

MARYLAND CHILDREN'S ENVIRONMENTAL HEALTH PROGRESS REPORT

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A REPORT OF THE
MARYLAND ENVIRONMENTAL HEALTH NETWORK



MARYLAND ENVIRONMENTAL
HEALTH NETWORK

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TABLE OF CONTENTS

Executive Summary	1
Pesticides	5
Chemicals and Toxics	12
Fracking	17
Water Contamination	21
Air Pollution	25
Climate Change	30
Conclusion	33
Source Notes	34

Endorsements

Advocates for Children and Youth
Alliance of Nurses for Healthy Environments
Beyond Pesticides
Chemical Sensitivity Disorders Association
Environmental Justice Partnership, Inc.
Equity Matters, Inc.
Learning Disabilities Association of Maryland
Maryland Children's Environmental Health Coalition
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Maryland Public Interest Research Group
Physicians for Social Responsibility – Chesapeake Chapter
Public Health Committee of MedChi

EXECUTIVE SUMMARY

Children make forts with sofa cushions treated with toxic flame retardants. They breathe in tobacco smoke, diesel exhaust, ozone, and small particles suspended in the air. They swim in streams and play in the grass, crawl on carpets and suck fingers covered with household dust. Whatever is in the water, the grass, the carpet, the dust, will be in our children. Homes, playgrounds, schools – even the hospitals children are born in – are treated with dangerous pesticides. Chemicals known to be endocrine disrupters or carcinogens are used to make toys, cleaning products and school supplies.

When we take full stock of these threats, the need to be more proactive in protecting our children is apparent. Parents and pediatricians, teachers and child care workers can take some steps to reduce environmental risks children face. But the most effective protection must come from policy-makers and legislators. Because of children's special vulnerability, reducing environmental risks demands our society's full attention. Government's role in this is central.

Emerging evidence suggests that the epidemics of obesity and diabetes as well as the rising prevalence of allergic diseases and autism are due, at least in part, to chemical exposures during those most sensitive and vulnerable windows of development, mainly in-utero and the first few years of life. Sadly, few national laws address children's exposure to environmental hazards. Existing laws and regulations such as the Occupational Safety and Health Act (OSHA) are designed to protect adults and do not address the unique points of vulnerability of children. Other laws such as the Toxic Substances Control Act have been found inadequate to protect adults and children alike. In some cases, sound laws are bypassed (e.g. fracking exemptions from the Clean Water Act and other federal environmental laws) when perceived economic gain is given greater weight than public health and environmental considerations.

*Whatever is in the water, the grass, the carpet,
the dust, will be in our children.*

Our report points out key successes in Maryland, and building from that strong foundation, examines the opportunities ahead to protect our children from environmental health threats. While we know more each year about these environmental threats, U.S. and state lawmakers have yet to enact, or in many instances enforce, key protections for children. In this realm, there is no substitute for government action.

This report details only some of the environmental health concerns that deserve our attention. The focus here is on pesticides, toxic chemicals, air and water pollution, hydraulic fracturing for natural gas extraction ('fracking') and climate change. There are equally compelling issues to be examined in other areas. For instance, we do not explore the relationship between the built environment and the epidemic of childhood obesity, nor cover the role of food systems, food access, and food quality in children's health. We touch only briefly on the continuing threat of lead poisoning, the impact of second hand smoke on children, and the impact of housing conditions on child health. We do not fully explore the disproportionate impact of environmental degradation on the lives of low income children and families of color. These are all significant environmental health issues and they deserve to continue to receive the attention of child health advocates, law-makers and policy-makers.

Maryland's Progress in Protecting Children

Maryland has been a leader in child health and safety. The Maryland Children's Environmental Health Protection Advisory Council created in 2000 is tasked with ensuring that the State protects children from environmental hazards. Maryland has passed nationally ground-breaking laws, such as requiring Integrated Pest Management in Schools, and banning bisphenol A in sippy cups, bottles and infant formula containers.

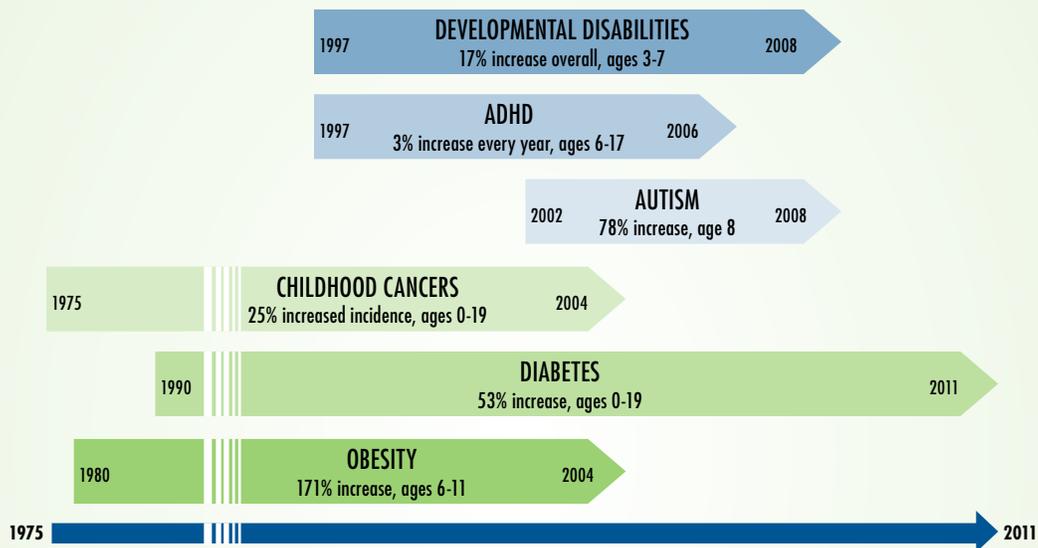
Yet in recent years, other proposed laws have failed – measures to identify carcinogenic chemicals in consumer products, protect school children from harmful construction dust, and require the tracking of pesticide use. Maryland has fallen behind other states such as New York which in 1999 adopted the Comprehensive Public School Safety Program. Contained in these regulations are Uniform Safety Standards which provide basic health protections for children and other school building occupants during renovation and construction. The Washington State Children's Safe Products Act of 2008 is another model for state action to protect children from chemicals of concern. These and other steps offer Maryland a path to becoming a healthier and safer state for children and a role model for other states.

How Children Are Affected

Environmental health threats affect children and the developing fetus in unique ways. Compared to adults, children absorb more toxins relative to body weight from the food they eat, air they breathe and water they drink. Pregnant women, infants, and children during puberty are at critical moments of vulnerability, when a small exposure can have a long-term and significant impact. Low income children are often more exposed by

From flame retardants in children's sleepwear to lead in toys, new threats to our children's health are being identified. Dramatic rises in childhood obesity and in the incidence of autism have made recent news. Parents and pediatricians, teachers and child care professionals are increasingly aware of how air pollution, pesticides, chemicals and other environmental factors are affecting our children. As the chart below indicates, many childhood health harms are on the rise.

Children's Health Harms on the Rise, 1975-2011



Source: PANNA - Used by permission

virtue of living near industry and toxic waste sites, or by having less choice about what they buy and eat.

The new science of epigenetics is discovering how prenatal and childhood exposure to pollution influences the risk of chronic conditions in adult life. A rapidly growing body of scientific literature links exposures even at very low levels to adverse impacts on children's neurological, respiratory, immune, and endocrine systems. For some chemicals, there may be no safe level of exposure. Yet children are exposed daily to a far greater range and combination of chemicals and toxic substances than have been tested by the Centers for Disease Control and Prevention (CDC), the Food & Drug Administration (FDA), the Environmental Protection Agency (EPA) or the National Institutes of Health (NIH).

*For some chemicals,
there may be no safe level of exposure.*

The 2008 report Maryland's Children and the Environment, issued under the joint leadership of the Maryland Department of Health and Mental Hygiene (DHMH) and the Maryland Department of Environment (MDE), acknowledged that we do not know enough about how children are harmed by environmental factors. That report documented data gaps and highlighted the lack of testing to establish the levels of contaminants in children. Lead in children's blood is the only example of routine biomonitoring and it takes place only in certain communities. Like the authors of that report, we conclude that disclosure of hazards and monitoring of exposures is a critical component of protecting our children.

Where Should Maryland Focus to Protect Children?

Maryland can do more to address our children's daily exposure to environmental health threats in the following areas:

- **Pesticides** are a serious threat to Maryland’s children. Just one exposure at a critical stage of fetal or child development can have long-term health consequences. Of the forty pesticides commonly used in homes and schools, 28 may cause cancer, 26 can affect reproduction, 26 are nervous system poisons, 14 can affect the endocrine system, and 13 can cause birth defects. As this breakdown illustrates, many pesticides have multiple health effects.

While Maryland passed groundbreaking laws on Integrated Pest Management (IPM) in public schools in 1998 and 1999, implementation and enforcement is lacking. Maryland needs centralized reporting of what is applied by non-homeowner applicators, when and where. Public health officials must be empowered to assess the link between certain pesticides and illness clusters in communities, such as asthma, autism spectrum disorders, and childhood cancers.

Parents and pediatricians, teachers and child care workers can take some steps But the most effective protection must come from policy-makers and legislators.

- **“Fracking”** is a new and fast growing energy technology with health implications that we are just beginning to understand, based on problems emerging in other states. The health threats related to hydraulic fracturing and extraction of gas from shale formations are now being studied, while shale gas exploitation proceeds at full tilt in nearby Pennsylvania and West Virginia. The chemicals used in the fracking process are linked to respiratory, immune system, nervous system, gastrointestinal and cardiovascular problems, as well as cancer.

Before Maryland becomes the next state to engage in unconventional gas drilling practices, we need to fully understand the health implications for children and families. Pursuing clean energy sources will better secure the future health of our children through lower greenhouse gas emissions, and cleaner water and air.

- **Chemicals and Toxic Substances** in consumer products have been linked to many health problems – premature birth, learning disabilities, behavioral disorders, asthma and allergies, early puberty, obesity, diabetes, infertility, and some types of cancer. BPA, formaldehyde, flame retardants, phthalates, and many other chemicals enter children’s bodies in too many ways for parents to prevent. They are in plastic food containers, hand lotions, drinking water, fabric treatments, household dust, and foam pads, and many more consumer products.

Maryland state agencies need the resources to conduct timely biomonitoring and other data collection activities. The public must also have access to better information, but government action is critical to truly protect Maryland families.

- **Air Pollution** in Maryland remains a threat to our children’s health, in spite of many recent advances. Sources of concern include incinerators and power plants that emit mercury, particulate matter, and sulfur dioxide. Ground level ozone scars young lungs and air pollution as a trigger for asthma can have impact on young lives in the form of missed school days, increased hospitalizations and reduced participation in sports.

Air pollution has been linked to acute and long-term health impacts for children including impaired lung function and growth, increased cancer risk, preterm birth, and even infant death. In addition to respiratory effects, air pollution has been linked to heart disease, high blood pressure and neurodegenerative diseases.

To protect communities that are most vulnerable to air pollution, Maryland must adopt a policy of considering the cumulative effect of industrial land uses and vehicle traffic. Schools and athletic fields especially should not be sited near polluting industries, highways, or transportation hubs.

- **Polluted waterways and contaminated land** pose threats to Maryland children ranging from toxic waste sites and lawn care chemicals, to contaminated streams and agricultural runoff. Last year, Maryland took a major step by banning arsenic in chicken feed. But relatively little has been done to protect children and others from dangerous toxics on land and in water. The health of the Bay is linked to the health of our residents. Pesticides, pharmaceuticals and antimicrobials have been linked to intersex fish in several of Maryland’s waterways that are also the source of our drinking water. Low income children are likely to eat fish from polluted waters with a real risk of ingesting toxics such as PCBs.

When Maryland takes steps to reduce the sources of toxic pollution contributing to the Bay’s deterioration, we also take steps to protect our children. Many new storm water management practices bring benefits for children, such as greening urban neighborhoods, restoring streams thereby making them safe recreational areas, and reducing children’s accidental exposure to raw sewage during floods.

What Strategies Should Maryland Pursue to Protect Children?

The concerns outlined in this report belong properly in the sphere of good government; private sector and consumer actions cannot provide the protections needed, nor will voluntary measures and education suffice. Only good government, committed to transparency and dedicated to protecting the vulnerable, can accomplish what is needed.

There are key strategies that Maryland can deploy to address the threats outlined above, and in some cases, one strategy can address multiple threats.

- Increase the **available data** for assessing child environmental health priorities. Examples include annual reporting of pesticide applications, biomonitoring studies to identify toxic substances being carried in our bodies, and evaluation of cancer hotspots.
- Apply a **cumulative impact analysis** to communities that are disproportionately affected by pollution. Such approaches are relevant in the siting of new industries and highways, the enforcement or revision of permits, and the setting of priorities for toxic waste clean-ups.
- Identify **chemicals of greatest concern**. Empower state agencies to phase out the use of chemicals deemed most dangerous to children.
- Give greater weight to **the health implications of major initiatives**, incorporating present and future health costs and

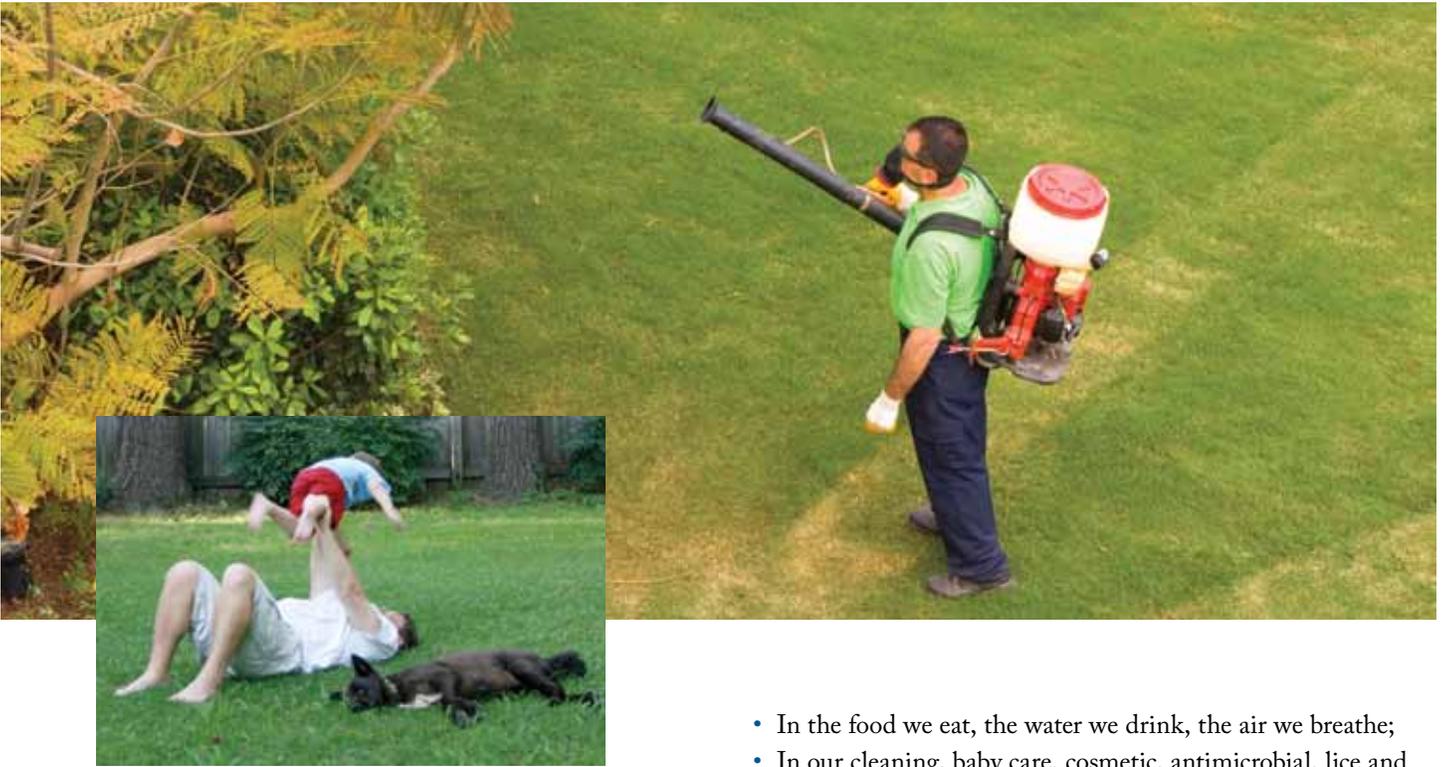
savings into the economic analysis. Recognize and quantify the health benefits of renewable energy sources, and health harms from fossil fuel sources.

