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CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION



CHILDHOOD CANCER
PREVENTION INITIATIVE

#PREVENTCHILDHOODCANCER





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CHILDHOOD CANCER CROSS-SECTOR STRATEGIES FOR PREVENTION

CHILDHOOD CANCER PREVENTION INITIATIVE

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DEDICATION

The Childhood Cancer Prevention Report is dedicated to every child who has been diagnosed with cancer and to the memory of Richard L. Plotkin, Co-Founder and Vice Chairman of the Max Cure Foundation, a driving force behind this initiative. Sadly, Richard passed away in 2019 from his own fight with cancer. Having spent the majority of his career in the practice of law defending corporations across various industries, Richard left the practice of law in 2007 following the diagnosis of his grandson Max Plotkin, on the eve of his 4th birthday, with a rare form of childhood cancer. Richard generously and selflessly dedicated



FOR MORE INFORMATION ABOUT THE INITIATIVE

Contact ChildhoodCancerPrevention@asbcouncil.org

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DEEP APPRECIATION TO OUR FUNDERS

Richard S. Reynolds Foundation

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Cancer Free Economy Network

Garfield Foundation

the remainder of his life to the fight against childhood cancer. This Report has its genesis in the unique friendship that started over eight years ago between Richard Plotkin and Anne Reynolds Robertson, Max Cure Board Member, environmental health entrepreneur, activist and advocate. Out of that friendship emerged new recognition on Richard's part of an important and overlooked opportunity in the fight against childhood cancer: the potential for environmental exposures to cause childhood cancers, and the changes in knowledge, practice and policy needed to reduce exposures and advance prevention.





CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION

INTRODUCTION

The Childhood Cancer Prevention Initiative 1

FOREWORD

Dr. Philip Landrigan, MD, MSc, FAAP,
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EXECUTIVE SUMMARY

The Problem 3
Our Approach 3
Conclusions and Recommendations 4

MAKING THE CASE

Childhood Cancer: Trends We Can't Ignore 5
Trends in Childhood Cancer 5
The Economic and Social Burden 6
Prevention—The Path Forward 6
Acting on What We Know: Environmental Risk Factors 7
References 9

THE SCIENCE CASE

Environmental Risk Factors as Opportunities for Childhood Cancer Prevention 10
Evidence Linking Childhood Cancer to Environmental Chemicals 10
Cause or Contribution—The Path to Cancer Development 13
These Risky Exposures are Preventable—But Are We Willing to Act? 14
References 15

THE BUSINESS CASE

Responsibility and Opportunity: Creating a Toxic-Free Future for Children 17
Business as an Agent of Change 18
A Financial Analysis of Safer Chemicals 19
Safer Chemistry: Increased Awareness Leads to Profitable Innovation 20
Investments in Safer Chemistry 23
Business and Government Working Together 24
Conclusion 25
References 27

THE POLICY CASE

Public Policy—Systemic Change for Prevention 28
How Government Action Improves Public Health 29
What We Need Now to Reverse the Rise in Childhood Cancers 30
Conclusion: “Ounce of Prevention” Applies to Childhood Cancers 35
Key Resources for Policy Development 36
References 36

CONCLUSION

Childhood Cancer Prevention: We Need to Act Now 37
References 39

THE COALITION

Childhood Cancer Prevention Initiative 40



CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION



WE ARE PLEASED TO SHARE THIS REPORT, which examines the impacts of toxic chemicals on children's health, particularly childhood cancer, and charts a course for action to protect our children.

A broad array of stakeholders including scientists, health professionals, business leaders, policy experts and advocates have worked together to examine each of our unique areas of influence and understand their relation to one another as we build collaboration to achieve meaningful results.

BECAUSE OUR CHILDREN ARE WORTH IT!

While adults and young people can breathe in, swallow, and absorb hazardous chemicals through their skin, children face added risks through maternal or paternal transfer of toxics. Reducing production and use of chemicals that can cause cancer is an opportunity for childhood cancer prevention.

Our work suggests that prevention is possible, via research, education, development of safer chemistries, business innovation and strong public policies. But the scale of investments in these areas must dramatically increase. We need solutions that leverage the capacities of organizations across multiple sectors.

Our premise is that to fully understand the scope of the problem and the opportunities for action, we must

see the whole picture. This report aims to provide the foundational information needed to understand the health, science, business and policy needs—as well as opportunities—for reducing hazardous chemicals as a pathway to prevention.

Because companies produce the chemicals, products and emissions that pose cancer risks, they are also a potential source for solutions, and have a particularly important role to play. We encourage chemical producers, manufacturers and retailers to turn off the tap on toxic chemicals and replace them with viable, safer alternatives that people can access regardless of their economic status.

THIS IS INCREASINGLY FEASIBLE. The green chemistry market and the green products market is growing and expanding. The global market is on a trajectory to grow from \$11 billion in 2015 to \$100 billion by 2020. The North American market is projected to grow from \$3 billion to \$20 billion for the same time period. Adoption of green chemistry principles, and producing safer chemicals, technologies and products is good for business. Innovation can align with good jobs and healthy environments, while it also helps reverse the upward trend in childhood cancer incidence.

SAFER CHEMICALS ARE GOOD FOR BUSINESS AND FOR CHILDREN'S HEALTH!

This report is a first step. It signals the commitment of multiple organizations to work together to scale access to safer products and healthier environments.

WE INVITE YOU TO JOIN US IN CREATING A TOXIC-FREE FUTURE FOR ALL CHILDREN.

FOR MORE INFORMATION ABOUT THE INITIATIVE

Contact ChildhoodCancerPrevention@asbcouncil.org

Visit ChildhoodCancerPrevention.org

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**CHILDHOOD CANCER
PREVENTION INITIATIVE**



CHILDHOOD CANCER PREVENTION: CALL FOR A NATIONAL PLAN

CHILDHOOD CANCER IS A DREADED DISEASE. In 2019, more than 16,000 children in the United States were diagnosed with cancer. These children have leukemia, brain cancer, kidney cancer, bone cancer and more. Fifteen percent of them will not survive beyond five years. Cancer is now the largest cause of death from disease in American children.

The death rate from childhood cancer is falling, as a result of breakthroughs in research and advances in treatment. Cancer treatment can be harsh and painful, and can result in long-term health problems, but thanks to treatment, more and more children with cancer survive each year. This is one of the great triumphs of modern medicine.

However, the incidence rate of childhood cancer—the number of new cases of cancer per 100,000 children—is increasing. Since the mid-1970s, cancer incidence rates in American children have increased sharply. From 1975 to 2017, leukemia incidence rates increased by roughly 34%, and incidence rates of brain and other central nervous system cancers increased 40%.

These increases are too rapid to be due to genetic change. They cannot be explained by increased access to medical care or by improvements in diagnosis. Recognition is growing that hazardous exposures in the environment are powerful causes of cancer in children. In recent years, medical researchers have identified a number of environmental causes of childhood cancer. For example, maternal exposure to ionizing radiation such as X-rays during pregnancy, and early childhood exposures to CT-scans, have been found to increase risk of childhood leukemia and brain tumors. Prenatal exposure to diethylstilbestrol (DES) causes adenocarcinoma of the vagina in female fetuses. In more recent years, robust evidence has emerged for other links, including traffic-related air pollution, paints, and solvents such as benzene, which elevate risks of leukemia, lymphoma and brain tumors. Prenatal exposures to pesticides are associated with increased incidence of leukemia. Children living in communities surrounded by manufacturing facilities, refineries or intensive agriculture—where residents are often low-income or people of color—may have particularly high exposures.

Yet these recognized causes of childhood cancer account for only a small fraction of cases. Known carcinogens are used throughout the economy to produce goods and services, but recent research suggests that many chemicals in addition to

those known to be carcinogens may contribute to cancer—and there are more than 85,000 manufactured chemicals in use in America today. Because most of these chemicals have never been tested for safety or toxicity, we do not have a comprehensive list of those that may cause cancer in children. We do not know which of these 85,000-plus chemicals may be driving increases in the incidence of childhood cancers. We are flying blind with no instruments.

We must act now on the urgent need to confront the rising incidence of cancer in America's children. We need to launch a National Cancer Prevention Plan—a second front on the War on Cancer—a powerful program of intervention against the root causes of childhood cancer that will complement and sustain the great advances we have made in cancer treatment.

To be successful, the National Cancer Prevention Plan needs the support of people in every sector of American society, in every region of our great country and of all political beliefs and persuasions. This plan is about our children, our values as a country, and ultimately about our future.

In the National Cancer Prevention Plan, we must require that all new chemicals and all widely-used existing chemicals be tested for safety and toxicity. We can no longer allow our children to be exposed to thousands of chemicals of unknown hazard. We must support strong research programs that include epidemiological and toxicological studies. We must strengthen state and federal laws to better protect our children—and we must enforce those laws. We must work with the business community to develop new green chemicals that will sustain our society without harming future generations. We must act as true guardians of our children.

This marvelous report by a talented collaboration presents us with a blueprint for a national childhood cancer prevention plan. It charts a course for action to protect our children. I strongly endorse it.

Philip J. Landrigan, MD, MSc, FAAP

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CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION



THE PROBLEM

CANCER IS THE LEADING CAUSE OF DEATH BY DISEASE AMONG CHILDREN IN THE UNITED STATES.

Over 46 children per day (more than 16,000 children per year) were diagnosed with cancer as of 2019. This number is growing. Since 1975, rates of new cases of cancer in young people under the age of 20 have increased by approximately 34%—an increase not explained by improved diagnostic techniques, and too great to be of genetic origin. There is growing concern in the research community and beyond that environmental chemicals are contributing to rising cancer incidence.

RATES OF CANCER INCIDENCE AMONG PEOPLE UNDER THE AGE OF 20 HAVE INCREASED **34%** SINCE 1975.

The human and social toll of these diagnoses cannot be overstated. Families are devastated by a child's death. Financial costs are astronomical; cancer-related hospitalization costs totaled \$1.9 billion in 2009 alone. As parents take time away from work to ensure proper care and treatment for their children, lives are disrupted and income can plummet. For children who do survive, costs often persist after treatment.

Thankfully, more children are surviving cancer today than ever before. But for these young people, the disease is not always in the rearview mirror. Children who have been treated for cancer are at greater risk for other health issues later in life, like cardiac and respiratory diseases or the occurrence of second cancers. They also are more likely to miss work or forgo job opportunities as a result of ongoing health issues.

Yet to date, there has been no comprehensive initiative to prevent childhood cancers, and in particular, no commitment to examining the contribution of

CANCER REMAINS THE LEADING CAUSE OF DEATH BY DISEASE PAST INFANCY AMONG CHILDREN.

environmental chemicals. Indeed, there has been hesitancy on the part of legislators, businesses and even researchers to acknowledge or focus on this issue. The purpose of this report is to establish a foundation of information for collaboration across sectors to catalyze presumptive action to reduce risks.

OUR APPROACH

We began by reviewing the scientific literature relevant to the contribution of environmental chemicals to the development of childhood cancers. The review identified three categories of chemicals—**PESTICIDES, TRAFFIC-RELATED AIR POLLUTION, AND PAINTS/SOLVENTS**—for which there is robust evidence suggesting links between exposure and the most common childhood cancer types, including brain tumors, leukemias and lymphomas. Exposures pre-conception via both parents, during pregnancy from exposures to the mother, and during early childhood are all of concern.

Our review also included other chemicals known to cause cancer in adults, many of which are present where children live, play and go to school. These chemicals may also expose parents in workplaces, potentially conferring additional risk to children. As of yet, few studies directly link these chemicals to childhood cancers, but this absence of evidence reflects the difficulty of studying environmental contributors to rare diseases; it does not mean that carcinogenic exposures are safe for children. Where exposures to children are plausible, these too should be priorities for prevention.

Finally, our analysis acknowledges the disproportionate exposures to hazardous chemicals among children who live near industrial manufacturing, agricultural facilities, major transportation routes or hazardous waste sites. We recognize that risk factors related to poverty and racism in these communities may heighten risk of chronic disease in children.

CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION



In addition to the scientific literature, the report draws on data relevant to the economic burdens of childhood cancer, a review of the investment landscape for safer chemistry alternatives and practices, and policy approaches that keep the public safe from environmental risk factors. Our research points to opportunities for a range of sectors and constituencies to drive the removal of hazardous chemicals and to replace them with safer alternatives, as an important element in childhood cancer prevention strategy.

CONCLUSIONS AND RECOMMENDATIONS

Individuals can make choices that reduce children's exposures—before conception, during pregnancy and in childhood—to chemicals known to contribute to cancer. But a dramatic and equitable transition away from hazardous chemicals to safer alternatives, at the scale needed, requires action by businesses, community institutions and government. Specifically, our recommendations are to:

- Increase investments in research to fill gaps in understanding of the roles of environmental chemicals in childhood cancers
- Strengthen information and tools provided to consumers so they can help drive change
- Increase investments in research and development to remove chemicals of concern from supply chains
- Improve public health and level the playing field for responsible companies by requiring existing chemicals to meet the same testing requirements as new chemicals
- Promote major retailers' and manufacturers' adoption of comprehensive safer chemicals policies that identify, reduce, and eliminate toxic chemicals, replacing them with safer substitutes in products made for children and babies, and in other products that children are exposed to wherever children live, learn and play. These products include home furnishings, food, food packaging, cleaning products, and installed building

materials. Safer chemicals policies also should also provide consumers with ingredients disclosure, both online and on-pack.

