POLLUTION KNOWS NO BORDERS

HOW THE POLLUTION CRISIS IN LOW- AND MIDDLE-INCOME COUNTRIES AFFECTS EVERYONE'S HEALTH, AND WHAT WE CAN DO TO ADDRESS IT

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Authors:
Angela Bernhardt, Dr. Jack Caravanos, Richard Fuller OAM, Stephen Leahy and Ami Pradhan with substantive input from GAHP members.

The contents of this publication do not reflect positions of individual member organizations of GAHP.

For questions, comments and feedback, please contact:

Angela Bernhardt
Pure Earth
475 Riverside Drive, Suite 860
New York, NY 10115
+1 212 870 3490
angela@pureearth.org

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COVER PHOTO:

NIGERIA

Burning fields in Onitsha.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

Additional input provided by:

Jack Caravanos, DrPH, CIH, Clinical Professor of Environmental Public Health Sciences, College of Global Public Health, NYU; Director of Research, Pure Earth

J. Carl Ganter, **Jennifer Möller-Gulland**, and **Cody Pope**, Circle of Blue

Dr. Laura A. Geer, Associate Professor and Chair, Department of Environmental and Occupational Health Sciences, SUNY

Dr. Philip J. Landrigan, Professor of Biology; Director, Global Public Health Program, Schiller Institute for Integrated Science and Society, Boston College

Dr. Bruce Lanphear, Clinician Scientist at the Child & Family Research Institute, BC Children's Hospital, and Professor in the Faculty of Health Sciences at Simon Fraser University in Vancouver, British Columbia

Gina McCarthy, Director of Harvard University's Center for Climate, Health, and the Global Environment

Katherine Bruce Mechner, MSc, Board member, Pure Earth

Greg Medcraft, Director of the OECD Directorate for Financial and Enterprise Affairs

Dr. Frederica Perera, DrPH, PhD, Professor of Environmental Health Sciences, Director of the Columbia Center for Children's Environmental Health

Janez Potočnik, Co-Chair of UN International Resource Panel, Former European Commissioner for Environment

Shazia Rafi and **Rafay Alam**, Air Quality Asia

Nicholas Rees, UNICEF Policy Specialist

Baskut Tuncak, UN Special Rapporteur on Human Rights and Toxics

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Pollution does not always stay in its country of origin. It moves in the air and water, and through the food and product chains globally. These toxins can not only be considered local phenomena. The very nature of global ecosystems and the global economy spread them far and wide.

INDIA

To irrigate their crops, in this case rice, farmers near Muzaffarnagar pump putrid water from a nearby canal contaminated with raw sewage, industrial chemicals, and heavy metals. The contaminants are finding their way into India's food supply.

Photo: Jennifer Möller-Gulland/Circle of Blue

EXECUTIVE SUMMARY

TOXIC, DISEASE-CAUSING POLLUTION TRAVELS THE GLOBE and crosses national borders in many guises, both visible and invisible. Air pollution from coal-fired power plants, vehicle emissions, and factories circle the earth, as does vaporized mercury and many other airborne pollutants. Toxic chemicals and pesticides banned in the United States, Canada, and Europe are used in industrial and agricultural practices in low- and middle-income countries lacking environmental regulations. Toxicants not only harm workers and their children in these countries but also make their way to consumers around the world.

The 2017 Lancet Commission on Pollution and Health found pollution, especially in low- and middle-income countries, to be the largest environmental cause of death and disability in the world.[1] Multiple expert opinions, backed by literature review, have drawn attention to the global flow of toxins from countries lacking substantive pollution controls to the rest of the world. This report outlines some of these findings, aggregating reliable reports and analyses related to transboundary pollution.

“Toxic pollution is invisible and often takes years before the health impacts become evident but it is one of the biggest health threats we face today,” says Gina McCarthy, director of Harvard University’s Center for Climate, Health, and the Global Environment and former head of the US EPA. “There are still many domestic sources of modern pollution but increasingly our exposure comes from low and middle-income countries. That’s why it’s in everyone’s interest to advocate that pollution be addressed at the source, wherever it is around the world.”

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High-income countries have invested in pollution control, with success

The US, Canada, Europe, and other OECD countries have benefited from decades of investment—cleaning up the environmental disasters created by industrial growth in the 19th and 20th centuries. A great deal of legacy pollution remains, but many of the most visible problems have been cleaned, contained, and are being managed, thanks to strong environmental protection agencies. These nations have benefited greatly in terms of improved health, economic growth, and intellectual productivity from investments in pollution control.

In the US alone, each dollar invested in air pollution control has returned an estimated $30 (USD) in benefits since 1970. Higher IQs and increased productivity from removing lead from gasoline has returned an estimated $200 billion each year since 1980, for a total of $6 trillion.[2]

Those of us living in wealthy countries might think, after half a century and billions of dollars spent on pollution clean-up, that we—especially our children—are free from toxic threats. Unfortunately, that is an illusion. Pollution from other countries does not stop at political borders.

Pollution has grown enormously in low- and middle-income countries

From a health perspective, deaths from toxins in the air, water, soil, and workplace outstrip malaria, HIV, tuberculosis, even war and murder. In 2015, pollution was responsible for 9 million deaths. Most of these fatalities—over 92 percent—occurred in low- and middle-income countries.[3]

Pollution is a consequence of industrialization and urbanization, two dominant forces shaping the world over the last century and a half. Wealthy countries have generally moved past the dirtiest parts of the industrial revolution into digital and knowledge economies. But in low- and middle-income countries, rapid industrialization, while lifting millions out of poverty, is creating an enormous burden of ill health. Countries like China, India, Nigeria, Bangladesh, and Vietnam are accumulating intolerable levels of pollution. In some of these countries, pollution is responsible for one in four deaths, far more than infectious diseases like malaria.[4]

Pollution moves globally: Through the air, the food chain, and products

Many toxic pollutants do not decay into non-toxic byproducts. Air particulates, heavy metals, and some pesticides can move in the air and water, and through the food and product chains globally. These toxins cannot be considered local phenomena because the very nature of ecosystems and the global economy spread

Children are most at risk. We now know that even low doses of toxicants such as lead and air pollution can have profound impact on their health and well being. There has been a rapid increase in noncommunicable diseases among children in recent decades, including diabetes, birth defects, autism spectrum disorder, leukemia, and more, a development that medical experts are calling a "silent epidemic."

BANGLADESH

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

them far and wide. This report highlights dozens of examples of these kind of toxins moving across borders.

It is important to note that most exposures identified in the reports are low, often just above regulatory standards. Additionally, only a small portion of most foods and products show positive results for toxicity. As a result, the risk to the average person for significant health impact is probably low. However, these risks are real. Releases of toxins in poorer countries are clearly growing, and attention to pollution in poorer countries has been inadequate. With research in this area limited, more attention and resources are needed, both to understand risks and to establish practical solutions.

All of us share responsibility. Some part of transboundary pollution comes as a result of wealthy countries off-shoring highly polluting industries to countries with weak environmental regulations and lower production costs. In an interdependent global economy, products containing toxins return undetected in food and product imports, essentially forming a toxic feedback loop.

Air, soil and chemical pollution hit children the hardest

Children are most at risk. We now know that even low doses of toxicants such as lead and air pollution can have profound impact on their health and wellbeing. There has been a rapid increase in noncommunicable diseases among children in recent decades, including diabetes, birth defects, autism spectrum disorder, leukemia, and more, a development that medical experts are calling a "silent epidemic."[5] Most of those diseases are expected to be the result of environmental exposures.

Heavy metal contamination of agricultural products is of particular concern. Reports of lead, arsenic, mercury, and other toxic metals in baby food, sweets, chocolate, and spices are commonplace.[6,7,8] Several studies have documented the increase in use of industrial wastewater laden with heavy metals for crop irrigation by farmers lacking access to clean water.[9,10] Farmers in countries like China and India contend with climate-related water stress and rapid growth of polluting factories around their fields, leaving them no choice but to use toxic water. Constant exposure to this water sickens farmers and their families, while the effluent contaminates the soil, gets absorbed by the plants, and makes its way into global food markets, exposing consumers around the world.