- Take a **comprehensive view of toxics** in our state, rather than addressing sources and substances individually. Use administrative as well as legislative action to pursue child protection from environmental harms.

Addressing environmental health in Maryland holds great promise. The costs of treating environmentally mediated child health problems in the US were estimated at \$76.6 billion in 2008 up from \$54.9 billion in 2002.¹ Greater environmental protections would have a powerful impact on reducing those costs. In a 2012 comparison of over 400 studies of cost-effectiveness, environmental prevention was found to be more cost effective than prevention efforts consisting of behavioral or clinical interventions.² The opportunity to improve quality of life and reduce health care costs by focusing on environmental protection of human health is great.

Maryland has many opportunities to protect our children from exposure to toxics in the air, water, land and consumer products. As research pinpoints how exposures in early life raise the risk of serious disease in adulthood, nothing less than the future health of our state lies in the balance. The time to protect our children is now.

PESTICIDES



Our nation's most respected scientific authorities – the National Academy of Sciences, American Public Health Association, the American Academy of Pediatrics and U.S. EPA, among others – have voiced concerns about the danger that pesticides pose to children. A rapidly growing body of evidence links pesticides to adverse health impacts on children's neurological, respiratory, immune, and endocrine systems, even at low levels of exposure. Numerous studies consistently show birth defects and developmental problems when fetuses and infants are exposed to pesticides.

How Our Children are Exposed to Pesticides

Pesticide exposure is a more severe health hazard for children, because they take in more pesticides relative to their body weight than do adults.³ Children are vulnerable whether they are exposed directly or in utero through their mother's exposure. Studies have found that pesticides such as the weed killer 2,4-D pass from mother to child through umbilical cord blood and breast milk.⁴ Children's developing organ systems make them more sensitive to toxic exposure. There are multiple pathways of pesticide exposure:

- In the food we eat, the water we drink, the air we breathe;
- In our cleaning, baby care, cosmetic, antimicrobial, lice and pet products, as well as pest management and insect repellent products;
- In day-care centers, schools, hospitals and homes, on lawns, athletic fields and parks and on or near golf courses;
- From pesticide spray drift such as the state's mosquito and gypsy moth control programs and rights-of-way applications on roads.

Pesticide runoff from farming and land care into our waterways has an impact on the health of the Chesapeake Bay. Pesticides in our waterways end up in drinking water. Our children swim, play and fish in Maryland's waterways.

Where Children Play - Children play on the floor, on grass or in the dirt – all 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 may remain there at detectable levels for a year.⁵ Children playing on a treated lawn or playing field will get insecticides and herbicides on their skin. In addition to skin exposure, young children who frequently put their hands in their mouth may ingest lawn care and indoor pesticides. Children at age four put their hands to their mouths as much as 19.4 times per hour.⁶

In the home, items such as flea collars and mothballs may release contaminants into the air where children inhale them.⁷ A 2012 study found that children exposed to high levels of naphthalene, the active ingredient in mothballs and in deodorizers for diaper pails and toilets, are at increased risk for chromosomal aberrations associated with increased cancer risk in adults.⁸ Outdoors, pesticides sprayed for mosquito control purposes, such as the possible carcinogen permethrin, or on crops, may be picked up by the wind.⁹

Farm and Farmworker Family Exposure

- Children living on or near farms face more serious health hazards because they are regularly exposed to seasonal pesticide applications. A 2009 study found a significant association between the season of elevated agrichemicals (April-July) and birth defects.¹⁰ Calculating children's pesticide exposure in Maryland is difficult, but based on the Maryland Department of Agriculture's last pesticide use data report, done in 2004, over 10 million pounds of pesticides were used by farm operators, certified private applicators, commercial applicators and public agencies in the state in just one year. The data were collected through a voluntary survey that achieved approximately a 55% response rate, and thus under-represents total annual pesticide use.¹¹ In Maryland, there is no up-to-date comprehensive database available to public health experts on what, when and where pesticides are used. Thus, it is impossible to link pesticide exposures and children's health.

A study of children in two farming areas in Mexico provides evidence that chemical mixtures in use today affect cognitive development. Farmers in the Yaqui Valley have used pesticides since the 1940s, while farmers in the foothills avoided pesticide use. While the children did not differ in physical growth, those exposed to high levels of pesticides were less able to perform basic tasks and showed behavioral problems. Heavily exposed children were deficient in stamina, balance, hand-eye coordination and short-term memory, compared to less-exposed counterparts.¹²

Overview of Health Impacts

Pesticides can cause or make worse: asthma, nausea, vomiting, diarrhea, numbness, headache, dizziness, eye, nose and throat irritation, change in vision, fatigue, muscle and joint pain, numbness, mental confusion, contact dermatitis, blisters and skin burns.

Long-term potential consequences of pesticide exposure from even one exposure at a critical stage of fetal development

include certain cancers, birth defects, miscarriages, respiratory, neurological, developmental, learning and behavioral problems and immune system disorders. A study published in the Journal of the National Cancer Institute found that household and garden pesticide use can increase risk of childhood leukemia as much as sevenfold.¹³

A study published in Environmental Health Perspectives found that children exposed to herbicides in their first 12 months were 4½ times as likely to develop asthma. Children exposed to pesticides in general were nearly 2½ times as likely to develop asthma.¹⁴ Animal studies of common pesticides have demonstrated a link to hyperactivity, slower reflexes, impaired brain growth and motor dysfunction.¹⁵ In some cases, impacts were

observed only when exposure occurred at key points during development, but in others exposure at any time caused damage. Youngest children are most vulnerable, but exposure is also a problem through teen years, as the brain nears maturity.

Pesticide exposure harms brain functions and the nervous system, recent research indicates. In particular, neurotoxic pesticides contribute to rising rates of attention deficit/hyperactivity disorder (ADHD), autism, as well as declines in measures of cognitive function, such as IQ. During fetal development, exposure to neurotoxic pesticides can fundamentally alter brain structure. These impacts often are irreversible because the brain cannot repair damaged cells.¹⁶

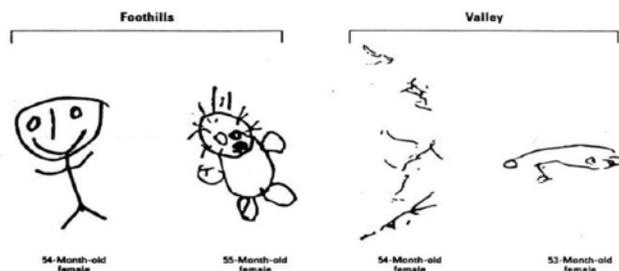


Figure 1. Representative drawings of a person by 4-year-old Yaqui children from the valley and foothills of Sonora, Mexico. Source: Dr. Elizabeth Guillette - used by permission.

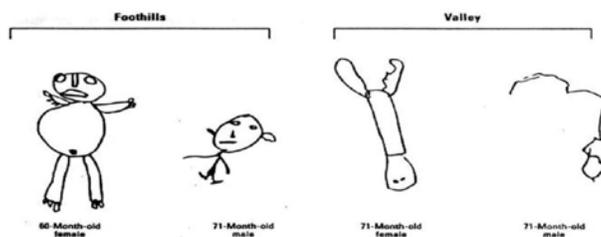


Figure 2. Representative drawings of a person by 5-year-old Yaqui children from the valley and foothills of Sonora, Mexico. Source: Dr. Elizabeth Guillette - used by permission.

About one third of all neurobehavioral disorders, including autism and ADHD, are caused either directly by pesticides and other chemicals or by interaction between environmental exposures and genetics, according to the National Academy of Sciences.¹⁷

In addition, exposure of mothers and fathers in agricultural areas during peak pesticide spray season has been linked with increased birth defect risk, when exposure occurs close to conception.¹⁸ And the Centers for Disease Control and Prevention Fourth National Report on Body Burden, published in 2009,¹⁹ found that exposure to synthetic pyrethroids remains widespread. This was found in more than 50% of subjects tested, based on blood and urine samples collected from some 2400 people who participated in CDC's National Health and Nutrition Examination Survey (NHANES).

Permethrin is commonly used by the Maryland Department of Agriculture in communities that sign up for mosquito control. It is also found in some treatments for lice. Exposure to synthetic pyrethroids has been reported to trigger asthma, and lead to headaches, dizziness and nausea.

The National Cancer Institute found that household and garden pesticide use can increase risk of childhood leukemia as much as sevenfold.

There also are serious chronic health concerns related to synthetic pyrethroids. EPA classifies both permethrin and cypermethrin as possible human carcinogens. Many synthetic pyrethroids such as Bifenthrin, which is used to combat ticks – as well as for indoor pest management by pest control companies – have been linked to endocrine system disruption. This can adversely affect reproduction and sexual development, interfere with the immune system and increase chances of breast cancer.

Triclosan, an antibacterial pesticide used in products from countertops to toothpaste, was found in the urine of 75% of the U.S. population. Triclosan is shown to alter thyroid function, is linked to compounded antibiotic resistance, and contributes to contamination of surface waters and sewage sludge. Other studies have found that triclosan and its metabolites are present in fish, umbilical cord blood and human milk.

In the third National CDC Body Burden study testing 3,000 people, 90% had 5 to 16 pesticides in their bodies. Some 76% had the pesticide permethrin and 76% had the pesticide chlorpyrifos (an organophosphate) in their bodies. Most of the 6-to-11 year old children tested had very high levels of pesticides in their bodies – four times the amount deemed acceptable by EPA.²⁰

Pesticides and Childhood Health Harms

Pesticides	Childhood Health Harms					
	Brain & nervous system impacts	Childhood cancers	Birth defects	Reproductive & developmental harms	Metabolic effects (e.g., obesity, diabetes)	Immune disorders, asthma
Herbicides 442 million lbs e.g., atrazine, glyphosate, 2,4-D	✓	✓	✓	✓		✓
Insecticides 65 million lbs e.g., chlorpyrifos, malathion, permethrin	✓	✓		✓	✓	✓
Fungicides 44 million lbs e.g., mancozeb, chlorothalonil	✓	✓	✓	✓		✓
Fumigants 108 million lbs e.g., metam sodium, methyl bromide, chloropicrin	✓	✓		✓		✓

Researchers have linked exposure to various pesticides with a range of childhood health harms. A ✓ indicates that links to health harm are particularly well supported by scientific evidence. Source: PANNA – used by permission.

Recent Research

A growing and convincing body of research underscores that pesticide exposure can adversely affect a child's neurological, respiratory, immune, and endocrine system, even at low levels. Just over the last few years, for example:

Birth Defects. There is a strong seasonal correlation between birth defects and the herbicide atrazine in surface water, according to a nationwide review of USGS water data and CDC birth defect records. When elevated atrazine concentrations are present between April and July, infants conceived at that time have a significantly higher birth defect risk.

The risk of birth defects of the brain and spinal cord also has been linked to pesticide exposure. This risk is increased if insecticide bombs or foggers are used in the home during the period of conception, if women live within a quarter mile of a cultivated field where pesticides are sprayed.²¹

Brain abnormalities. In April 2012, researchers reported that babies exposed in utero to a common insecticide have brain abnormalities after birth.²² The insecticide chlorpyrifos (used in agriculture, mosquito control and golf course management), is well documented as inducing neurodevelopmental abnormalities in infants exposed in their mother's womb, including ADHD, cognitive deficits, and serious learning, behavioral or emotional disorders. The Maryland Department of Agriculture last reported that 237,508 pounds of Chlorpyrifos were used in 2004.

In 2012 a Duke University School of Medicine study confirmed the highly toxic effect of piperonyl butoxide (PBO), a chemical "synergist" used to increase the potency of more than 700 pesticides – including those used in mosquito and community spray programs and homes. PBO disrupts a biological signaling system "critical in neurological development."²³

Pregnancy impacts. Another April 2012 study found exposure of pregnant women to organophosphate (OP) pesticides may affect both length of pregnancy and birth weight.²⁴ In some cases, household use of OPs has been cancelled because of extreme health risks to children. But agricultural, golf course and mosquito control uses continue. According to EPA, approximately one million pounds of malathion, an OP, are applied annually for residential uses. The OP Naled is also used in Maryland's mosquito control program.

Attention deficit. ADHD now affects three to seven percent of all school children in the U.S., according to CDC. Studies have found links to a variety of environmental contaminants, including exposure to organophosphate and pyrethroid insecticides during pregnancy and throughout childhood.²⁵

Organophosphate metabolites at levels commonly found in the bodies of U.S. children are linked to increased likelihood of ADHD. Every 10-fold increase of organophosphate metabo-

lite levels in the urine of children aged eight to 15 years was associated with a 55% to 72% increased likelihood of the disorder. Prenatal organophosphate exposure has been linked to attention problems. Each ten-fold increase in a pregnant

mother's urinary concentration of organophosphate metabolites led to a five-fold increased risk her child would be diagnosed with ADHD by age five.

