, mercury and other pollutants from power plants and seek strong federal limits on emissions in other states.

Introduction

Environmental health threats are all too prevalent in Maryland. High concentrations of ground-level ozone and particulate matter cause asthma, trigger asthma attacks and impair lung development. Mercury-tainted fish caught in lakes and streams across the state can cause neurological damage. Lead paint in deteriorating homes may impair children's learning abilities. Widespread use of pesticides in homes, schools, parks, atheletic fields, agricultural products and household products such as cleansers and antimicrobials exposes children to toxic chemicals. Other common chemicals found in food containers and household items may interfere with brain development or trigger birth defects.

This pollution is not inevitable. As action in other states shows, there are effective policy options available to reduce the pollution that threatens children's well-being.

- States such as Massachusetts and New York have enacted emission standards for power plants that will reduce air pollution. Massachusetts adopted rules that will reduce emissions of mercury by 85% from the state's six dirtiest power plants.[1]
- Emission standards for cars and light trucks in New Jersey and seven other states replace more lenient federal standards and will reduce emissions of hydrocarbons (which lead to the formation of ground-level ozone) by 15%.[2]
- Thanks to focused state effort, the majority of children in New York are tested for elevated levels of lead in their blood. Identifying lead poisoning problems at an early age allows the child to receive treatment and allows repairing the source of the problem.[3]
- Connecticut has banned lawn-care pesticides on the grounds of children's day-care centers and grammar schools.[4]

Local governments also can take steps to protect children's health.

- Montgomery and Prince George's counties purchase five percent of their electricity from renewable sources, a move that reduces smog, particulate matter and mercury pollution.[5]
- Anne Arundel County opens household hazardous waste collection sites several times per year. Residents can drop off mercury-containing items and pesticides for recycling or proper disposal.[6]
- The Integrated Pest Management (IPM) Institute of North America awarded the Anne Arundel County Public School District its IPM STAR certificate in recognition of its comprehensive pest management system. The school district also launched a pilot program that reduced pest control costs by 70% in one year.

As these examples show, states and local governments have taken strong action to protect children from environmental pollution. Maryland, too, should strive to protect children from environmental harm to the greatest extent that it can. This does not require extraordinary action but rather a consistent effort to reduce pollution from obvious sources. As other states have demonstrated, effective policies are available today to address the biggest threats to children's health. Maryland should adopt these effective policies and reduce the environmental pollution that impacts children's health.

Children's Environmental Health Threats in Maryland

Mercury

Mercury is a highly toxic, bioaccumulative metal. Children may be exposed to mercury by eating contaminated fish or by handling liquid mercury exposed when a mercury thermometer breaks.

Health Impacts

Mercury can have a variety of health effects, but its most potent effect—and the effect most likely to occur at the lowest doses—is neurotoxicity. Children born to mothers exposed to mercury during pregnancy can exhibit a wide array of neurological problems, including a delayed ability to walk and talk, impaired motor function, decreased attention span and reduced neurological test scores.[7] Other health effects of mercury exposure may include damage to the immune, cardiovascular and reproductive systems. Developing fetuses are the most vulnerable to mercury's effects, but all children are at risk.

Children can be exposed to mercury at every stage of development. Methylmercury, an organic form of mercury that is easily absorbed by animals, is readily transported across the placental barrier, meaning that a pregnant woman's lifetime exposure to mercury exposes her fetus as well. Mercury has been found in breast milk, presenting a route of exposure for nursing infants. Small children may be exposed by eating fish.

Fish consumption is the most important route of mercury exposure for children and women of childbearing age. A liquid at room temperature, mercury released from coal-fired power plants and other sources can become airborne, where it is dispersed by the wind before being deposited onto soil or water hours or months later. In waterways, aquatic organisms convert mercury to its organic form, methylmercury. At each step of the aquatic food chain—from tiny plankton through small fish up to larger fish—methylmercury becomes increasingly concentrated in fish tissue, such that large

Table 2: Mercury Sources in Maryland[12]

Rank	Facility	2002 Total Air Emissions (lbs.)	Source Sector	County
1	Morgantown	794	Power Plant	Charles
2	Brandon Shores & Wagner Complex	709	Power Plant	Anne Arundel
3	Chalk Point	354	Power Plant	Prince George's
4	Mead Westvaco Corp.	277	Pulp and Paper Production	Allegany
5	Dickerson Generation Station	224	Power Plant	Montgomery
6	Curtis Bay Energy (formerly Phoenix Services)	198	Medical Waste Incinerator	Baltimore City
7	Waste Energy Partners	162	Municipal Waste Incinerator	Harford
8	Montgomery County RRF	154	Municipal Waste Incinerator	Montgomery
9	St. Lawrence Cement	102	Cement Manufacturing	Washington
10	C.P. Crane Generation Station	91	Power Plant	Baltimore
Total mercury air emissions:		**3,295 lbs/year**		

fish can accumulate significant amounts within their bodies. This mercury can cause health problems in people who eat fish.

Health Impacts in Maryland

Maryland's waterways are polluted with mercury from power plants, incinerators, industrial facilities and other sources. As a result, fish from the state's lakes, rivers, and streams are contaminated. Certain species of fish accumulate more mercury than others, and the state warns residents to limit their consumption of those fish. Children and women of childbearing age must limit their intake more than the rest of the population. Small and largemouth bass, bluegill and yellow perch are on the state's list of fish that sensitive people should eat in only limited quantities.[8]

No data is available on the number of Maryland children affected by mercury exposure, but national data suggests that it afflicts hundreds of thousands of children in Maryland. A 2004 study by U.S. Environmental Protection Agency scientists found that one in six American women of reproductive age has levels of mercury that exceed levels that could damage a developing fetus.[9] That means that each year between 317,000 and 637,000 children are exposed in utero to mercury that exceeds federal safety levels.[10]

This mercury exposure has significant national consequences. Exposed children have lower IQs, with those whose exposure was greatest suffering the largest losses. The productivity loss that results over a lifetime from this widespread exposure is estimated at $8.7 billion.[11]

Lead

Lead affects the central nervous system, kidneys and the reproductive system. Children's main source of exposure is through deteriorating lead paint in older housing. Unsafe renovations in older homes are also a problem. Children with high levels of lead in their blood are at increased risk for learning disorders, behavior problems, hearing problems and delayed growth.[13] Later in life, they may suffer from hypertension and kidney disease.[14] Lead poisoning has been consid-

ered the most significant environmental health threat to children in the U.S. and it is entirely preventable.

Children are more vulnerable to lead in the environment than are adults. Children play on floors where lead dust accumulates and more often put their hands in their mouths. Furthermore, children's small bodies are more sensitive to the effects of lead.

Health Impacts in Maryland

The risk of elevated blood levels of lead is greater for children who live in older housing, which is more likely to be painted with lead-based paint, banned in 1978. As it deteriorates, it presents a risk to children. In poorly maintained homes where paint is peeling or damaged surfaces are difficult to keep free of dust, parents may be unable to protect children from exposure to lead. This problem is more prevalent in low-income areas where homes may be in disrepair and owned by a landlord who has less stake in maintaining the home, but the problem exists in all areas. Any house built before 1978 may have lead paint and simply opening a door or window can release lead into the air. Based on these criteria of older, low-value homes in areas with higher poverty rates, all children living in Allegany, Caroline, Dorchester, Garrett, Somerset, Washington, Wicomico, and Worcester counties and Baltimore City are at risk, as are children in portions of other counties.[15]

More than 200,000 Maryland children under age 6 are at risk of lead poisoning.[16] Because so few children at risk are tested, it is unclear how many Maryland children actually suffer from lead poisoning. We do know that of the nearly 80,000 children tested in 2002, approximately 2,300, or 3%, had elevated blood lead levels.[17] The problem is more severe in Baltimore City, where 12% of tested children had elevated blood lead levels in 2002. The state is making some progress, as evidenced by a 53% decrease in the number of Baltimore City children with lead poisoning from 1994 to 2002.[18]

Pesticides

Pesticides are as abundant as the insects, weeds, rodents and fungi they kill. Pesticides include herbicides, insecticides,

Table 3: Lead Testing and Lead Poisoning Rates by County[19]

County	% of Children 0-72 Months Tested for Lead	% of Children 0-72 Months with Lead Level Greater than 10 micrograms/dL
Allegany	20% or more	2-4%
Anne Arundel	10-14%	1% or less
Baltimore County	10-14%	1% or less
Baltimore City	20% or more	10% or more
Calvert	10-14%	1% or less
Caroline	15-19%	5-9%
Carroll	less than 10%	1% or less
Cecil	15-19%	1% or less
Charles	less than 10%	1% or less
Dorchester	15-19%	10% or more
Frederick	less than 10%	1% or less
Garrett	10-14%	2-4%
Harford	less than 10%	1% or less
Howard	less than 10%	1% or less
Kent	20% or more	2-4%
Montgomery	10-14%	1% or less
Prince George's	15-19%	1% or less
Queen Anne's	10-14%	2-4%
Saint Mary's	10-14%	1% or less
Somerset	20% or more	5-9%
Talbot	10-14%	5-9%
Washington	15-19%	1% or less
Wicomico	15-19%	5-9%
Worcester	15-19%	2-4%

fungicides, rodenticides, disinfectants and wood-preservative chemicals. In addition to killing their intended target, pesticides can cause a wide range of health problems in humans. Children are especially vulnerable to these effects.