"We're increasingly seeing the health impacts of toxic pollution on children," says Nicholas Rees, a policy specialist at UNICEF. Those impacts include the weakening of children's immune systems, making them more vulnerable to infectious diseases. "We can't close our eyes about how this is affecting children's health in those countries," he adds.

Pollution and climate change are inextricably linked

Climate change, also borne from two centuries of industrialization, is intertwined with the toxic pollution problem.

"As millions of tons of toxic air pollutants and carbon dioxide are generated by fossil fuel combustion globally every year, the twin impacts of climate change and toxic pollutants have become the world's most significant threat to children's health and future," says Frederica Perera of the Columbia Center for Children's Environmental Health at Columbia University.

"Tiny particles of soot and other toxicants inhaled by the mother can reach the unborn child, affecting health immediately and potentially seeding latent disease that may only

▲ **INDONESIA, GOLD MINING VILLAGE**

Boy watches as his father uses mercury to extract gold particles.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

"When it comes to pollution, we are all connected. There is an invisible toxic thread that links workers being poisoned in low- and middle-income countries producing products and consumers exposed to poisons while consuming these products."

—Richard Fuller, President, Pure Earth

become evident in later life. Toxic air pollutants and climate change can affect health and functioning over an entire lifespan," says Perera. Recent studies show children of pregnant women who breathe polluted air or experience impacts of climate change are at elevated risk of worse birth outcomes, developmental disorders, and respiratory illness.[11,12] "These exposures are impairing children's health, ability to learn, and potential to contribute to society," says Perera.[13]

Because pollution is global, solutions must be global as well

Solutions to most pollution issues are well known and understood, and eminently doable. Cleaner fuels, treatment plants for effluents, safe production techniques, and guidance on and enforcement of pollution regulations for small- and medium-sized enterprises—all these techniques have been shown to work successfully. Costs and benefits for pollution mitigation programs have proven their effectiveness again and again. These solutions need to be encouraged and brought to scale in low- and middle-income countries.
Given the extent of global trade and the complexity of supply chains and manufacturing processes, relying on import inspections to stop all dangerous products from coming into a country is not realistic. Instead, identifying the problems at the source and helping to prevent that pollution from occurring in the first place are the only reasonable strategies for success.

"When it comes to pollution, we are all connected. There is an invisible toxic thread that links workers being poisoned in low- and middle-income countries producing products and consumers exposed to poisons while consuming these products," says Richard Fuller, president of Pure Earth. "Not only is helping them reduce their pollution the right thing to do for children growing up in these countries, it's necessary to safeguard the health of children in wealthy consumer nations."

"You can't solve air pollution or transboundary pollution on a country-by-country basis," says Janez Potocnik, the European Union's former environment commissioner. "It requires global cooperation to deal with the problem at the source. The good news is that international efforts underway to combat climate change will greatly reduce air pollution and improve the health of children everywhere."

As Potocnik says: "To help ourselves we must help others."

“You can’t solve air pollution or transboundary pollution on a country-by-country basis. It requires global cooperation to deal with the problem at the source. The good news is that international efforts underway to combat climate change will greatly reduce air pollution and improve the health of children everywhere.”

—Janez Potocnik, Former Environment Commissioner, European Union

CHILE

Air pollution in Santiago.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

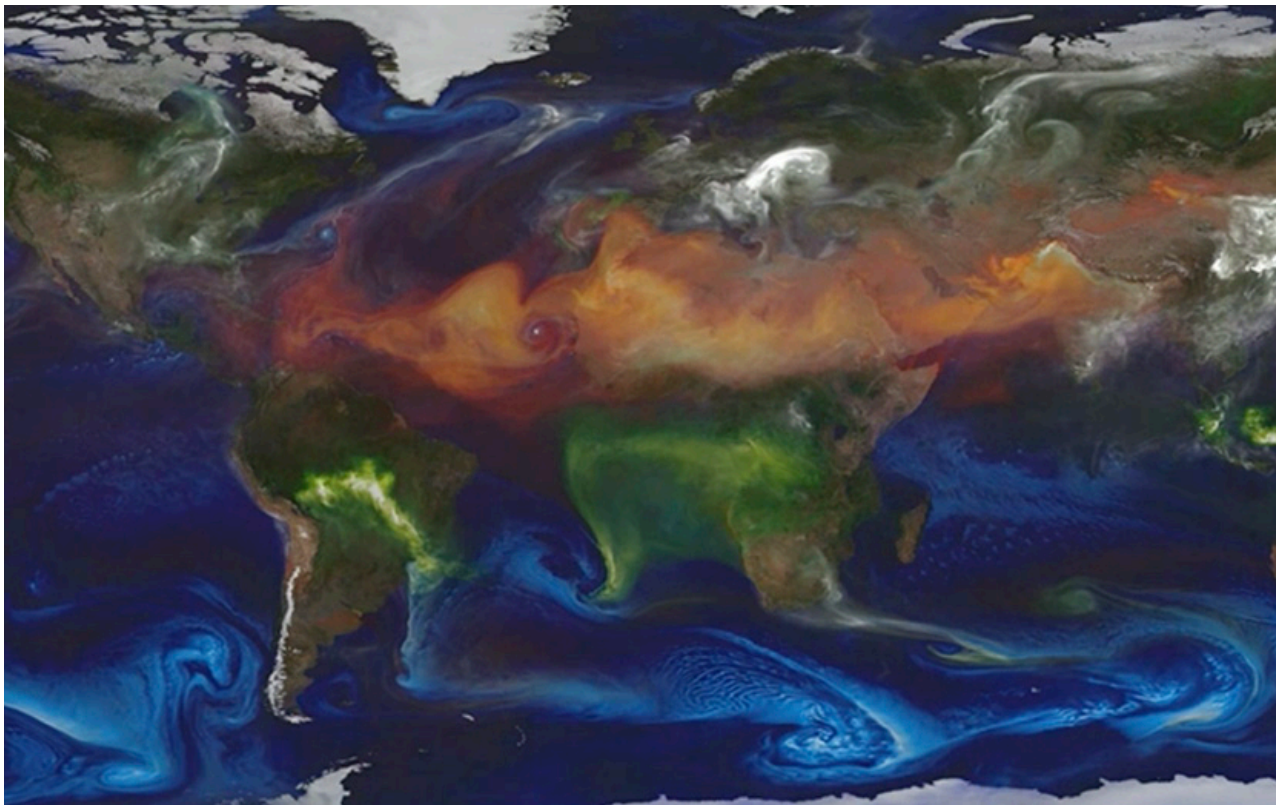
WHAT IS TRANSBOUNDARY POLLUTION?

With this paper, we look at pollution through a different lens, examining how it moves through two of the largest, most influential systems we share—the global ecosystem and the global economic system of trade.

So, what exactly do we mean when we refer to transboundary pollution? It is disease-causing toxicants created by industrialization, agriculture, household burning of biomass for cooking, or the burning of garbage that circulates the globe. Much of this pollution does not stay where it was generated but moves through the earth's natural ecosystems, as well as our systems of global trade, across national and regional borders, across oceans and continents, and cannot be contained by political boundaries.

A large number of substantial analyses, academic publications, and government reports in recent years have detailed various aspects of transboundary pollution. This white paper aggregates these reports in an attempt to show a more complete story. In doing so, it outlines the risks to all of us, especially our children.

Each section shows how toxins in air, water, soil, food, and products impact us globally. Examples from government reports and peer-reviewed literature are listed in the body of the report and in more detail in the appendix.



AIR POLLUTION

The most visible and well-documented form of transboundary pollution is air pollution.