Cognitive development. Researchers using Magnetic Resonance Imaging on the brains of infants observed significant structural changes, including abnormal areas of thinning and enlargement, in those who had been exposed to chlorpyrifos during pregnancy. Three cohort studies released in 2011 document cognitive impairment caused by exposure to organophosphates in the womb, including a seven-point reduction in IQ by age seven.²⁶ Three-month-old infants who were most exposed to the pyrethroid pesticide synergist piperonyl butoxide, scored 3.9 points lower on the Bayley Mental Developmental Index, which is predictive of school readiness.²⁷

Asthma. In 2011, researchers concluded pesticides may increase the risk of developing asthma, worsen a previous asthmatic condition or trigger asthma attacks.²⁸ In a study of over 4,000 children from 12 southern California communities, exposure to pesticides in the first year of life increased the risk of being diagnosed with asthma by age five.²⁹

Endocrine disruption. Pesticides are registered by the US EPA based on the concept that 'the dose makes the poison'. A report published in April 2012^{30 31} documents extensive research showing that endocrine disrupting chemicals can be toxic to humans even in minute doses. Endocrine disrupting pesticides mimic or block estrogen, testosterone and other hormones. The study concluded that health effects "are remarkably common" when people or animals are exposed to low doses of endocrine-disrupting compounds and that low doses cannot be ignored. The health effects in people – from fetuses to aging adults – include links

Exposure of pregnant women to certain pesticides may affect both the length of pregnancy and birth weight.

to infertility, cardiovascular disease, obesity, cancer and other disorders. “Whether low doses of endocrine-disrupting compounds influence human disorders is no longer conjecture,” the report says.

To date, approved exposure levels have largely been based on what adults can tolerate rather than children’s developing bodies for registering pesticides. Further, the cumulative and synergistic effects of pesticides and other toxins have not been factored in. This lack of US EPA data on real-life impacts on children for registering products is now further faulted by this ground-breaking research.³²

Cancers. Childhood leukemia, non-Hodgkin lymphoma and childhood brain cancer risk rises as a result of home insecticide use during pregnancy, according to a review of 15 studies over the past two decades, as well as case-control studies. Moreover, children up to age 15 in areas with intense agricultural activity experienced significantly increased risk of childhood cancers.³³

Poor motor development. A recent study³⁴ has found a positive link between exposure to the pesticide propoxur and poor motor development in infants. At the age of two, children exposed to propoxur in the womb experience poor development of motor skills, according to a test of mental development.³⁵

Autism. Dr. Philip Landrigan and researchers at Mt. Sinai Medical Center in 2010 released a list of ten types of chemicals most likely to be linked to the development of autism. It includes both commonly used organophosphate pesticides and long lasting organochlorine pesticides.³⁶ In addition, research in New York City found that infants most exposed to chlorpyrifos, an organophosphate pesticide, in utero were much more likely to have developmental disorders – including autism – by the time they were three years old.³⁷ Another study³⁸ linked the pesticide Bifenthrin – an endocrine disrupting pesticide banned by the European Union, but used for the past two years in a Maryland state-sponsored study for reduction of Lyme Disease – with increased rates of autism.

Preventing Pesticide Exposure: Successes & Challenges Ahead

Schools and Day Care Centers

In 1998 the Maryland General Assembly passed the nationally ground-breaking Integrated Pest Management (IPM) in Schools law, which subsequently was expanded in 1999

to include outdoor grounds care. It is an example of how the state can assist in reducing childhood exposure to pesticides. The law requires public schools to focus on non-chemical methods and to use pesticides only as a last resort. Parents, students and employees are to be notified prior to any pesticide applications and after an emergency application. Notification must include potential adverse health impacts of pesticides being used. This law has been a model for the federal Schools Environmental Protection Act currently before Congress, as well as for state and local laws passed across the country.

Maryland’s Integrated Pest Management in Schools law – and its expansion in 1999 – is a national model for reducing childhood exposure to pesticides.

Implementation problems

However, anecdotal reports from parents and teachers indicate many schools are not properly implementing this law. Enforcement by the

Maryland Department of Agriculture is limited due to lack of staff. Thus our children continue to be at risk in schools. We need to find a better government strategy for ensuring enforcement. Additionally, there are no requirements for private schools or day care centers to practice IPM.

Hospitals

A 2006 IPM in Health Care Facilities Project (co-sponsored by the Maryland Pesticide Network and Beyond Pesticides) hospital survey revealed an overall reliance on toxic pesticides. Of 25 pesticides used at facilities, 11 are linked to cancer, 10 with reproductive effects, 12 with neurological effects, five with developmental and birth defects and 12 are irritants. Babies, children and pregnant women in hospitals are particularly at risk of exposure of pesticides:

- A child hospitalized for a severe asthma attack can unknowingly be exposed to a pesticide that exacerbates asthma applied in a children’s pulmonary ward;
- A child with cancer may be exposed to a pesticide linked to certain cancers;
- A newborn is particularly vulnerable to toxic exposures in its first few days of life;
- A pregnant woman’s exposure to certain pesticides at a critical stage of fetal development can have life-long impact.

A growing number of health care facilities in our state are transitioning from conventional pest management with reliance on pesticides to IPM. The IPM in Health Care Facilities Project in collaboration with the Maryland Hospitals for a Healthy Environment (MDH2E) have been assisting health care facilities in making this transition since 2006. In 2010, Springfield Hospital, a state facility, was recognized by the Project and MDH2E for having transitioned to a pesticide-free campus.

In 2011, Johns Hopkins Bayview Medical Center received the award for exemplary implementation of IPM, and in 2012 it was given to the University of Maryland Medical Center.

Health care facilities – including hospitals, nursing homes, rehab centers and schools for autistic children – need to ensure children and adults are protected from unnecessary exposures.

Lawn Care- Residential and Government Land

Maryland residents tend to rely on professional companies for lawn care, which for the most part practice conventional pest and weed control. The Maryland Pesticide Network has received reports from customers that commercial companies say a pesticide is safe, even though it is not. Indeed, it is illegal for a pest control company to state that any pesticide is safe.

The state of Maryland is taking steps to reduce unnecessary pesticide use on state land, as have the cities of Greenbelt and Baltimore. In 2012, the state and Baltimore city established demonstration sites on government land to underscore the viability of pesticide-free and phosphorus-free land care to protect public health and the Bay.

Food & Consumer Products

Pesticides are found in not only in conventionally grown food, but also in cleaning, cosmetic, baby care, antimicrobial and other consumer products. Understandably, the public tends to believe that because chemicals are registered for use, they are ‘safe.’

Parents have choices to buy organic food and non-chemical products. But they must be well informed and have access to alternatives. In other categories of consumer goods, choosing non-toxic products may not be practical. While green cleaning alternatives are not necessarily more expensive, organic foods usually involve added cost. Relying on consumer choice is not sufficient; government’s responsibility is to protect all families from known toxic products.

Pesticide Registration

Pesticides are registered based on a risk/benefit ratio – risk to human health vs. benefit to intent of product. Often human health risk is outweighed by the benefits of a product’s effi-

cacy. The benefits may not be to the consumer, but to the manufacturer. Risk/benefit allows a certain amount of risk in exchange for calculations of benefit and uses a threshold of harm that can vary at EPA discretion. While children exhibit higher vulnerability than adults to pesticide exposure, risk assessments for most pesticides in use do not fully take this into account. The “unreasonable adverse effects” standard of safety in FIFRA allows EPA to accept risk levels among the population.

The vast majority of pesticide products registered for use by EPA and state governments have never been tested for the full range of human health effects, such as cancer, birth defects, genetic damage, reproductive effects, neurological disorders and endocrine disruption. Pesticides can be registered even when they have been shown to cause adverse health effects. There is no way to predict effects on children based solely on EPA’s method of toxicity testing in laboratory animals.

Additionally, pesticides are registered by EPA based on the paradigm that the “dose makes the poison” and that there are safe thresholds of exposure. National Institute of

Environmental Sciences Director Dr Linda Birnbaum urges, “It is time to start the conversation between environmental health scientists, toxicologists and risk assessors to determine how our understanding of low-dose effects and ... the way risk assessments are performed for chemicals with endocrine-disrupting activities.”³⁹

Most Canadian provinces have outlawed use of cosmetic lawn care pesticides in order to protect public health and waterways.

Maryland needs a mandatory pesticide usage reporting system to enable public health experts to identify links between pesticide use and unusual clusters of cancer, autism, ADHD and birth defects.

Inadequate Data for Monitoring, Assessing and Preventing Health Impacts

Health care providers are required to report suspected pesticide injury to local county health departments, who then must report to the Maryland Department of Health and Mental Hygiene. However most health care providers are unaware of this. Therefore, state and county authorities need to regularly alert health care providers about this reporting requirement.

Maryland lacks a central on-line, timely, database of information that our state agencies and public health experts can access to determine what, when and where pesticides are being applied commercially within the state. Without this data, we cannot

ascertain the occurrence and impact of pesticide runoff on our waterways and the link between pesticide use and health impacts. This data is critical to enable public health experts to assess changes in incidence patterns and unusual clusters of cancers, autism, ADHD, birth defects and other health impacts.

The Maryland Department of Agriculture is conducting a voluntary survey of certified applicators and farmers once every five years to collect pesticide usage information. The report to be published in 2013 will only be available in printed copy. The last MDA voluntary usage survey published in 2004 had only 55% of applicators reporting. This means the current voluntary system provides unreliable data and fails to meet the needs of

scientists and public health experts seeking to assess the pesticide impacts on watersheds and communities.

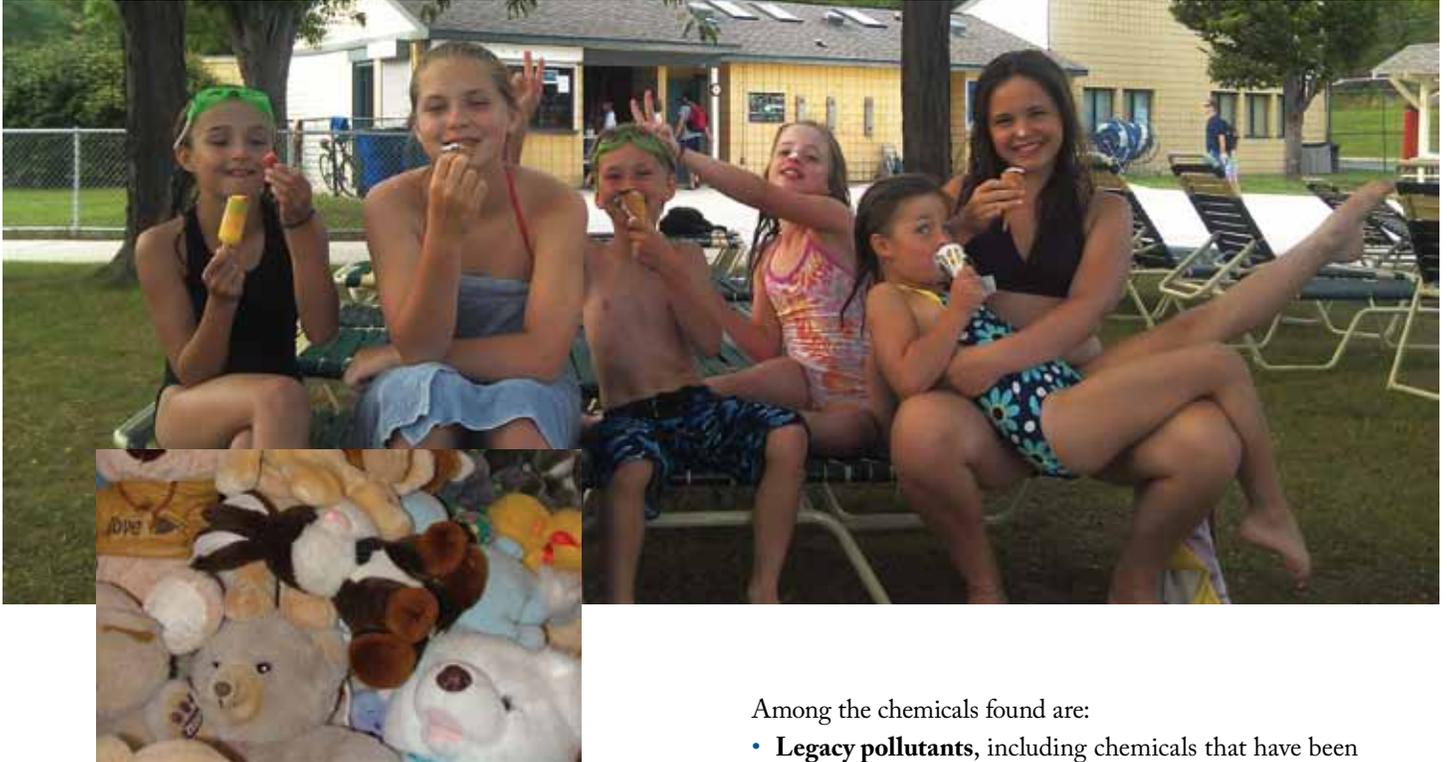
Pesticide Applicators - Mandatory Reporting

Maryland needs a mandatory pesticide usage reporting system requiring applicators (other than homeowners) to submit usage data annually. An easily accessed centralized database should allow experts to assess the impact of pesticides on health and the Bay. This would provide critical information for protecting children by identifying pesticides-of-concern linked to clusters of health impacts in communities. Bay restoration also would be supported by associating fish kills, fish diseases and water pollution with specific pesticides.

“By their very nature, most pesticides create some risk of harm. [They] can cause harm to humans, animals or the environment because they are designed to kill or [harm]... living organisms.”

– U.S. Environmental Protection Agency

CHEMICALS AND OTHER TOXICS IN CONSUMER PRODUCTS AND THE BUILT ENVIRONMENT



More than 85,000 industrial chemicals are on the market in the United States. While many chemicals have had undeniable benefits for society, from improved medical care to increases in economic productivity, these benefits have come with unintended consequences – harming our health often without our knowledge or consent.

Scientists studying the effects of toxic chemicals on living organisms have discovered hundreds of substances that can harm human health by interfering with development. These chemicals can interfere with the transmission of signals within and between cells, the building blocks of life, or damage important parts of cells, from genetic material to key proteins. The Centers for Disease Control and Prevention report that measurable quantities of 200 high-production-volume chemicals have been detected in the blood and urine of virtually all Americans.⁴⁰ Independent biomonitoring has also detected more than 200 chemicals in pregnant women⁴¹ and newborn infants.⁴²

Scientists have detected more than 200 chemicals in pregnant women and newborn infants.