In the short term, pesticides can exacerbate asthma, cause nausea, vomiting, diarrhea, headache, dizziness, eye, nose and throat irritation, change in vision, fatigue, muscle and joint pain, numbness, mental confusion, contact dermatitis, blisters and skin burns. Other typical long-term effects of pesticides include damage to children's respiratory, immune and endocrine systems.

Respiratory damage includes the onset of asthma. A study published in the peer-reviewed journal Environmental Health Perspectives found that children exposed to herbicides in their first 12 months were more than four and a half times as likely to develop asthma. Children who were exposed to pesticides in general were nearly two and a half times as likely to develop asthma.[20]

Studies have also linked pesticide exposure to cancer, including leukemia, brain tumors, Wilm's tumors, sarcomas and lymphomas. One study of home and garden pesticide use found that it raised the chance of childhood leukemia by 6.5 times.[21] Children are vulnerable whether they are exposed directly or in utero through their mother's exposure.

One study, conducted by the Environmental Working Group, examined the umbilical cord blood of 10 newborn children born between August and September 2004. Researchers tested the blood for 28 organochlorine pesticides, which are largely banned in the U.S. today, and found 21 detectable amounts of the pesticides, known to cause cancer and reproductive disorders.[22]

Nervous system damage is another effect of pesticide exposure because many pesticides are designed as neurotoxins. Animal studies of common pesticides have demonstrated a link to hyperactvity, slower reflexes, impaired brain growth and motor dysfunction.[23] In some cases, impacts were observed only when exposure occurred at key points during development but in others exposure at any time caused damage. The youngest children are the most vulnerable, but exposure through the teen years as the brain is nearing maturity is also a problem.

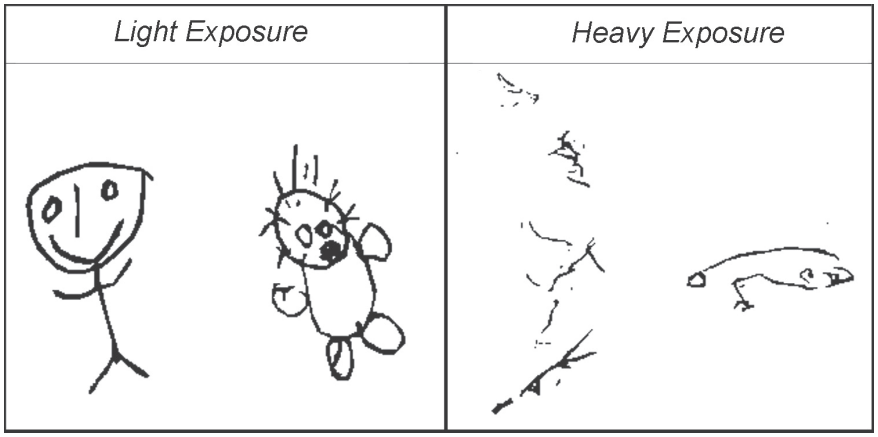
A study of children in two farming areas in Mexico provides evidence that chemical mixtures in use today affect cognitive development. Dr. Elizabeth Guillette at the University of Arizona and her colleagues in Sonora, Mexico looked at the effects of pesticides on preschool-age children in the Yaqui Valley, Mexico. Farmers in the valley have used pesticides since the 1940s, while farmers in the foothills avoided pesticide use. Dr. Guillette compared children from both areas, and discovered dramatic functional differences.

While the children did not differ in physical growth patterns, children exposed to high levels of pesticides were less able to perform basic tasks and showed behavioral problems. For example, Dr. Guillette asked 4-year olds to draw a picture of a person. Less-exposed children were able to produce recognizable drawings, while children with high levels of pesticides were not. Heavily exposed children were also deficient in stamina, balance, hand-eye coordination and in short-term memory compared to their less-exposed counterparts.[24]

Unfortunately, children are exposed to pesticides in day-care centers, schools and homes, and on lawns, athletic fields and parks. Eating tainted food, drinking polluted water, inhaling sprayed poison and touching treated areas are common routes of exposure for everyone, but children's habits make them especially likely to take in pesticides.[25]

Children are more likely to play on the floor or ground, places with higher concentrations of pesticides. Pesticides applied outdoors may be tracked into the house. For example, 2,4-D applied to a lawn has been found in carpet dust inside and possibly may remain there at detectable levels for a year.[26] Children playing on a treated lawn or playing field will get insecticides and herbicides on their skin. In addition to exposure that occurs as pesticides are absorbed into the skin, young children who frequently put their hands in their mouth may ingest pesticides. Children also eat, drink and breathe more per pound of body weight than do adults.

Figure 1: Drawings of People by 4-Year-Old Children Exposed to Pesticides in Mexico's Yaqui Valley



Pesticides may also become airborne. In the home, items such as flea collars and mothballs may release contaminants into the air where children inhale them.[27] Outdoors, pesticides sprayed on crops or for mosquito control purposes, such as the possible carcinogen permethrin, may be picked up by the wind.[28]

To combat West Nile Virus, mosquito spraying in urban areas has become more prevalent. There are two types of pesticides used in such spraying, pyrethroids and organophosphates. Exposure to pyrethroids can cause headaches, facial swelling, tremors, asthma-like reactions and burning and itching sensations. Organophosphates, a highly toxic class of pesticides, affect the central nervous, respiratory and cardiovascular systems. In 2000, the New York State Department of Health found that more people reported getting sick due to the pesticide spraying than from exposure to West Nile Virus.[29]

In addition to potentially greater pesticide exposure than adults, children are more susceptible to the toxic effects of pesticides. Their lower body weight means a smaller dose of pesticide can easily produce a high concentration. Furthermore, children are extremely vulnerable to synthetic pesticides that mimic naturally occurring hormones and enzymes.[30]

Unfortunately, commercial pesticides may permit a false sense of security about toxic exposure because there are often no immediately observable symptoms and because of a perception that they have been tested and approved. Whether applied by a professional pesticide applicator or a homeowner, pesticides create a health risk for children. Though a pesticide is permitted for use, approved exposure levels may be based on what adults can tolerate rather than children's developing bodies. Further, the cumulative effects of pesticides and other toxins have not been fully factored in.

The U.S. Centers for Disease Control and Prevention (CDC) tested people for the presence of 23 pesticides in their bodies and found that the average person had detectable amounts of 13 different pesticides.[31] A study led by Mt. Sinai School of Medicine in New York tested 9 adults and found an average of 91 detectable amounts of industrial compounds, pollutants and other chemicals in their blood and urine. Researchers tested the 9 adults

for 32 pesticides, finding 17 different pesticides with the average person having 7 different pesticides in their blood or urine.[32]

Maryland Health Impacts

Children in Maryland are exposed to pesticides in day care centers, at school, on treated athletic fields and lawns, from agricultural drift and from other sources, such as the state's mosquito control programs and rights of way applications. Accurately gauging children's exposure to pesticides in Maryland is difficult, but based on the Maryland Department of Agriculture's most recent use data 17 million pounds of pesticides were used by farm operators, certified private applicators, commercial applicators and public agencies in the state in one year. The data was collected through a voluntary survey that achieved a 60 to 77% response rate from the various groups, and thus underrepresents total annual pesticide use.[33] Maryland children likely have significant exposure.

A 1999 survey by the Maryland Pesticide Network of outdoor pesticide use in 15 public school districts found that 67% of districts used Round-Up, which can cause respiratory problems and eye and skin irritation, among other problems.[34] Over half of districts applied Turflon or Garlon, which can harm eyesight, and Surflan, a potential carcinogen. Forty percent applied the endocrine disruptor 2,4-D, which may cause infertility and birth defects.

Air Pollution

Air pollution in Maryland—including smog-forming volatile organic compounds and nitrogen oxides, air toxics and particulate matter—is a threat to the health of every Maryland resident. Children, because of their growing bodies and greater air intake relative to the size of their bodies, are at greater risk. Injuries sustained during this time can cause permanent damage that will have life-long effects.