This NASA simulation (*Figure 1*) illustrates how global air currents transport air pollution across continents and oceans.[14] One study identified that 29% of particulates in the San Francisco area came from coal power plants in China.[15]

Wealthy countries have done reasonably well in tackling air pollution in the last decades. Looking at the change in PM2.5 pollution around the world from 1999 to 2016 (*Figure 2*), it is clear that air quality in the US, Canada, and Western Europe has improved.[16] This type of particulate matter (*Figure 3*), ranging in size from 2.5 microns in diameter and less—about 1/30th the width of a human hair—is the most dangerous air pollution particle, able to penetrate deep into the lungs, and has an array of health impacts, including increasing the risk of heart attacks, strokes, respiratory diseases, and cancer. It often contains toxic heavy metals like lead and mercury.

But meanwhile, the air quality across Asia and other parts of the globe

FIGURE 1

NASA animation showing how aerosol particles move around the globe.

Credit: NASA's Goddard Space Flight Center/Global Modeling and Assimilation Office

See animation at www.svs.gsfc.nasa.gov/30637

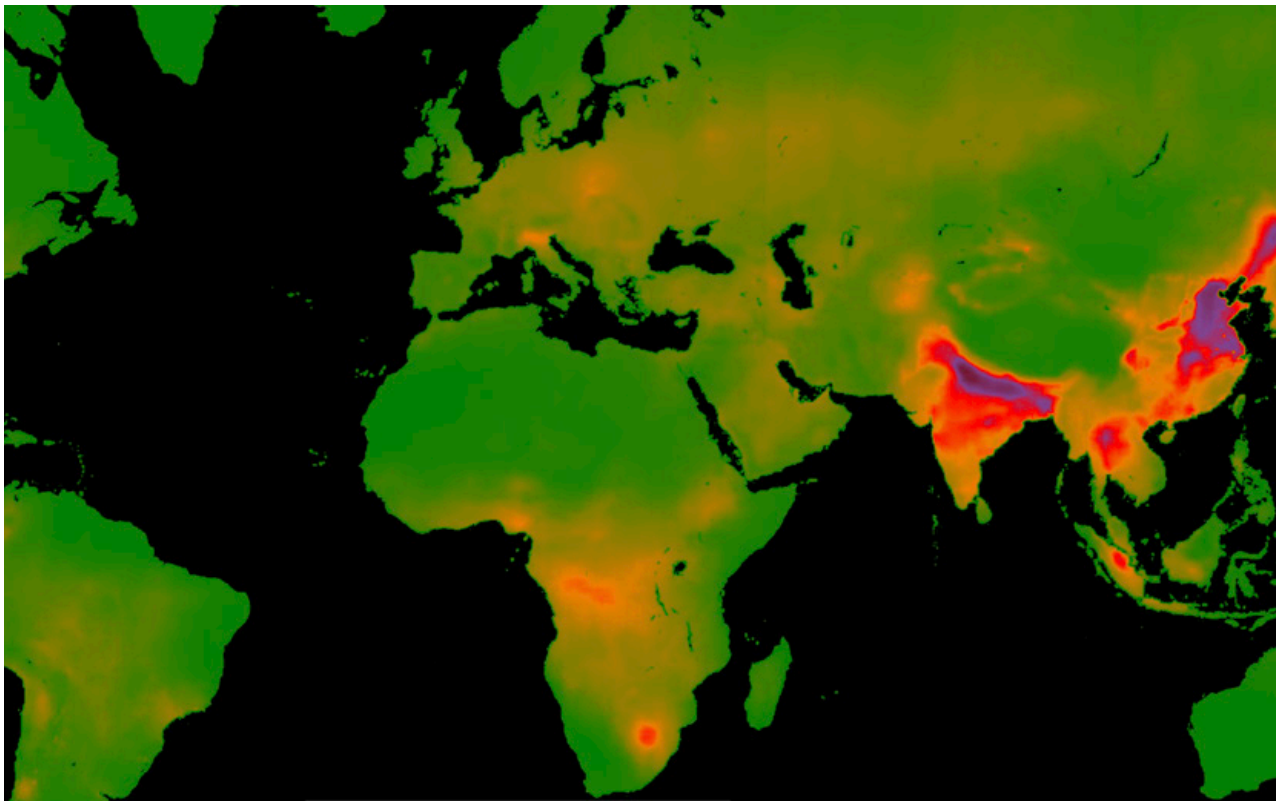


FIGURE 2

Changes in PM2.5 pollution from 1999 to 2015, www.earthtime.org/pollution, developed by CMU CreateLab and Pure Earth.

See animation at www.pureearth.org

has become much worse. As air currents move toxins around the globe, the implication for the world is stark. Air pollution now steals, on average, a year of life from every person around the world.[17] Between 3.5 million and 6 million deaths every year have been linked to outdoor air pollution.[18] About 20 percent of those deaths result from air polluted while making goods in one location that are sold in other countries.[19]

Everyone is downwind when it comes to air pollution. Particles from dust storms in Asia blow across the Pacific Ocean and become haze in the skies of North America. Asian air pollution produced from burning fossil fuels like coal is, by far, the biggest contributor to the rising smog levels in the Western US.[21] The effects in Korea and Japan from pollution in other parts of Asia are even more profound.[22] Western Europe has seen a similar impact from emissions originating in Eastern Europe.

“In North India and Pakistan, the Kharif (or Autumn) crops such as rice and wheat are harvested in late October and November,” explains Shazia Rafi of Air Quality Asia. Burning crop residue is a cheap means of clearing land for the next crop and has become a major contributor to poor regional air quality, affecting countries throughout South Asia.

Other examples of this cross border effect include:

- Within the European Union, the biggest health impacts from coal

▲ **MACEDONIA**

A worker at an outdoor quicklime kiln in the southeastern village of Kosturino. The operation burns tires for fuel.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting/Undark.org

are seen in France, with 1,200 premature deaths caused by coal pollution from Germany, the UK, Poland, Spain, and the Czech Republic.[23]

- About half of new mercury emissions in Europe originate from outside its borders. Approximately 45 percent of surface water in the European Union contains unsafe levels of mercury.[24]

- China's severe air pollution has been linked to more than 64,800 premature deaths outside its borders, including over 3,100 deaths in Western Europe and the US.[25]

Smog and particulate pollution have now been linked to increases in heart attacks, respiratory illness (including asthma), kidney disease, and mental illness. Exposure to air pollution has also been linked to significant reductions in intelligence.[26] Ultrafine particles of soot have been detected in children's urine after entering their bloodstream through their lungs and circulating throughout their bodies.[27]

MERCURY: A TOXIN THAT TRAVELS

Mercury comes in many forms, most of them toxic. Methyl mercury, an organic compound, that damages the neurological system, is particularly problematic for the youngest, and can cause permanent neurological damage in fetuses, along with cognitive impairment and developmental disabilities in children.

While the risk of bioaccumulation in seafood is well known, it can be hard to grasp that mercury actually travels across continents to land on our dinner tables. A landmark study published by the US Geological Survey (USGS) in 2009 documents the process by which increased mercury emissions from human sources across the globe, and in particular Asia, make their way into the North Pacific Ocean-rich feeding grounds for tuna and other marine life.[28]

Meanwhile, thousands of miles away in the US, Sophie, age four, could no longer tie her shoes and was losing her nascent ability to read. Tests revealed that the tuna-sandwich-loving girl was suffering from high levels of mercury. After a couple of months of fish-free eating, Sophie's mercury levels dropped.[29]

The largest source of anthropogenic mercury contamination these days is the activity of small-scale gold miners, with coal-fired power plants a close second.[30] Artisanal gold miners use the element to extract gold from crushed ore. They burn off the mercury as part of the mining process, releasing mercury vapor into the air from where it eventually settles into the ocean. With most of the mercury that enters the North Pacific coming from the atmosphere, scientists have predicted an additional 50 percent increase in mercury in the Pacific by 2050 if emission rates continue as projected.[31]

In just the nation of Indonesia, more than a million small-scale gold miners have released hundreds of tons of mercury into the air, from at least 850 locations that are considered environmental hotspots that require urgent remediation. Many of their children suffer from mercury poisoning, and some are born with severe birth defects.