- Sustain and continue to improve public policies that restrict harmful chemicals, and accelerate the development of safer alternatives.

Collaborative work across sectors is a promising strategy for realizing these recommendations. With a commitment to a common goal, the private sector and government—and those that influence them—can adapt and adjust to the changing landscape over time. By integrating information, opportunities and recommendations across the science, business and policy realms, this report aims to maximize the effectiveness of a joint initiative to prevent childhood cancer. The need is urgent: both because too many children succumb to cancer, and because rates of new cases are rising. The opportunity is great: there are myriad examples of the replacement of hazards with safer materials, driven by consumer and retailer demand, policy change and business innovation, with the potential to catalyze a wholesale transition to safer materials.

Whether we are parents, researchers, healthcare professionals, elected officials, business or community leaders, each of us has a role to play in driving this transition: towards an economy based on chemistries, products and technologies that do not contribute to cancer, but instead enable all children to thrive.



CHILDREN ARE EXPOSED TO DOZENS OF CHEMICALS KNOWN TO CAUSE CANCER IN ADULTS.

CHILDHOOD CANCER TRENDS WE CAN'T IGNORE



ONE OF THE MOST DEVASTATING PRONOUNCEMENTS TO A PARENT IS, "YOUR CHILD HAS CANCER."

Unfortunately, more and more parents are hearing this terrifying news because rates of childhood cancer are rising. More and more children are being diagnosed. Children are more likely to survive cancer than they were a decade ago. Yet survival often comes with lifelong health and financial burdens. Why are we not making more headway in preventing cancer in young people?

TRENDS IN CHILDHOOD CANCER

Childhood cancer—cancer diagnosed among people under the age of 20—is rare: the risk of a child in the United States developing cancer before their 20th birthday is about 1:264.² However, this translates into 16,050 diagnoses in 2019, and cancer remains the leading cause of death by disease past infancy among children in the US.^{1,3} Almost 50 years after the declaration of a "War on Cancer," we are still waiting to see a drop in incidence (rates of new cases). Cancer incidence among people under the age of 20 has increased approximately 34% from 1975 to 2017; roughly 0.7% each year.⁴ Leukemia, brain/central nervous system cancers and lymphomas are the most common cancers in children under the age of 14.³ Rates of leukemia are highest among Latinx children.^{5,6} In the teenage years, testicular cancer and thyroid cancer become more common.³

Death rates from childhood cancers have declined 55% since 1975, in large part due to successes in the treatment of childhood leukemias and non-Hodgkin's lymphomas.⁷ However, these outcomes are not shared by all. Survival rates remain low for some cancers—for example, particular kinds of brain tumors—and the prognoses for particular cancers vary by age groups.³



CANCER REMAINS THE LEADING CAUSE OF DEATH BY DISEASE PAST INFANCY AMONG CHILDREN.

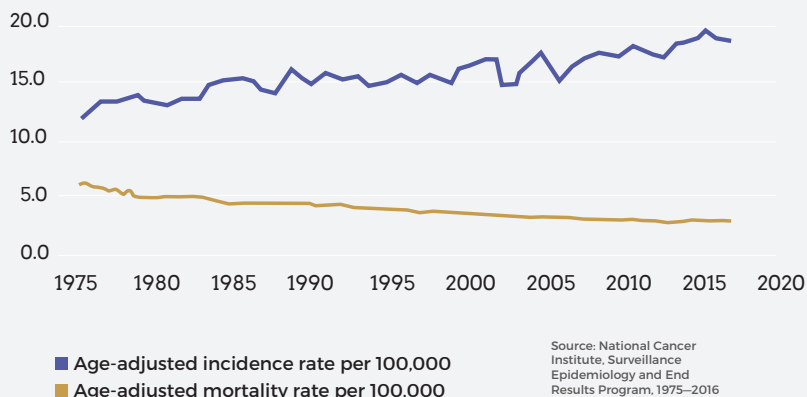


16,050 CASES OF CANCER WERE DIAGNOSED AMONG CHILDREN AND TEENS (AGES 0–19) IN 2019 IN THE US.¹



Trends in Childhood Cancer Incidence and Mortality

Declining childhood cancer deaths, but rising childhood cancer incidence





THE ECONOMIC AND SOCIAL BURDEN

The rise in rates of childhood cancers and the continued burden of these diseases on families and children is exacting high human and social costs.

- From 2000 to 2005, childhood cancer-related hospitalization costs in the United States doubled.⁸ In 2009 alone, costs totaled \$1.9 billion.⁹
- A survey conducted by the National Children’s Cancer Society found that 1 in 5 families who receive a new diagnosis of childhood cancer are already living in poverty. The survey also found that families reported losing more than 40% of their annual household income as a result of work disruption related to their children’s cancer treatments. This figure does not account for out-of-pocket expenses such as traveling to the hospital and extra childcare at home.

For young people who survive cancer, the disease is not always in the rearview mirror. **CHILDHOOD CANCER SURVIVORS CAN DEVELOP AN ARRAY OF PHYSICAL, MENTAL AND COGNITIVE HEALTH COMPLICATIONS LATER IN LIFE AS A RESULT OF RADIATION, CHEMOTHERAPY AND SURGICAL TREATMENTS.**

Studies show that adult survivors of childhood cancers are at greater risk of cardiac, respiratory and renal diseases; stroke; occurrences of second cancers; sleep disturbances; inattention-hyperactivity and learning problems.^{10, 11, 12} Depending on the type of treatments, both male and female survivors may suffer from infertility.¹³ Survivors are also more likely to need assistance with personal care and routine needs, have work limitations, be unable to work because of health issues, miss more days of work, and have greater loss in household productivity compared with adults without a history of cancer.¹⁴ The National Cancer Institute estimates that as of 2015, there were at least 429,000 adult survivors of childhood cancer.¹⁵ A significant fraction of these individuals continue to shoulder health and financial burdens associated with their early-in-life disease.^{14, 15}

PREVENTION: THE PATH FORWARD

Cancer charities, research organizations and clinical institutions devote substantial resources to cancer treatment and survivorship, but scarce support for the primary prevention of childhood cancers. Of course, a focus on treatment is essential, especially given its increasing effectiveness. **YET SUCCESSFULLY TREATING INCREASING NUMBERS OF CANCERS CANNOT REPLACE MAKING PROGRESS ON PREVENTION.**

Neglecting prevention is a grave disservice to young people, their families and society, that goes far beyond the crippling damage of exorbitant healthcare costs. It is almost always more effective to prevent harm than to restore wellbeing.



From 2000 to 2005, childhood cancer-related hospitalization costs in the United States doubled. In 2009 alone, costs **TOTALED NEARLY \$1.9 BILLION.**

HOWEVER, MAKING THE CASE FOR PREVENTION IS MORE COMPLICATED THAN MAKING THE CASE FOR TREATMENT. In contrast to children who have had cancer, whether or not they were cured, we do not know the faces of children whose cancers have been prevented. Reversing the trends in rates of childhood cancers will require making the life-and-death stakes for all our children clear. That will require passionate dedication, innovation, creativity and significant resources. Investments in prevention of adult cancers have dramatically reduced rates of some new diagnoses, such as reductions in lung cancer diagnoses that are being driven by declines in tobacco smoking. Our children deserve no less investment in dedicated research and interventions to reduce their cancer risk.





ACTING ON WHAT WE KNOW: ENVIRONMENTAL RISK FACTORS

Cancer prevention in adults has focused on behavioral and environmental risk factors over which the individual has control, such as diet, exercise, excessive alcohol consumption, smoking and UV exposure from the sun. Unlike adults, most children do not smoke, drink alcohol, or have other adult-type risk factors; if they do, these factors are more likely to influence their disease risk in adulthood than during childhood. **For children, toxic chemicals in their home, learning and play environments may be important risk factors for cancer. This is because children’s bodies are ill-equipped to take on the insult from carcinogens with which they may easily come in contact:**

- Pound for pound, children take in more food, water, air and other environmental substances than adults.¹⁶ If an infant’s or child’s drinking water is contaminated with carcinogenic chemicals, or if they live near roadways with high levels of air pollutants from vehicular traffic, they will experience a much higher relative dose of these contaminants than will adults.
- Young children crawl, play close to the ground, and put their hands and toys in their mouths, making it more likely that they ingest or inhale dirt and dust which can contain toxicants.¹⁶
- Children’s high susceptibility to hazardous chemicals in their environments begins at the fetal stage and continues through adolescence. During these developmental periods, children’s bodies are in a dynamic state of growth, with cells multiplying and organ systems developing at a rapid rate.¹⁶

FOR CHILDREN, TOXIC CHEMICALS IN THEIR HOME, LEARNING AND PLAY ENVIRONMENTS MAY BE IMPORTANT RISK FACTORS FOR CANCER.



These mattresses/pads should deal with these basic two fundamental concerns:

If the mattress is not waterproof at the surface, then you’re growing a not-very-nice garden. So they should be waterproof in order to maintain basic hygiene. But, if waterproof, it’s important to use a non-toxic waterproofing material. Vinyl (PVC) and perfluorinated compounds (PFCs) are toxic and should never be used.

Polyurethane foam fill is highly flammable. As such, in addition to the many questionable chemicals in the foam, flame retardant chemicals or barriers are commonly used. These chemicals and materials should not be used in any baby products.”

– Barry Cik, Founder and Technical Director, Naturepedic

Our children have inherited an environment that is vastly different from that of previous generations. Today, thousands of synthetic chemicals used to fuel cars, rid agricultural crops of pests, and manufacture household products, electronics, furniture and clothing result in ubiquitous exposure to hazards known and unknown. While levels of some kinds of pollutants have decreased—for example, fine particulate matter in air (although levels are still high in some regions)—**the number of toxic chemicals used and released has been allowed to increase exponentially, with minimal requirements for understanding their impact on human health, and a growing body of robust science documenting their potential to contribute to cancer.**¹⁷

From conception on, children can be exposed to pollutants passed along by their parents—in utero; through breast milk; by the presence of toxic chemicals in air, food, soil, household or other products; and the built environment itself. Children who live near manufacturing or agricultural facilities, traffic corridors, or hazardous waste sites can be exposed to carcinogenic pollution at higher levels than the general population, and residential proximity to such facilities is often tied to income, resulting in disproportionate

exposures for low-income children and children of color. While not all exposures result in illness, they do represent opportunities for prevention, both of childhood cancers and other diseases such as neuro-developmental disorders; the prevalence of which is also increasing.^{18, 19}

In 1948, Wilhelm Hueper, a prescient senior scientist at the National Cancer Institute wrote:

“Carcinogenesis is the newest and one of the most ominous of the end products of our industrial environment. Though its full scope and extent are still unknown, because it is so new and because the facts are so extremely difficult to obtain, enough is known to make it obvious that extrinsic carcinogens present a very immediate and pressing problem in public and individual health.”²⁰

Cancer is a multifactorial disease, resulting from a combination of genetic susceptibility and environmental exposures, with multiple pathways that can contribute to its development. As discussed in the next section, for some populations of children, studies show strong associations between exposures to particular pollutants known to be capable of causing cancer and elevated rates of cancers in those populations. **Near-term action to reduce exposures to known carcinogens and longer-term investment in safer materials and products can catalyze innovation for cancer prevention. Researchers, investors, policymakers and people who have experienced the devastating impacts of cancer all have important roles in ensuring healthy environments for nurturing our children.** Rachel Carson’s words are as poignant and true today as they were when she wrote *Silent Spring* in 1962:

“For those in whom cancer is already a hidden or a visible presence, efforts to find cures must of course continue. But for those not yet touched by the disease and certainly for the generations as yet unborn, prevention is the imperative need.”²¹





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ENVIRONMENTAL RISK FACTORS AS OPPORTUNITIES FOR CHILDHOOD CANCER PREVENTION



GIVEN THE DRAMATIC INCREASE IN CHILDHOOD CANCER CASES (ages 0–19) over the last 40 years, increased scrutiny is needed on possible causal risk factors.¹ This rise is simply too rapid to be of genetic origin and cannot be explained by improved diagnostic techniques.² **Currently, researchers estimate that up to 10% of all cancers in children ages 0–19 derive from heritable genetic risk factors.³ For many of the other cancers, hazardous chemicals are among the potentially preventable risk factors. Of particular concern is risk to low-income children of color living in communities where environmental exposures are high.**

EVIDENCE LINKING CHILDHOOD CANCER TO ENVIRONMENTAL CHEMICALS

Studying environmental links to childhood cancers is methodologically challenging. Characterizing and quantifying exposure to environmental contaminants is extremely difficult, especially when investigating prenatal and early life exposures, which often rely on data collected from parents. Moreover, rare diseases, which include childhood cancers, are inherently difficult to study because statistical associations are less likely to be robust when study sizes are small.