Health Impacts

Children in Maryland are constantly exposed to air pollution, breathing it day in and day out. Recent science has shown that this exposure causes a range of lung injuries, even among otherwise healthy infants and children. Children exposed to air pollution cannot breathe as well as children growing up in cleaner areas. Their lungs are scarred and less flexible than they should be, their lungs hold less air and they are not as able to breathe normally. These injuries manifest themselves in respiratory illness, missed school days, increased doctor visits, hospitalizations and for a small number, death.

New Asthma Cases

Asthma, which can be caused by air pollution, is the leading chronic illness in children and is becoming increasingly common.[35] The Centers for Disease Control estimates that asthma prevalence among persons up to 17 years old increased about 5% per year from 1980 to 1995.[36]

- Striking new results from the ambitious Southern California Children's Study indicate that exposure to ozone can cause asthma in children.[37] Children who exercise frequently in smoggy areas are more than three times as likely to develop asthma as those in cleaner parts of the country.

- In Taiwan, researchers linked development of asthma with several individual air pollutants: fine soot, sulfur dioxide, nitrogen dioxide and carbon monoxide. The scientists surveyed more than 160,000 schoolchildren and looked at levels of air pollutants, finding that air pollution increased asthma prevalence by as much as 29%, independent of exposure to second-hand tobacco smoke.[38]

Asthma Attacks, Acute Bronchitis, and Missed School Days

Air pollution triggers asthma attacks and increases cases of acute bronchitis in children. Asthma is the number one cause of missed school days in the United States.[39] Air pollution worsens the impact of this disease, causes other acute respiratory illnesses, and increases school absence rates.

- Dr. Janneane Gent at the Yale University School of Medicine and her colleagues recently published a study showing that children with asthma are vulnerable to air pollution well below federal health standards.[40] According to the study, every increase of 50 parts per billion (ppb) in ozone concentrations yields a 35% increased likelihood of wheezing and a 47% increased likelihood of chest tightness.
- Dr. Douglas Dockery at Harvard University and his colleagues showed that children living in areas with high levels of acidic particle pollution were 66% more likely to have had an episode of bronchitis in the last year than children in low pollution areas.[41]
- Researchers participating in the Southern California Children's Health Study found that increased smog pollution causes more children to stay home from school.[42] When ozone levels rose by 20 ppb, illness-related absence rates went up by 63%, and by 174% for lower respiratory illnesses with wet cough.
- Researchers in Korea found the same relationship between air pollution and school absences.[43] When air pollution levels rose, so did illness-related absences. When pollution levels fell, more children came in to school.

Increased Hospitalizations and Doctor Visits

Children who suffer from asthma are more likely to go to the doctor for respiratory problems or need to be hospitalized for asthma when air pollution is worse.

- Children in inner-city Seattle and its suburbs were found to go to the emergency room for asthma treatment more frequently when particulate matter pollution was high.[44]
- A study of emergency room visits and hospitalizations during the 1996 Olympic Games in Atlanta showed that cleaner air—the result of better public transportation and reduced driving—led to fewer visits to the emergency room and hospitalizations for asthma.[45]

Impaired Lung Function Growth

Air pollution can stunt the growth of children's lungs.

- A study of children in Southern California found that children who spent more time breathing air polluted with particulate matter,

nitrogen dioxide and inorganic acid vapor had measurably reduced lung capacity compared to their peers who did not have such exposure.[46]

- College freshmen who were raised in less polluted areas have lungs that work better than their schoolmates who grew up in polluted cities. For example, University of California at Berkeley freshmen from the relatively clean San Francisco Bay area can exhale more forcefully than students from the polluted Los Angeles area.[47] Yale freshmen who had lived for four or more years in a county with high ozone levels can't breathe as well as freshmen from cleaner areas.[48]

Increased Cancer Risk

The federal Environmental Protection Agency lists 188 chemicals as hazardous air pollutants (HAPs). Many of them have the potential to cause cancer.

- Benzene can cause leukemia and a variety of other cancers, as well as central nervous system depression at high levels of exposure. Styrene is also a central nervous system depressant that is a possible human carcinogen.
- 1,3-Butadiene and formaldehyde are probable human carcinogens and are suspected of causing respiratory problems.
- Acetaldehyde is a probable human carcinogen that also has caused reproductive health effects in animal studies.
- Acrolein is a possible human carcinogen that can cause eye, nose and throat irritation.[49]

Infant Death

Air pollution can cause premature death in infants and young children. Experiments have tied particulate levels to deaths both from respiratory disease and from sudden infant death syndrome.

- Dr. Tracey Woodruff at the U.S. EPA and her colleagues linked fine soot pollution levels and neonatal deaths in 86 U.S. metropolitan areas.[50] Normal-weight infants less than one year old born in high soot areas were 40% more likely to die of respiratory disease and 26% more likely to die from sudden infant death syndrome than infants born in low soot areas.
- Researchers in the Czech Republic found that newborn deaths due to respiratory causes were linked to increased levels of fine soot, sulfur dioxide and oxides of nitrogen.[51] The study concluded, "the effects of air pollution on infant mortality are specific for respiratory causes in [the period between one month and one year of age], are independent of socioeconomic factors, and are not mediated by birth weight or gestational age."
- The National Bureau of Economic Research found that as levels of particulate pollution fell during the recession in the early 1980s, so did rates of death in newborn children younger than 28 days old. Specifically in Pennsylvania, researchers found that when total fine particulate levels dropped 25%, newborn death rates from cardiopulmonary and respiratory causes fell 14%.[52]

Air Pollution in Maryland

Air pollution in Maryland is severe enough to inflict the problems reviewed above on many of the state's children. The state frequently is ranked as one of the worst in the nation for ozone and particulate matter pollution, and the state's children pay the price.

Smog

Smog forms when a mixture of nitrogen oxides and volatile organic compounds, released primarily from the burning of fossil fuels, react in the presence of sunlight and form ground-level ozone.

The U.S. Environmental Protection Agency has established standards for the highest allowable level of ozone in a 1-hour period and an 8-hour period. For any 8-hour period, average ozone concentration should not exceed 0.08 parts per million (ppm). Concentrations slightly above that level present a risk for active children and they should limit their activity. At very high concentrations, active children should avoid playing outdoors.

In Maryland, however, levels routinely exceed the federal standard in Anne Arundel, Baltimore, Carroll, Calvert, Cecil, Charles, Frederick, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's and Washington counties and Baltimore City.[53] During 2003, the eight-hour health standard for ground-level ozone was exceeded 78 times in Maryland.[54] In previous years, Maryland experienced 200 to 300 violations that threatened human health. (See Table 4.)

Though in 2003 Maryland had fewer days than normal in which ozone concentrations were unacceptably high, the Baltimore-Towson area had one day where the eight-hour average concentration spiked to double the federal health standard.[55] This ozone concentration of 0.153 ppm tied with a reading in Riverside, California, for the highest in the country for the summer.

Table 4: 2003 County Violations of 8-Hour Ozone Health Standards

County	Number of Violations	Highest Reading	% Above Standard
Harford	9	0.101	26.25%
Anne Arundel	9	0.107	33.75%
Prince Georges	5	0.1	25%
Cecil	3	0.098	22.50%
Baltimore City	2	0.103	28.75%
Kent	2	0.094	17.50%
Montgomery	2	0.094	17.50%
Carroll	1	0.097	21.25%
Charles	1	0.097	21.25%
Frederick	1	0.095	18.75%
Baltimore Co.	1	0.085	6.25%
Washington	1	0.085	6.25%

Acceptable levels for any 1-hour period are higher, yet air quality in 11 counties and Baltimore City still fails to meet the standards.[56]

Particulate Matter

The dark plume of smoke from a power plant, the black exhaust from the tailpipe of a diesel-powered vehicle, and invisible emissions from industrial facilities are among the sources of particulate matter (PM).

Particulate matter can be released directly or can form from existing pollution, including chemicals and liquid droplets. Some particles, such as those in diesel exhaust or produced by construction, mining operations or coal combustion, are released as relatively large particles that are readily visible. Others are tiny, only 2.5 microns in diameter (for comparison, a single strand of human hair

Table 5: Maryland Smog Levels Regularly Exceed Federal Health Standards[57]

Year	Number of Smog Days	Number of Measured Violations	Maryland's Rank for Smog Days	Maryland's Rank for Smog Violations
1998	40	194	6	8
1999	44	319	9	9
2000	19	100	16	9
2001	30	214	8	3
2002	40	275	12	10
2003	9	57	25	16
2004	10	34	-	-
2005	28	78	-	-

Table 6: Potential Added Cancer Risk from Diesel Soot by Maryland County[64]

Rank	County	Factor by which Estimated Exposure Exceeds Health-Protective Threshold for Cancer	*Contribution to Added Cancer Risk*	
			On-Road Mobile Sources	Non-Road Mobile Sources
1	Baltimore City	792	42%	58%
2	Baltimore	652	36%	64%
3	Anne Arundel	571	33%	67%
4	Howard	567	33%	67%
5	Montgomery	535	34%	66%
6	Harford	520	36%	64%
7	Cecil	490	39%	61%
8	Prince George's	489	35%	65%
9	Frederck	472	38%	62%
10	Carroll	464	39%	61%
11	Kent	423	33%	67%
12	Queen Anne's	404	33%	67%
13	Charles	391	34%	66%
14	Talbot	391	33%	67%
15	Washington	381	41%	59%
16	Calvert	378	34%	66%
17	Saint Mary's	333	37%	63%
18	Dorchester	326	31%	69%
19	Caroline	305	36%	64%
20	Wicomico	284	41%	59%
21	Allegany	253	42%	58%
22	Worcester	212	35%	65%
23	Somerset	193	38%	62%
24	Garrett	178	42%	58%

has a diameter of 70 microns).[58] This fine particle pollution, known as $PM_{2.5}$ can result from chemical reactions between sulfur dioxide, nitrogen oxides, volatile organic compounds and other compounds in the atmosphere.