Often, mining is a family's only source of income, and there is little awareness among the miners of the health impacts of mercury.[32]

Other toxicants, including arsenic, PCBs, heavy metals, and pesticides are also transported long distances, through air and water into the food chain. Polar bears and penguins living in the remotest regions of the world have high amounts of these toxins in their bodies. Inuit children in Canada's Arctic have high levels of PCBs in their bodies even though the sources of PCBs are thousands of miles away.[33] PCBs have been banned for decades but persist in the environment so that some Inuit children eating local seafood today continue to have high PCB levels, impairing their fine motor skills such as the ability to write or print.[34]

▲ INDONESIA, GOLD MINING VILLAGE

Baby born with severe birth defects from mercury poisoning.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

FOOD IMPORTS AND TOXINS

When we go grocery shopping for our families, whether we know it or not our carts are filled with products that come from all over the world: spices, fresh produce, packaged food, and perhaps fish and meat products. These are often grown and processed under standards less stringent than those required by wealthy countries, or may not come under any pollution or contamination control at all.

In our global economic system, just as electronics and cars are assembled from materials sourced from multiple countries, food products are sometimes an amalgam of ingredients originating in multiple countries. A recent analysis of a frozen pizza found that it was made from 35 ingredients that had passed through 60 countries on 5 different continents.[35]

This is not to say that toxins are in all foods and products from overseas—just that reliable studies have revealed that some of them show contamination. Plus, a positive test for contamination does not mean disease or impairment is inevitable; the levels used in tests are conservative, and usually imply high levels of consumption. But toxins ought not to be something a family should worry about when they visit the supermarket.

Labeling can be misleading. Apple juice proudly labeled "Product of Canada" was actually made of apple concentrate from China. China exports 90 percent of the world's fruit juice concentrate, and the US and Europe are its major markets.[36]

Contamination can happen anywhere along the production process. Produce, for example, can be tainted by unsafe farming practices. In countries like India, China, Morocco, Mexico, and others where clean water for agriculture is becoming scarce due to climate and population pressures, farmers sometimes have no option but to use a toxic cocktail of untreated wastewater and industrial effluent to irrigate crops.[37] Industrial effluent delivers heavy metals—lead, cadmium, chromium, mercury—that contaminate the soil and are absorbed into the crops.

More contamination may occur at the processing and packaging stage, and plastic packaging and ink can leach cadmium, lead, and endocrine-disrupting chemicals into food products.

Only a tiny fraction of the tens of billions of dollars' worth of food and products imported everyday into Europe, the US, and other wealthy nations ever gets inspected.[38] The test results, scarce as they may be, are often concerning. One analysis found that nearly 70 percent of fresh produce tested by the US Department of Agriculture tested positive for pesticide residues from one or more of 230 different pesticides, albeit mostly at very low levels.[39]

Increasing regulations or border inspections can never be wholly effective. Inspections are expensive and a hindrance to global trade. Rejected companies often close down only to reopen a short time later under a new name. It is simply not realistic or cost effective for any government to be able to conduct thorough testing of all the imports coming into a country.

In our global economic system, just as electronics and cars are assembled from materials sourced from multiple countries, food products are sometimes an amalgam of ingredients originating in multiple countries. A recent analysis of a frozen pizza found that it was made from 35 ingredients that had passed through 60 countries on 5 different continents.

INDIA

Farmers stop near Vijayapura to wash red beets in contaminated water on the way to the Bangalore produce markets.

Photo: J. Carl Ganter, Circle of Blue

Here are a few recent examples:

- The US Food and Drug Administration (US FDA) **examines a mere one-tenth of one percent** of imported fish for drug residues and other toxins. In 2016, 12 percent of tested shrimp were rejected, as were 11 percent of tilapia.[40]
- An August 2018 study by *Consumer Reports* tested 50 foods made for babies and toddlers, including organic and nonorganic brands, and found evidence of **at least one dangerous heavy metal in every product**. Fifteen of the 50 contained enough contaminants to pose potential health risks to a child eating one serving or less a day.[41]

However, James Dickerson, Ph.D., Chief Scientific Officer at Consumer Reports explains, "Parents who have been feeding these foods to their children don't need to panic." He notes that consuming these foods doesn't guarantee that a child will develop health problems, but that **it may simply increase that risk**. And whether problems develop depends on a host of factors, including genetics and exposure to other sources of heavy metals, such as from lead paint or contaminated water.

- Rice teething biscuits and cereals tested had between **61 and 92 times higher levels of mercury**, and nearly **10 times more arsenic** than products made with wheat or oats, a 2017 study found.[42]

- A US study of nearly 500 brands of infant formulas and baby foods conducted in 2017 found that over **30 percent contained lead as well as many other contaminants**, including arsenic, mercury, pesticides, and acrylamides, with many linked to brain damage, reproductive harm, and cancer.[43]

- Although banned in Europe in 2007, the **carcinogenic herbicide paraquat is still exported** and used in large volumes in palm oil plantations in low- and middle-income countries. Palm oil is in about half of the packaged products in any supermarket.[44]

- A study of spices in New York City in 2018 found that **over 50 percent had detectable levels of lead**. Products from Georgia, Bangladesh, Pakistan, Nepal, and Morocco were found to have especially high levels, and imported spices in general are now considered to be a major factor in lead poisoning in the US.[45]

- **Of 60 lead-related health alerts issued in California, 91.6 percent were for imported foods**, primarily candies from Mexico, China, and India.[46]

- **High levels of aluminum, nickel, cadmium and lead** were found in 12 types of sweets widely consumed in Spain.[47]

Long-term solutions to this problem will rely on embedded systems that can trace supply chains with finesse. Especially with manufacturers who pursue lowest cost strategies, shortcuts can result in lower quality and the possibility of contaminated materials. There is a need for transparent, traceable supply chains, and systems that support mitigation of pollution at the source.

Organisation for Economic Co-operation and Development (OECD) has published guidelines for multinational enterprises which recommend that businesses conduct supply chain due diligence to identify and address risks of contributing to adverse impacts on human rights, labor rights, the environment, and financial integrity.

According to Greg Medcraft, director of the Directorate for Financial and Enterprise Affairs at the OECD, "the OECD guidelines are a strong set of standards to prevent environmental abuse and powerful mechanism to hold companies into account for their activities. They also provide tools to ensure enterprises in an industry's supply chains meet international standards."

Blockchain technology for responsible supply chains holds some promise. Poor conduct by one actor in the supply chain can hurt business, and the promise of blockchain technology is its greater transparency. "With blockchain, there is no place to hide," said Medcraft.

HOW MUCH FOOD DO WE IMPORT FROM COUNTRIES WITH HIGH POLLUTION LEVELS?

The US imports 50 to 60 percent of its fruits and vegetables, more than 80 percent of its fish and shellfish, almost all of its spices, coffee, cocoa, and a large quantity of pet food from other countries.[48,49] According to a recent U.S. Agriculture Department report, fresh produce imports will rise 45 percent from 2016 to 2027.[50,51]

Pure Earth has assessed thousands of toxic sites in over 50 low and middle-income countries in the past decade. See www.contaminatedsites.org for details. In our work around the world, we see industrial and chemical pollution growing, and scant investment to halt or reverse this trend—with China being the exception. A brief look at the import data from countries with severe pollution suggests that without intervention at the source of the contamination, the risk to human health and the food supply will continue and may get worse.

U.S. IMPORTS OF AGRICULTURAL PRODUCTS FROM:

India totaled $2.6 billion in 2017.

Leading categories include: spices ($272 million), tree nuts ($236 million), essential oils ($182 million), rice ($178 million), and processed fruit & vegetables ($125 million).[52]

Bangladesh totaled $20 million in 2017.