Nevertheless, **there are several well-established links between environmental exposures and childhood cancers.** Maternal exposures while pregnant are of special concern. These include diethylstilbestrol (DES), an estrogen prescribed from the late 1940s to the early 1970s to prevent miscarriage, which increases the risk of clear-cell adenocarcinoma of the vagina and cervix as well as breast cancer among females exposed in-utero;⁴ ionizing radiation, including from nuclear fallout, which increases the risk of childhood leukemia and thyroid cancer; and maternal exposure to X-rays as well as a child's exposure to computerized tomography (CT scans) in early life, both of which have been found to increase the risk of childhood leukemia, brain tumors and possibly other cancers.³

In addition to these established risk factors, solid evidence has emerged for three additional categories of chemical exposures: **PESTICIDES, TRAFFIC-RELATED AIR POLLUTION, AND PAINTS AND SOLVENTS, WHICH ARE ASSOCIATED WITH LEUKEMIAS, BRAIN TUMORS AND LYMPHOMAS.** Lack of evidence about environmental contributors to other kinds of childhood cancers does not necessarily absolve a broader set of environmental risk factors from responsibility for a wider range of cancers; it may instead reflect the inherent challenges discussed above in studying the association between environmental risk factors and rare diseases, as well as a lack of funding to support such investigations. Children's exposure to chemicals known to contribute to the development of cancer in adults should be of concern, even if populations of children exposed to these chemicals have not been studied.

Below, we review several kinds of scientific studies widely regarded as robust approaches for assessing the state of the evidence related to risk factors for rare diseases: (1) meta-analyses—which review multiple case-control studies—and (2) pooled analyses, in this case from an international consortium of case-control studies examining risks associated with childhood leukemia. Pooling data across studies is commonly used as a method to increase the overall sample size and the statistical precision of the pooled results.



RESEARCHERS ESTIMATE THAT UP TO 10% OF ALL CANCERS IN CHILDREN AGES 0–19 DERIVE FROM HERITABLE GENETIC RISK FACTORS. FOR MANY OF THE OTHER CANCERS, HAZARDOUS CHEMICALS ARE AMONG THE POTENTIALLY PREVENTABLE RISK FACTORS.





PESTICIDES

Exposure to pesticides—the catch-all term for chemicals used to control insects (insecticides), weeds (herbicides) and fungi (fungicides) on crops and at home—has been implicated as a risk factor for leukemias, brain cancers and childhood lymphomas.

RESIDENTIAL PESTICIDE EXPOSURE. A robust evidence base has emerged tying early life exposures to pesticides used at home to an increased risk of leukemia and brain tumors.^{5, 6, 7, 8, 9, 10} Consistency across multiple meta-analyses indicates an increased risk of both childhood leukemia and brain cancer with exposure to residential pesticides.^{5, 7, 8, 11} Increased risk for childhood lymphomas has also been observed.^{7, 11} Both insecticides and herbicides have been implicated, although risks are more consistently elevated for exposure to insecticides indoors.^{5, 7, 8} In comparison to controls, elevated risks for childhood leukemia have been observed in children born to mothers who were exposed before conception and during pregnancy^{5, 6, 11} and in children exposed after birth.^{6, 7} For brain cancer, risks are elevated for children born to mothers exposed during pregnancy⁸ and children whose fathers were exposed prior to conception.¹¹ For lymphoma, risks are strongest for children whose mothers were exposed during pregnancy.¹¹

A number of currently used pesticides are known or suspected carcinogens, according to evaluation by the International Agency for Research on Cancer (IARC) of the evidence for specific pesticides. Because parental interviews are often the source of exposure information and individuals rarely know all the products they have used, few studies to date have identified the specific agents or pesticide products responsible for the elevated risks. However, one recent study examined household dust as a marker of exposure and revealed increased risk of childhood leukemia associated with higher levels of the residential herbicide chlothalonil and possibly alachlor,³ used as an agricultural herbicide.¹² The investigators who conducted this study suggest that contaminants in the production of these herbicides, such as dioxins, may be the responsible agents. Yet it is possible that exposure to the herbicides themselves could contribute to cancer.

PARENTAL OCCUPATIONAL PESTICIDE EXPOSURE.

Studies have examined associations between parental occupational exposure to pesticides and childhood leukemias and brain cancers. Maternal exposure during pregnancy is implicated in two meta-analyses examining links between chemicals and childhood leukemia,^{13, 14} one of these found evidence linking leukemias with exposure to insecticides as well as herbicides.¹³ Both maternal and paternal exposures from working in the agricultural sector are associated with elevated rates of childhood brain tumors.¹⁵ It is important to note that the children exposed to high levels of agricultural pesticides are often low-income and immigrant children.

Links between pesticide exposure and other types of childhood cancer are less studied, but one meta-analysis supports the hypothesis that pesticide exposure in a range of settings is associated with Wilms' tumors in children.¹⁶



RESIDENTIAL PESTICIDES — SOURCES OF EXPOSURE:

- Professional pest control services
- Indoor uses
- Outdoor uses (in garden)
- Handling treated or contaminated pets or use of insecticidal shampoos for lice infestation

EXAMPLES OF EPA-REGISTERED PESTICIDES CURRENTLY USED IN THE US and classified by the International Agency for Research on Cancer as known, probable or possible human carcinogens:

- 2,4-D, diazinon, dichlorvos, heptachlor*, ethylene dibromide, formaldehyde, glyphosate, lindane*, malathion, parathion, pentachlorophenol*, toxaphene

* restricted uses





TRAFFIC-RELATED AIR POLLUTION

Chemical contaminants released in the exhaust of motorized vehicles have been the focus of multiple studies investigating the causes of childhood cancers. IARC has classified many of these air pollutants as known, probable or possible human carcinogens.¹⁷ Several, including 1,3-butadiene, benzene and formaldehyde, are known causes of leukemia in adults.¹⁸

The evidence linking traffic-related air pollution with childhood leukemia is strong. Several independently conducted meta-analyses have observed elevated risks of childhood leukemia associated with exposure to traffic-related air pollution.^{19, 20, 21} Exposures in early childhood are of greatest concern.^{19, 20} Most studies to date have examined risk in relation to proximity to dense traffic as a measure of exposure to toxicants in vehicle exhaust. Some studies have examined specific pollutants, however, and find increased risk associated with exposure to benzene and 1,3-butadiene.^{20, 22} In addition, children with Latino fathers exposed at work to polycyclic aromatic hydrocarbons (PAHs) in exhaust emissions also have elevated childhood leukemia risk.²³ One recent study demonstrates that soot in air pollution, which is a mixture of known carcinogens, including fine particulate air pollution (known as PM_{2.5}) and PAHs, can cross the placenta and expose the developing fetus.²⁴ Other childhood cancers are less studied, but increased risks for some types of cancer have been documented. Recent research has identified increased risk of childhood brain tumors associated with both industrial and traffic-related sources of pollution.²⁵ Risk of retinoblastoma has also been linked to exposure to PM_{2.5}.²⁶

PAINTS AND SOLVENTS

Paints and solvents used in the home or in the workplace have been the focus of a number of childhood cancer studies, primarily focused on the risk of childhood leukemia.

PAINTS. A recent pooled analysis of case-control studies found that home paint exposures shortly before conception (1-3 months), during pregnancy and after birth increases the risk of childhood leukemia.²⁷ Increased risk associated

with maternal exposure during pregnancy has also been documented in a recent meta-analysis.²⁸ In addition, IARC recently examined the state of the science linking paint exposures with cancer and found positive associations between maternal exposure—both preconception and during pregnancy—and increased risk of childhood leukemia.²⁹

SOLVENTS. Given that benzene is a known cause of adult leukemia (particularly AML), and exposures to children also occur, studies have focused on this particular organic solvent and the risk of childhood leukemia. Multiple studies document that maternal occupational exposure to benzene during pregnancy is of particular concern.^{30, 31, 32, 33} Evidence of an association with paternal exposure preconception is not as strong, but risk is still elevated in some studies.³⁰ These patterns of increased risk were also documented in two recent meta-analyses.^{28, 34} Parental exposure to other types of solvents have not been as well studied, but early evidence from the cluster of childhood leukemia in Woburn, Massachusetts revealed associations between childhood leukemia and chlorinated solvents: risk was eight-fold higher in children whose mothers drank contaminated water while pregnant.³⁵ Moreover, incidence of childhood leukemia in the community reverted to background levels after the contaminated drinking wells were turned off.³⁵

A recent study examining exposure to organic solvents and chlorinated solvents in particular (which include solvents such as trichloroethylene, a known carcinogen in adults) found an increased risk of leukemia among children of Latino fathers, but not non-Latino fathers—one of the only studies to date documenting evidence of racial disparities.²³



EXAMPLES OF CARCINOGENIC AIR POLLUTANTS IN VEHICLE EXHAUST, classified by the International Agency for Research on Cancer as known or probable human carcinogens:

1,3-butadiene, benzene, benzo[a]pyrene, diesel exhaust (as a mixture), formaldehyde, fine particulate matter (PM_{2.5})





Chlorinated solvents have also been shown to increase risk of brain tumors in children whose mothers were occupationally exposed any time before birth.³⁶ This same study found that paternal exposure to solvents (in particular aromatic solvents) prior to conception also increased risk, although not as strongly as maternal exposure.

OTHER CHEMICALS/ POLLUTANTS OF CONCERN

In addition to the risk factors discussed above, dozens of other chemicals that contribute to cancer in adults are also of concern for children. These chemicals or classes of chemicals are classified by IARC³⁷ as possible, probable or known human carcinogens, on the basis of comprehensive review of data in animals and humans. Although many of these chemicals have not been studied in populations of children, the greater susceptibility of children to the deleterious effects of hazardous chemicals should raise red flags, especially when exposure is plausible or documented. Examples include perfluorooctanoic acid (PFOA) which has contaminated drinking water for millions of people in the US as a result of its use in non-stick or stain-resistant materials,³⁸ or benzo[a]pyrene, a carcinogenic substance found in crumb-rubber athletic fields.³⁹ In addition, chemicals suspected of impacting hallmarks of cancer—though they may not be “complete carcinogens” (see below)—should also be regarded as hazardous for infants and children. An example of such a chemical is bisphenol-A (BPA), which may be found in food and drink packaging, in water bottles and in baby bottles.



“The burden to protect one’s self and one’s children from toxic chemicals should not be placed on the general public. It’s our collective moral duty to protect the health and wellbeing of future generations.”

– Joey Bergstein, CEO of Seventh Generation

CAUSE OR CONTRIBUTION: THE PATH TO CANCER DEVELOPMENT

Cancer has long been understood to be a multifactorial, multistage disease where multiple alterations—or “hallmarks”—are necessary for the disease to develop.⁴⁰ **Research on environmental carcinogenesis has determined that chemical toxicants may contribute to one or more of the alterations, and likely interact both with each other and with other risk factors; some environmental and some genetic.** This understanding has led to a more recent hypothesis that some chemicals may not be “complete carcinogens” as determined by gold-standard toxicology tests (e.g., 2-year rodent assays), but may nevertheless contribute to cancer by influencing individual cancer hallmarks.

Evidence from the Halifax Project suggests that dozens of chemicals considered “noncarcinogens” interact or interfere with these hallmarks at levels of exposure that are relevant to humans.⁴¹ Over the last few years, greater understanding of cellular characteristics of carcinogens has also emerged, illuminating additional mechanisms of action by which chemicals can contribute to cancer beyond gene mutations (“mutagenesis”).⁴² These include immunosuppression and epigenetic alterations (e.g., DNA methylation), both of which have been postulated as the mechanisms responsible for the leukemia-inducing activity of some of the environmental factors reviewed above that are related to childhood leukemia.⁴³



EXAMPLES OF HIGH PRODUCTION VOLUME SOLVENTS ON THE US MARKET*

and classified by the International Agency for Research on Cancer as known, probable or possible human carcinogens:

Benzene, carbon tetrachloride, methylene chloride, n-propyl bromide, perchloroethylene, trichloroethylene.

*These solvents are used in industrial processes, found in consumer products, and/or as pollutants in water and air.





THESE RISKY EXPOSURES ARE PREVENTABLE – BUT ARE WE WILLING TO ACT?

COHERENCE AMONG THE STUDIES REVIEWED ABOVE PROVIDES STRONG EVIDENCE THAT A RANGE OF PREVENTABLE RISK FACTORS are increasing the risk of childhood cancers. For example, studies examining associations based on exposure to benzene in air pollution, in consumer products and even by parental occupational exposure all document increased risk of childhood leukemia as a result of exposure.