Federal standards require that concentrations of $PM_{2.5}$ not exceed 15 micrograms per cubic meter ($\mu g/m^3$) on an annual basis or 65 $\mu g/m^3$ in a 24-hour period.[59] Concentrations in Maryland frequently exceed these limits and, unlike smog, particulate matter pollution occurs year-round. In Baltimore in 2003, for example, particulate matter pollution reached levels that are unhealthy for sensitive groups in every season.[60]

The U.S. Environmental Protection Agency has identified Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery and Prince George's counties and Baltimore City as regularly exceeding federal standards for $PM_{2.5}$ concentrations.[61] In Baltimore City in 2003 the average annual concentration of $PM_{2.5}$ was 16.8 $\mu g/m^3$ and in Hagerstown concentrations averaged 16.2 $\mu g/m^3$, higher than federally acceptable limits.[62] (Current federal limits, however, do not adequately protect public health.[63] Were standards for acceptable concentrations reduced, the full impact of $PM_{2.5}$ pollution in Maryland would be more apparent.)

Children who live in these counties are regularly exposed to unacceptably high levels of particulate matter. Masked in the county-wide figures are geographical hotspots of particulate matter pollution that may exist in neighborhoods near local sources, such as freeways, busy intersections and train yards. In addition, children across the state who are transported to school on diesel-powered school buses may be subjected to additional particulate matter every time they ride the bus (see text box).

Air Toxics

Mobile sources—which include cars, trucks and other highway and non-road motorized machinery—are major emitters of airborne toxic compounds. EPA estimates that mobile sources emit 41 percent of all air toxics by weight and that on-road vehicles are responsible for approximately half that amount.[68] Several air toxics—such as benzene and toluene—are also volatile organic compounds (VOCs), which play an important role in the chemical reaction that creates smog.

In 1990, the U.S. Congress mandated that the EPA take steps to address emissions of airborne toxic chemicals. In the Clean Air Act amendments of that year, Congress set a standard of reducing the cancer risk from airborne toxins to one case of cancer for every one million residents following a lifetime of exposure. But, years later, Maryland residents are still exposed to levels of air toxics that are many times higher than this standard.

In 1996, the most recent year for which complete data is available, human exposure levels of formaldehyde and benzene in all Maryland counties exceeded the national standard. Exposures of 1,3-butadiene exceeded the EPA's cancer benchmark in all but four Maryland counties, and acetaldehyde exposure exceeded the benchmark in all but seven counties.

Though updated information on human exposure to air toxics is not available, updated emissions data is. A comparison of emissions data from 1996 and 1999 shows little change in emissions of air toxics from on-road motor vehicles, suggesting that Maryland residents continue to be exposed to these substances in dangerous amounts. Emissions of acetaldehyde, benzene and formaldehyde have declined slightly, but not by enough to alter the magnitude of the cancer risk they present to Maryland's residents.

High levels of smog and particulate matter take their toll on Maryland's children. More than 150,000 children in the state have a history of asthma and one-third of them have missed school because of it.[70] On average, these children missed 7.4 days of school in 2002. Minorities and children from low-income families are more likely to have asthma and to miss school because of it. Children under age five are more likely to go to the emergency room for treatment of asthma than are older children or adults, and are more likely to be hospitalized. In the overall population, African-Americans are hospitalized for asthma three times as often as whites and are six times as likely to die from asthma.[71]

Table 7: Statewide Cancer Risk from Air Toxics[69]

Air Toxic	Estimated Average Human Exposure (micrograms per cubic meter)	Factor by which Estimated Exposure Exceeds Health-Protective Threshold for Cancer	Percent of Added Cancer Risk from On-Road Sources	Percentage Change in On-Road Emissions, 1996-1999
Acetaldehyde	0.82	2	58%	-2%
Benzene	1.77	14	62%	-8%
1,3-Butadiene	0.08	2	78%	11%
Formaldehyde	1.19	15	44%	-6%

Particulate Matter and Diesel School Buses

The air inside a diesel school bus often has high concentrations of diesel particulate matter as pollution from the bus's own tailpipe and from other cars on the road fills the bus. Tests of buses in different driving conditions revealed that particulate matter concentrations were 2.5 times higher when buses had their windows closed, such as in the winter, because exhaust from the tailpipe entered the cabin when the door opened but was not flushed out once the bus resumed its route. Buses operating in congested urban areas contained two to three times more diesel particulate matter than buses on suburban or rural routes.

A child riding to school on an older diesel bus every school day for 12 years has an estimated 4% increase in cancer risk compared to a child who makes the same trip in a car.[65] (By other markers, such as crash fatality rates, traveling by bus is safer.) The study authors predict that this level of $PM_{2.5}$ exposure likely results in increased hospitalizations for asthma.

More than 600,000 children in Maryland rode on school buses to public schools in 2004.[66] Compared to children in other states, students in Maryland are exposed to relatively little diesel exhaust, thanks to a state program that is one of the best in the nation for protecting children from diesel exhaust on school buses.

The state requires that buses be replaced when they are 12 years old, meaning that older vehicles that were built under looser emission standards are removed from the road. The state also provides funding to purchase new buses.[67] Maryland could further protect children's health by replacing diesel buses with natural gas-powered vehicles, which release 90% less soot and 30% less smog-forming pollution compared to a new diesel bus.

Chemicals that Mimic Sex Hormones

Some chemicals are able to mimic the effects of hormones—important signals that the body depends upon to direct growth and development, regulate mood and behavior, adjust the flow of energy and nutrients, time the menstrual cycle and guide many other important functions. These chemicals, called "endocrine disruptors," can interfere with the normal processes of the body and cause permanent developmental damage.

In addition to certain pesticides, phthalates and bisphenol-A are contaminants that mimic sex hormones. They are among the most widespread contaminants found in the human body, and they are likely causing significant harm to children in Maryland and across the nation. A significant route of exposure is through a pregnant women's body to her developing child. Women's bodies accumulate the countless chemicals encountered in everyday experiences and found in common consumer products. When a woman is pregnant, her child is also exposed to these chemicals.

Phthalates

Phthalates are a family of chemical "plasticizers" added to PVC plastics to make them more flexible and to personal care products such as perfumes, lotions and nail polish. Phthalates are among the most frequently found contaminants in human bodies. To date, practically every person tested by the CDC has had measurable levels of phthalate contamination in their bodies.[72]

Phthalates interfere with the testosterone hormone system.[73] In experiments with animals, certain types of phthalates interfere with the normal process of male development, increasing the likelihood of

defects like malformed urinary tracts, undescended testicles, lowered sperm counts, damaged genetic material within sperm and testicular cancer in adulthood.[74] Phthalates have also been linked to premature breast development in young girls.[75]

In May 2005, Dr. Shanna Swan and her colleagues at the University of Missouri published a study showing that some of these same problems occur in baby boys exposed to phthalates.[76] The study revealed that the levels of phthalate exposure causing significant changes in male development are found in one-quarter of Americans tested for phthalates by the CDC.

Trends in the frequency of male development problems in the U.S. indicate the potential scale of the phthalate problem. The frequency of genital malformation in baby boys doubled from 1970 to 1993, sperm density has declined 40% in the U.S. since World War II and incidence of testicular cancer in the U.S. increased 51% from 1973 to 1995.[77]

Bisphenol-A

Bisphenol-A is the main ingredient in hard polycarbonate plastics used in baby bottles, drinking water bottles (such as the Nalgene brand), food containers and to line metal food cans. It is one of the 50 most produced chemicals in the industry, generating revenues on the order of $6 million per day in the U.S., Europe and Japan.[78] U.S. industry produces over 1 billion pounds of this chemical a year.[79]

Plastic items containing bisphenol-A can sometimes be identified by the recycling code "7," although the code represents a few other types of plastic as well.