Leading categories include: tobacco ($7 million), snack foods ($3 million), rice ($2 million), spices ($687 thousand), and tea, including herbs ($517 thousand).[53]

China totaled $4.5 billion in 2017, our 4th largest supplier of agricultural imports.

Leading categories include: processed fruit & vegetables ($1.1 billion), fruit & vegetable juices ($320 million), snack foods ($204 million), fresh vegetables ($181 million), and spices ($159 million).[54]

The Philippines totaled $1.2 billion in 2017.

Leading categories include: tropical oils ($555 million), processed fruit & vegetables ($199 million), tree nuts ($109 million), raw beet & cane sugar ($105 million), and fruit & vegetable juices ($79 million).[55]

Brazil totaled $3.2 billion in 2017, our 8th largest supplier of agricultural imports.

Leading categories include: coffee, unroasted ($1.1 billion), fruit & vegetable juices ($365 million), red meats, prep/pres ($234 million), tobacco ($199 million), and essential oils ($117 million).[56]

Mexico totaled $25 billion in 2017, our largest supplier of agricultural imports.

Leading categories include: other fresh fruit ($6.0 billion), fresh vegetables ($5.5 billion), wine and beer ($3.3 billion), snack foods ($2.1 billion), and processed fruit & vegetables ($1.5 billion).[57]

Peru totaled $2.0 billion in 2017.

Leading categories include: other fresh fruit ($737 million), fresh vegetables ($329 million), processed fruit & vegetables ($320 million), coffee, unroasted ($223 million), and spices ($49 million).[58]

Ghana totaled $265 million in 2017.

Leading categories include: cocoa beans ($186 million), cocoa paste & cocoa butter ($37 million), rubber & allied products ($12 million), fresh vegetables ($9 million), and tree nuts ($7 million).[59]

Europe imported 93 million tonnes of food in 2016 —

182 kilograms (403 pounds) for every person— mainly from Brazil, Argentina, China and Turkey.[60]

PROFILES OF CONTAMINATED FARMLANDS

INDIA
CHINA
INDONESIA

INDIA

Women transplanting rice plants in a field irrigated with industrial wastewater pumped from a nearby canal.

Photo: J. Carl Ganter, Circle of Blue

DELHI, INDIA

Farmers irrigate rice with raw sewage.

Photo: J. Carl Ganter, Circle of Blue

> **"The water is so polluted, we can only grow resistant crops... if we use river water or not—we always lose."**
>
> —Farmer, India

INDIA

A report by the not-for-profit news and science network Circle of Blue, that reports on water, food, energy and climate globally, found that industrial wastewater contaminated with metals and chemicals irrigate much of India's food. Rapid population growth and water scarcity exacerbated by climate change is feeding into this crisis and potentially reaching the world's grocery shelves.[61]

Across India, and specifically around large metropolitan regions, many farmers raise their crops with untreated industrial and urban wastewater. Only 30 percent of India's wastewater undergoes any sort of treatment before being discharged as industrial effluent that contains multiple heavy metals and toxic chemicals.

"The water is so polluted, we can only grow resistant crops," says one farmer. "Half of our chili plants have diseases, and at times the industries discharge acid, which damages the crops. If we use river water or not—we always lose."

The problem is so severe in this area, the farmers told Circle of Blue that they do not consume the contaminated crops, but sell them all in Delhi. They use scarce clean groundwater to grow safe vegetables for their own families.

But some do not have that luxury. They link the increased rate of diseases within their families, particularly of skin diseases, to the bad water quality. "Kids are born healthy, but fall ill very quickly afterwards," one farmer says. "Over time we realized that some crops are riskier to consume than others. Lentils seem to be less contaminated, so we eat them. Other vegetables, such as cauliflower, okra, and aubergine seem more contaminated. We believe they are unfit for consumption, so we don't eat them. We sell them to the markets in Delhi."

In several technical assessments for vegetables, researchers found nickel, lead, and other metals at concentrations in excess of permissible levels.[62] Food samples from various markets showed that all tested food—including fruits/curd, root vegetables, and leafy vegetables—demonstrated contamination levels by at least one heavy metal that exceeded the Indian Food Standard. When applying international standards on food safety, the picture becomes even bleaker. Most samples exceeded all international thresholds for analyzed heavy metal content.[63]

SHIJIAZHUANG, CHINA

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

CHINA

Food safety is a major concern for the Chinese public. One study collected 465 published papers on heavy metal pollution rates in farmland soil throughout China. The results showed that cadmium was the most common pollutant, clocking in at 7.75%, followed by mercury, copper, nickel and zinc. The total pollution rate in Chinese farmland soil was 10.18%. The human activities of mining and smelting, industry, irrigation by sewage, urban development, and fertilizer application released certain amounts of heavy metals into soil, which resulted in the farmland soil being polluted. Almost 14% of grain production is affected by heavy metal pollution in farmland soil.[64]

Circle of Blue reported, "I have seen farmers in Hebei use contaminated water, because there's nothing else to use. Farmers won't eat what they produce. They have fields for themselves and fields for the market," said Hu Kanping of the non-profit Chinese Ecological Civilization Research and Promotion Association, based in Beijing. "This is a very serious problem, not just for farmers but also for everyone else. It's not just about water safety; it's about food safety as well."

INDONESIA

YUSUP, FARMER, INDONESIA

Photo: Chandni Vatvani

Using water from the highly polluted Citarum River for irrigation has contaminated rice paddy fields, as evidenced by their discoloration, hindering the healthy growth of crops.

Fifty-six-year-old Yusup, interviewed by Channel News Asia, said waste from factories has been harming harvests since 1995.[65]

“In a year we usually harvest our crops three times, but now with the contamination it gets delayed, sometimes it can be twice a year, sometimes three. If there are floods then the crops become rotten,” he explained.

Even working in the fields poses a toxic exposure challenge for farmers. Yusup coats his body in a mixture of salt and soap to

INDONESIA

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

reduce direct contact with the toxic water he has to use.

“There is an agricultural area nearby, which under normal circumstances would yield nine tonnes of crops in one hectare of land. But after being contaminated by toxic waste from these industries, the harvest only yields 4 tonnes of crops,” said one farmer, as he further explained the damaging and long-lasting impact of the industrial waste.

Yusup said he feels the government appears to be paying less attention to the plight of farmers, seemingly protecting business interests instead.

PRODUCT IMPORTS—FURNITURE, CLOTHING, TOYS, AND PERSONAL CARE PRODUCTS

Many of the toxic chemicals found in high levels in our bodies come from consumer products.[66] In 2007, thousands of people in Finland and Britain received chemical burns from sitting on sofas manufactured in China and treated with dimethyl fumarate, an anti-fungal agent that was later banned by the EU.[67] The same toxic chemical was found in children's shoes imported into Australia. In 2017, Canadian health officials warned that an increasing number of imported consumer goods, such as sofas and clothing, contain pesticides and fungicides not declared on any label.[68] They also said Canada lacks adequate safety checks to deal with this growing issue.

"The risk to children is not only from pesticide residues in food; in the US and Canada, most chemicals used in consumer products are not tested for toxicity," says Bruce Lanphear, a leading health researcher at Simon Fraser University and British Columbia Children's Hospital Research Institute. "By allowing children to be exposed to toxic chemicals or chemicals of unknown toxicity, we're unwittingly using our children as a part of a massive experiment."

Less than 20 years ago, researchers discovered some common chemicals interfered with human hormone production even at very low doses, leading to cancer, developmental impacts, and birth defects. Now more than 1,000 chemicals, including

INDIA

Boy working in tannery.