THE VAST MAJORITY OF CHILDHOOD CANCER RESEARCH FUNDING GOES TOWARDS STUDIES OF CHILDHOOD CANCER TREATMENT AND SURVIVORSHIP, LEAVING ONLY A SMALL PORTION FOR THE CRITICAL WORK ON PREVENTION. Significant additional investment is needed to fill prevention-related research gaps. For example, well-defined epidemiological investigations can help illuminate the roles of specific environmental exposures in the development of childhood cancers. Currently, we know very little about causes and possible environmental risk factors of rare childhood cancers, including Wilms' tumor, osteosarcoma, retinoblastoma, and others. Moreover, dozens of environmental and occupational chemicals known to cause cancer in adults have rarely been studied for their contribution to childhood cancers. Studies to reduce lingering uncertainties, including the use of more refined assessment tools to ascertain specific pesticide exposures, are vital to pursue. Additional studies of exposure are also needed to prioritize where and how best to intervene. Particular attention should be paid to populations that are disproportionately exposed.

Yet preventive action need not wait for these research gaps to be filled. Policy should promptly support limiting exposure to suspect environmental factors as meaningful preventive action.



“To protect children’s health, it is prudent to establish programs to alter exposure to those factors with well-established associations with leukemia risk rather than to suspend judgment until no uncertainty remains.”

– Catherine Metayer et al.⁴⁴

PROGRESS ON PREVENTING CHILDHOOD CANCER CAUSED BY ENVIRONMENTAL RISK FACTORS HAS FALLEN FAR SHORT OF WHAT IS POSSIBLE. Despite accumulating evidence that environmental exposures put children at risk, trusted messengers—including oncologists, researchers and leaders of cancer charities—tend to dissuade patients and the public from a focus on preventive actions with statements such as: “The origins of childhood cancer are not well-understood, but we are making great progress in treating the disease.” These comments, while accurate, miss an opportunity to educate patients and the public about opportunities to prevent hazardous exposures.

Lack of acknowledgment of the link between environmental exposures and childhood cancer stems from a lack of understanding of the state of the evidence. It also stems from a general lack of training in occupational and environmental health among health professionals (medical students have minimal training in occupational and environmental health across four years in medical school⁴⁵). Lack of progress stems from relentless efforts by industry to discredit relevant research on the links between chemicals and cancer. Resources are now available to help clinicians, other health professionals and community leaders communicate about environmental risk factors in ways that are accurate, compassionate and empowering. We need to deploy these resources so that people are motivated and prepared to take preventive action.

What is the burden of childhood cancers attributable to chemical toxicants in our environment? We don't fully know. **WHAT WE DO KNOW IS THAT AN EXPERIMENT HAS UNFOLDED OVER THE LAST DECADES IN WHICH CHILDREN ARE EXPOSED TO TOXIC CHEMICALS IN CONSUMER PRODUCTS, IN WATER, IN FOOD, AND IN THE AIR THEY BREATHE.** Cancer-causing substances are present in amniotic fluid,⁴⁶ in the umbilical cord blood of those just born^{47,48,49} and in mothers' milk.⁵⁰ We will never know how much childhood cancer this experiment has caused until we do another experiment: replacing toxicants with safer materials and observing subsequent cancer trends.⁵¹ This new experiment can build on myriad examples of success in replacing hazardous chemicals, which open up new economic opportunities and confer health benefits that include not only cancer prevention but also reduced risk of other debilitating diseases and disorders in children.



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BUSINESS RESPONSIBILITY AND OPPORTUNITY TO CREATE A TOXIC-FREE FUTURE FOR CHILDREN



TO DEFEAT CANCER, WE CANNOT RELY SOLELY ON CURES. Forever turning to medical science to cure existing cancers, we neglect the effective option of reducing causation of cancer by ending the production and use of toxic chemicals. Business has a dominant role in cancer causation—and can have an equally powerful role in accelerating our transition to an environment free of cancer-linked products.

If reducing causation is itself prevention, why don't all businesses comply? Many are confused about the linkage for the same reasons as the general public, as discussed earlier. Others do not know what they should do, and still others choose not to take the needed actions. However, a growing number of businesses are at the forefront of safer solutions, providing innovations throughout the lifecycle of chemicals and products. All businesses have the responsibility and the opportunity to address the product-related risk factors associated with childhood cancer, both in their business practices and by advocating for responsible public policy that protects human health.

Consumers will notice the choices a business makes, as scientific studies continue to link exposure to hazardous chemicals in our environments with negative health impacts. Science has also made it clear that while we are all at risk, children are more susceptible to harm from hazardous materials. Legitimate news reports have shown we are constantly being exposed to risk factors for cancer through air pollution from car emissions, lead in the paint of outdated schools and playgrounds, hazardous chemicals in cleaning products, and other toxic chemicals hiding where we and our children live, learn, work and play every day. It should be noted that environmental risks are not equal, and that “age, poverty, and minority status place some groups at a disproportionately high risk for environmental disease.”⁷¹ Children from low-income and minority families are more likely to be at risk because they are more likely to be exposed to polluted air, live near hazardous waste sites and other

industrial facilities, come into contact with lead-based paint, suffer devastating consequences from climate change, and have limited access to clean water among other routes of exposure.²

Consumers are also increasingly striving to identify these hazards and avoid exposure to them in their everyday environments. While there is still work to be done to understand the importance of various exposures to hazardous chemicals—pre-conception, in utero and in early childhood—it is obvious to consumers and other stakeholders that we need to rethink the products and environments we provide for our children. Astute business leaders are also aware of consumers’ and other stakeholders’ growing concerns and how they impact company success. Becoming fully and accurately informed, and investing in innovative solutions, are two main ways companies can do their part to prevent childhood cancer.





BUSINESS AS AN AGENT OF CHANGE

From the earliest days of trading to today's hyper-complex transactions, business has produced and distributed goods and services to satisfy a market of one or more buyers. Over the last several decades, the responsibility of business to do more than meet a market has become a topic of serious debate in our society. Responsible companies recognize that the asymmetrical knowledge they have compared to the public's requires providing products that are safe, both in functional use and in non-hazardous ingredients. Increasingly, society holds business responsible for what is in what it produces; for being transparent about ingredients and the known human health impacts of its products.

CONSUMER AWARENESS IS A KEY DRIVER OF SUCCESSFUL, RESPONSIBLE BUSINESS DECISIONS.

Shoppers expect a product not only to do the job as advertised, but to do it in a way that does not create problems down the road. Today, business is expected to recognize its impact on all stakeholders, not just shareholders. Customer preferences are always in flux: with every purchase comes an opportunity to learn something about a product and slightly adjust our behavior. If a specific hazardous chemical is being called out in multiple media sources, consumers are more likely to look out for that hazardous ingredient the next time they go shopping. Customers probably don't know, for example, why parabens in their facial scrub are harmful, but knowing that a product contains a toxic compound will be a determining factor in their purchasing decision.

CUSTOMER AWARENESS IS USUALLY HEIGHTENED BY HAVING A CHILD. Parents worry about what they are exposing their child to, what they're bringing into the home, and even what they are exposing themselves to that might affect their child. They don't need to know the function of bisphenol-A (BPA) in their child's bottle to know they know they don't want it around, and that's enough to shift the way they shop.

Accordingly, leading brands collaborate with highly-aware, informed stakeholders to understand today's broader range of expectations and embed those insights into strategic

initiatives. A leading expectation is that products—including their ingredients and the methods with which they are made and distributed—must be free of chemicals associated with cancer and other chemicals of concern. In response, many brands are leveraging their influence to meet these expectations by targeting and replacing hazardous chemicals with safer alternatives in their own manufacturing processes, and by requiring transparency and safety in their supply chains. We see the emergent change articulated in this quote from a 2015 article, "Business and Society in the Coming Decades."³



"Sustainable, responsible, and long-term capitalism takes a deeper view of business's role in society, recognizing that, in the long run, the interests of stakeholders converge with the interests of the broader community. The actions of any one company may reverberate throughout the various systems in which it operates, generating second- and third-order benefits as well as negative externalities. Under long-term capitalism, companies recognize that fact and, through concerted action with others of sufficient scale, work to ensure constant improvements to those systems."

-Doug McMillon, Walmart CEO

-Kathleen McLaughlin, SVP of Sustainability.³



A LEADING EXPECTATION is that products—including their ingredients and the methods with which they are made and distributed—must be free of chemicals associated with cancer and other chemicals of concern. In response, many brands are leveraging their influence to meet these expectations by targeting and replacing hazardous chemicals with safer alternatives in their own manufacturing processes, and by requiring transparency and safety in their supply chains.



To reduce negative externalities, brands are building effective internal policies governing chemicals into their strategies and using their buying power to transform their businesses, supply chains and entire market segments with safer alternatives. These measures increase brand value, stakeholder confidence and differentiated market share while reducing business risk. To guide this transformation, businesses can reference the 12 Principles of Green Chemistry,⁴ building these principles into internal product design and manufacturing processes. Other tools such as Clean Production Action's Green-Screen for Safer Chemicals⁵ set in place rigorous evaluation and assessment processes to ensure that inherently safer chemicals are selected.

Adopting and enforcing an effective chemicals policy lets brands—both manufacturers and the retail chains with influence over their standards—improve existing products while designing safer chemistry into all new products. Such a policy supports and enables the corporate mission and vision by describing relationships, scope of work, design standards, specifications for supply chain partners, disclosure of chemical ingredients, roles and responsibilities, timelines, and outcomes. Ideally, the chemicals policy is embedded into quality and environmental management systems such as ISO 9001/14001 to ensure its ongoing integrity and continuous improvement. Many large retailers, from Amazon to Walmart, have already adopted chemical policies that exceed current regulatory requirements. Others include CVS, Home Depot, Lowe's, Rite Aid, Safeway and Whole Foods.

A FINANCIAL ANALYSIS OF SAFER CHEMICALS

Removing a chemical of concern from a product is obviously a business expense, but there is a compelling business case for doing it. Conducting research and development (R&D) to find safer alternatives that deliver acceptable performance comes at a price—but continuing to use chemicals of concern comes with a risk of staggeringly higher costs to reputation as well as finances.

Consider the 2015 case of Lumber Liquidators, featured in a *60 Minutes* report when accused of selling laminate flooring that contained formaldehyde—a known carcinogen—that failed to meet appropriate health and safety standards. Several samples of the Chinese-made laminate floorings

were tested and found to contain the cancer-causing chemical formaldehyde at levels 6 to 20 times above levels permitted in California. According to Dr. Philip Landrigan, children exposed long-term at these levels are more likely to show signs of chronic respiratory irritation.⁶ After the report aired, Lumber Liquidators Holdings Inc. saw an immediate 25 percent decline in value.⁷

Similarly, in early 2019, Bayer's stock value plummeted over 44%—a near seven-year low for the company—in the wake of yet another lawsuit which found that Bayer's recently acquired product, Roundup, was a cause of cancer.⁸ With over 13,000 claims focused on the carcinogenicity of glyphosate, the active ingredient in Roundup, investors were left wondering if Bayer's \$63-billion acquisition of Monsanto in 2018 was worth the financial risk.⁹

Businesses that avoid making needed changes risk millions in legal fees from consumer lawsuits, and even more if an accident occurs involving chemicals of concern that harms employees and local residents. In 2014, a chemical spill into the Elk River in West Virginia sent nearly 600 people to the emergency room and cost the local economy \$61 million in lost business activity.¹⁰ The company responsible for the spill, Freedom Industries, had to file Chapter 11 bankruptcy after paying more than \$2.9 million in fines from dozens of lawsuits.



PRINCIPLES FOR CHEMICALS POLICY

Leading businesses that use chemicals—"downstream users"—are endorsing a common set of guiding principles for moving away from toxic chemicals to safer alternatives:

1. Know and disclose product chemistry.
2. Assess and avoid hazards.
3. Commit to continuous improvement.
4. Support public policies and industry standards (to achieve the above three principles).

These four principles reflect both the vision for best business practices and the need of downstream users for government chemicals policy reform.



By removing toxic chemicals from their supply chains, businesses also protect themselves from high remediation costs should accidents or incidents of exposure occur. Removing chemicals of concern from the workplace demonstrates good intent in the legal sense, shows employees and consumers their wellbeing is a priority, and reduces the chance of public exposure to cancer-causing compounds. Companies manufacturing or using hazardous chemicals must factor in potential immediate and long-term costs of major fines, product liability, and loss of credibility with consumers and investors. Retailers have already received significant fines for mishandling hazardous materials, and have had to contend with the crisis at hand and with lost sales from a tarnished reputation. These financial considerations reasonably motivate retailers to develop internal chemical safety policies, leverage suppliers to disclose and improve their product ingredients, and advocate for stronger chemicals policies industry-wide.

SAFER CHEMISTRY: INCREASED AWARENESS LEADS TO PROFITABLE INNOVATION

An argument for change that is rarely made but is very powerful is that green chemicals and green products can be profitable. The market is shifting, and sooner or later, companies that refuse to implement a safer chemical policy will lose customers and profits. Business models utilizing safer chemistry are supported and encouraged by organizations such as the American Sustainable Business Council (ASBC), the Green Chemistry & Commerce Council (GC3) and Clean Production Action (CPA). NGOs currently collaborate with businesses on strategies to implement top-quality policies and practices for safer products, and to collect real-world data for assessing business and economic risks and opportunities of “going green.”