Bisphenol-A was invented in the 1930s as a synthetic estrogen drug.[80] Only later did scientists figure out that they could make plastic out of it as well.[81] Unfortunately, the plastic breaks down over time, contaminating the water or food it comes in contact with. In recent testing, the CDC found bisphenol-A in 95% of the Americans they tested.[82]

A flood of new evidence links bisphenol-A exposure to developmental problems—acting much like the birth control drug ethinylestradiol and the infamous "morning sickness" drug diethylstilbestrol or DES (banned after it was found to cause serious birth defects and cancer in the children of pregnant women).

Scientific experiments with animals show that bisphenol-A disrupts cell signaling, fetal development, adult body function and reproduction.[83] At levels of exposure currently found in many Americans—far below the current "safe level" of exposure established by the U.S. Environmental Protection Agency—bisphenol-A could be contributing to the following health problems:

- Breast cancer.[84]
- Prostate disease, including prostate cancer.[85]

- Spontaneous miscarriage and Down Syndrome.[86]
- Physical defects in female reproductive development.[87]
- Early puberty.[88]
- Reduced sperm count.[89]
- Obesity—predisposing children to become overweight because of cellular changes caused by exposure during pregnancy.[90]
- Impaired immune system function.[91]
- Changes in brain development.[92]
- Changes in behavior—including hyperactivity, increased aggressiveness, impaired learning, altered sexual behavior, decreased maternal behavior and increased susceptibility to drug addiction.[93]

Pesticides

In addition to the other health concerns described above, at least eleven commonly used pesticides are likely or known endocrine disruptors.[94] They include the herbicides atrazine, trifluralin and glyphosate (also known as Roundup) and the insecticide malathion.

Glyphosate, the active ingredient in Roundup, is another endocrine disruptor in widespread use. The U.S. agriculture sector used 85 to 90 million pounds of glyphosate in 2001, making glyphosate the most commonly applied pesticide in the nation.[95] Glyphosate is also the second most common non-agricultural pesticide.

A recent study found that even very low exposures to glyphosate, especially as part of the Roundup formula, disrupts the endocrine system in human cells. At concentrations 100 times lower than those recommended for agricultural use, glyphosate changed cells' ability to synthesize sex hormones. When the glyphosate was tested as part of the Roundup formula, the impacts were even greater.[96]

Atrazine, the second most used pesticide in the nation, is applied to crops such as corn, a major Maryland product. In frogs, atrazine is an endocrine disruptor that causes male frogs to develop ovaries, abnormal testicles, or a mixture of ovaries and testicles; and to become demasculinized. These effects occur at exposure levels more than 10,000 times lower than those previously identified as non-toxic to frogs, as low as 0.1 ppb.[97] Atrazine appears to affect the testosterone signaling pathway by promoting the conversion of testosterone to estrogen.

Atrazine is a common water contaminant in Maryland. In 2000, farmers used 618,515 pounds of atrazine in the state, mostly on crops such as trees, grasses, and corn.[98] After application, the pesticide contaminates drinking water sources through runoff.

In the late 1990s, the U.S. Geological Survey looked for pesticide contamination on the Eastern Shore. They found atrazine at an average concentration of 0.02 to 0.039 parts per billion and up to 4.10 parts per billion in the two rivers that were tested. This peak concentration is up to 41 times higher than the levels associated with reproductive development problems in frogs.[99] In both rivers, atrazine was detected in more than half of all surface water samples.

Chemicals that Interfere with Brain Development

In addition to bisphenol-A and phthalates, many other types of chemicals can interfere with the normal functioning of the body. In particular, scientists are concerned about a variety of chemicals that

can impair the thyroid hormone system, which is critical for normal brain development in fetuses, infants and children.

Changes in thyroid hormone levels early in life can lead to a variety of serious learning and behavior problems, including lower IQ, impaired learning, hyperactive behavior, delayed growth, mental retardation or other serious problems.[100] Changes in thyroid hormone levels may be part of the cause of attention deficit and hyperactivity disorder (ADHD), a serious and growing problem across the country.[101] In 1985, there were 650,000 to 750,000 people in America diagnosed with ADHD. By 2000, that number had risen to 4 to 5 million, mostly school-aged children.[102] Experts estimate the number of school children across the U.S. suffering from ADHD ranges between 3% and 17%.[103]

Several major environmental contaminants—including toxic flame retardants, rocket fuel, common anti-bacterials such as triclosan and the well-known polychlorinated biphenyls (PCBs)—can impair the thyroid hormone system.[104] They pose serious (and potentially additive) threats to the developmental health of infants in Maryland and across the country.

Toxic Flame Retardants

Household products made from flammable materials, such as polyurethane foam in furniture and plastics in computers and electronics, contain chemicals designed to reduce the spread of fire in the event of an accident. Unfortunately, these flame retardants can escape from products into household dust and the environment, eventually contaminating human bodies. These chemicals accumulate in fatty tissue and do not readily leave the body. As a result, these chemicals are building up rapidly in the tissues of women across Maryland and the country. Contamination levels in the breast tissue and breast milk of women throughout America are up to 75 times higher than those found in European countries where these chemicals are less common.[105]

Flame retardants pose a threat because:

- Toxic flame retardant chemicals are able to alter the thyroid hormone

Toxic Cocktail

Individuals are not exposed to pesticides in isolation. People are regularly exposed to a cocktail of pesticides.

Because individual pesticides are technically different chemicals, each is treated separately in regulation. In reality, however, different pesticides can interact to cause increased health effects. Pesticides with similar chemical structures and mechanisms of toxicity can have *additive* effects, in which the total toxicity is the sum of the toxicity of the two components. Some combinations of pesticides have *synergistic* effects, in which different contaminants work together to produce a result that is exponentially more toxic than either of the components. Pesticides can also have *potentiating* effects, whereby one is not toxic except in the presence of another.

While recent studies provide qualitative proof that additive or even synergistic effects exist for many pesticides, they do not provide sufficient data to quantify those effects. Though regulatory agencies could add an extra uncertainty factor to compensate for this lack of data, thus far agencies have ignored the combined effects of pesticides.

system at very low levels of exposure.[106]

- Flame-retardant chemicals given to newborn mice in small doses permanently impair their learning and behavior—problems that worsen as the animals grow older.[107]
- Evidence in animals suggests that exposure will have the same effect in humans. In the case of PCBs, humans were actually found to be at least 1,000 times more sensitive to exposure than rodents used in experiments.[108]
- Flame retardant levels found in some mothers and fetuses are rapidly approaching the levels shown to impair learning and behavior in laboratory experiments.[109]

Maryland has already banned two categories of flame retardants with a clear record of causing damage in humans. A third class of flame retardants, known as Deca, was not banned. Growing evidence, however, suggests Deca, the most widely used flame retardant, is a problem. It can break down in sunlight, ultraviolet light or in the body to form other compounds that are easily absorbed by the body.[110] As a result, Deca should be banned in Maryland as well.

Rocket Fuel

Perchlorate, the major ingredient in solid rocket fuel, contaminates military bases and chemical factories across the country. One of these spills contaminated the Colorado River—the source of irrigation water for the nation's winter vegetable supply. As a result, rocket fuel is being found in supermarkets across the country. Rocket fuel has been found in many places in Maryland:

- Whole organic milk in Maryland tested by the Food and Drug Administration was found to have 11 parts per billion of rocket fuel, a level much higher than safe levels for water.[111]
- Rocket fuel has been detected in 127 of 1,204 surface water, groundwater and soil samples taken at the White Oak Naval Surface Warfare Center in Indian Head in southern Maryland.[112]
- Three drinking water wells in Aberdeen contain perchlorate, the result of pollution from nearby military facilities.[113]

Because of this exposure, rocket fuel is turning up in the breast milk of nursing mothers. In 2005, researchers at Texas Tech University found rocket fuel in the

Table 8: Toxics Release Inventory, 2000 (pounds unless otherwise noted)[118]

	Air	Water	Total	State Rank
Suspected Respiratory Toxicant	33,869,843	N/A	N/A	20
Dioxin (grams)	34.1	16.3	50.4	21
Suspected Neurological Toxicant	7,738,537	487,961	8,226,498	31
Cancer Causing Chemical	628,605	22,293	650,898	33
Developmental Toxicant	277,128	5,267	282,387	37
Reproductive Toxicant	21,305	4,082	25,387	44

breast milk of all 36 women who were tested, at levels higher than many experts anticipated.[114] Perchlorate poses a threat because:

- Perchlorate affects the thyroid hormone system at very low levels of exposure. It acts by preventing uptake of iodine into the thyroid gland, reducing the gland's ability to produce enough hormone.[115]
- According to a study of rocket fuel levels in human breast milk, breast-fed babies ingest more than twice as much perchlorate on average than the National Academy of Sciences' recommended "safe dose."[116]
- Infants exposed to the highest levels of contamination receive a dose comparable to levels that cause changes in brain structure and behavior in infant rats.[117]

Evaluating Maryland's Progress in Protecting Children's Environmental Health

Protecting the health of children should be a top priority for the state's leaders. Healthy children are more likely to grow into healthy adults who can be productive, active members of society.