Among the chemicals found are:

- **Legacy pollutants**, including chemicals that have been banned in the United States for more than 30 years but can still be found in our bodies today, such as polychlorinated biphenyls, or PCBs, a class of chemicals that was often used as coolants or insulating fluids.
- **Bisphenol A**, a chemical originally invented as a synthetic estrogen hormone and now used in polycarbonate plastics and found in countless consumer products.
- **Phthalates**, a class of chemicals often added to polyvinyl chloride (PVC) plastics for flexibility and found in some personal care products.
- **Toxic Flame Retardants**, including PBDE flame retardants and replacement chemicals used extensively in foam and plastic consumer products.
- **Non-stick and non-stain chemicals**, used in products like Teflon pans and stain-resistant carpeting.
- **Dioxins and furans**, byproducts of burning chemicals containing chlorine, such as polyvinyl chloride (PVC) plastic.
- **Metals**, including lead, mercury, cadmium and arsenic, in consumer products, food, water and air.

How Our Children are Exposed

Not all toxic chemicals enter the environment dripping from a factory waste pipe, leaking from a hazardous waste dump at the edge of town, or billowing into the air from an incinerator smokestack. Products containing hazardous materials are made in factories and shipped to our homes and offices, increasingly becoming a part of our daily lives. Objects and products in the home can release toxic chemicals that then circulate through indoor air or accumulate in household dust, becoming a part of our bodies.⁴³

Bisphenol A, or BPA, was originally invented as a synthetic estrogen hormone. It became commonplace in the manufacture of polycarbonate plastics. While BPA does not accumulate in the body, people are continuously exposed to it. The chemical is so ubiquitous in society that tests almost always find it in the blood, tissue, and urine of adults and children across the United States.⁴⁴ Although Maryland now bans the use of BPA in certain children's products, there remain many ways Marylanders are exposed:

- Contact with paper goods including paper receipts, toilet paper and paper towels, and newspaper.⁴⁵
- Consuming food or liquid from metal cans, the linings of which are known to leach BPA.
- Drinking from polycarbonate plastics, used in office water coolers or in older Nalgene bottles.

Bisphenol A can also be transferred in utero; the chemical travels across a pregnant woman's placenta and into the blood of the child in her womb.⁴⁶ Market forecasters predict that industry will manufacture 14 billion pounds of the chemical per year by 2015.⁴⁷

Flame Retardants. Most polyurethane foam in furniture and plastics in computers and electronics contain flame retardants. One of the most common classes is polybrominated diphenyl ethers, or PBDEs. PBDE flame retardants build up in fatty tissue and do not readily leave the body. As a result, these chemicals have been building up rapidly in our bodies – despite the fact that many states have taken action to ban certain types of flame retardant chemicals.

While PBDE flame retardants are no longer used in household products, the chemicals still exist in our homes, schools, and offices. New products may contain harmful alternatives such as chlorinated Tris, or untested mixtures of chemicals with unknown health effects.⁴⁸ Chlorinated Tris (TDCPP) has a long history of problems: it was used in children's pajamas in

the 1970s until it was found to be mutagenic and potentially cancer-causing. TDCPP is now one of the leading chemicals used to treat polyurethane foam for flame resistance, and by 2006 over 10 million pounds were produced or imported into the United States on a yearly basis.⁴⁹

Exposure to flame retardant chemicals can come from a variety of sources:

- Upholstered furniture, bedding and certain electronic devices contribute to exposure to toxic flame retardants in household dust and in automobile dust.⁵⁰
- Young children in particular may be prone to ingesting contaminated dust – surveys show children have 10 times as much PBDEs on their fingers as adults.⁵¹
- Recent product testing indicates that chlorinated Tris is far and away the most prevalent flame retardant in children's products including car seats, nursing pillows, strollers, and co-sleepers.⁵²

Phthalates are a group of chemicals including diethyl phthalate (DEP), diethylhexyl phthalate (DEHP), and dibutyl phthalate (DBP). The polyvinyl chloride (PVC) plastic industry uses

phthalates as additives to improve flexibility in such products as home siding, flooring, furniture, food packaging, toys, clothing, car interiors, and medical equipment including IV bags. Other manufacturers use phthalates in personal care products such as soaps, shampoos, hand

lotion, nail polish, cosmetics and perfumes.⁵³

- According to the National Institutes of Health, children can be exposed to phthalates by chewing on soft vinyl toys, by breathing household dust that contains phthalates, or using IV tubing or other medical devices made with phthalates.⁵⁴
- Use of products such as shampoos, perfumes, lotions, and nail polish can lead to skin absorption of phthalates.⁵⁵ One study found that the more lotions, powders and shampoos parents used on their babies, the higher the level of phthalates that showed up in the babies' urine.⁵⁶
- Just about every American has a variety of phthalates in his or her body. In 2009, the U.S. Centers for Disease Control and Prevention found measurable levels of 12 different phthalate compounds in urine samples from thousands of Americans.⁵⁷

Non-stick and stain-resistant chemicals including perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and related compounds are used to make non-stick cookware, found in grease-proof food packaging, and stain-proof coating on clothing and carpeting.

Products containing hazardous materials are made in factories and shipped to our homes and offices, increasingly becoming a part of our daily lives.

- According to the CDC people are most likely exposed to PFOA by drinking contaminated water sources. CDC scientists found PFOA in the serum of nearly all the people tested, indicating that PFOA exposure is widespread in the U.S. population.⁵⁸
- A 2012 study found that older children have higher levels of PFC chemicals found in anti-stick products than younger children.⁵⁹ Older children may have higher levels due to accumulation of the chemicals over time.

Formaldehyde is a toxic chemical widely used in furniture, cabinets, countertops, insulation, wallpaper, paints, and paneling. It is present in consumer products, such as antiseptics, medicines, cosmetics, dishwashing liquids, fabrics and fabric softeners, shoe-care agents, carpet cleaners, glues and adhesives, lacquers, paper, coatings, and plastics.⁶⁰

- When used in the home, formaldehyde-containing products can release the chemical into indoor air. In particular, products made from composite wood containing urea-formaldehyde glue tend to create indoor air pollution.⁶¹
- Formaldehyde off-gassing from building materials and other products can lead to indoor formaldehyde concentrations far exceeding outdoor levels, making childhood exposure common.⁶² In a recent California study, nearly all new single-family homes had indoor formaldehyde concentrations that exceeded guidelines meant to prevent cancer and chronic lung irritation.⁶³

Lead is a highly toxic substance, putting children at increased risk for learning disorders, behavioral problems, delayed growth, hypertension, and kidney disease.⁶⁴ Lead also affects the central nervous system, kidneys and the reproductive system, and is especially dangerous because symptoms are often not readily apparent.⁶⁵ Children are particularly vulnerable because they play on floors where lead dust accumulates.

- Deteriorating lead paint and unsafe renovations of older houses is a main source of lead exposure.⁶⁶ 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.
- Children may also be exposed in school, in products, drinking water, air, soil, and even toys and children's jewelry.⁶⁷ More than 200,000 Maryland children under age 6 are at risk of lead poisoning.⁶⁸

Overview of Health Impacts

Chemical exposures can interfere with key steps in human development in ways that likely contribute to a range of diseases, from birth defects to learning disabilities to cancer.

Cancer

The 2nd leading cause of death in the U.S. and in Maryland is cancer. In 2009 more than 26,000 Marylanders were diagnosed with cancer, and more than 10,000 died from cancer.⁶⁹ Recent research shows that early life exposures can increase the risk of cancer many decades later.

- At the University of Alabama, rats exposed to low doses of bisphenol A through mothers' milk at a young age developed increased susceptibility to breast cancer later in life.⁷⁰
- In laboratory animals, bisphenol A, dioxin, and perfluorooctanoic acid (PFOA) have been shown to alter gene expression and/or modify mammary gland development, increasing the later risk of cancer.⁷¹
- Parents who work in trades that increase their exposure to industrial solvents, or are exposed to solvents such as those in household paint, before or during pregnancy are more likely to have children that develop leukemia.⁷²
- Mothers with high levels of PCBs, hexachlorobenzene, and chlordanes were about 4 times more likely to give birth to sons that developed testicular cancer.⁷³

Premature Birth and Low Birth Weight

Children born prematurely and undersized face more challenges growing up, including a greater risk for hospitalization due to infections throughout childhood, reduced intelligence, and behavioral problems, including attention deficit hyperactivity disorder (ADHD).⁷⁴ Growing evidence links birth outcomes with chemical exposures:

- In a 2012 study, exposure during the month of conception to a phthalate common in plastics was linked to miscarriages among women attempting to become pregnant with their first child.⁷⁵
- In 2009, the University of Michigan found that women in Mexico City with higher levels of phthalates in their blood during the third trimester were twice as likely to have their babies early as pregnant women with lower phthalate levels.⁷⁶
- Women living near a factory that manufactures anti-stick chemicals (specifically perfluorooctane sulfonate or PFOS) with blood levels of the chemical above the median were 50 percent more likely to have had a child with low birth weight, and 10 percent more likely to have given birth prematurely than women with lower exposure.⁷⁷
- Infants born in Baltimore who had higher levels of non-stick chemicals in their umbilical cord blood were more likely to be smaller than less exposed babies. Nearly every baby tested had detectable levels of the toxins in their blood.⁷⁸

Early Puberty

Since 1980, the average age of first menstruation has advanced by 3 to 5 months, and the average age of breast development has advanced by 1 to 2 years.⁷⁹ The cause of the trend toward earlier puberty in girls is unknown, but exposure to toxic chemicals could be an important factor.⁸⁰ A 2005 review of the scientific evidence found that a variety of compounds had the potential to affect puberty timing.⁸¹

- When pregnant mice are fed very small doses of bisphenol A, their female offspring tend to grow larger and menstruate earlier.⁸² Rats exposed to bisphenol A after birth develop long-lasting changes to reproductive hormone levels which contribute to early puberty and aberrant ovulation patterns.⁸³
- Girls exposed to high levels of dichlorobenzene had their first period seven months earlier than girls with lower exposures. For those with the highest levels of dichlorobenzene metabolites in their urine, the average age of first menstruation was 11.8 years, while for girls with the lowest levels it was 12.4 years, or more than seven months later.⁸⁴
- Puerto Rican girls experience the highest rates of premature breast development ever recorded. The University of Puerto Rico looked for foreign chemicals in blood samples from a group of very young girls with premature breast development (average age of 31 months). The phthalate DEHP was seven times higher in girls with premature breast development than in the control group.⁸⁵ The younger girls are when they enter puberty, the greater their risk of breast cancer later in life.⁸⁶ Many scientists conclude that earlier development may not be healthy and may indicate environmental problems that need to be further researched and addressed.

Obesity, Diabetes and Heart Disease

In the United States overall, the number of overweight children between 2 and 5 years of age grew from 5.0 percent in the 1970s to 10.4 percent in 2007. The overall prevalence of this condition in children and adolescents quadrupled in the past four decades.⁸⁷

The fact that obesity is increasing in very young people as well as adults points to events in child development that could predispose people towards obesity. Starting in the womb, hormonal signals direct the development of fat tissues that take up and store energy in the body. Chemicals that interfere with these signals could influence the development of these tissues in ways that increase the odds of developing metabolic diseases later in

life. Researchers call toxic chemicals with this effect obesogens.

- In 2002, researchers in Japan first discovered that bisphenol A can trigger the conversion of fiber cells into fat storage cells.⁸⁸ Combined with insulin, bisphenol A increased the fat content of cells by 1,300 percent.
- A survey in Japan found that people with the highest body levels of dioxin and PCBs were five times more likely to have metabolic problems including obesity, glucose intolerance, or high blood pressure – symptoms connected with diabetes and heart disease.⁸⁹
- In 2007, researchers found that Americans with higher levels of persistent pollutants – including many organochlorine pesticides and PCBs – were more likely to have insulin resistance, thus a higher risk of developing type 2 diabetes.⁹⁰

Learning and Developmental Disabilities

The number of American children with learning and developmental disabilities has been climbing over the past decade, reaching nearly one in six by 2008. The increasing prevalence of autism and attention deficit hyperactivity disorder accounts for most of this change.⁹¹ The National Academy of Sciences estimates that environmental factors, including exposure to toxic chemicals, along with genetic susceptibility, cause or contribute to at least 25% of learning and developmental disabilities in American children.⁹²

- A recent study shows that exposure to BPA and phthalates can cause behaviors similar to those of children with ADHD, including difficulty with interpersonal skills and decreased social awareness.⁹³
- In 2010, Cincinnati Children's Hospital Medical Center found girls whose mothers had high BPA levels during pregnancy were somewhat more aggressive than normal; boys were more anxious and withdrawn.⁹⁴
- Mt. Sinai School of Medicine found children of mothers with higher urine levels of phthalates during pregnancy were more likely to show symptoms of ADHD and behavior problems.⁹⁶ Newborn girls of mothers with high phthalate levels were more likely to show decreased levels of attention and alertness.⁹⁷
- Researchers at Harvard and Boston University found that higher levels of non-stick chemicals in blood samples were associated with a doctor's diagnosis of ADHD.⁹⁸
- Moderate lead exposure during childhood can cause irreversible brain damage.⁹⁹ Even exposures under the CDC's "safe" level (10 mcg/dL) can have detrimental effects on children's intelligence.¹⁰⁰ Lead can inhibit learning and cognitive function, altering neural development.¹⁰¹ A 2011 study found that childhood exposure to even low levels of lead can affect IQ in adulthood.¹⁰²

Asthma

The rising rates of asthma and allergies cannot fully be attributed to dirtier air or exposure to more cockroaches or dust mites. Asthma care imposes large costs on Maryland citizens and its health care system. Exposure to chemicals may be playing a role in the incidence of the disease.

- In 2008, scientists in Denmark found an association between phthalates in indoor dust and wheezing among preschool children. A higher level of DEHP was found in homes of children with asthma symptoms. The presence of PVC flooring in the child's bedroom offered the strongest prediction of asthma symptoms.¹⁰³
- People with the highest level of formaldehyde exposure in a 2011 study were 3.5 times more likely to have asthma than those with the lowest level of exposure.¹⁰⁴ Recent scientific studies confirm that children chronically exposed to elevated levels of airborne formaldehyde face an increased risk of developing allergic sensitivities and/or asthma.¹⁰⁵
- In 2009, researchers at the University of Texas found that mice born to mothers who had been exposed to bisphenol-A during pregnancy were more likely to develop asthma.¹⁰⁶ Penn State College of Medicine found at 6 months, infants whose mothers had high levels of BPA during pregnancy were twice as likely to wheeze as babies whose mothers had low levels of BPA.¹⁰⁷

Additional information on asthma can be found in the Air Pollution section.