FACTS AND FIGURES OF CHILDHOOD CANCER

The costs of keeping chemicals of concern in products on the market not only puts business value at risk but puts a hefty financial burden on patients and their families, and society as a whole.

- A recent analysis demonstrated that cancer patients face a higher risk of personal bankruptcy than individuals without cancer.¹¹
- The average total cost for one child with cancer (medical costs and lost parental wages): **\$833,000**.^{1,2}
- 1 in 5 children who receives a new diagnosis of childhood cancer is already living in poverty, while 10–15% of US families studied were not poor at the time of diagnosis but became poor during treatment for their child’s cancer.¹³
- Families also reported losing more than **40%** of their annual household income as a result of work disruption related to their children’s cancer treatments.¹⁴
This figure does not account for out-of-pocket expenses such as traveling to the hospital and extra childcare at home.
- From 2000 to 2005, cancer-related hospitalization costs **DOUBLED**.¹⁵
- In 2009 alone, childhood cancer-related hospitalization costs totaled nearly **\$1.9 BILLION**.¹⁶

\$ 833K

TOTAL COST FOR ONE CHILD WITH CANCER

1 in 5

NEWLY DIANOSED KIDS IS LIVING IN POVERTY

\$ 1.9 BILLION

HOSPITALIZATION COSTS PER YEAR DUE TO CHILDHOOD CANCER



THE GREEN CHEMISTRY MARKET—defined by Pike Research to include biobased chemicals, renewable feedstock, “green” polymers and less-toxic chemical formulations—and the green products market are growing and expanding. The global market is on a trajectory to grow from \$11 billion in 2015 to \$100 billion by 2020. The North American market is projected to grow from \$3 billion to \$20 billion over the same time period. Consumer interest in green chemistry is seeing a similar trend, with companies reporting a growth in interest from 57% in 2009 to 62% in 2014.

“Green” jobs are also growing. The US Department of Labor defines Green Goods and Services (GGS) as “goods and services produced by an establishment that benefit the environment or conserve natural resources.”¹⁰ From 2010 to 2011, the number of US chemical manufacturing positions classified under GGS grew by 7%. In contrast, total employment in the chemical manufacturing sector decreased by 0.4%.

These significant market insights have led companies to increasingly invest in green technology and safer chemical solutions. The transition from fossil fuel-based to bio-based chemicals and products is underway, although in the US the transition’s success suffers from lack of government support. The bio-based raw materials generally used in the production of green chemicals and green products—including bioethanol, sugar, starch, cellulose, and vegetable oils—have application across numerous industries including healthcare, food processing and construction. In our economy’s transition to safer chemicals, business innovations are vital to reducing the use of chemicals of concern and their harmful impact on children.

Companies producing products without chemicals of concern are no longer outliers. Numerous companies that provide safer alternatives to conventional products are thriving because they chose to listen to the marketplace. They are creating products that prioritize the wellbeing of the public and the environment and use their distinctive brand stories to inform consumers. They also advocate for action by public policymakers.

Because consumer credibility requires companies to support their “green” claims, nonprofit organizations such as Made Safe®, government certifications such as the Environmental Protection Agency’s Safer Choice program, and others work with companies to verify claims through certification. This process certifies that a company’s products are free of chemicals of concern.



THE GLOBAL MARKET IS ON A TRAJECTORY TO GROW FROM

\$11 billion to \$100 billion
(2015 to 2020)

THE NORTH AMERICAN MARKET IS PROJECTED TO GROW FROM

\$3 billion to \$20 billion
over the same time period





ALAFFIA

First started as a fair-trade company to benefit women in Togo, West Africa, origin of sought-after shea butter, the firm's retail brands include a line for babies which is among the highest-performing products at Whole Foods Market. Finding that consumers wanted to know its products were safe from harmful ingredients, the brand has responded to consumers by focusing its message on its safer ingredients.



BABO BOTANICALS

A well-known brand found at Target and many smaller stores, it has built its reputation on being better for kids and effective for parents. The firm demonstrates that brands choosing safer chemistry can be successfully mass-marketed at affordable price points.



BEAUTYCOUNTER

A leader in the national movement for improved transparency and accountability in the beauty industry. It develops and distributes beauty and personal care products free of hazardous chemicals.



BIOSERIE

This innovative toy manufacturer uses bio-based plastic and is free of phthalates, fire retardants, heavy metals and more. The firm is showing that thoughtful selection of materials can provide a practical yet healthier approach.



CABOO

A maker of baby wipes and other disposable paper products, this firm is an example of a company making mass-marketed products that come in direct contact with people and are made without harmful preservatives.



COMMUNITY PLAYTHINGS

A maker of high-quality products for child care programs, it uses the least toxic approaches to making climbing structures, cribs, nap mats, and more. It has eliminated all chemicals that must be disclosed under Washington State's Children's Safe Products Act, including phasing out all PVC/vinyl.



EARTHKIND

Creates naturally effective products guaranteed to keep pests out without killing or poisoning them, or causing harm to our delicate ecosystem. 80% of ingredients are from US regenerative farms, 20% of assembly workers are handi-capable, and North Carolina-based manufacturing is carbon neutral.



ECOS

Creates affordable household cleaning products that are derived from plants, free of toxic chemicals, and made using Zero-Waste guidelines. It never tests on animals and its manufacturing facilities are carbon neutral.



NATUREPEDIC

This bedding maker's products are manufactured using NO toxic materials. It offers mattresses, mattress pads and protectors; crib mattresses, baby mats, and changing mats; all crafted without harmful flame retardants, high-risk pesticides, carcinogenic material or other ingredients harmful to humans or the ecosystem.



PATAGONIA

is a widely-recognized outdoor apparel and equipment company whose sustainable practices can be seen in each aspect of the business, from the way it sources materials to its WornWear® repair and reuse service.



PLENI NATURALS

A maker of personal care products for children, this company uses minimally processed, food-grade ingredients. It is one of the firms demonstrating that it is possible to make, and profitably sell, products for children that are non-toxic, highly functional, and do not degrade human and environmental health.



PURA STAINLESS

A durable-goods bottle company, the firm uses surgical-grade stainless steel and silicone to replace traditional plastic products. Its durable, long-lasting bottles have spurred a movement in plastic-free bottle tops that don't leach hazardous chemicals.



SEVENTH GENERATION

Offers plant-based products with all ingredients listed on its packaging, which is made from recycled materials. In considering each step of a product's life cycle, the company creates a sustainable supply chain and reduces its impact on people and the planet.



These and other innovative companies clearly demonstrate that healthier solutions can be profitable, which is important in mainstreaming the more responsible approach. Green chemicals are foundational and essential for products that foster environmental sustainability over time and across industries. Demand for green chemicals and products is expected to increase exponentially.



A growing number of guides are also available that identify common sources of toxic chemicals in children's products, identify safer options, and give the public information to make safer purchases. From pacifiers to cribs, Getting Ready for Baby's Safe Baby Products Guide helps families choose safer products to care for their children and teaches them how to avoid chemicals of concern when shopping, including chemicals that contribute to increased cancer risk.

The Ecology Center's Healthy Stuff project tests everyday products and materials to identify common sources of toxic chemicals and reports on its findings. For example, their most recent report on children's car seats in December 2018 found that some tested seats still contain chemicals, such as brominated flame retardants, phosphorus-based flame retardants and per- and polyfluoroalkyl substances (PFAS), that are linked to cancer. Children and adults can be exposed to these chemicals through other routes as well. Healthy Stuff has recently found PFAS, for instance, in the plastic grass blades of artificial turf, commonly used for children's athletic fields.

It is also important to note that safer chemicals and products are not just a privilege and an opportunity for wealthy communities, but a critical need and business opportunity in less well-off communities. Coming Clean and the Environmental Justice Health Alliance started the Campaign for Healthier Solutions (CHS), which works to transform discount retail stores ("dollar stores") from sources of toxic products and unhealthy food into sources of safer products and locally grown, healthy, sustainable foods. The CHS' efforts have led Dollar Tree to develop an initial chemical management policy, begin to phase out seventeen harmful chemicals from the products it sells, and become only the third retail corporation to join the Chemical Footprint Project. Dollar General is also developing an initial chemical policy and restricted substances list.

THE CAMPAIGN FOR HEALTHIER SOLUTIONS (CHS)

works to transform discount retail stores ("dollar stores") from sources of toxic products and unhealthy food into sources of safer products and locally grown, healthy, sustainable foods.



INVESTMENTS IN SAFER CHEMISTRY

Consumer demand is driving an ever-increasing level of investment into research and development of safer chemistry and safer consumer products. Such demand is most readily observable, for example, in consumer shopping for local, organic and plant-based products across the food sector. According to the Organic Trade Association (OTA), US sales of organics broke the \$50-billion mark in 2018 and increases by double digits each year, making it the fastest growing sector of the US food industry.¹⁷

Amazon's acquisition of Whole Foods has accelerated this trend; small brands can now easily scale their product to be distributed nationwide without the logistical challenges they previously faced.¹⁸ Investments and acquisitions such as these show a significant shift in investor thinking. They encourage increased production and broader distribution of alternative products that consumers are actively seeking—products that let them avoid pesticides and other questionable chemical ingredients that may be undisclosed in products from conventional big brands. When a high-profile business like Amazon accelerates a trend, it allows products—in this case organics—to be less expensive and more accessible to all people. Safer Made, a venture capital fund, is a prime example of the shift in investor thinking as it invests in companies and technologies that reduce people's exposure to toxic chemicals and is driven by the public's demand for safer products.

Over the past 30 years, growing investor and shareholder interest in safer alternatives has been reflected in global initiatives as well, such as the UN Environment Program Finance Initiative, the UN Principles of Responsible Investing, and the UN Global Compact's 10 Principles of Corporate Citizenship, as well as an initiative from the banking sector, the Equator Principles, and many institutional asset managers' groups. Many retail investors, especially family offices with Millennial heirs, have also been directing asset managers to shift their portfolios toward clean, renewable companies, green infrastructure, green bonds, and young, privately held firms.



Large institutional investors in particular look to sustainability reporting to identify key metrics.¹⁹ The Sustainability Accounting Standards Board's (SASB) reporting fulfills such informational requirements, underscoring the importance of chemicals management. In 2014, the SASB released a report containing its standard for the chemicals industry which, among other metrics, provided data on the percentage of products by revenue that qualify as substances of very high concern, or fall into the acute toxicity hazard categories. It also provided data on market and market share for green chemistry-based products.²⁰ Such data may help investors clearly understand and associate financial risk from chemicals of concern—and convey that understanding to governing bodies and manufacturers.

The other issue to remember is that the economic impact of toxic chemical disasters, pervasive toxic emissions and dumping is felt most heavily in low-income areas and communities of color. Safer chemicals and products should reduce the harm to these communities' residents, and our efforts to make those safer products available should also create good jobs. Economic well-being and healthier environments can go together to create stronger communities nationwide.

To continue moving the market, businesses and investors must continue critical research to identify barriers to investing in sustainable R&D.

BUSINESS AND GOVERNMENT WORKING TOGETHER

Businesses advance support for safer chemistry by showing that it is definitely possible to provide products free of harmful chemicals and still be profitable. They greatly amplify that support by advocating for better public policy.

Through its safer chemicals campaigns, the American Sustainable Business Council has brought together a wide

range of companies—some of them direct competitors—to collaborate in advancing public policy at the state and national levels. These campaigns fight for ingredient transparency and the removal of chemicals of concern, both to protect human and environmental health and to foster a fair competitive arena for companies that value safety. Public policy is needed to level the playing field: without regulations that require new and existing chemicals to meet standards recommended by the health science communities, companies may struggle to retain their competitive positions while switching to safer chemicals in their products. Public policy has a stake in facilitating more, not fewer, healthful options for consumers.

Working together, business and government must develop policies that establish common definitions and strong safety guidelines and ensure that the integrity and intent of existing chemical regulations are enforced to keep the public safe.²¹ Policy can also provide incentives that accelerate innovation in sustainable R&D so that businesses can afford to create safer alternatives that reduce cancer risk.

Science-based, results-oriented government initiatives and regulations create an environment conducive to the growth of the green chemicals and products market. The US Environmental Protection Agency (EPA) has historically provided significant crucial support for research and education on preventing pollution and reducing toxic chemicals in products. Government can provide the basic, science-based definitions and guideposts to businesses so they can efficiently operate on a level playing field.



BUSINESSES ADVANCE SUPPORT FOR SAFER CHEMISTRY by showing that it is absolutely possible to provide products free of harmful chemicals and still be profitable. **They greatly amplify that support by advocating for better public policy.**





Already, business and government together have expanded awareness that using green chemicals and materials support a cleaner environment while supporting economic and social wellbeing—the formula for true sustainability. The EPA Safer Choice program is an important example of how a public agency can support consumers and responsible businesses by highlighting safer products in the marketplace. This approach complements the role of regulations in maintaining industry accountability.