In the following pages, we examine and evaluate the steps Maryland has taken to reduce pollution and to address children's environmental health problems. When the state has fallen short, we highlight some of the most effective policies available for the state to adopt to improve the health and safety of children. We conclude with a scorecard summarizing the state's progress.

Reducing Mercury Exposure

Maryland has not adopted strong mercury emission standards for power plants, the most important step to reducing in-state emissions of mercury. Not all the state's leaders have demonstrated support for federal mercury standards which would help to control pollution from out-of-state sources. By collecting mercury from schools and beginning to reduce mercury emissions from medical and municipal waste incinerators, the state has reduced children's exposure to mercury from those sources. Wide distribution of fish consumption advisories helps to ensure that sensitive groups such as children limit their intake of mercury-contaminated fish. Grade: C-.

There are a number of steps Maryland can take to reduce children's exposure to mercury. They include reducing the amount of mercury that is released to the environment and preventing children's exposure through contaminated fish. Maryland uses only a fraction of the tools at its disposal to cut releases of mercury. The state does a better job of warning parents and children about contaminated fish, but could do more. Warning labels on store-bought fish, including fresh fish and canned fish, would better inform parents and children about possible mercury exposure.

Mercury comes from power plants, municipal and medical waste incinerators, paper and cement manufacturers, and other sources. Nearly 3,300 pounds of mercury were released into the atmosphere in 2002 by Maryland facilities. Power plants, primarily coal-fired elec-

Why State Action Matters: Mercury in the Florida Everglades

Since the early 1990s, Florida has made significant progress toward making fish safe for human consumption by reducing mercury emissions from local sources. Florida's action reduced mercury from major in-state emitters, caused deposition rates to fall, and cut the amount of mercury in fish, though not to safe levels.

In the 1990s, two industries were responsible for the bulk of South Florida's mercury pollution. Medical waste incinerators and municipal waste combustors emitted 92 to 96 percent of the region's mercury.[119]

Those sources were relatively new to Florida. In 1983, several medical waste incinerators and municipal waste combustors began operating in the state, primarily in South Florida. As a result, in 1983 South Florida mercury emissions soared to 3.5 times higher than 1982 levels.[120]

When tighter controls were imposed on mercury pollution from incinerators and combustors, emissions dropped. In 1992, Florida adopted stronger restrictions on mercury emissions from waste incinerators, banning the disposal of fluorescent lamps in incinerators and tightening standards for the amount of mercury that could be released through exhaust gas.[121] Florida also implemented a mercury recycling campaign to reduce the amount of mercury in the waste stream.[122] In 1995, Florida began promoting mercury recovery and reclamation.[123] Stringent federal standards also took effect in the late 1990s.

These measures significantly reduced mercury emissions. Releases in 1993 were 65 percent lower than in 1991, and continued to decline throughout the decade.[124] By 2000, total mercury emissions from all sources in Florida had dropped by 93 percent compared to the 1991 peak.

The rates of mercury deposition into Florida's waterways also decreased over this time period, though not by the same degree. Though emissions fell by 93 percent from 1993 to 2000, statewide deposition rates fell by 25 percent.[125] Greater benefits were experienced in the Everglades, located downwind from South Florida's high concentration of incinerators. Deposition of mercury there declined by approximately 60 percent from 1990 to 2001. Mercury levels in fish there fell, dropping 75 percent from the mid-1990s to 2002.[126]

Despite the reductions in emissions from incinerators, there is still much work to do. Fish in the Everglades remain unsafe for human consumption. For a 3-year-old largemouth bass caught in the Everglades to reach a safe level of mercury contamination, mercury deposition will need to be reduced by 80 percent.[127] Achieving that level of reduction will require further reductions in emissions from local and non-local sources—including electric power plants.

tricity generators, were responsible for 66% of this pollution.[128] Because mercury can travel great distances once airborne, power plants and other facilities outside of the state also contribute to Maryland's mercury pollution. Some of this released mercury lands in Maryland.

Maryland has done very little to reduce mercury emissions from coal-fired power plants, the biggest source of mercury pollution. The state has failed to establish limits on mercury released from power plants—the most important step to curtail mercury emissions. Recently adopted

appliance efficiency measures and the renewable energy standard could reduce the growth in demand for electricity, thus reducing the need for electricity from dirty coal-fired power plants.

To address the problem of mercury pollution from sources outside the state, Maryland's leaders should seek stronger federal controls on all coal-fired power plants. Twelve states are challenging proposed federal rules to control mercury because the rules do not reduce mercury as much or as quickly as possible. Maryland has chosen not to join that lawsuit.[129]

Though the state has implemented federal guidelines that reduced emissions from incinerators, problems remain. By requiring that all mercury-containing waste be separated from other waste before incineration, helping medical institutions replace mercury-containing items with safer versions and phasing out the sale of mercury-based thermostats, relays and other goods, the state could further reduce mercury emissions from incineration.

Thanks to the state's efforts, children's exposure to mercury at schools has decreased. All of Maryland's public schools have participated in the State Department of Education's mercury collection campaign, which removed nearly 350 pounds of liquid mercury and approximately 7,000 mercury-containing devices from the state's schools.[130] The Maryland Department of the Environment has undertaken mercury-collection efforts that encouraged citizens to turn in mercury fever thermometers. However, there is no easy way for Maryland residents to dispose of other mercury-containing devices, such as fluorescent lightbulbs.

The state also provides fish consumption advisories, which are particularly important for anglers who eat lots of locally caught fish, women of childbearing age and children. Maryland updates its advisories annually, providing the information to everyone who receives a fishing license and issuing a public announcement for the general public. However, the state could do a better job of providing information to non-English speakers and of indicating that fish are listed for mercury contamination, not PCB contamination which can be alleviated by careful preparation of fish. Also, the state should provide mercury warnings where fish is sold, given that most people buy fish in supermarkets. This will better ensure that all those who eat fish, not just people who catch their own fish, are aware of mercury contamination.

To protect the state's children from mercury emissions, Maryland should:

1. Cap mercury emissions from power plants.
2. Advocate for strong federal standards to reduce mercury from out-of-state sources.
3. End waste incineration, beginning with waste containing high quantities of mercury, such as medical waste.
4. Create collection programs for all types of mercury-containing devices, keeping them out of the waste stream.
5. Ensure fish consumption warnings are complete, available in multiple languages and provided where fish is sold.
6. Expand fish-testing to ensure data on contaminated fish is up to date.

Reducing Lead Poisoning

Approximately half of rental housing that is likely to contain lead paint has been registered with the state, as required by law. Even fewer of those homes are inspected to confirm they are adequately maintained to protect children. Only a portion of at-risk children are tested for blood lead levels in accordance with state law. Grade: D+.

To end lead poisoning, children's exposure to lead must be reduced and potentially vulnerable children must be tested so that they can be treated when necessary. Maryland's current efforts to reduce childhood lead poisoning have fallen short, with low compliance and inadequate enforcement of state laws.

Owners of rental property built before 1950 are required to register the property with the state, pay a fee, and maintain the property to protect residents from exposure to lead. Each time a new tenant moves in, the landlord must perform specific maintenance tasks and a state-approved inspector must confirm that the maintenance has been completed. Based on data from Baltimore City, these policies are not effectively implemented or enforced. In the city, only half of pre-1950 rental housing is registered with the state and inspectors have visited less than one quarter of the privately owned units that may contain lead paint.[131]

In 2000, Baltimore City joined with the state of Maryland to address the lead paint problem in 148,000 of the city's homes. The program provided $3 million in funding to remove or contain lead paint in selected older, lower-value neighborhoods, but in the course of the first two years of the program, only 1,720 housing units were treated. At that pace, addressing the lead paint problem in these selected Baltimore homes would require 45 years.[132] Faster progress in Baltimore and in other communities will require greater funding.

The state also fails to test at-risk children. Early detection of lead poisoning is important because it allows treatment to begin sooner. State law requires that children who live in areas that likely contain lead paint be tested for lead poisoning at 12 and 24 months of age. Currently, however, testing rates are far lower. In Baltimore City, one of nine jurisdictions where all children should be tested, only 32% were tested in 2002.[133] Testing rates have been higher in the past—50% of at-risk Baltimore City children were tested in 1994—demonstrating that the state is capable of doing a better job.

The lead paint law that went into effect on October 1, 2005 cut in half the amount of lead that must be found in a child's blood to trigger a law requiring that landlords immediately remove the source of lead poisoning and provide medical care to affected children. The Maryland Department of the Environment is also empowered to penalize landlords not following the law.