Photo: Larry C. Price/ Pulitzer Center on Crisis Reporting

pesticides, bisphenol A (BPA), phthalates, and flame-retardants have been identified as endocrine disruptors, and many of them have been found in food, furniture, clothing, and personal care products.[69]

In 2017, every fifth toy inspected in Europe contained high levels of restricted phthalates which are used to soften plastics. Baby boys exposed in the womb to phthalates are at risk of birth defects in their reproductive organs and behavioral abnormalities.[70] Many other imported products contained unsafe levels of cadmium, asbestos, and chromium, the inspectors reported. While 17 percent of these products came from China, the origins of 39 percent of these contaminated products could not be determined.[71]

The volume of products imported from low- and middle-income countries is staggering. In 2017, the US imported over $500 billion worth of clothing, toys, electronics, footwear, furniture, and lighting products from China alone.[72]

The same is true for the EU, where imports of goods from China and India have increased more than 60 percent in the past decade.[73] In 2017, the EU issued over 2,200 alerts regarding dangerous products.[74] The majority was for toys made outside the EU, often in China. More than 20 percent posed a serious chemical risk.

“People put too much trust in government,” says Harvard’s Gina McCarthy, the former head of the US EPA. Regulations and spot checks at the border are not going to stop an imported T-shirt with lead-contaminated graphics on it, says McCarthy. “Companies need to know it won’t be profitable to sell products with toxins.”

> **"By allowing children to be exposed to toxic chemicals or chemicals of unknown toxicity, we're unwittingly using our children as a part of a massive experiment."**
>
> —Bruce Lanphear, Leading Health Researcher, Simon Fraser University and British Columbia Children's Hospital Research Institute

Slime and magnetic putty

In April 2018, the Norwegian Environmental Directorate removed some slime-like toy products from the market after it found they contained high levels of lead and arsenic. British authorities removed gold and blue magnetic putty products from the national market as they were found to contain 32.9mg/kg of arsenic and 29mg/kg of lead. This is eight times the level of arsenic permitted by Norwegian toy regulations and twice that of lead.[75]

Toys and jewelry

A study investigating toxic metal contamination in children's toys and jewelry sold in the US and Canada concluded they pose an acute health risk.[76] Another study not only found toxic metals like cadmium and mercury in thousands of children's products sold in the state of Washington but dozens of other chemicals of high concern.[77]

School supplies

Testing of school supplies for sale in the US in 2018 found high levels of lead in two brands of children's water bottles, benzene—a known carcinogen—in markers, and asbestos in a popular brand of crayons.[78]

Children's makeup

Asbestos, known to cause lung cancer and mesothelioma, was found in children's makeup in 2017.[79]

Modeling clay

Modeling clay and crayons made in China have previously been found to contain asbestos.[80]

Discount retailers

Often, the cheaper the products the more likely it is made in low- and middle-income countries with weak pollution or contamination enforcement. Healthy Stuff, a US environmental organization, tested 164 products purchased at four major discount retailers located in six different US states. They found at least one toxic chemical above the level of concern in a majority of tested products.[81]

These are just a few recent reports of exposure to toxins in the US and Europe; the situation in low- and middle-income countries is far worse, although rarely documented. Understanding the global extent of toxic pollution can be overwhelming but it is important to remember that solutions are proven and feasible. What is required is awareness and political will to invest in these solutions.

YOUNG VICTIMS OF POLLUTION

Photos: Larry C. Price/Pulitzer Center on Crisis Reporting

“Children are exquisitely vulnerable to toxic chemicals at levels once believed to be inconsequential.”

—Dr. Philip Landrigan, Director of the Global Public Health Initiative, Boston College

THE HEALTH IMPACTS OF POLLUTION

Toxins, even at low levels, can be dangerous to children. Children are at far greater risk at extremely low levels of exposure for a number of reasons. Growing cells are more vulnerable to toxins and the blood–brain barrier of the developing brain is not fully formed. The fetus or newborn may also lack critical enzymes to metabolize environmental toxicants. Young children have higher respiratory rates, which means they breathe in air pollution faster, less body mass, and undeveloped immune systems, leaving them with weaker defenses.

“Children are exquisitely vulnerable to toxic chemicals at levels once believed to be inconsequential,” says Dr. Philip Landrigan, director of the Global Public Health Initiative at Boston College.

“There is an unrecognized global pandemic of health impacts on the world’s children, including asthma, cancer, birth defects, lowered IQs, autism, attention deficit and hyperactivity disorder, and conduct disorders,” says Landrigan. “We don’t know the full magnitude but we do know it’s getting worse.”

Childhood asthma rates have increased 300 percent in wealthy countries since the 1970s, and autism now affects one in 68 children, up from one in 5000.[82] Shockingly, cancer–not infectious diseases—is now the leading cause of death in children. Over the past 40 years, this increase in non-communicable diseases (NCD) among children, including diabetes, birth defects, leukemia, and more, is becoming what leading medical health experts are calling a “silent epidemic.”

A growing volume of evidence now finds that daily exposure to chemical pollution is driving this increase.[83] Few of the 100,000 or so chemicals in use have been adequately tested for safety, and rarely are they tested for impacts on children’s health, according to the World Health Organization.[84]

BANGLADESH

Children working at a brick factory.

Photo: Larry C. Price/Pulitzer Center on Crisis Reporting

"Many toxic chemicals, such as lead and pesticides, are bioactive in amounts as low as 10 to 50 parts per billion," says Bruce Lanphear, a health researcher at Simon Fraser University and British Columbia Children's Hospital Research Institute. "One part per billion is about one tablespoon of sugar in an Olympic swimming pool. Ritalin, a drug used in treating ADHD, is effective at levels that are lower than some toxic chemicals found in children's blood," says Lanphear, who has been studying the impacts of toxic chemicals on children for 20 years.

"Pesticides and chemicals known to be too risky to use in the US or Europe have long been exported in large quantities to poor countries that don't have adequate standards of protection or ability to enforce existing standards," says Baskut Tuncak, the UN Special Rapporteur on Human Rights and Toxics. "The exploitation of these double standards for production and consumption results in huge impacts on local communities in these countries and oftentimes widespread exposure of these toxics through the global environment and consumer products."

As Tuncak urged in his 2016 report to the UN Human Rights Council, *Rights of Child and Toxics*, "We have a duty to prevent childhood exposure."

"Children everywhere are being born 'pre-polluted,'" Tuncak warns in his report. "States have an obligation to prevent children from being exposed to toxics and pollution, and businesses a corresponding responsibility. Case after case has illustrated the myriad of rights violated when states and businesses fail to prevent the exposure of children to toxics and pollution."[85]

GHANA

Father and child in the e-waste burning fields in Agbogbloshie.

Photo: Pure Earth

“Children everywhere are being born ‘pre-polluted.’ States have an obligation to prevent children from being exposed to toxics and pollution...”

—Baskut Tuncak,
UN Special Rapporteur on Human Rights and Toxics

POLICY RESPONSE IS INADEQUATE

Policies to protect citizenry are in place in most wealthy countries, with varying levels of success. The EU requires the chemical industry to conduct extensive safety testing of new chemicals before they are allowed to come to market. If a chemical has a potential for risk, even absent conclusive proof, the EU has a better-safe-than-sorry philosophy and generally will not approve it. Not surprisingly, many hazardous chemicals allowed in consumer products in the US have been banned in Europe. Other countries are adopting the EU REACH model on the grounds that the burden of proof should be on business to demonstrate that a new product is fit to be introduced rather than on government to prove that it should be withdrawn from sale.[86]

In June 2016, the US Congress passed bipartisan legislation to update a badly broken chemical safety system. This significantly amended the Toxic Substances Control Act (TSCA) and was the first major change to the US's primary toxic chemicals law since it was first passed in 1976. It gave the US EPA the power to strengthen health protections for American families. The current US administration has not supported this legislation, and has directed the EPA to dismantle the new authorities and mandates that Congress just gave it under the reformed Toxic Substances Control Act. Some organizations have expressed concern that the administration's aim is to shift critical policies to serve the chemical industry's agenda instead of protecting public health.[87]

SOLUTIONS

This problem can be solved with concerted attention and international cooperation from stakeholders across society and sectors. Citizens, especially youth activists, are encouraging governments to make needed changes in policy and invest in solutions that will make the world a safer place for all of us.