Preventing Exposure: Successes & Challenges Ahead

Maryland has been a leader in banning dangerous chemicals. Five children's health bills have become law with the signature of Governor Martin O'Malley. In 2010 the Maryland General Assembly banned the use of BPA in baby bottles and toddler cups. In 2011, the General Assembly also banned the sale, manufacture, or distribution of baby formula packaging containing BPA, making Maryland the second state to restrict BPA in infant formula. A ban on decaBDE, linked to cancer and hyperactivity disorder, was achieved in 2010. Cadmium was restricted from children's toys in 2011, and health standards for cleaning products in public schools were improved in 2012.

Maryland, like other states acting to protect children from toxic chemicals (Maine, Oregon, Michigan, and Connecticut, to name a few) has acted where the federal government has not. The Toxic Substances Control Act (TSCA), the nation's primary chemical safety law, has failed to protect public health and Maryland families. Under TSCA, the EPA has severely limited authority to restrict or ban chemicals of concern. The "unreasonable risk" standard in the TSCA has been so burdensome that EPA has not been able to remove chemicals from the market except when

there is overwhelming evidence of potential harm. In fact, in the thirty-five years since its passage, only five chemicals have been controlled under the act.¹⁰⁸

Maryland families deserve protection from chemicals that can cause harm.

Maryland families deserve protection from chemicals that can cause harm, or, at the very least, have the right to know about those chemicals that can cause harm. However, in reality, state officials have few effective tools to protect public health from chemical hazards or address the broad impacts of toxic chemical exposure. Lawmakers in Washington, D.C. should work together to pass a reform bill that will provide public health protections based on the best science. But there is much we can do to protect children right here in Maryland.

Maryland should support research and innovation in the field of green chemistry, making Maryland a leader in safe product development. Safe alternatives to toxic chemicals are possible as the growing field of green chemistry demonstrates. Maryland can reduce our exposure to toxic chemicals in our everyday environments, promote innovation and jobs in fields like green chemistry, and protect public health.

Maryland should ensure public information about chemicals and their uses. The public has a right to know about potential hazards to health and the environment, and routes of exposure. Businesses and consumers should be able to compare the safety of chemicals and create demand for safer alternatives.

Maryland should empower regulatory agencies to restrict or ban the worst chemicals of concern. Where chemicals show evidence of intrinsic hazard, regulators should restrict or prohibit the use of these chemicals and require the substitution of safer alternatives, particularly in products and applications that lead to children's exposure.

FRACKING — UNCONVENTIONAL SHALE GAS EXTRACTION



Tap Water from a home near a PA Gas Drilling Site

As Pennsylvania and West Virginia actively pursue a new form of energy extraction, there is growing interest in the question of Maryland’s participation. Horizontal hydraulic fracturing, commonly called “fracking”, is a relatively new process to extract natural gas from underground shale deposits.

Although the gas industry uses the word “fracking” to refer to a narrow portion of the total process, in this report we will use the term broadly to cover the shale gas industry and its technology. Currently, fracking is not taking place in Maryland, but the Marcellus Shale and potentially other Maryland shale formations are targets of shale gas development.¹⁰⁹ With an Executive Order on June 6, 2011, Governor O’Malley established the Marcellus Shale Safe Drilling Initiative Advisory Commission.¹¹⁰ A factsheet issued by the Maryland Department of the Environment clarifies that this order does not establish a moratorium but does mandate that a study of fracking impacts be conducted.¹¹¹

The Governor’s fracking advisory commission “will assist State policymakers and regulators in determining whether and how

gas production from the Marcellus Shale in Maryland can be accomplished without unacceptable risks of adverse impacts to public health, safety, the environment, and natural resources.”¹¹² The commission’s final report is due in August 2014. The membership of the commission does not include a public health or medical professional.

This commission is charged with assessing 18 specific issues related to fracking, ranging from well spacing to greenhouse gas emissions. A recent call for a thorough study of the health, environmental, and economic impacts of fracking proposes that this study be made mandatory through statute. Other issues related to the future of fracking in Maryland are also being raised including a state-wide ban and a prohibition against disposing in Maryland the toxic wastewater from other states. The impacts on children throughout our state should be a consideration in assessing these issues and establishing Maryland policy.

Health Impacts on Children

How would fracking affect the children of Maryland? While industrial installations are increasing throughout rural Pennsylvania, few studies have thoroughly assessed the implications for children. To date, no states have conducted a comprehensive assessment of the impacts of fracking on human or animal health in a state. Yet health concerns are raised frequently by those living in areas with gas drilling activity. In Maryland,

the impact of this industry will also likely be felt by proposals to build new LNG storage and transportation facilities to bring the extracted gas to the Port of Baltimore.

Hydraulic fracturing has been in use for decades. But recent innovations in the technology allow the oil and gas industry to drill horizontally into layers of shale previously inaccessible. The new methods involve injecting millions of gallons of fresh water mixed with toxic chemicals and sand deep underground at high pressure to break up rock and release gas. This has rapidly increased the number of new wells in the US. This rapid growth has also raised the number of instances of reported health and environmental problems.

Fracking is primarily regulated by states, because the natural gas industry was exempted from key federal provisions by the 2005 Energy Policy Act. These exemptions include the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, the National Environmental Protection Act, and the Superfund Law. Communities in New York have mobilized to ban fracking out of concern over the health and environmental consequences, and a moratorium in that state has been in place for four years.

The Marcellus region, one of the mostly highly targeted areas, lies under Pennsylvania, New York, West Virginia, Ohio, Maryland, and Virginia. Extraction of natural gas from shale deposits involves transporting large volumes of water and chemicals to well sites, building pipelines and drilling wells, installing diesel and other equipment that is operated 24 hours a day over the years of well exploitation, and disposing of toxic wastewater. The mechanisms by which human health is affected include air pollution, noise pollution, water contamination, community disruption, increased traffic, exposure to toxic chemicals, and release of greenhouse gasses that contribute to extreme weather events.

Fracking fluids contain benzene, toluene, ethylbenzene, and xylene.¹¹³ These chemicals are major air pollutants and are found on the EPA list of Hazardous Air Pollutants. The inhalation of trimethylbenzene, benzene and xylene can impair the nervous system.¹¹⁴ Even at low exposure levels, effects include dizziness, headaches and fatigue.¹¹⁵ At higher exposure levels, effects include numbness in the limbs, incoordination, tremor, temporary limb paralysis, and unconsciousness.¹¹⁶ Benzene alone causes anemia, blood disorders including acute and chronic nonlymphocytic leukemia, acute myeloid leukemia, and chronic lymphocytic leukemia.¹¹⁷ Exposure to ambient levels of benzene in pregnant women has recently been associated with spina bifida,

also known as myelomeningocele, a neural tube birth defect.¹¹⁸ Toluene is also harmful to fetal and child development.¹¹⁹

The Endocrine Disruption Exchange recently concluded that of the 944 products identified as having been used in fracking fluids, only 14 % had a known chemical composition.¹²⁰ For this subset, adverse health impacts included respiratory, immune, nervous, gastrointestinal and cardiovascular problems, as well as cancer.¹²¹ A study examining air emissions from drilling and fracking in Colorado reported higher cancer risks for residents living near natural gas operation sites,¹²² as well as higher levels of eye irritation, headaches, asthma symptoms, acute childhood leukemia, acute myelogenous leukemia, and multiple myeloma.¹²³

Additional information on health harms can be found in the Pesticides, Water, Air, and Chemicals & Toxics sections.

Evaluating these threats before Maryland allows fracking is an opportunity for Maryland's children to be a priority in policy-making from the outset, rather than for child health protections to be enacted piecemeal after harms have begun to materialize. The widely respected network of Pediatric Environmental Health Specialty Units (PEHSUs), based in academic centers across North America, issued a fact sheet in 2011 pointing out the lack of adequate human health studies and urging a precautionary approach.

*A distinct challenge in discussing these possible health effects is the lack of research regarding the human health effects of NGE/HF [natural gas extraction/hydraulic fracturing]. Most of the research to date focuses on ecosystem health. Because many questions remain unanswered, the PEHSU network recommends a precautionary approach*¹²⁴

In this fact sheet, the PEHSUs cite air pollution, water contamination, and noise pollution are key concerns and summarize the special vulnerability of children:

*Children are more vulnerable to environmental hazards. They eat, drink, and breathe more than adults on a pound for pound basis. Research has also shown that children are not able to metabolize some toxicants as well as adults due to immature detoxification processes. Moreover, the fetus and young child are in a critical period of development when toxic exposures can have profound negative effects.*¹²⁵

An October 2012 study by Earthworks' Oil and Gas Accountability Project is one of the first to systematically document the health impacts of fracking. The report *Gas Patch Roulette: How Shale Gas Development Risks Public Health in Pennsylvania* documents the results of health surveys of 108 individuals living in 14 counties and includes 34 air tests and 9 water tests. In addition to extensive animal health impacts, the survey participants reported a wide range of symptoms consistent with the known health effects of the contaminants found in the air and water near well sites. The study found an association between severity of health symptoms and proximity to gas wells.¹²⁶

The Earthworks air tests found 19 volatile organic compounds (VOCs) and more than half the water samples contained methane. It concluded that "there is a strong likelihood that residents who are experiencing a range of health problems would not be if widespread gas development were not occurring."¹²⁷ Because natural gas companies do not have to reveal the chemicals in use, a study of this kind is currently the only way to establish what chemicals humans are being exposed to and how symptoms of illness are correlated with exposure.

In Pennsylvania, a new law mandates that natural gas companies must reveal to physicians the chemicals that their patients have been exposed to, but doctors must sign confidentiality agreements to use the information only to treat their own patients. This has been seen as a "gag order" and the American Medical Association reported in August 2012 that the law is being challenged as a violation of First Amendment free speech rights.¹²⁸ In some Pennsylvania communities, expertise in diagnosing and treating environmental health diseases is inadequate to deal with the number of new cases.

In addition to the threats of pollutants, child health and well-being is also threatened when the social fabric of a community is disrupted. Pennsylvania communities have reported increases in crime, housing shortages, and increased demands on social service systems as a result of the influx of industrial workers into rural communities.

Fracking wastewater disposal poses risks to children as well. Municipal water sources have been compromised in Pennsylvania. Wastewater treatment plants do not eliminate radioactivity, which is released into the fracking fluids,¹²⁹ and most testing of municipal water supplies fails to detect the toxic chemicals used in fracking. The National Resource Defense Council concluded in 2012 that all currently available treatment and disposal methods are inadequate for fracking wastewater.¹³⁰ The disposing of wastewater in underground wells has

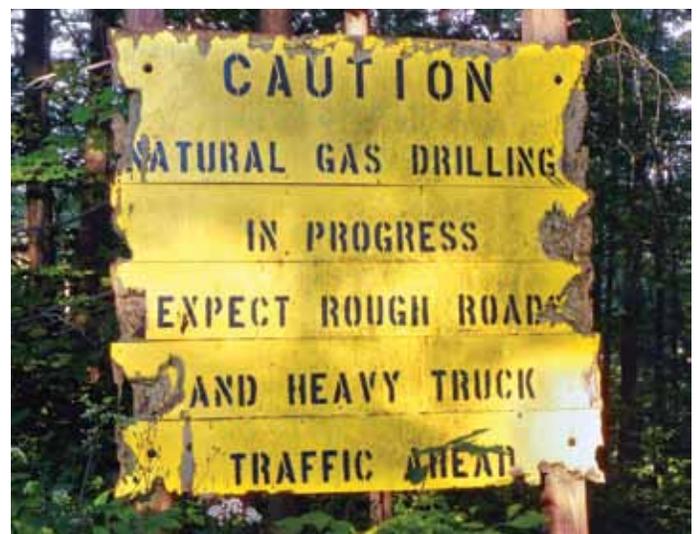
been linked to earthquakes by the US Geological Survey.¹³¹ This wastewater disposal method can change the subterranean structure of geological formations and threaten aquifers.

Maryland's Policy Opportunities

Maryland has an opportunity to put children's health, and all human health, in the forefront of policy-making, now before fracking is allowed. Maryland can insure that public health and medical experts are involved in assessing the impact of natural gas drilling; we can set a high standard for the kind of study to be performed before a decision is made whether to issue permits; and we can adopt protective measures and regulations based in sound science, that moderate the impact on our state of drilling activity in other states.

The Health and Environmental Funders Network in *Drilling Deeper* (September 2012) calls attention to the absence of public health and medical experts on fracking oversight commissions established by Pennsylvania and the US Secretary of Energy.¹³² An April 2012 concluded that recognizable public health experts were missing at both the state and national level in shale gas advisory commissions.¹³³ Maryland's analysis of the impact of fracking should be informed by a robust public health study, interpreted by a panel of qualified health researchers and policy analysts.

Advocates and policy-makers in Maryland are now calling for specific protections from fracking beyond the measures outlined in the Governor's Executive Order, ranging from an outright ban to a legal moratorium that could only be lifted by legislative action after a full study. One approach is to conduct a Health Impact Assessment (HIA) of fracking, a systematic analysis using data sources and analytic methods, with input from stakeholders.¹³⁴



The HIA is a formal tool that has been endorsed by the World Health Organization and the Centers for Disease Control and Prevention (CDC). Advocates concerned about the public health impacts of fracking in New York are calling for a Health Impact Assessment and in Maryland, Physicians for Social Responsibility is also proposing that this approach be embedded in the study being conducted by the fracking advisory commission.

Initiatives and policy priorities that focus on our watershed, the health of the Chesapeake Bay and the integrity of our water supply should also address fracking. During the 2012 legislative session, a measure to ban the transportation into and treatment of fracking wastewater in Maryland water treatment plants was introduced. The Bay and Maryland's drinking water could both be affected by allowing such treatment. Similarly, proposed natural gas pipelines and other infrastructure could disrupt ecosystems that are protective of human health such as forests and waterways.

Policies of other states regarding disposal of contaminated fracking wastewater will have an impact on Maryland. No matter what actions we take within our own borders, we live downstream from fracking in Pennsylvania and West Virginia. Maryland should monitor policies in Pennsylvania and take steps to protect the Bay and our sources of drinking water.

Assertions that fracking is important for Maryland's economy, growth of jobs, and future energy supply deserve to be given close attention. A stable economy contributes to the well-being of children at a most basic level. A far-sighted public health

approach to fracking will take into account the jobs creation impact of various forms of energy investment and production. But the jobs creation impact of the natural gas industry is less than that for renewable energy investments.

In 2011, the World Bank reported that the oil and gas industry creates 5.2 jobs per million of investment, as compared to 13.2 for wind and 13.7 for solar energy.¹³⁵ This report also cited an analysis of "job years" created per Gigawatt hour (GWh) of energy produced. For wind, solar, geothermal, and investments in energy efficiency, the job years produced were more than twice that produced from fossil fuel investment.¹³⁶ Maryland's pursuit of renewable energy sources such as offshore wind and community solar, as well as investment in energy efficiency measures, may have a much greater payoff for our economy, and hence for our children, than investing in natural gas.