The state has created a Childhood Lead Screening Program and established a goal of eliminating childhood lead poisoning by 2010. A recent analysis expanded the list of areas where children are more likely to be exposed to lead and should therefore be tested for lead poisoning.

To protect children from lead poisoning, state and local governments should:

1. Register and inspect all rental properties that might contain lead.
2. Tighten housing codes and state regulations to require the removal of leaded paint from the most problematic surfaces (e.g. windows, doors, radiators, trim, etc.) in older homes.
3. Provide sufficient levels of funding for abatement and enforcement programs.
4. Educate homeowners and inspect owner-occupied homes in high risk areas.
5. Prosecute landlords who continually violate the law.
6. Test all potentially vulnerable children.
7. Provide treatment and support for children with lead poisoning.

Reducing Pesticide Exposure

By requiring that schools use integrated pest management techniques to limit their reliance on pesticides, Maryland has taken an important first step in reducing children's exposure to pesticides. However, poor implementation of the program has limited its effectiveness. Grade C.

Maryland has started to reduce children's exposure to pesticides by requiring schools to use pesticides as a last resort, but implementation of the policy has been inconsistent. More aggressive use of alternative pest control methods in schools will reduce one source of children's exposure to pesticides. Pesticides that the U.S. EPA has classified as category I or II (the most toxic) should also be banned for all uses in which children may be exposed.

In 1998, Maryland adopted the IPM-in-Schools Program to reduce pesticide application. IPM, or Integrated Pest Management, explores alternatives to pesticide use. Such pest control methods include sanitation, structural repairs, mechanical and living biological controls, and other non-chemical processes. These techniques create systems to mitigate or eliminate the economic and health consequences caused by pests while minimizing the use of pesticides and their associated health risks. With further legislation that was passed in 1999 requiring public schools to use IPM, pesticides were removed as the primary line of defense against pest infestation. Except in cases of emergency applications, public schools must notify parents before using pesticides.

Since the law's implementation, pesticide use has nearly ended in some districts but has not changed at all in others. Though 30% of schools do not use pesticides during the school year, a majority of schools continue to apply pesticides. Nearly 10% of schools continue to use pesticides as the first response to pest control problems. Many schools are also failing to notify parents before using pesticides.[134]

Schools, hospitals, parks and mosquito control programs around the country have proven that non-chemical pest management works. New York City recently adopted a law banning the use on city property of pesticides that are known or are suspected of causing cancer or developmental disorders. The most toxic pesticides (EPA category I pesticides) will be banned also. Overall pesticide use is to be reduced as much as possible through alternative pest control methods.[135] Connecticut recently banned the application of lawn care pesticides at daycare facilities, public and private preschools and elementary schools. The law will begin phasing out lawn care pesticides in 2006 and prohibit their use by 2008.[136] Michigan, Oregon, Washington and Connecticut required that state agencies and state run facilities adopt an IPM program.[137]

Healthcare facilities in Delaware and California are required to have information regarding pesticide use at the facilities available upon request. Massachusetts, Maine, New Jersey, Illinois and Texas require healthcare facilities to notify patients and employees if certain types of pesticides are used.[138]

To reduce children's exposure to pesticides, state and local governments should:

1. Correctly and completely implement the state's IPM-in-schools law, using pesticides only as a true last resort and fully notifying parents before use.
2. Follow the example of Washington, D.C. and use only non-chemical preventive strategies and larviciding for mosquito control.
3. Eliminate pesticide use in parks and other public spaces.

4. Inform and educate the public about the health hazards pesticides pose for children prior to any government use of pesticides.
5. Phase out the use of the most toxic pesticides (those that the U.S. Environmental Protection Agency classifies as having category I or II toxicity) from use in schools, day care centers and hospitals.
6. Ensure that all health care providers are aware of the Maryland regulation mandating reporting of suspected pesticide injury.

Reducing Air Pollution

The state has failed to adopt tighter emission limits for cars and light trucks and has not cut emissions from power plants. Maryland has established a program for replacing aging diesel school buses, ensuring that older vehicles that do not meet modern emission standards are removed from use. Grade: D+.

The major sources of air pollution are power plants and mobile sources such as cars and trucks. Though the state has reduced air pollution from some sources, Maryland has not yet acted to cut emissions from the biggest contributors to the problem.

Nitrogen oxides, volatile organic compounds, sulfur dioxide and particulate matter all contribute to Maryland's air pollution woes. Nitrogen oxide and volatile organic compounds are precursors of both smog and particulate matter, meaning that efforts to reduce ozone pollution may also reduce particulate matter. Sulfur dioxide contributes to particulate matter.

On-road vehicles such as cars and trucks are responsible for 44% of nitrogen oxide pollution and 69% of volatile organic compounds released in the state. Power plants that generate electricity release 18% of nitrogen oxide emissions and 77% of sulfur dioxide.[139] Just a handful of plants released the bulk of this pollution. The state's seven oldest and dirtiest power plants release approximately 96% of the total nitrogen oxide and sulfur dioxide emitted by Maryland's electric utility industry.[140]

Although much of Maryland's pollution comes from sources within the state, a large share of some pollutants also originates from out of state, including states as far away as the Midwest. Prevailing westerly winds carry pollution to Maryland and other eastern states, adding to pollution generated locally. This transport of pollutants means Maryland must seek to reduce in-state emissions as much as possible while also advocating for strong federal standards to reduce pollution from other states.

The U.S. Environmental Protection Agency estimates that more than half of $PM_{2.5}$ in eastern states comes from regional sources like power plants and urban centers.[141] Wind currents spread the pollution across the state, raising $PM_{2.5}$ concentrations in both rural and urban areas and making particulate matter pollution a state-wide problem. Total concentrations are even higher in urban areas, due to an increased number of local sources. Fuel combustion in cars, trucks, power plants and factories are among the biggest local contributors to $PM_{2.5}$.[142]

Controlling Emissions from Cars and Trucks

Maryland can choose between two sets of emissions standards for cars, light trucks and SUVs. The state currently relies on the more lenient federal standards instead of selecting standards that will better control emissions of smog-form-

ing pollutants and protect the health of the state's children.

The more protective standards would reduce light-duty vehicle emissions of nitrogen oxide by approximately 10%, volatile organic compounds by 13% and select air toxics from 12% to 15%.[144] New York, New Jersey and other states equaling more than one-quarter of the nation's car market have already adopted these tighter standards. Maryland should not delay any longer in taking this important step to reduce air pollution from vehicles.

The state also should reduce emissions from diesel vehicles. While the federal government has set tighter standards for many diesel vehicles that will take effect in 2007, the new standards will have no impact on existing diesel vehicles, many of which may remain in use for as long as 28 years.[145] Maryland has a program to replace diesel school buses, but not other diesel vehicles. Maryland can reduce diesel particulate matter emissions by speeding the transition to lower emission vehicles and by retrofitting existing vehicles. The state should:

Reducing Air Pollution Protects Children's Health: The Case of the 1996 Olympics in Atlanta

The 1996 Summer Olympic Games in Atlanta offered researchers a unique opportunity to observe the connection between lowered pollution levels and improved children's health.[143]

Atlanta implemented a comprehensive transit plan as a part of the Olympic Games. The plan was designed to reduce congestion in the downtown area and reduce travel delays. Atlanta launched an expanded 24-hour-a-day public transportation network, added 1,000 buses for park-and-ride service, encouraged local employers to institute alternative work hours and telecommuting, and closed the downtown area to private vehicles.

The transit plan produced impressive results, despite the million or so additional visitors to the city. Weekday morning traffic trips declined by 22.7% and public transportation ridership increased by 217%.

The plan produced some unintended benefits for air quality and health that were equally impressive. The average daily maximum ozone levels decreased by 28%, from 81 ppb before and after the Olympics to 59 ppb during the Olympics. Presumably, this effect resulted from the decreased levels of traffic-related air pollution. Nearby cities did not experience similar reductions in ozone pollution.

At the same time, asthma-related emergency room visits for children decreased by 41.6% in a Medicaid database, 44.1% in an HMO database, and 11.1% in two major pediatric emergency departments. Additionally, hospitalizations for asthma decreased by 19.1%. Unfortunately, Atlanta discontinued the transit program at the conclusion of the Olympics, and pollution levels and emergency room visit rates returned to normal.

This study powerfully demonstrates how reducing pollution levels would benefit the health of children. It also highlights the role that motor vehicles play in creating high levels of urban pollution.