Following the release of The Lancet Commission on Pollution and Health, international institutions are beginning to elevate pollution in the global environmental agenda.

The United Nations Environment Program at its third Environmental Assembly in December 2017 declared the need for a Pollution Free Future. This first-of-its-kind meeting of politicians and agencies confirmed the need to deal with pollution and its health consequences.[88]

The FAO's recent Global Soil Symposium resulted in a consensus on the urgency of the soil contamination problem. Experts at the symposium concluded that there is convincing scientific evidence that soil pollution is a global threat to food production systems, to human health, and to the environment, and that coordinated action needs to be ramped up to address this issue.

The conference noted "Soil pollution is a global issue, which transcends borders and whose source can be very distant. For these reasons, tackling soil pollution requires joint efforts of all stakeholders to prevent, minimize and remediate it when feasible. The prevention of soil pollution should be a top priority worldwide, because the cost of remedying or changing the land use is too high."[89]

At the conclusion of the first WHO Global Conference on Air Pollution and Health in October 2018, participants agreed an aspirational goal of reducing the number of deaths from air pollution by two thirds by 2030.[90] Leaders from national and city governments, intergovernmental organizations, civil society, philanthropy, research and academia considered the scientific evidence on air pollution and health and emphasized the urgent need for bold and prompt action to address this health crisis. Countries, urban mayors, and civil society were invited to make commitments to the global advocacy campaign BreatheLife2030 to meet *WHO's Air Quality Guidelines* and reduce climate emissions.

This growing attention to pollution and health is laudable. However, the problem has languished for decades, and these are just the first steps on our way to a safer world for all children.

POLICIES TO PREVENT POLLUTION

A variety of tools exist to help countries develop skills and capabilities to prevent pollution. Some efforts currently underway include:

National capacity building
Much value can be achieved with a planning process that involves all government departments: health, environment, finance, industry, agriculture, transport, and the like. When all agencies review where they see the largest risks from pollution, a game plan for prevention can be developed. Health and Pollution Action Plans (HPAP) assist countries to develop national strategies, focusing government efforts on public health and sustainable interventions.

Inventory toxic hotspots around the world
To date, more than 4,000 locations in 50 low- and middle-income countries have been identified where families are exposed to toxins at dangerous levels. A central online database coordinates information on each, and creates a platform for national and local governments and international agencies to prioritize interventions.

Collaborative platform with local champions
A focus on solutions that encourages full stakeholder participation in implementation, rather than litigation, works best. When local agencies, scientists, government officials, and concerned citizens join forces, then environmental cleanup programs show the most effectiveness.

Best science and best practices at all times
The Global Alliance for Pollution and Health, an international body of more than 60 countries, NGOs, funding agencies, and academic institutions, uses best practices to raise resources and awareness, as well as to build capacity, around pollution and prevention control.

In broad strokes, here is what is needed:

1. Make pollution a priority in the global agenda. Make sure countries that are most affected also have it as a priority so they are focusing on solutions at the ground level. Help countries that want to address prevention with technical assistance, because global problems need global solutions.

2. Implement projects that prevent and reduce pollution at the source. Solutions to mitigate toxic exposures can be found in all corners of the globe. Places like Mexico City, Beijing, and Bangkok have successfully implemented programs to reduce air pollution. Projects related to chemicals and metals exposures work well in many locations.

3. Develop mechanisms to trace exposures back to the source. Provide support to those at the source of pollution to reduce their toxic exposure, and to the broader population that they inadvertently affect. Most large corporations pay close attention to supply chains. We need to take these initial successes and build on them, developing mechanisms that allow for tracking of toxins back to their source.

"The supply chain for nearly anything—textiles, jewelry, food—is likely to result in local pollution or health impacts on workers at some point down the supply chain," says the UN special rapporteur on toxic wastes, Baskut Tuncak. "Companies need to be more vigilant for toxic chemical risks throughout their supply chains and the life cycle of their products. This should be part of the human rights due diligence that is expected of all companies. Consumers should demand that the products they are buying don't come at the cost of poisoning workers and local communities," Tuncak says.

4. Expand imports testing, not with the intent of closing off imports but to provide the evidence base for cooperation between countries. Integrate a mechanism for prevention and source reduction into agency responses.

5. Expand research into toxins and prevention. Research is urgently needed to better understand the health impacts and costs to global society of known toxins and newer chemical pollutants such as endocrine disruptors. This research ought to include analyses that define the burden of disease for various toxic exposures. It is vital to have both the data and a methodology to know which toxics issues are worse than others, so that we can allocate limited resources for maximum health benefits.

"The real victories in public health, like the prevention of lung cancer and the decline in deaths in car accidents were community-wide prevention programs." Lanphear explains, "Our lives depend on switching our focus to preventing toxic pollution."

6. Find ways to allow consumers to monitor what they eat and consume themselves, and help with the prevention solutions too. Not-for-profits can develop systems to test local products and find ways to support prevention at the source. This includes supporting local schools and communities doing low-cost testing for toxins in their food and products. By providing a cleanup solution at the source of the pollution, we will make a huge difference in all our lives.

"Consumers also need to speak up. Not only should the public ask more questions about how products are made and what toxic chemicals they contain, but also pressure policymakers to act globally to ensure that a healthy environment is not simply a privilege enjoyed by the few, but a universal right of everyone," Tuncak says.

All these efforts should result in the implementation of a set of technical solutions that prevents pollution in the first place. We know how to do these projects already; we simply need to do more of them.

PROJECTS TO REDUCE TOXINS

Major institutions, UN agencies, and NGOs already have strong track records for pollution mitigation projects.

The World Bank and its regional affiliates have been helping countries build water treatment projects for decades. Recent industrial water treatment programs in East Asia, Africa, and the Pacific, along with substantial investments in India, have had successes in reducing heavy metals discharges.

Programs to reduce air pollution have been implemented in dozens of countries supported by groups like the Alliance on Clean Cookstoves, the Climate and Clean Air Coalition, development banks, WHO, and UN agencies.

A number of international and local NGOs have developed projects in low- and middle-income countries. Pure Earth, Pesticides Action Network, and Green Cross have implemented successful programs to reduce pollution

Recent Pure Earth projects include:

- In Mexico, training traditional potters to use lead-free glaze, and partnering with hotels and restaurants to purchase the new lead-free cookware and serving dishes;
- In Peru, Bolivia, the Philippines, and Mongolia, training artisanal gold miners in mercury-free methods;
- In Vietnam, India, and Bangladesh, breaking the cycle of lead poisoning from informal recycling of car batteries by relocating operations outside of residential areas;
- In Ghana, Uruguay, and Palestine, providing alternatives to e-waste burning by using affordable, non-polluting recycling equipment.

ZAMBIA

Children play on lead-free soil in Kabwe after a 2016 cleanup project led by Pure Earth.

Photo: Pure Earth

"The real victories in public health, like the prevention of lung cancer and the decline in deaths in car accidents were community-wide prevention programs. Our lives depend on switching our focus to preventing toxic pollution."

—Bruce Lanphear, Leading Health Researcher, Simon Fraser University and British Columbia Children's Hospital Research Institute

WHAT YOU CAN DO TO PROTECT YOUR FAMILY

While unsafe chemicals are difficult to avoid completely, people can reduce contact with some of the most harmful and common toxins.

With respect to food, the safest way to avoid exposures from international sources is to eat as locally as possible. Eat food that you know is grown in places with clean soil and water. Organic products can also provide a level of protection from pesticides and other toxins.

Many non-profit organizations have good resources on ways to prevent exposure to pesticides and chemicals in food, furniture and personal care and cleaning products and more.

Safer Chemicals, Healthy Families—Mind The Store campaign

www.retailerreportcard.com

Safer Chemicals, Healthy Families urges all retailers to adopt comprehensive safer chemicals policies, fully disclose the ingredients of their products and packaging, and substitute hazardous chemicals with safer solutions. Safer Chemicals, Healthy Families calls on consumers to join its Mind the Store campaign and press retailers where they shop to clean up their act.