Global warming remains possibly the most significant threat to the health and well-being of Maryland's children in the long run. Thus, our pursuit of a clean energy future, one that reduces

greenhouse gas emissions and our reliance on fossil fuels, is a legitimate and necessary step towards protecting our children's health. The discussion of global warming and climate change as a threat to children's health is offered in a separate chapter.

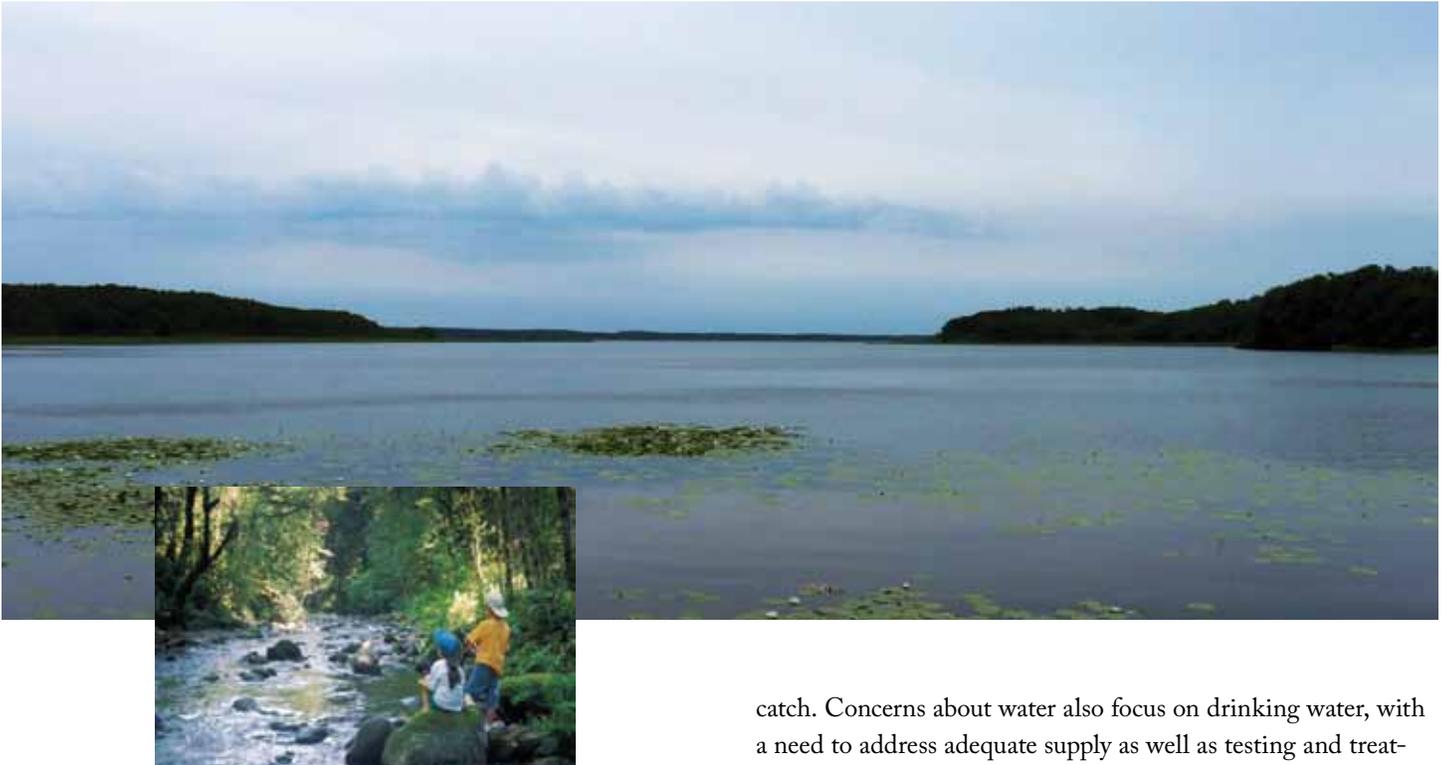
Fracking presents an opportunity for Maryland's children to be a priority from the outset in policy-making.

Hydraulic fracturing of shale deposits has rapidly evolved from an innovative and extreme form of energy extraction to a widespread and complex industrial process. Maryland should put the health and future wellbeing of our children at the head of our evaluation criteria as we determine the place of fracking, if any, in our economy and environment.

"The findings of this study stand in strong contrast to statements—often made by industry representatives and policymakers seeking to expand drilling—dismissing claims of health impacts as "personal anecdotes" and isolated incidents. Directly impacted people are frequently told that what they experience is a random occurrence and that some other source—traffic, lifestyle choices, family disease history, household products—is to blame."

—*Gas Patch Roulette: How Shale Gas Development Risks Public Health In Pennsylvania (Oct 2012)*

WATER AND CHILDREN'S HEALTH



Water is life. The human body can survive for weeks without food. Without water, death occurs in a matter of days. Access to fresh, clean drinking water is a staple of life, and must be one of the highest priorities to protect children's health.

In Maryland, the Chesapeake Bay is our iconic body of water, the largest estuary in the country and the destination for almost all water that runs off the lands of our state. While the Chesapeake Bay watershed spans six states and the District of Columbia, Maryland more than any other state can claim the Bay as our own. Much of our drinking water is drawn from tributaries to the Chesapeake Bay. Water contamination is also a threat to children if they are exposed as they swim, wade, search for tadpoles, or fish with a parent.

The Chesapeake Bay is closely allied with the well-being of our state and with the health of our population. For centuries Marylanders have harvested the abundance of fish and crabs from the Bay as an important food source. Today, high levels of pollution in the Bay and its tributaries threaten fish and crab populations and thus the livelihood of fisherman, as well as the health of amateur anglers and those with whom they share their

catch. Concerns about water also focus on drinking water, with a need to address adequate supply as well as testing and treatment methods for new contaminants.

How Children are Threatened by Water Contamination

Maryland is fortunate in having access to ample sources of fresh water, such as the Susquehanna and Potomac Rivers, and the Liberty and Tridelphia Reservoirs. Yet the quality of our drinking water is not assured. In 2009, the Washington DC based non-profit Environmental Working Group ranked Baltimore City as 69th in water quality out of 100 cities analyzed.¹³⁷ This ranking was based on 24 contaminants reported in city water samples between 2004-2008. Fifteen of these contaminant levels exceeded government health standards. Baltimore City's water quality can be a gauge for state water quality, since parts of other counties (Howard, Baltimore, Carroll and Anne Arundel counties) receive their water from the City.¹³⁸

The 2008 report, *Maryland's Children and the Environment*, issued by the Maryland Department of Health and Mental Hygiene and the Maryland Department of the Environment notes the frequency of non-compliance with drinking water standards in public water supplies.

In Maryland in 2004-2005, a range of 4-11% of children lived in areas served by water systems with violations in drinking water monitoring and reporting requirements."

And the report notes that “There is a significant data gap for private domestic wells, for which there is no routine water quality testing.”¹³⁹ As with other routes of exposure, children will be more vulnerable because they consume more water per unit of body weight than adults.

Drinking water may become contaminated in many ways. Maryland is home to four EPA Superfund sites: Aberdeen Proving Ground, Beltsville Agricultural Research Center, Fort Detrick and Fort Meade. These sites have been found to leach chemicals into the surrounding water table and pose health risks to families living in close proximity. Contaminants include solvents, heavy metals, tetrachloroethylene, trichloroethylene, explosives, arsenic, and pesticides.^{140, 141, 142, 143} Furthermore, these are not the only locations of concern. Wherever an industrial or agricultural process has taken place, leaching of byproducts into the water is a risk.

Contaminants of concern include microbial pathogens in sewage, chemical by-products of disinfection processes used to kill microbial pathogens, and lead released from indoor plumbing and run off from contaminated soil. When stormwater drainage systems are overwhelmed by heavy rains or floods, raw sewage may become mixed with rainwater. Creeks and streams that become contaminated with sewage can expose children to bacterial infections and viruses.

Additionally, children are at risk when drinking water sources receive new streams of contaminants and which cannot be effectively removed. This is the case with natural radioactivity which is released from deep in the ground when it comes up in fracking fluids. Likewise, pharmaceuticals and certain chemicals in personal care products are not effectively removed by water treatment plants.³

Nitrates from fertilizer and pesticides for agricultural and home use are significant pollutants in Maryland waterways. The prevalence of pesticides is exemplified by studies of atrazine, detected in 100% of water samples taken at 60 different stations spread across five different Bay tributaries.¹⁴⁴ Atrazine, a pesticide associated with intersex fish in our waterways, has also been detected in our drinking water at levels linked to birth defects and cancer in humans.¹⁴⁵

Leaching of chemicals from coal ash ponds associated with coal fired power plants is a source of ground water contamination that is receiving renewed attention. Coal ash is not regulated as a hazardous waste. Yet, a recent report found that samples collected by EPA and industry at seven plants across the US had concentrations of selenium and boron far above EPA or state

water quality criteria.¹⁴⁶ The Dickerson plant in Montgomery County, Maryland and Hatfield’s Ferry and Keystone plants in Pennsylvania were cited. Coal ash is also disposed of in Curtis Bay (south Baltimore) and was the subject of a class action settlement for residents of Gambrills, MD whose wells were contaminated.

Additional information about the impact of water contaminants on children can be found in the Pesticides, Fracking, and Toxics chapters.

The overall trend for chemical contamination of Bay waters is disturbing. In 2006, the proportion of tidal tributaries deemed ‘unimpaired’ by chemical contaminants was calculated at 33.7% by the Chesapeake Bay Program. In 2008 the percentage of unimpaired waterways fell to 28.1 and in 2010 that number fell again to 27.8%.¹⁴⁷

In addition to drinking water contamination, water pollution is a concern for people who rely on fish as a source of protein. The level of toxic substances in some fish and crabs has led the Maryland Department of the Environment to issue fish consumption advisories. In 2011, six types of fish listed by MDE were to be avoided by all age groups if they were taken from certain waterways. The 9-page advisory covers 20 species of fish, detailing the recommended maximum monthly consumption for three categories of people. Recommended consumption by pregnant women and young children is always far lower than for the general population.¹⁴⁸

For many recreational and subsistence fishermen, MDE warnings go unheeded. When hunger is at the door, the fact that fish contain mercury or other toxic substances becomes irrelevant. A November 2012 survey by Opinion Works documents the attitudes of anglers towards the dangers of consuming Anacostia River fish.¹⁴⁹ The study finds that anglers and the community of people with whom they share their catch have little understanding of the dangers of eating fish from contaminated waters. 12% of anglers surveyed say children eat the fish they catch and 11% report sharing with wives or girlfriends (who could be pregnant). Channel catfish are the most commonly reported catch (65%), a species which when caught in the Anacostia River, is on the MDE’s list of those that should not be eaten at all by anyone.

Health Impacts

The health effects of contaminants in drinking water are varied:

- **Arsenic** has been shown to cause cancer of the skin, lung and bladder and probably liver, and is associated with other adverse health effects, such as hyperkeratosis (an abnormal

thickening of the skin) and peripheral vascular disease.¹⁵⁰

- **Selenium** exposure through drinking water can cause changes in peripheral nerves and decreased prothrombin time (the time it takes blood to clot) which can lead to bleeding disorders. It is also associated with hair loss, weakened nails and skin lesions.¹⁵¹
- **Uranium** is found in groundwater associated with certain mineral deposits. It produces kidney damage, impairing the way the organ filters out toxins.¹⁵²
- **Nitrates** from fertilizer run-off have been called “the most important [agricultural] contaminant.”¹⁵³ Nitrates represented just under 90 percent of all the toxic releases by volume in a recent national review.¹⁵⁴ Nitrates can cause methaemoglobinemia, or blue-baby syndrome, in bottle-fed infants under 3 months of age. Nitrates have also been found to be carcinogenic.
- **Pesticides** in drinking water have been linked to birth defects, cancer, immune and endocrine system disorders, neurological damage to the developing brain of the fetus, infants and young children, including autism spectrum disorders and ADHD.^{155, 156}
- **Disinfection by-products** such as trihalomethanes in drinking water or absorbed while swimming, showering and bathing have been associated with adverse birth outcomes such as spontaneous abortion, low birth weight, stillbirth and congenital malformations.¹⁵⁷
- **Endocrine disrupting compounds** interfere with the natural hormone system, producing a wide range of effects. Examples found in sewage effluent and discharged into surface water include phthalates, phenols, pesticides, and pharmaceuticals.¹⁵⁸

Examining the freshwater tributaries to the Bay can be an indicator of drinking water quality and a predictor of Bay water quality. In 2010, the Chesapeake Bay Program rated 57% of the freshwater streams in the Chesapeake Bay Watershed as in poor or very poor condition.¹⁵⁹ The Chesapeake Bay watershed is the largest and most biologically diverse estuary in the United States. Toxic contaminants that are being studied by the Chesapeake Bay Program for their impact on the Bay include pesticides, PBCs, flame retardants, biogenic hormones, pharmaceuticals, and heavy metals.¹⁶⁰

EPA’s findings of “seasonal pulses” of the pesticide atrazine and its metabolites raise specific concerns about the impact of pesticides on fetal development. Epidemiological data suggest that seasonal changes in atrazine and nitrate in water may alter genitalia, language and mathematical skills and other subtle biological responses in children conceived in months when concentrations are high.¹⁶¹

Large-scale commercial livestock and poultry operations in the US produce an estimated 500 million tons of manure each year, more than three times the sewage produced by the entire US population.¹⁶² Unlike household waste processed by municipal sewer systems, the manure is untreated. Instead, factory farm waste is stored in manure pits or lagoons, and ultimately applied to farm fields as fertilizer.¹⁶³ The resultant nitrogen run-off produces algal blooms in the Bay that deplete oxygen and form ‘dead zones.’¹⁶⁴ Despite intensive efforts to curb nitrogen pollution in the Bay, improvements were observed at just under half of the monitoring sites, while most sites had no significant change, over the past 10 years.¹⁶⁵

Fish Contamination

Disturbing effects of water pollution on marine life across Maryland raise concerns about the impact on humans. Fish abnormalities have been increasingly detected in the Potomac and its tributaries. Abnormalities found by the US Geological Survey include a high prevalence of intersex fish (those with both male and female reproductive organs) in the same locations where fish lesions and fish kills are found. These abnormalities have been linked to endocrine disrupting chemicals including pesticides, such as the widely used agricultural herbicide atrazine, and triclosan, a pesticide used in anti-microbial consumer products.¹⁶⁶