- Create a program to help fund the replacement of existing diesel equipment. In the first three years, such a program in California helped replace or retrofit several thousand diesel engines and reduce annual nitrogen oxide emissions by more than 5,000 tons and particulate matter by 146 tons.[146]
- Continue to fund the frequent replacement of diesel school buses and purchase natural gas buses whenever possible.
- Reduce emissions from trucks and buses by enforcing anti-idling provisions and by promoting truck-stop electrification efforts, which allow long-distance truckers to heat and cool their cabs during rest stops without running their engines.

Further federal action is needed to reduce emissions from ships and trains, and to ensure strong enforcement of new diesel emission standards that take effect next year.

Controlling Emissions from Power Plants

Maryland has the authority to control emissions from power plants located in the state, which would reduce levels of both smog and particulate matter, but has done very little.

When the federal Clean Air Act was adopted in 1970, it exempted existing power plants from emission standards. Decision-makers reasoned that installing pollution-control equipment on plants that would close soon did not make sense. However, many of these plants continue to operate today without adequate pollution controls.

Even though the federal government has refused to close this loophole that allows older power plants to emit a disproportionate amount of pollution, Maryland can establish strong standards to reduce emissions of nitrogen oxide, sulfur dioxide, mercury, and carbon dioxide pollution from power plants. Requiring modern pollution controls on Maryland's seven dirtiest power plants—simply requiring them to meet the same standards as new plants—would eliminate 77% of the nitrogen oxide and 89% of the sulfur dioxide released from the state's electricity generators by 2011.[147] (Though the recent federal Clean Air Interstate Rule will reduce emissions of these pollutants also, the reductions will be smaller and will occur over a longer timeframe.)

The state has adopted appliance efficiency standards that will reduce the amount of power required, thus cutting nitrogen oxide and sulfur dioxide emissions slightly. The newly enacted renewable energy standard also will lessen the demand for power from coal-fired plants. In Baltimore City, the state has undertaken an effort to improve the efficiency of boilers at schools, thereby reducing air pollution.[148]

In addition, the state should request strong federal action to reduce the release of sulfur dioxide, nitrogen oxide and particulate matter from power plants in other states. On the legal front, Maryland, a dozen other states and several cities sued the federal government to block rules that would weaken the Clean Air Act and allow old power plants to upgrade without improving their emission control equipment.[149] Most recently, Maryland joined several other states to sue Allegheny Energy for pollution released from three of its power plants in Pennsylvania upwind from Maryland.[150] However, the state has not joined a lawsuit calling for stronger federal standards on mercury emissions.

To protect the state's children from air pollution, Maryland should:

1. Reduce pollution from cars by adopting tighter emission standards.
2. Reduce emissions from power plants by establishing statewide emission limits and by advocating stronger federal standards for all power plants regardless of age.
3. Replace old diesel vehicles with newer, cleaner ones or non-diesel alternatives.

Reducing Exposure to Other Chemicals

Maryland has not banned phthalates, bisphenol-A, a dangerous class of flame retardants or pesticides that are known to affect children's development. The state has not established a drinking water standard for perchlorate. Grade: D-.

The use of chemicals known or suspected of posing hazards to the health, safety, or the environment of children should be reduced and eliminated. Protecting Maryland children from the effects of chemicals that mimic hormones and those that affect brain development requires reducing exposure as much as possible. To accomplish this, the state should ban the use of bisphenol-A, phthalates, all brominated flame retardants and certain pesticides.

A ban can quickly reduce the amount of chemical to which people are exposed. In Sweden, after tests revealed that the concentration of flame retardants—a chemical that mimics hormones—was doubling every five years in the breast milk of Swedish women, the country banned some classes of flame retardants. Since then, concentrations have declined dramatically.[151] Maryland recently enacted a similar ban on two classes of flame retardants and should do the same the third class of flame retardants, which can degrade into the two forms of flame retardants already banned.

Because of its military applications, banning perchlorate (the chemical name for a component of rocket fuel) may not be possible. Instead, Maryland should establish a drinking water standard for perchlorate at 1 part per billion (ppb), the level necessary to protect infants, who are the most vulnerable part of the population. A recent National Academy of Sciences report supports a standard at this level.[152]

The state should require those responsible for contaminating drinking water supplies with perchlorate to pay for its clean up. Maryland taxpayers should not be forced to pay to solve a problem they did not create. However, because the Army claims it will not clean up the pollution it has created in Aberdeen and other locations until a federal drinking water standard has been established, Maryland's leaders should advocate for prompt creation of a federal standard of 1 ppb.

To reduce exposure to chemicals that mimic hormones and affect brain development, Maryland should:

1. Phase out the use of all toxic flame retardants, bisphenol-A, phthalates and all pesticides that are known and probable endocrine disruptors.
2. Establish a state drinking water standard of 1 ppb for perchlorate and advocate that the federal standard be set at the same level.
3. Require polluters to clean up perchlorate that has contaminated drinking water supplies, groundwater and soil.

Create a Children's Health Registry

Many of the health impacts of air pollution, lead and mercury are well known. The effects of chemicals such as toxic flame retardants, phthalates and rocket fuel have only more recently been discovered. Additional impacts of all these pollutants and new ones are uncovered regularly.

Maryland could help the effort to discover environmental health problems and better protect children's health by creating a health registry. By centrally collecting data on chronic diseases, it becomes possible to detect unusual patterns in disease development. Those patterns may be the result of exposure to environmental hazards that would otherwise go unnoticed. With full information about diseases, the state is better placed to address environmental pollution.

A disease registry should track cancers, birth defects, respiratory diseases such as asthma, learning disorders, neurological ailments such as Alzheimer's, metabolic diseases such as diabetes, auto-immune disorders such as Lupus, and other chronic diseases. In addition, the registry should include data on exposure to environmental hazards such as pesticides and heavy metals.

To date, Maryland has a mandatory statewide cancer registry, which maintains records on all new cases of cancer in the state. Created in 1982, the registry allows the state to track cancer by type and location. As of March 2004, pesticide injury has been added to the state's mandatory reporting requirement for infectious diseases. An asthma registry is planned. A comprehensive disease registry would benefit all Maryland residents, including children.

Conclusion

Maryland earns a barely passing grade for its efforts to protect children's environmental health. Mercury that taints the state's waterways and the fish that live there comes from in-state and out-of-state sources. Maryland has not reduced emissions from in-state power plants by establishing tighter state standards and has not significantly advocated for stronger federal standards that would cut pollution from out of state. The state has done a better job of warning parents and children not to eat too much fish from polluted areas and of reducing children's exposure to mercury from other sources, such as at school, but still could do more.

Deteriorating lead-based paint is a problem in homes across Maryland. More than 2,000 children have elevated blood lead levels, potentially leading to learning disabilities and other diseases in the short term, as well as life-long health problems. Though the state has established ambitious goals for reducing lead poisoning by 2010, current funding levels and testing rates are too low to even come close to that goal.

The state has made little progress on reducing children's exposure to pesticides. While the state's law requiring integrated pest management in schools is a strong first step, better implementation is necessary before all children can attend school without encountering pesticides. Further, when schools do resort to pesticides, they are still allowed to use the most highly toxic compounds. Children in day care centers continue to be exposed to a variety of toxic pesticides because the current law does not protect them at all. Widespread pesticide use in schools, homes, gardens, parks, agricultural settings, disinfectants, lice treatments and play equipment mean children are regularly exposed to toxic chemicals.

Children are exposed to toxic chemicals such as flame retardants, phthalates, bisphenol-A and rocket fuel throughout the day at home, in stores and at school. Because these chemicals have some of their most devastating impacts even before a child is born, reducing everyone's exposure to them is key. This will require the state to end use of these chemicals.

Maryland fails to adequately protect children from air pollution-related diseases. Despite serious smog, air toxic and particulate matter pollution, the state has not acted to reduce emissions from vehicles and power plants, the largest emissions sources, and thus asthma rates and school absenteeism is widespread. The state has, however, undertaken an important program to retire aging diesel school buses that most affect children.

Table 9. Grading Maryland's Actions to Protect Children's Health

	Grade
Reduce Mercury Exposure:	**C-**
Cut emissions from power plants	F
Advocate for strong federal standards on power plants	D-
Reduce mercury from other sources	C
Issue adequate fish consumption advisories	B
Reduce Lead Poisoning:	**D+**
Register all rental properties that might contain lead	C
Regularly inspect registered homes to ensure landlords perform maintenance	D
Test all at-risk children	D
Reduce Pesticide Exposure:	**C**
Completely implement IPM in schools	C
Reduce Air Pollution:	**D+**
Tighten emission standards for cars and trucks	F
Cut emissions from power plants	F
Reduce emissions from diesel school buses	B
Reduce emissions from other diesel vehicles	F
Seek strong federal standards	C+
Reduce Exposure to Other Chemicals:	**D-**
Ban phthalates, bisphenol-A and toxic flame retardants	D-
Establish a 1 ppb drinking water standard for rocket fuel	F
Overall:	**C-**

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