Some of the policies advocated for by responsible businesses and others focus on ingredient disclosure and better labeling of products, the removal of specific harmful chemicals or classes of chemicals from products, and the reporting of toxic chemical use at any level in products or facilities.²² For example, California’s Cleaning Products Right to Know Act of 2017 (SB-258) requires manufacturers of cleaning products sold in the state to disclose their ingredients both online and on the product label so that consumers can easily access information.²³ Online tools are also available to explain in more detail about legislative initiatives in green chemistry, including Safer States’ Bill Tracker and California’s Safer Consumer Products Program. It aims to move manufacturers to safer alternatives for identified chemicals in specific products, while avoiding regrettable substitutions through the use of its Candidate Chemical list.

Policymakers want to know what businesses want, and company leaders’ support for product transparency and safety legislation speaks volumes. Companies have the expertise to explain what responsible businesses want, based on their first-hand experience and values. In an environment where ruthlessness has been touted as the only way, firms that successfully switch from conventional chemicals to safer alternatives are living proof that they can and do reap profits without exploiting people and destroying the planet.²⁴ These success stories encourage more companies to change their own processes and lend their voices to influence legislation that shifts the market in the right direction. The biggest winners in this shift will be our children.

FIRMS THAT SUCCESSFULLY SWITCH from conventional chemicals to safer alternatives are living proof that they can and do reap profits without exploiting people and destroying the planet.



CONCLUSION

Moving away from toxic substances toward safer, cleaner chemicals and products will boost business growth, job creation and our economy overall, while providing safer, healthier environments for our children. By changing the laws that govern how chemicals in commerce are used, tested and reported on, we can establish a fertile landscape for green, renewable chemistry to create exciting new alternatives to toxic chemicals. Consumers, including our vulnerable children, can have confidence knowing what is in the products businesses make and sell when meaningful transparency rules are in place.

Instituting safer chemicals as standard makes sense for our children’s health and our environment—and also for our businesses and the economy. This essential transition will:

- Identify chemicals of high concern to human health or the environment.
- Improve public health and level the playing field for responsible companies by requiring existing chemicals to meet the same testing requirements as new chemicals.
- Expand markets for safer, greener chemicals and products.
- Create a more predictable regulatory system for easier business compliance.
- Reduce costs and risks of managing chemicals in products and across supply chains.
- Lower expenses for chemically-induced employee illness and enhance productivity with improved employee health.
- Increase trust among consumers, employees, communities, and investors.
- Improve transparency and communication throughout the supply chain.
- Create a more competitive, innovative and economically sustainable US chemical industry.

Business owners and investors have a leading role to play in reducing the impact of toxic chemicals as a causal factor in childhood cancer and other environmentally-induced childhood diseases. By increasing investments in research and development, stimulating market competition and innovating use of safer chemicals throughout their supply chains, businesses and investors can make a major difference. But they can't do it alone. Public policy support for healthy alternatives is essential.

Today, new chemicals are being allowed to enter the market without adequate testing, which naturally discourages companies from putting effort and money into developing safer alternatives. According to a report produced by James Heintz and Robert Pollin from the Political Economy Research Institute at the University of Massachusetts, Amherst, "regulatory reform must level the playing field between new and existing chemicals in order to encourage innovation while maintaining core protections for all chemical products."²⁵ For businesses to make the decision to replace toxic chemicals with safer alternatives, there must be increased stringency for existing chemicals and equally strict testing for new chemicals. Government policies must be in place to incentivize those decisions. As we seek safer chemicals and healthier product solutions, we must work to ensure that we are building a more inclusive and just economy creating good jobs, growing local economies and creating economic well-being and healthier communities for all.



"Children are our most precious gift, and at ECOS we want to champion change in the cleaning products industry to protect them. The science is irrefutable—toxic chemicals are responsible for an increase in childhood cancers. All cleaning product manufacturers must join us to innovate safer green chemistry and create safer cleaning products for homes, daycare facilities and classrooms."

— Kelly Vlahakis-Hanks, President & CEO, ECOS®





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PUBLIC POLICY: SYSTEMIC CHANGE FOR PREVENTION



AS THIS REPORT MAKES CLEAR, A GROWING BODY OF SCIENTIFIC EVIDENCE CONNECTS EXPOSURE TO CHEMICALS IN OUR ENVIRONMENT WITH CHILDHOOD CANCERS. Exposure begins even before conception and continues throughout childhood. Environmental contributors to childhood cancers such as leukemia include: solvents, ambient air pollution (including benzene), ionizing radiation, and pesticides. Parental exposure to or contact with pesticides, including before and after conception,¹ as well as direct childhood exposures to pesticides may all contribute to childhood leukemia. Legal restrictions on cigarette smoking likely reduce pre- and post-natal exposure to tobacco smoke, which can cause cancers; however, many other dangerous common chemical compounds are far less controlled.

The devastation associated with exposure to chemicals in the environment is a serious public health problem. Even when children survive cancer, the illness and its necessary treatment regimens inflict residual damage. Patients are at lifelong increased risk of cancer recurrence, damage to heart and lungs, decreased bone density, infertility, and problems with learning, attention, and memory.² Both young patients and their families are emotionally and physically stressed and exhausted due to necessary treatment regimens, and the costs of medical care alone are often overwhelming. Cancer-related hospitalizations alone accounted for \$1.9 billion in US healthcare spending in 2009. For all these reasons, people who survive cancer as children face increased economic, health, and emotional costs throughout their lives.³

CANCER-RELATED HOSPITALIZATIONS ALONE ACCOUNTED FOR \$1.9 BILLION IN US HEALTHCARE SPENDING IN 2009.



“Serving as the Board Chair of Hyundai Hope on Wheels for now over 10 years I have seen first-hand the work being done by so many talented and dedicated doctors/ researchers throughout the United States. These wonderful people need money to fund their life-changing research. Hyundai Hope On Wheels has granted over \$160M to fight pediatric cancer. Sadly, the US government does not allocate the resources necessary to really advance treatments. It takes the corporate sector stepping up to fill that void, a void not only filled by seeking cures, but also by making real the vision of Children Living in a World without Products Linked to Cancer. Together, we who seek a cure and those who pursue preventative strategies, must conquer pediatric cancer.”

– Scott Fink, Chairman of the Board, Hyundai Hope On Wheels, CEO of Hyundai and Volkswagen of New Port Richey, Florida; CEO of Hyundai, Mazda and Chevrolet of Wesley Chapel, Florida.

Many of these costly impacts are preventable. The marketplace can and in some cases already does design products and utilize processes to avoid known and suspected carcinogens. There are many examples of innovative, responsible business practices that foster healthier environments, with more coming to the fore.



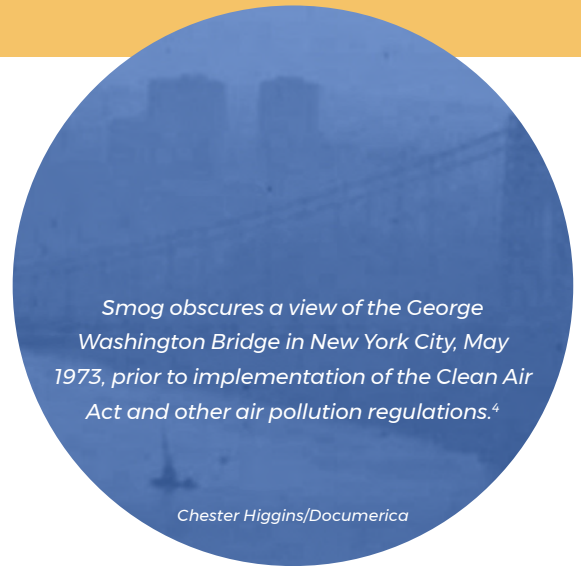
However, too many companies are lagging and are content to merely comply with current regulatory requirements which are far weaker than needed to stem the costly damage to public health. These firms are relying on government to establish and enforce better requirements—and government has a duty to provide them. Government regulation is therefore crucial to reducing environmental exposure to chemicals that contribute to cancer and other diseases and disorders.



HOW GOVERNMENT ACTION IMPROVES PUBLIC HEALTH

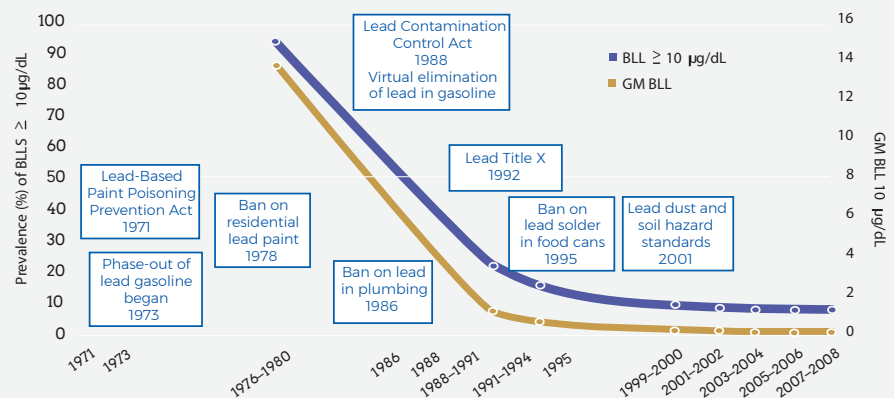
Government’s acceptance of its job to set the foundation for what is acceptable in its society has always had profound implications for human health and the environment. A cursory glance through history provided multiple examples of the protections we now take for granted that were once argued by legislators. At one time, stuffed animal toys for children were made with oily rags and other “filthy, putrid” materials. Since state and federal passage of better laws, stuffed animals are made with clean materials, either new or recycled. Toys for babies were made with parts small enough for a young, actively “mouthing” child to swallow and choke on them, until federal regulations ended that practice. The federal Clean Air, Clean Water, Resource Conservation and Recovery, Hazardous Substances, Consumer Product Safety Improvement, and Toxic Substances Control Acts have all significantly—although incompletely—improved our health and that of the environment we depend on.

One need only compare pictures taken in cities such as New York and Los Angeles during smog events prior to enactment of the Clean Air Act with images of those same cities now, to see the great difference pollution control regulations have made. Most people are aware of the devastating effects on children’s brains from exposure to lead, but this chart dramatizes how an enormous improvement can be achieved with government regulation. In this case, the huge drop in children’s blood lead levels followed laws requiring removal of lead from household paint, automobile gasoline, and other products.⁵



Government Regulation Instrumental in Improving Children’s Blood Lead Levels

Following laws requiring removal of lead from paint, gasoline, and other products



Source: <https://pediatrics.aappublications.org/content/pediatrics/138/1/e20161493/F1.large.jpg?width=800&height=600&carousel=1>



WHAT WE NEED NOW TO REVERSE THE RISE IN CHILDHOOD CANCERS

In order to decrease childhood cancer rates, we need our governments to take responsible action and limit the environmental factors that contribute to these diseases. Laws, regulations, and internal purchasing policies of government and other institutions are needed to produce healthier outcomes for our children.

PROGRESS AT RISK

While air quality has improved in the US over the last several decades, millions of people still live in places where pollution from mobile and point sources threaten their health. In some communities located downwind of manufacturing plants or near busy roadways, risk of cancer from air pollution is many times higher than in places with cleaner air. In addition, the hopeful trends in air quality across the country may now be in jeopardy. Federal data show that, “over the last two years, the nation suffered more polluted air days than just a few years earlier. There were 15% more days with unhealthy air in America both last year (2018) and the year before (2017) than

there were on average from 2013 through 2016; the four years when America had its fewest number of those days since at least 1980.”⁶ While it is unclear whether this is the beginning of a trend, health experts say it’s troubling to see air quality progress stagnate or regress.

The New York Times began tracking the number of rollbacks in environmental laws and regulations in January 2017. The current count is 95, with 25 loosened regulations on air pollution and emissions.⁷ Combined with more lax restrictions on drilling and extraction (19 rollbacks) and toxic chemicals (8 rollbacks), these threaten children’s health and cancer risk. These rollbacks are likely to lead to measurable increases in childhood cancer.