Consumption of contaminated fish has direct human health impacts. Many pollutants degrade slowly if at all. Mercury and dioxin are of primary concern in the fish population. These are two examples of Persistent Bioaccumulative Toxicants. Mercury may enter the waterways directly, through the discharge of mercury-tainted wastewater from industrial facilities, or indirectly through emissions from power plant smokestacks.¹⁶⁷ Similarly, dioxin may be discharged from paper mill operations, or may be released into the air from the combustion of plastic. Consuming fish contaminated with mercury can impair the neurological development of the fetus and young child.¹⁶⁸ Dioxin is a known carcinogen.¹⁶⁹

Fish from most major bodies of water in Maryland are tested for certain contaminants. For example, monitoring black bass helps track mercury pollution in lakes, reservoirs, and streams, where mercury is the most common problem. White perch are a useful indicator of polychlorinated biphenyl (PCB) contamination in the tidal tributaries of the Chesapeake Bay, where PCBs are the most common cause of fish consumption advisories.¹⁷⁰

PCBs illustrate the problem of persistent bioaccumulation in our environment. These toxic chemicals were used as industrial insulators and lubricants decades ago. PCBs were banned in 1979, but are still found in large quantities in fish, animal and human samples, including breast milk. In the body, PCBs can damage a child's neurological development, eliciting subtle detrimental effects on intelligence, language, attention, and memory. Because of these and other water pollutants, the Maryland Department of the Environment issues detailed recommendations limiting consumption of various species of fish for women of childbearing age and children up to 6 years of age.¹⁷¹

Progress & Challenges

Among Maryland's opportunities to make progress in protecting the health of our child are major initiatives to protect the integrity of our waters. For instance, establishing a centralized data base to track use of pesticides by non-homeowner applicators will be protective of both water quality and children's health. Such a system would allow public health experts to track the source of pesticides in our waterways, and correlate usage with disease outbreaks. Better data on pesticide use also supports the President's Executive Order which states that EPA's Chesapeake Bay Program partnership will develop new goals for reducing toxic contaminants in 2013 and strategies by 2015 to carry out the goals. As the DHMH and MDE report of 2008 on Maryland's Children and the Environment stated, "data about pesticide use, exposures and pesticide-related illnesses exist but are limited."¹⁷²

Shale gas extraction or 'fracking' poses a number of risks to our waterways and to the contamination of drinking water. While studies documenting the impact of fracking operations on contaminated well water are as yet limited, a ProPublica review found more than 1,000 cases of contamination documented by courts and state and local governments in Colorado, New Mexico, Alabama, Ohio and Pennsylvania.¹⁷³ Especially pertinent for Maryland, in 2011, 30,000 gallons of fracking fluid were released from a drilling operation in Bradford County, Pennsylvania into the Susquehanna River Watershed, which serves the Chesapeake Bay. In addition, an Associated Press analysis of state data found that in the second half of 2011,

about 78 million gallons of drilling wastewater from conventional oil and gas wells were sent to water treatment plants that discharge into rivers.¹⁷⁴

Our state's cautious approach to determining whether and how to move forward with shale gas extraction is protective of children's health. New technologies used to extract natural gas from shale formations in other states utilize large volumes of water which, with current technology, cannot be safely treated. Assurances that gas extraction in Maryland will not threaten the health of our waterways, the Bay, and our drinking water sources must be from objective sources, based on science, and grounded in the experience of other states.

Maryland's current efforts to develop watershed improvement plans at the federal, state and local level are a major step forward in protecting children from water contamination. In 2010, the US EPA established the Chesapeake Bay Total Maximum Daily Load (TMDL) for several water contaminants.¹⁷⁵ For example, the TMDL sets Bay watershed limits of 185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year. This represents a significant reduction from amounts released in previous years.¹⁷⁶

No current Maryland law mandates consideration of the cumulative impact of multiple polluting sources in the issuing of industrial permits.

The 2012 Maryland General Assembly passed legislation providing for upgrades to the state's 67 major wastewater treatment plants, upgrades to septic systems and the planting of cover crops to act as natural filters and reduce the run-off of pollutants into the Bay.¹⁷⁷ These measures will reduce contaminants from effluent, improve ground water quality and the health of the Bay, and ultimately are protective of children's health.

While progress has been made, vigilance is required to minimize threats to water quality and ensure healthy drinking water and waterways for Maryland's children. Recommendations that address fracking, pesticides, and toxic chemicals are also protective of water. In addition, climate action plans that address mitigation and adaptation can also ensure safe water quality and protect children's health. Understanding the value to children's health of clean water should strengthen state and local commitments to all these areas of public policy.

AIR POLLUTION



Maryland's air quality has been steadily improving due to strong state regulatory policies and actions. Yet in the summer of 2012, our state experienced its worst air quality in five years.¹⁷⁸ Outdoor and indoor air pollution poses a significant threat to the health of Maryland's children because of their greater air intake relative to the size of their bodies. An infant's air intake per pound of body weight is twice that of an adult.¹⁷⁹ Children are also vulnerable because their lungs are still developing and because they tend to be more physically active than adults in play and sports.

Outdoor air is polluted by emissions from vehicles and industry. Industrial by-product gases, such as nitrogen oxides and sulfur dioxide threaten human health, as well as ground-level ozone and particles suspended in the air. Ozone and particle pollution (called particulate matter or PM) have multiple sources and represent the greatest threats to Maryland's air quality at the state level.

How Children Are Exposed

Air quality is a local matter, due to different atmospheric and geographic conditions (e.g., inland areas vs. the shore), and

unhealthy air also varies by time of day and time of year. Some communities in Maryland have a disproportionate exposure to bad air and many Maryland counties do not meet EPA standards for certain pollutants that are harmful to human health.¹⁸⁰

Furthermore, not all harmful forms of air pollution are regulated. Schools, parks, and homes are often located near highways and industrial sites with high concentrations of toxic gases and fine particles that penetrate deep into the lung. Unlike smoke stacks and passenger cars, emissions from diesel trucks and other commercial vehicles as well from small industries and agricultural are largely unregulated, yet they contribute to toxic indoor and outdoor air.¹⁸¹

Children's exposure to outdoor air pollution occurs from breathing the exhaust of vehicles (marine vessels, cars, diesel trucks, mass transit vehicles, etc.), emissions from industrial smoke stacks, drift from pesticide applications (on lawns and in fields), and the off-gassing of chemicals called volatile organic compounds (VOCs). All of these can combine with sunlight to form ozone, creating yet another and different threat. Ground level ozone damages and inflames lungs in a way that has been compared to how sunburn damages skin. Repeated exposure to ozone in childhood can lead to reduced lung function in adult life. Children are among those most vulnerable to the damaging health effects of ground-level ozone.¹⁸²

Indoor air can also be seriously compromised. The National Library of Medicine notes that indoor air can often be much worse than outdoor air;¹⁸³ estimates for bad indoor air vary between 2 and 5 times worse than outdoor air.

Additional information on health harms can be found in the Pesticides, Water, Fracking, and Chemicals & Toxics chapters.

Sources of indoor air pollution include: consumer products such as cleaning fluids, paints, and flame retardants; incomplete combustion of cooking and heating fuels; volatilizing pesticide products; the vaporizing of pest urine such as from mice and rats; radon seeping into buildings through foundations; and second hand tobacco smoke. The health impact of these myriad sources of indoor air pollution is much greater for children who have asthma or compromised lung function. American children are particularly vulnerable to bad indoor air quality because as a society, we spend so much time inside. The EPA cites recent research that Americans spend 90% of their time indoors.¹⁸⁴

Children's behavior patterns put them at special risk for exposure to air pollution and to ingesting toxics that are transmitted through the air to surfaces they touch. Young children play on the floor, touch household objects and put their hands in their mouths, picking up dust that is laden with the residue of household pesticide applications, as well as nicotine,¹⁸⁵ cleaning chemicals and flame retardants.

Children need to play and run around outdoors. Yet, during Code Red and Code Orange days, health officials warn that children should not be outdoors. The extent to which parents, schools and child care workers follow this advice is probably limited by lack of information and alternatives.

Children's exposure to air pollution is affected by the location of homes, schools, child care facilities, recreation centers and athletic fields. Incinerators and power plants can be especially dangerous to children and pregnant women because they are a source of mercury and other toxic metal emissions such as chromium.¹⁹⁶ For example, the existing Curtis Bay Waste Incinerator is located only a mile from Curtis Bay Elementary School and Benjamin Franklin Middle School, putting these children at higher risk of exposure.¹⁸⁷ The proposed incineration of poultry waste on the Eastern Shore raises the specter of emitting arsenic as well as particulate matter and other pollutants. Although Maryland banned arsenic in poultry feed last

year, arsenic remains in stockpiles of poultry litter and would be released into the air by incineration.¹⁸⁸

Health Impacts on Children – Research Findings

The list of diseases that are associated with exposure to air pollution is long: asthma, chronic obstructive lung disease, emphysema, lung cancer, cystic fibrosis, pneumonia, and cardiovascular disease. While many of these emerge in adult life, they begin with childhood exposure. The American Heart Association in its first “Air Pollution and Cardiovascular Disease” statement in 2004 asserted that exposure to particulate matter increases the incidence of heart disease.¹⁹⁸

Examples of childhood disease being caused by air pollution are many. For instance, new diagnoses of asthma are associated with children exercising in communities with high ozone concentrations.¹⁹⁰ Exposure to tobacco smoke and/or lead in utero can put children at increased risk of Attention Deficit Hyperactivity Disorder, ADHD.¹⁹¹ And studies have demonstrated the relationship between premature birth and maternal exposure to air pollution.

Asthma Triggers and the Environment

Asthma is the childhood disease best understood to be exacerbated by environmental factors. Asthma risk factors are referred to as triggers, and the most commonly cited asthma triggers are related to air pollution. Asthma attacks can be brought on by exposure to: freeways and other traffic exhaust; industrial air emissions; mold and mildew; poor indoor ventilation of cooking and heating equipment; dirty indoor conditions that promote dust mites, cockroaches and rodent infestations; and cleaning products and inhalation of pesticides.¹⁹² Exposure to mouse urine which volatilizes quickly in infested homes has been found to be a powerful asthma trigger for inner city children who are often exposed to mice.¹⁹³

The American Lung Association reports that asthma is the third leading cause of hospitalization among children under the age of 15 and is a leading cause of school absences from chronic disease. The EPA's fact sheet on asthma states that asthma accounted for over 10.5 million lost school days in 2008.¹⁹⁴

Maryland needs to be particularly concerned about asthma; adult asthma rates in Maryland are the 5th highest in the country.¹⁹⁵ The DHMH 2012 report “Asthma in Maryland” states that in 2010, “approximately 535,500 (12.4%) Maryland adults and 216,000 (16.4%) children had a history of asthma. Of those, approximately 359,000 (8.4%) adults and 155,500

Not all forms of air pollution that are harmful to health are regulated.

(11.9%) children currently had asthma.¹⁹⁶ Of children enrolled in Medicaid programs who have been diagnosed with asthma, 33.9% are reported to have persistent asthma, an indication that their asthma is affecting the child's health on an on-going basis.

Asthma care imposed large costs on Maryland citizens and its health care system. Hospital charges for inpatient asthma treatment exceeded \$66 million, plus an additional \$26 million for treatment in an emergency department.¹⁹⁷ 44% of parents reported that their child missed school because of asthma.

Asthma can be well controlled by medication and reducing exposures to environmental triggers. But in Maryland, asthma emergency room visits and hospitalizations have risen, indicating that for many Marylanders, their asthma is not under control. The Baltimore City Health Department reports that Baltimore has the highest rate in the state for pediatric asthma hospitalizations, and in fact, one of the highest rates in the nation.¹⁹⁸

Particulate Matter and Asthma

Particulate matter may increase cases of asthma locally, or exacerbate symptoms in children who are already asthmatic. Some studies have demonstrated that reducing particulate matter in inner-city homes can lower the rate of asthmatic cases and help manage asthma symptoms.^{199, 200} Increases in particulate matter in the home have been linked to increases in adverse respiratory symptoms in preschool asthmatic children in Baltimore.²⁰¹ The Johns Hopkins Center for Childhood Asthma in the Urban Environment found that asthmatic children in Baltimore are exposed to high levels of allergens and air pollutants, especially indoors.²⁰²

Traffic pollution has especially been linked with asthma symptoms. A 2010 study concluded that children exposed to traffic-related pollution while at school were more likely to develop asthma.²⁰³ Another study found that exposure to pollution from cars and trucks could cause asthma in children at an early age, with symptoms persisting through the age of eight.²⁰⁴

While the asthma epidemic in Maryland may be linked to poor regional or local air quality, the obesity epidemic is related to poor air quality in a different way. Poor air quality is one of several environmental factors that affect a child's ability to exercise, through reduced opportunities for outdoor sports and less time spent walking – as well as higher overall incidence of respiratory disease. The months of June and July 2012, for instance, brought 17 Code Orange and 4 Code Red days – days when the ozone level was so high that children and other vulnerable groups were advised to limit their time spent outdoors.²⁰⁵



Moreover, good nutrition is now understood to mediate the adverse effects of air pollution.²⁰⁶ A March 2009 article in *Pediatrics* states that “dietary supplementation for individuals with low antioxidant levels is one promising approach to reducing susceptibility to air pollution”. Inadequate nutrition that does not provide a child with antioxidant defenses can increase a child's vulnerability to the health impacts of exposure to air pollution.²⁰⁷

There is evidence that bad air is also linked to poor school performance. An analysis of 3,660 public schools in Michigan found that schools with the highest air pollution levels had the worst performance on standardized tests. This result persisted even after researchers controlled for demographics, attendance rates, and school expenditures.²⁰⁸

Air pollution drives up health care costs. One study estimates that new asthma cases would diminish by 75% if polluted communities were to achieve the air quality that is enjoyed by cleanest air communities. Cost savings associated with emergency room visits and hospitalizations would be matched by reductions in asthma-related school absenteeism.²⁰⁹ Another study quantified the rising costs of a young child's health care in direct relationship to average exposure to fine particulate matter.²¹⁰ Exposure to air pollution may also be linked with neurological and cardiovascular problems. A 2012 study found brain changes similar to those found in Alzheimer's patients in children who breathed polluted air.²¹¹

Tobacco Smoke

Second hand tobacco smoke is a peculiar form of air pollution, one that is generated by the people that a child lives with. Second hand smoke is a trigger for asthma as well as a risk factor for pregnant women. Breathing second hand tobacco smoke can increase the likelihood of a child developing chronic rhinosinusitis,²¹² Attention Deficit Hyperactivity Disorder (ADHD)²¹³ or even lung cancer.²¹⁴

Exposure to secondhand tobacco smoke also seems to mediate blood lead levels. Johns Hopkins researchers found that blood lead levels in children increased proportionately to the number of smokers who live in their household.²¹⁵ A 2009 Johns Hopkins study determined that the contaminant nicotine present in tobacco smoke is especially concentrated and dangerous in confined spaces such as a car.²¹⁶

Air Quality and Birth Outcomes

A 2012 study found that air samples in the homes of pregnant Hispanic women contained multiple household pesticides that could harm fetuses and young children. The pesticides found are linked to disorders such as autism and attention deficit hyperactivity disorder. The researchers sampled air in 25 households, finding at least five pesticides in 60 percent of the dwellings. All the women were in the third trimester of pregnancy, when the fetal brain undergoes a growth spurt.²¹⁷

Another study discovered a link between children exposed to common air pollutants in the womb and lower IQ scores by kindergarten age. These same pollutants are known to have neurodevelopmental and carcinogenic impacts.²¹⁸ A 1995 study of births in Beijing found a statistically significant relationship between gestational age and the level of sulfur dioxide and particulate matter that mothers were exposed to during the prenatal period.²¹⁹ These results were replicated for fine particle air pollution in a study of births in 80 counties in North Carolina over a 5 year period.²²⁰

Progress & Challenges

Maryland can be proud of its record in adopting strong air pollution measures. In 2006, the Maryland General Assembly enacted the Healthy Air Act. In 2007, it enacted the Maryland Clean Cars Program, following the lead of California. The Maryland Department of the Environment has worked with the Maryland Transit Administration and the Maryland Port Authority to secure federal funds to reduce diesel truck emissions. These measures are responsible for significantly improving Maryland's air quality.

The Maryland State Health Improvement Plan and Process (SHIP) includes a goal for Maryland and its counties to reduce the number of days when the Air Quality Index is over 100. At a level over 100, air quality is deemed by EPA to be unhealthy for certain sensitive groups including children. While at least

six counties had more than the SHIP target of 8.8 days with an AQI above 100, Maryland's statewide average is moving down from 9.3 days in 2010 to 8.9 days in 2011.²²¹

Some analysts of air quality emphasize that further progress will only occur if other states in our region adopt equivalent measures. A regional approach to air quality is indeed important, but it should not be an excuse to avoid further action within our state and at the jurisdictional level. The dramatic steps already taken illustrate our state's ability to protect our children from air pollution.

Building on this record, Maryland has opportunities to make further progress. Decisions about building new waste-to-energy incinerators are prime examples. Incineration of trash of any kind is neither a renewable resource, nor a benign one when compared to true renewables such as wind and solar. Incineration creates air pollution and greenhouse gases.²²² Maryland state agencies should consider the cumulative impact of multiple polluting sources when issuing permits. Today, an incinerator can be built in a community like Curtis Bay that is already subject to high traffic and airborne debris such coal dust from nearby marine terminals.

Asthma, chronic obstructive lung disease, emphysema, lung cancer, cystic fibrosis, pneumonia, cardiovascular disease...many chronic conditions in adults may begin with childhood exposures.

Government policies should consider children's health and air quality in land use and permitting decisions. Two current examples of siting decisions that will affect children's health are the Energy Answers waste-to-energy incinerator proposed for Curtis Bay in South Baltimore, and the Clean Bay Power Project, a pro-

posed 10 megawatt (MW) plant to burn poultry litter on the Eastern Shore.

How many children live within the "airshed" of these proposed industrial facilities? What is the existing quality of the air in these areas? What Maryland agency is charged with determining this information and insuring that it is considered in the public process? The Maryland Public Service Commission issued a permit to Energy Answers which waives the requirement that no schools be located within a 1 mile radius.

Ensuring good air quality in and around schools should be a priority for Maryland. A bill proposed in 2009 laid the groundwork for mandating the distance between incinerators and schools, playgrounds and other resources for children. Delaware has a law which sets this distance at 3 miles.

Similarly, in the construction of new schools, Maryland children deserve to be as well protected as Maryland workers. While Occupational Health and Safety (OSHA) laws mandate protections for workers during construction, no such protections exist for the students, teachers, and administrators working in schools undergoing renovation. A ground-breaking demolition standard for minimizing the release of construction dust (often laden with lead, asbestos and other toxics) was developed by the East Baltimore Development Initiative. This standard, focused on outdoor air exposures, was developed with community input and has been voluntarily followed in a number of demolition and new construction projects. EPA's renovation rule, effective in 2012, focuses primarily on lead and addresses indoor air quality. Maryland can build on these standards, to insure protection across our state of both children and the adults who work with them.

Green Building Standards and Air Quality

Green building standards are mandated for new public construction projects over a certain size, but these standards can be met without insuring good indoor air. As school districts evaluate the condition of their buildings and face the need for modernizing, Maryland should give priority to good air quality as part of the design process and mandate protection from construction dusts.

The US EPA has issued extensive guidance on improving indoor air quality in schools. But technical and financial resources are not in place to assist schools and school districts in assessing indoor air quality of existing schools and taking steps to improve it. The National Green and Healthy Homes Initiative, led by the Coalition to End Childhood Lead Poisoning, is pioneering an integrated approach to weatherization, energy efficiency, integrated pest management and safety improvement. Baltimore City is one of 13 cities nationally taking part. This is a promising practice, demonstrating that indoor air quality can be dramatically improved in a cost effective manner.²²³ Wider participation throughout Maryland in this program should be promoted, as an effective means of addressing indoor air quality in homes and schools.



Maryland can also take measures to protect our 155,000 children with active asthma. Some effective measures for eliminating asthma triggers in homes are inexpensive but remain beyond the means of low and moderate income families. Given rising rates of asthma hospitalization and the search for cost controls under health care reform, Maryland should consider requiring insurance coverage of proven effective measures such as bedroom air filters, HEPA vacuums, the use of Integrated

Pest Management (IPM) in homes, and organic land care for residential buildings, schools, child care centers, and on athletic fields. Maryland has tough mandates for testing blood

lead levels, as well as home visits for children with elevated blood lead levels. A similar standard can be adopted for children who have been to the hospital for an asthma attack.

Additionally, air pollution must be heavily factored into energy policy-making. Seeking to meet Maryland's future energy needs through investments in offshore wind, solar farms, or other non-polluting renewable energy sources is a great strategy for protecting children from air pollution. Investments in waste-to-energy incinerators or shale gas extraction may create more harm for children and long term health costs for all Marylanders. Maryland's children are our future. A seemingly cheap or plentiful fuel supply that warms our atmosphere, creates particle or gaseous air pollution, or carries other unforeseen costs is a bad bargain, when our children's health and future quality of life is at stake.

Air pollution is linked to poor school performance.

CLIMATE CHANGE AND CHILDREN



Children are likely to suffer disproportionately from the impacts of climate change. The American Academy of Pediatrics cites injury and death from extreme weather events, increases in infectious diseases and a rise in illness caused by air pollution as among the major consequences from climate change that will harm children to a greater degree than adults.²²⁴

Major weather events have special impacts on children such as the disruption of their education, increased stress on their caregivers, and a sense of a disordered world that adults cannot control. In extreme weather events, children lose their homes or family members and suffer trauma as a result.

The Chesapeake Bay Watershed in a Warming World

Climate change is already having an impact on the Chesapeake Bay and its watershed, as documented in vivid photographs in the Maryland Department of the Environment's Greenhouse Gas Reduction draft plan, issued in December of 2011.²²⁵ Rising sea levels and temperatures are altering the fragile ecological balance of the watershed in a way that creates a range of public health threats and reduces the Bay's value as an economic resource.

Climate impacts will affect fundamental aspects of the Bay's health, including water temperature, salinity, water level, quantity of precipitation, stream flow, the number and severity of extreme weather events affecting the Bay, and dead zones of dissolved oxygen. These were among the most important findings of a 2009 study by scientists from the University of Maryland, Pennsylvania State University, and the Smithsonian Environmental Research Center titled Potential Climate-Change Impacts on the Chesapeake Bay.²²⁶

Extreme Heat Events and Children

Children and the elderly are more vulnerable than most adults to the kinds of extended heat events that are occurring more frequently due to climate change. A child's ability to perspire is more limited than an adult's, because children have smaller body mass-to-surface area than adults. Children are more likely to become dehydrated because they lose fluid more quickly.²²⁷

In addition, children tend to be more active in outdoor settings than adults and may be at greater risk of heat stroke. The record-setting heat wave of late June and early July 2012 saw high temperatures regularly above 100 degrees Fahrenheit, while at the same time more than 1 million people in the DC region were without electricity due to the violent "derecho" storm of June 29, 2012.²²⁸

Decreasing Air Quality, Increasing Infectious Diseases, and Children

Greenhouse gases are a form of pollution regulated by the EPA and carrying significant lifetime health consequences for children. Greenhouse gas emissions contribute to physical inactivity of children and their caregivers, as the number of days of extreme heat increases. Changing weather patterns bring higher ozone concentrations²²⁹ and higher average temperatures in summer, both of which discourage healthy outdoor exercise. Exercising indoors, it should be noted, is not an option for many children, especially low income children living in communities where recreation centers have been closed and free sports facilities are few and access is limited.

Additional information on child health threats from pesticides can be found in the related chapter.

The rise in mosquito and tick populations is related to changes in average temperatures and creates several new threats for children. One is the potential for increased application of pesticides, whether by government or private property owners. The expected arrival of the Emerald Ash Borer, an insect which kills ash trees, will also increase pressure to use chemicals. In Baltimore City, the need for increased tree canopy is well understood as a measure to reduce heat island effect and soak up storm water. Yet the most common tree in the city's urban forest is the ash tree, which will be seriously threatened.

Maryland's children will grow up exposed to more insect-borne diseases, diseases such as West Nile Virus – formerly unknown in our state – as well as more pesticides.²³⁰ The use of insecticide applied to the skin is also likely to increase. Children have special vulnerabilities related to pesticide exposures. The alternative for parents may be to keep children indoors more often, which means a loss of play time, exercise, and exposure to nature.

Danger and Disruption

The frequency and severity of major storms is increasing. The torrential rain event of September 2011, Tropical Storm Lee, caused such heavy stream flows from the Susquehanna that it radically altered the Bay's salinity. The result was a surge of mud and debris.²³¹ In addition, more frequent and larger hurricanes striking the US East Coast, such as Hurricane Sandy in November 2012, demonstrated the potential for such storms



creating health hazards that particularly affect children – psychological trauma, forced departure from homes, suspension of school operations and health hazards such as lack of clean water. During and for weeks after Hurricane Sandy, the poor – especially children in poverty – suffered the most due to lack of financial resources and inadequate community support systems.

Warming Waters and Bacteria

In recent decades, the Bay's water temperature has warmed roughly one-half degree Fahrenheit every 10 years – a trend that is expected to continue.²³² The University of Maryland's Center of Marine Biotechnology, in a 2002 study, found an increased risk of bacteria linked to water-borne disease in the Bay due to the likelihood of increased water temperatures and higher flow rates from the Susquehanna River. Researchers have noted that the northern part of the Bay where salinity is lower is a potential breeding ground for cholera bacteria. Small increases in vibrio cholera bacteria have already been detected there.

This poses a risk to people who ingest the bacteria while eating oysters and swimming in the bay.²³³

During major storms, the flow of storm water and untreated sewage often mixes, due to flaws in the pipes or intentional features designed to relieve pressure. Streams and other water bodies become contaminated. During floods, contamination is even more widespread. Children may be affected by the temporary loss of access to playgrounds, parks and athletic fields. They may also be affected by straying into contaminated areas and becoming infected. Infection from water borne bacteria is not easily diagnosed because it can manifest with symptoms that are non-specific. The Centers for Disease Control and prevention report that waterborne bacteria account for about half of all cases of diarrhea worldwide.²³⁴

The Bay's water temperature has been warming roughly one-half degree Fahrenheit per decade.

Recommendations

Maryland is the third most vulnerable state to sea level rise.²³⁵ The Maryland Commission on Climate Change, created by Governor O'Malley in 2007, released its climate action plan in August 2008. The Maryland Department of Natural Resources issued its Policy on Building Resilience to Climate Change in October 2010. The Maryland Department of Transportation issued its climate action plan in 2011. The Maryland Department of the Environment released the draft plan for greenhouse gas reduction early in 2012. To date, no plan for coping with the health implications of climate change has been developed by the Maryland Department of Health and Mental Hygiene.

In addressing climate change, the American Academy of Pediatrics stresses the need to:

- Invest in prudent preparations for public health care systems, including immunization programs and disease surveillance, reporting, and tracking.
- Give specific attention to children's needs in emergency management and disaster response.²³⁶

Maryland needs to continue to pursue measures to mitigate and adapt to the impacts of climate change, but add a more robust public health component. These efforts will be particularly protective of children.

“Children are more vulnerable to climate extremes from heat stroke and infectious diseases.”

—American Academy of Pediatrics.

CONCLUSION



Our children are growing up in a world of chemicals and pollution. Even before birth, babies are exposed to a toxic soup in their mothers' bodies – a mix of synthetic chemicals linked to neurological, developmental, respiratory and reproductive problems as well as certain cancers.

For children, the burden of illness is measured not only in hospitalizations and doctor visits, but also in missed school days and lost physical activity. Chronic absenteeism in early years can also be a predictor of school drop-out and academic failure rates.²³⁷ As we have explored in this report, some chemical compounds have damaging biological effects at infinitesimally low doses. Our food, drinking water, and soil now contain chemicals in amounts that past generations of children were never exposed to.

Our understanding of environmental hazards for children is growing all the time. The emerging science of epigenetics explains how environmental conditions may have lifelong effects, starting in childhood and even in the prenatal period. Childhood exposure to pollution not only influences the quality of life during childhood but also the extent to which he or she will be at risk for chronic conditions as an adult. Environmental influences at critical periods of development can change the expression of a person's genes, including making that individual more susceptible to certain diseases in the future.²³⁸

As we better understand how early childhood exposures set the stage for adult chronic disease or cancers, the imperative to protect children's health only increases. Yet in a 2011 article in *Health Affairs*, two widely respected researchers in environmental health, Philip Landrigan and Lynn Goldman state:

"A key policy breakthrough occurred nearly twenty years ago with the discovery that children are far more sensitive than adults to toxic chemicals in the environment. This finding led to the recognition that chemical exposures early in life are significant and preventable causes of disease in children and adults."²³⁹

With this understanding, why have we not already done more to protect our children?

Unhealthy environments for children include both communities without playgrounds and communities where play structures are made of arsenic-soaked wood. Unhealthy environments for children continue to develop as we issue industrial permits without consideration for proximity to schools and athletic fields and residential neighborhoods. Unhealthy environments for children are created every time polluted storm water runs off paved surfaces directly into streams and into the Chesapeake Bay, the heart of our regional ecosystem.

Maryland must do more to protect children from toxic exposures and pollution. Our children are our future and their health is our health.

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