An increase of specific pollutants in the air breathed by pregnant women resulted in increased likelihood of childhood cancer diagnoses: “The odds of acute lymphoblastic leukemia increased by 9%, 23%, and 8% for each 25-ppb increase in average nitric oxide, nitrogen dioxide, and nitrogen oxide levels, respectively, over the entire pregnancy. Second- and third-trimester exposures increased the odds of bilateral retinoblastoma.”⁸



ROLLBACKS IN ENVIRONMENTAL LAWS AND REGULATIONS 2017–2019

	58 Rollbacks Completed	37 Rollbacks in Progress	95 Total Rollbacks
 Air pollution and emissions	16	9	25
 Drilling and extraction	10	9	19
 Infrastructure and planning	11	1	12
 Toxic substances and safety	5	3	8
 Water pollution	4	6	10
 Other	12	9	21



POLICYMAKERS MUST FULFILL THEIR OBLIGATION TO PREVENT CHILDHOOD CANCERS OF ENVIRONMENTAL ORIGIN

This obligation to protect public health includes ensuring that we:

1. Protect existing and recent federal laws from rollbacks.
2. Hold the US Environmental Protection Agency accountable for enforcing existing regulations.
3. Expand air quality and water protections.
4. Require the reduction or elimination of pesticide use by measures such as integrated pest management (IPM).
5. Require use of safer materials in children's products and our built environment.
6. Increase funding for research on cancer prevention.
7. Use government and institutional dollars to purchase nontoxic options.
8. Ensure children's spaces are sited safely.
9. Require transparent disclosure of chemicals of concern in children's products and in areas intended for use by children, i.e. artificial turf.
10. Eliminate toxic chemicals in children's products.

MISSION CRITICAL: DEFEND FEDERAL REGULATIONS

With more than 80 science-based environmental regulations being undermined or dismantled by the current administration, legislators must aggressively protect programs that have been rolled back or are under attack. For example, after the president attempted to authorize drilling via executive order,⁹ the US House of Representatives passed bills to ban offshore oil and gas drilling in the Atlantic, Pacific, and off the Florida coast. Priority efforts should be given to environmental justice: restoring policies that protect communities of color and low-income neighborhoods, who are disproportionately harmed by polluting activities most often sited in their areas.



LOCATION MATTERS: PROTECTING CHILDREN IN EARLY CARE AND SCHOOL SETTINGS

The location of childcare programs, early education facilities, and schools can significantly increase or decrease a child's exposure to air pollution and pollution from previous land uses.¹⁰ For example, research has shown that air near highways is significantly more polluted, making these areas unsuitable for children's facilities. Policymakers should advance laws that require any proposed schools, early education facilities, and childcare programs planning for new facilities to assess potential locations and avoid locations:

- **WHERE FORMER USES MAY HAVE CONTAMINATED AIR, WATER, SOIL, OR THE BUILDINGS THEMSELVES.** These uses include industrial manufacturing, dry cleaning, auto repair, funeral homes.
- **ADJACENT TO PAST OR PRESENT ACTIVITIES THAT COULD LEAD TO MIGRATION OF HARMFUL CHEMICALS THROUGH THE SOIL, WATER, OR AIR ONTO THE NEW FACILITY'S PROPERTY.** These include sites designated as state or federal hazardous waste ("Superfund") or brownfield sites, waste transfer stations, auto repair shops, hair and nail salons, gas stations, factory farms and dry cleaners. These also include transportation infrastructure with increased hazardous emissions, such as transfer points, trucking facilities, bus garages, and rail routes that carry petroleum products or hazardous chemicals.
- **WITH THE PRESENCE OF NATURALLY OCCURRING HARMFUL CHEMICALS,** including radon, arsenic in soil, and asbestos.
- **WITHOUT ACCESS TO AMPLE, SAFE, HEALTHY DRINKING WATER.** Babies consume a significant amount of water, especially when it is used to make formula.
- **WITHIN 1,000 FEET OF HIGH TRAFFIC CORRIDORS, PARTICULARLY HIGHWAYS.** Vehicles generate air pollution, including ultrafine particles and a cocktail of chemicals. California forbids siting schools within 500 feet of freeways; all communities should enact similar policies, expand it to provide a more protective buffer of 1,000 feet and cover all care and educational programs for children from birth through secondary school.



The Agency for Toxic Substances and Disease Registry (ASTDR) has awarded \$10.5 million annually to 25 state health departments under a program known as APPLETREE (ATSDR’s Partnership to Promote Local Efforts to Reduce Environmental Exposure),¹¹ which will “use the funding to evaluate past and present exposure to environmental hazards and to prevent future exposures,” focused on the first four items in the list above. Such programs should be expanded to include assessment of health impacts resulting from proximity to heavy traffic.

The Eco-Healthy Childcare (EHCC) program is the only national program that partners with child care professionals to eliminate environmental health hazards found in or around child care facilities. EHCC is also a key collaborator on the APPLETREE Partnership. Under APPLETREE, funded states must also develop plans and take action to protect children from environmental hazards through the safe siting of early care and education facilities.

Funding for these programs must be protected at the federal level. Additionally, the program should be expanded in four ways:

- **ADDRESS PROXIMITY TO MOBILE AIR POLLUTION SOURCES**—also known as high traffic areas (particularly proximity to highways).
- **INCLUDE SCHOOLS** serving children in kindergarten through high school.
- **COVER ALL STATES AND TERRITORIES** and expand financial support to enact these policies. (Children in 25 states not currently funded must be afforded these protections. Many of these states include communities already disproportionately impacted by environmental threats.)
- **INCREASE FUNDING FOR STATES** to flow remediation funds to early care and education programs whose locations have been identified as problematic, but where remedy without relocation is sufficient to protect children’s health. This is a significant need for most states and most APPLETREE partners.

PEST CONTROL WITHOUT POISON

Three primary pathways expose pregnant women, babies, and children to pesticides: parental work in agriculture; food and beverage consumption; and insect and weed control in residential, work, education and care facilities. The Centers for Disease Control and Prevention has found that 90% of Americans have pesticides in their blood and urine, and parental exposure to insecticides and herbicides is linked to childhood cancer. **Recent research has found that reducing consumption of pesticides by choosing organically grown food reduces human consumption of pesticides and can reduce cancer risk.**¹² Other ways to reduce exposure depend on public policy.



THE LOCATION OF CHILDCARE PROGRAMS, early education facilities, and schools can significantly increase or decrease a child’s exposure to air pollution and pollution from previous land uses.





POLICYMAKERS AT ALL LEVELS SHOULD ENACT POLICIES THAT:



1. Require that government facilities and all early care and learning settings implement biologically-based Integrated Pest Management (IPM) strategies to minimize the use of chemicals to solve pest control problems.
2. Protect families from residential pesticides, ban the open-market sale of pesticides that are carcinogenic or neurotoxic.
3. Establish tight limits on acceptable levels of pesticides in final food products. Such limits discourage reliance on pesticides to maximize agricultural yields, and encourage organic food production, (which has strong pesticide restrictions as a cornerstone of organic certification) and encourage regenerative agricultural practices which help build soil health, address climate change and more.
4. Ban chemical pesticides for ornamental uses. Given the connections between pesticides and health problems, health should be put ahead of perceived aesthetics, and mechanical methods should be promoted in lieu of chemical solutions.
5. Keep new pesticides off the market; forbid approval of new pesticides until proven safe.
6. Learn from efforts underway in Europe for pest management strategies that do not allow the use of harmful pesticides.¹⁵

Unfortunately, carcinogens are commonly found in building products, including formaldehyde in particle board, toxic flame retardants in furniture foam, phthalates in flexible polyvinyl chloride (PVC) plastic products such as vinyl flooring, methylene chloride in paint strippers, and PFAS in carpets. These and other toxic chemicals migrate from products into the air and dust in our buildings.¹⁵

YOUNG CHILDREN ARE ESPECIALLY VULNERABLE TO THESE TOXIC CHEMICALS: they spend most of their time on the floor and in lower air spaces and can have significantly higher levels of these chemicals in their bodies than adult family members. Products made with benzene, formaldehyde and other volatile organic compounds can contribute to harmful indoor air, and products made with non-stick and waterproof coatings, or chemicals added as flame retardants, can contaminate dust.

Product manufacturers are often unaware that the materials they buy to assemble their products, such as foam for furniture seating, contain toxic chemicals. **MATERIAL SUPPLIERS ARE NOT REQUIRED BY LAW TO DISCLOSE ALL THE CHEMICALS IN THEIR MATERIALS, AND FINAL PRODUCT MANUFACTURERS OFTEN DO NOT ASK FOR FULL DISCLOSURE OF CHEMICAL INGREDIENTS.** Examples include multi-material items such as toy cars, personal care and cleaning products that contain ingredients only listed as “fragrances,” and in general, items made with plastic.

Although changes have been made to the federal Toxic Substances Control Act, these will not drive improvements quickly or broadly enough to shift how things are made for the US market. Further action is needed, and states are addressing the gap by creating their own policies and acting as a backstop for safety; this is critically important as many federal regulations are being eroded.

OUR INDOOR ENVIRONMENTS MATTER, TOO

According to the EPA, the average American spends 93% of his or her time indoors; 87% in buildings and 6% in vehicles.¹⁴ Our homes, workplaces, childcare facilities, schools, churches and other built environments, along with the furniture and furnishings in them, can and should be made with materials that do not contain carcinogens.





ESSENTIAL COMPONENTS OF EFFECTIVE TOXIC SUBSTANCE CONTROL REGULATIONS INCLUDE:

- 1. FULL TRANSPARENCY OF MATERIAL INGREDIENTS.** To change what materials and products are made of, we need to know what is in them now. Examples of policies that drive transparency about chemicals include California and New York requirements for cleaning product ingredient disclosure, California's Proposition 65 labeling law, and laws in Washington State, Oregon, and Vermont requiring reporting of chemicals of concern in children's products.
- 2. FULL TRANSPARENCY ABOUT CHEMICAL RELEASES FROM AND USE IN MANUFACTURING FACILITIES.** The Toxic Release Inventory (TRI) currently excludes a number of chemicals known or suspected of causing cancer and other health impacts. These chemicals, such as PFAS, must be added to TRI. Full knowledge of toxic chemicals used in manufacturing facilities is especially important to workers and fence-line communities that are highly vulnerable to exposure to these chemicals.
- 3. REGULATIONS TO RESTRICT PRODUCTION AND USE OF CLASSES OF CHEMICALS, NOT SINGLE CHEMICAL STRUCTURES.** Recent research has highlighted the problems that come from focusing on individual chemicals one at a time. One example is the restriction of certain polybrominated diphenyl ethers (PBDEs), but not others. As science struggled to keep up with manufacturers' changing chemical choices, researchers found that PBDEs not previously restricted also caused harm. **It is irresponsible to wait for proof of harm when credible evidence about similar chemical structures exists.** Instead, policies should include provisions for demonstrating that specific structures are inherently safe, and then allow them to be added to the list of acceptable chemicals, rather than repeatedly placing the burden of proof on government bodies to prove harm is occurring. For example, Washington State's 2019 law, SB 5135, gives the state the authority to restrict classes of chemicals of concern, such as the per- and polyfluoroalkyl substances (PFAS), in consumer products. San Francisco's 2019 ordinance requires all upholstered furniture and certain children's products to be free of flame-retardant chemicals.
- 4. SUPPORT FOR REDUCTION OF THE USE OF TOXIC CHEMICALS IN MANUFACTURING.** Beyond regulatory requirements, Massachusetts' Toxic Use Reduction Institute and New York State's Pollution Prevention Institute are examples of government-funded academic programs that support the marketplace's move toward safer solutions.
- 5. DIRECT GOVERNMENT AND INSTITUTIONAL PURCHASING OF INHERENTLY SAFER SOLUTIONS.** Historically, green procurement has focused on reducing material, energy and water consumption, but procurement can also effectively avoid materials and practices that contribute to childhood cancer and other diseases of environmental origin. The essential criteria for toxic substance regulations identified in this list can be applied to procurement decision-making. A national leader in procurement of safer products, San Francisco adopted new sustainable carpet purchasing requirements in 2018 that prohibit flame retardants, antimicrobials, PVC, polyurethane, and styrene butadiene latex in carpeting.
- 6. INVEST IN GREEN CHEMISTRY R&D—AND SHARE THE RESULTS AMONG AGENCIES.** Green chemistry and engineering research and development occur in many government agencies, and policymakers should direct agencies to coordinate their work, develop joint plans for how to advance green chemistry and engineering solutions, and prioritize green chemistry and engineering frameworks within existing research and development. In addition, policymakers should partner with and fund academic institutions with deep expertise in green chemistry and safer material design. Policymakers should also consider requiring prioritizing funding requests that include green chemistry considerations, and increase resources for exploring, developing, and implementing these approaches.





GREEN CHEMISTRY IS NONPARTISAN

In April 2019, House Reps. Dan Lipinski (D-IL) and John Moolenaar (R-MI) and Senators Chris Coons (D-DE) and Susan Collins (R-ME) introduced matching legislation called the “Sustainable Chemistry Research and Development Act.”

KEY ACTIONS OF THE SUSTAINABLE CHEMISTRY RESEARCH AND DEVELOPMENT ACT:

- “Direct the White House Office of Science and Technology Policy to establish an interagency committee under the National Science Technology Council to coordinate federal programs related to sustainable chemistry.
- Require the interagency body to develop a “roadmap” to characterize the field, assess the state of research, identify challenges for increasing sustainability in chemical sciences, and identify opportunities for expanded federal activity.
- Direct agencies to fund R&D and training programs in support of sustainable chemistry and report the resources allocated within their annual budget requests.
- Permit agencies to establish partnerships between institutions of higher education, industry, and other non-governmental organizations that support research and facilitate workforce training in sustainable chemistry.”¹⁶

CONCLUSION: “OUNCE OF PREVENTION” APPLIES TO CHILDHOOD CANCERS

Approximately 90% of the National Cancer Institute funding supports research on treatment, and while this has resulted in significant improvements in mortality, it still leaves thousands of families each year dealing with the pain and stress of fighting the disease and with the profound, long-term economic and health problems discussed here. Behavioral advice is useful for personal choices that increase the risk of cancer, but most contributors to childhood cancers are not choices but are environmental—and preventable. Enacting and enforcing strong, science-based laws and regulations to reduce and eliminate environmental contributors to cancer is urgent. To guide these vital regulations, we need increased funding for research that deepens our understanding of the causes of cancer, which chemicals or combinations of chemicals are contributors, and what prevention strategies will drive down cancer rates. Federal policymakers should invest increased funding for the National Cancer Institute’s Occupational & Environmental Epidemiology Branch to advance this fundamental strategy.

GOVERNMENT HAS A FUNDAMENTAL OBLIGATION TO PROVIDE FOR THE GENERAL WELLBEING OF THE PUBLIC AND OUR SHARED ENVIRONMENT, both of which are profoundly at risk due to the ways in which chemicals are manufactured, used, and released. Policies that restrict harmful chemicals and drive our economy toward safer solutions are essential if we are serious about preventing debilitating, deadly diseases like childhood cancers.





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FOR PESTICIDES POLICY: Pesticide Action Network of North America, panna.org

FOR POLICIES TO REDUCE TOXIC CHEMICAL PRODUCTION: Safer States, www.saferstates.org

SUSTAINABLE PROCUREMENT POLICIES ROADMAP: <https://www.ecocenter.org/sustainable-procurement-policies-roadmap>

FOR POLICIES AND PROGRAMS TO REDUCE ENVIRONMENTAL HARM IN THE CHILDCARE SETTING: The Eco-Healthy Child Care (EHCC) program <https://cehn.org/our-work/eco-healthy-childcare/> (EHCC is also a key collaborator on the APPLETREE Partnership).

ASBC'S THE BUSINESS CASE FOR SUSTAINABLE PROCUREMENT: https://www.asbcouncil.org/sites/main/files/file-attachments/procurement_2018.pdf

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CHILDHOOD CANCER PREVENTION: WE NEED TO ACT NOW



HISTORY PROVIDES FAR TOO MANY EXAMPLES OF EARLY WARNING SIGNS of serious health impacts that were ignored due to actual or perceived lack of scientific consensus—from tobacco to asbestos to medical diagnostic radiation exposure. The threat of childhood cancer is complicated by multiple vectors: tens of thousands of chemicals in commerce; widespread exposure to legacy contaminants that persist in air, water and soil; a lack of requirements for testing carcinogenicity before new chemicals are put on the market; and a near-impossible bar of proof—not only of risk but also (depending on the statute) of economic harm exceeding economic benefit—before a substance can be regulated. A new approach is needed to accelerate risk reduction.

WHEN DO WE KNOW ENOUGH TO ACT? How much evidence is needed before prevention is pursued? Protecting the public's health is not purely based on scientific judgement. The answer should depend on the strength of the evidence to date, the availability of alternative ways of achieving the same social good, the consequence of inaction or acting in error, and the consideration of co-benefits.^{1,2}

1. THE STRENGTH OF THE EVIDENCE.

Given the ethical and methodological challenges to understanding risk from environmental exposures described above, environmental health scientists rely on multiple kinds of evidence. Coherence among systematic reviews of relevant research (similar to the Cochrane reviews widely used in medicine), meta-analyses which combine data from multiple studies, and pooled birth cohort studies is considered strong evidence of risk and of the effectiveness of interventions. Where evidence is less robust, research gaps should be filled; for example, the role of risk factors in rare childhood cancers including Wilms' tumor, osteosarcoma, retinoblastoma, to name

a few. Additional studies of exposure are needed to help prioritize where to intervene and to what degree to mitigate harmful exposures. Yet it is important that research gaps not be used as justification for failing to act to reduce exposure to known hazards. Chemical manufacturers have adopted the playbook used effectively by the tobacco industry over many decades to woo smokers and undermine regulation. Sowing doubt about hazards is an explicit strategy used by some companies, one that accepts more sickness and death while we wait decades for even more evidence to accumulate.

2. AVAILABILITY OF ALTERNATIVES.

One of the most essential and powerful steps for change is understanding that there are alternatives.³ For many of the risk factors strongly tied to childhood cancers, safer alternatives exist. Where they do not, regulatory and consumer demand signals can drive innovation. For example:

- **PESTICIDES.** Markets for organically produced food are fast-growing, and grocery stores increasingly stock organic produce. Higher prices for organic food can exacerbate disparities in exposure between higher and lower income people, however. Policies should be developed to ensure that safe and healthy food is made available to all populations. Biologically-based Integrated Pest Management minimizes or eliminates pesticide use (and reduces the phenomenon of pest resistance which requires ever more potent materials) on crops and in public spaces. Where reduced use of or reliance on pesticides is impossible, personal protective equipment and washing of produce can (for some pesticides) reduce exposure. Wearing long pants for insect protection reduces the need for repellants. These and other strategies can reduce or eliminate the need for pesticides.





- **PAINTS AND SOLVENTS.** Paint products traditionally high in volatile organic compounds (VOCs) now have low-VOC options. Safer alternatives to hazardous consumer products such as methylene chloride and NMP-based paint strippers now line the shelves of home improvement stores. Known carcinogens such as trichloroethylene (TCE) are being phased out of industrial uses because of the availability of safer alternatives, for example, the use of ultrasonic aqueous processes for metal degreasing, and the adoption of “professional wet cleaning” to replace the use of perchloroethylene in dry cleaning. (Although the EPA proposed to ban the use of TCE as a degreaser and spot removal agent back in December of 2016, nearly three years have passed under the Trump Administration with no action.)
- **TRAFFIC-RELATED AIR POLLUTION.** Safer alternatives include transitioning fleets to electric vehicles, incentivizing clean public transportation, passing and enforcing no-idling laws, siting new schools and homes away from busy roadways, and reducing indoor diesel exposures in workplaces where parents can be exposed. Air quality monitoring and alerts can inform schools and families about “bad air days” when children should stay inside.

3. CONSIDERATION OF CONSEQUENCES OF INACTION OR ACTING IN ERROR.

Estimates of numbers of cases of childhood cancers likely to be prevented by a given intervention will be more or less precise depending on the availability of data on hazard and exposure. Anticipating outcomes of intervening—both beneficial and potentially harmful—is also an imprecise science. Yet open discussion of these consequences and considerations of trade-offs aligns with a principle of transparency in government decision-making widely embraced by organizations whose mission is to promote the public interest.

4. CONSIDERATION OF CO-BENEFITS.

Intervening to reduce pesticide use, air pollution and solvent exposure—among other environmental risk factors for childhood cancers—will confer benefits beyond cancer prevention; benefits which should be taken into account in decision-making. These include reduced risk of neuro-developmental disorders, adverse birth outcomes,

learning disabilities and asthma, among other impacts.^{4,5} Learning disorders, autism and other neurological impacts have been linked to children whose mothers were exposed to solvents.^{6,7} Co-benefits are even larger when considering broader public health impacts, such as global climate change associated with air pollution.

Policymakers and businesses—as well as the citizens who influence them—have important roles in securing resources for research to accelerate progress on understanding cancer mechanisms and the role of environmental factors, as well as development of tools that can rapidly assess chemicals for their potential to contribute to cancer. Also needed are incentives and investment in safer materials and products which show promise but are not produced at a scale commensurate with market need.

There has long been a heavy focus on conducting research to find a cure and improve the types of treatments we are able to provide for cancer patients, but little attention is being given to the prevention of childhood cancers from occurring in the first place. We believe that inaction on the prevention front is a missed opportunity and urge collaboration across sectors to ensure that children can live in a world where they are protected from avoidable risk.



FOR MORE INFORMATION ABOUT THE INITIATIVE

Contact ChildhoodCancerPrevention@asbcouncil.org

Visit ChildhoodCancerPrevention.org

Business/Investors asbcouncil.org/childhood-cancer-prevention



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CHILDHOOD CANCER PREVENTION INITIATIVE

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#PREVENTCHILDHOODCANCER



AMERICAN SUSTAINABLE BUSINESS COUNCIL

THE AMERICAN SUSTAINABLE BUSINESS COUNCIL (ASBC)

is a network of business organizations and companies, together representing over 200,000 businesses, working to advance market solutions and public policies for a vibrant, just and sustainable economy. ASBC raises up the voice and power of business at the state and national levels, engaging business leaders and educating decision makers and the media on issues including safer chemicals, sustainable packaging, high-road workplace practices, regenerative agriculture, climate change, clean water, the circular economy and more. www.asbcouncil.org



CANCER FREE ECONOMY NETWORK

THE CANCER FREE ECONOMY

is a dynamic, collaborative network of experts and stakeholders cultivating an inclusive movement to promote healthy environments free from toxic chemicals. We believe that cancer is an all-too-common diagnosis for which a key opportunity for prevention has been largely left on the sidelines: removing hazardous chemicals from the water we drink, the air we breathe, the food we eat, and the products we use. www.CancerFreeEconomy.org



CHILDREN'S ENVIRONMENTAL HEALTH NETWORK

THE CHILDREN'S ENVIRONMENTAL HEALTH NETWORK (CEHN)

is a national multi-disciplinary non-profit organization whose mission is to protect the developing child and developing fetus from environmental health hazards and promote a healthier environment. For over 28 years, CEHN has worked to achieve this mission by stimulating and participating in peer-reviewed science, raising awareness, providing education and training to a variety of lay and professional audiences, and promoting evidence-based and child-protective policy at the state and federal levels. www.cehn.org



CLEAN & HEALTHY NEW YORK

CLEAN AND HEALTHY NEW YORK

is an environmental health advocacy organization focused on promoting safer chemicals, a sustainable economy, and a healthier world by "turning off the tap" of toxic chemicals flowing into our lives. Their work focuses on advancing government policies, market shifts, and public education. They coordinate the national Getting Ready for Baby campaign, which focuses on ensuring products for babies and young children are free of harmful chemicals. www.cleanhealthyny.org and www.gettingready4baby.org



CLEAN PRODUCTION ACTION

CLEAN PRODUCTION ACTION (CPA)

translates its vision for preferred chemicals into tools and strategies that NGOs, governments and businesses need to advance green chemicals, sustainable materials and environmentally preferable products. Working closely with networks across the globe, we identify emerging trends and develop essential solutions. It is this combination of collaboration, empowerment and advocacy for a clearly defined vision that is key to facilitating the fundamental market transformations necessary for our economy. www.cleanproduction.org

The Childhood Cancer Prevention Initiative is a collaborative effort to improve children's health by widely sharing the evidence base about the impacts of toxic chemicals on children, as well as opportunities for preventing childhood cancer by removing toxic chemicals from products and environments where children live, learn and play. Together, we will engage scientists and health professionals to review and interpret research, help manufacturers and retailers drive a shift in business practices, and encourage legislators to implement responsible state and federal policies. We will learn from the experiences of parents, workers, businesses and communities, and provide them with information and tools to avoid exposure to potentially dangerous substances and exercise their power to shift the marketplace.

For more information about the Initiative:

Contact ChildhoodCancerPrevention@asbcouncil.org
Visit ChildhoodCancerPrevention.org



Lowell Center for Sustainable Production UNIVERSITY OF MASSACHUSETTS

THE LOWELL CENTER FOR SUSTAINABLE PRODUCTION AT THE UNIVERSITY OF MASSACHUSETTS

Lowell uses rigorous science and innovative strategies to develop practical solutions to environmental and health problems that promote environmentally sound systems of production and consumption. www.uml.edu/Research/Lowell-Center/



MADE WITH CARE. INCIDENT-FREE. MADE SAFE. WWW.MADESAFE.ORG

MADE SAFE®

is a human-health- and ecosystem-focused independent, third-party, scientific certification program that screens for known toxic chemicals in personal care, baby, and other household products. MADE SAFE uniquely employs an ecosystem evaluation approach to guide companies and consumers. This certification makes it easy to identify products made without chemicals known or suspected to be harmful to humans or the ecosystem. www.madesafe.org



MAX CURE FOUNDATION

THE MAX CURE FOUNDATION

is a national childhood cancer charity serving all aspects of the pediatric cancer community. Through its Roar Beyond Barriers program, the foundation assists low-income, military, and first-responder families with children diagnosed with cancer in active treatment. Max Cure also funds aggressive and translational research for clinical translation and promotes positive legislative change on the federal, state, and local levels to protect families and encourage further participation by governments in the pediatric cancer cause. www.maxcurefoundation.org



CHILDHOOD CANCER

CROSS-SECTOR STRATEGIES FOR PREVENTION

CHILDHOOD CANCER
PREVENTION INITIATIVE

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