Health and Environmental Alliance—HEAL

www.envhealth.wpengine.com/campaigns/

HEAL is a leading European non-profit focused on environmental health. HEAL works toward a future that is toxic free, decarbonised, climate resilient, and sustainable. They run campaigns on pesticides, air pollution, healthy buildings, endocrine disruptors, and clean energy.

Environmental Working Group Consumer Guides (EWG)

www.ewg.org/consumer-guides

EWG educates and empowers consumers to make safer and more informed decisions about the products they buy and the companies they support. In response to consumer pressure, companies are giving up potentially dangerous chemical ingredients in their products and improving their practices.

EWG Guidelines include:

- 12 Hormone-Altering Chemicals and How to Avoid Them
- 2018 Shopper's Guide to Pesticides in Produce
- Skin Deep Guide to Cosmetics
- Consumer Guide to Seafood
- Dirty Dozen Endocrine Disruptors

Healthy Babies, Bright Futures—Your Healthy Home

www.hbbf.org/your-healthy-home

Healthy Babies, Bright Futures offers parents simple actions to keep babies safe from toxic chemical exposures and recommends ways to measurably reduce the largest sources of babies' exposures to toxic chemicals that harm brain development.

Safer School Supplies: Shopping Guide

www.uspirg.org/reports/usp/safer-school-supplies-shopping-guide

The Safer School Supplies Shopping Guide empowers parents, teachers, and students to make more informed decisions while shopping for school supplies. This Shopping Guide should serve as a handy tool for finding products free of several types of toxic chemicals.

Project TENDR—Targeting Environmental Neuro-Development Risk

www.projecttendr.com/what-you-can-do/

Project TENDR's scientists, medical professionals, and advocates are proposing a broad set of policy measures that governments, corporations, and health care institutions should take to lower children's risks for developing neurodevelopmental disorders.

Center for Environmental Health

www.ceh.org

The Center for Environmental Health effectively employs scientific testing, public campaigns and legal action to remove unsafe products from the marketplace.

CEH works with parents, communities, businesses and government to protect children and families from toxic threats like flame retardants, pesticides and more.

A POLLUTION-FREE WORLD IS POSSIBLE

This problem affects all of us. But it need not. No one wants to see their children being poisoned. No one wants to seal borders stopping global trade, which has lifted billions of people in low and middle-income countries out of extreme poverty and greatly enriched all our lives. Pollution can be controlled, and will result in economic growth and lower health care costs.[91]

Solutions need to focus on prevention by stopping pollution at the source. In a globalized world this means working with other countries and helping those who are creating these exposures. From Pure Earth's experience, often pollution is generated due to lack of knowledge and resources. Intervention in the form of education and technical assistance is transformational.

Pollution has an enormous impact on the health and well-being of hundreds of millions of people. It is not only one of the largest risks of premature death, but one that directly impacts the future of children across the globe.

REFERENCES

1. Landrigan PJ, Fuller R, Acosta NJR, et al. The Lancet Commission on pollution and health. The Lancet. 2017; 391: 462–512.
2. The Benefits and Costs of the Clean Air Act from 1990 to 2020. Washington, DC: U.S. Environmental Protection Agency, Office of Air and Radiation; 2011. https://www.epa.gov/sites/production/files/2015-07/documents/fullreport_rev_a.pdf. Accessed December 10, 2018.
3. Landrigan PJ, Fuller R, Acosta NJR, et al. The Lancet Commission on pollution and health. The Lancet. 2017; 391: 462–512.
4. IBID.
5. Landrigan, PJ, Landrigan, MM. Children and Environmental Toxins: What Everyone Needs to Know. New York, NY: Oxford University Press; 2010.
6. "Toxic Chocolate." As You Sow. Accessed Nov 2018. Available at https://www.asyousow.org/environmental-health/toxic-enforcement/toxic-chocolate
7. Rothenberg, Sarah et al. "Exposure to methylmercury and inorganic arsenic in baby rice cereals and rice-containing teething biscuits." Environmental Research. Nov 2017; 159: 639-647. Available at https://www.sciencedirect.com/science/article/pii/S0013935117306564?via%3Dihub
8. "CLP Infant Formula & Baby Food Test." Clean Label Project. Oct 25, 2017. Available at https://www.cleanlabelproject.org/clp-infant-formula-baby-food-test/
9. Zhang, Xiuying et al. "Impact of Soil Heavy Metal Pollution on Food Safety in China." PLOS One. Aug 7, 2017. Available at https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0135182
10. Bhatia, Arti et al. "Heavy Metal Contamination of Soil, Irrigation Water and Vegetables in Peri-Urban Agricultural Areas and Markets of Delhi". Water Environment Research. Nov 2015; 87(11): 2027-2034. Available at https://www.ingentaconnect.com/contentone/wef/wer/2015/00000087/00000011/art00010
11. Irwin, Aisling. "Ultrafine Pollution Particles Create Air of Menace." Horizon Magazine. March 5, 2018. Available at https://horizon-magazine.eu/article/ultrafine-pollution-particles-create-air-menace_en.html#.WqbgUXvocrW.twitter
12. European Lung Foundation. "First Evidence that Soot from Polluted Air is Reaching Placentas." EurekaAlert AAAS. September 16, 2018. Available at https://www.eurekalert.org/pub_releases/2018-09/elf-fet091318.php
13. Perera, Frederica. "Pollution from Fossil-Fuel Combustion is the Leading Environmental Threat to Global Pediatric Health and Equity." Int. J. Environ. Res. Public Health. 2018, 15(1): 16. Available at https://www.mdpi.com/1660-4601/15/1/16
14. Putman, William and Arlindo da Silva. "Simulating the Transport of Aerosols with GEOS-5." NASA Global Modeling and Assimilation Office. Last accessed Nov 16, 2018. Available at https://gmao.gsfc.nasa.gov/research/aerosol/modeling/nr1_movie/
15. Ewing, Stephanie A., et al. "Pb Isotopes as an Indicator of the Asian Contribution to Particulate Air Pollution in Urban California." Environmental Science and Technology. 2010; 44(23): 8911-16. Available at https://pubs.acs.org/doi/abs/10.1021/es101450t#afn2

16. "Environmental Treaties and Resource Indicators (ENTRI) Query Service." Center for International Earth Science Information Network - CIESIN - Columbia University. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). 2013. Available at http://sedac.ciesin.columbia.edu/entri
17. Apte, Joshua S. et al. "Ambient PM2.5 Reduces Global and Regional Life Expectancy." Environmental Science and Technology Letters. 2018; 5(9): 546-551. Available at https://pubs.acs.org/doi/10.1021/acs.estlett.8b00360
18. Bernett, Richard et al. "Global Estimates of Mortality Associated with Long-term Exposure to Fine Particulate Matter." PNAS. September 2018; 115(38): 9592-9597. Available at http://www.pnas.org/content/early/2018/08/28/1803222115
19. Zhang, Qiang et al. "Transboundary health impacts of transported global air pollution and international trade." Nature. March 2017; 543: 705-709. Available at https://www.nature.com/articles/nature21712
20. "Particulate Matter (PM) Basics." Environmental Protection Agency. Last Updated Nov 2018. Available at https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM
21. Rice, Doyle. "Air pollution in Asia is wafting into the USA, increasing smog in West." USA Today. March 2, 2017. Available at https://www.usatoday.com/story/weather/2017/03/02/air-pollution-asia-wafting-into-usa-increasing-smog-west/98647354/
22. West, Larry. "Cross-Border Pollution: A Growing International Problem." ThoughtCo. Last Accessed Oct 2018. Available at https://www.thoughtco.com/cross-border-pollution-1204093
23. Jones, Dave et al. "Europe's Dark Cloud." World Wildlife Fund. June 2016. Available at https://env-health.org/IMG/pdf/dark_cloud-full_report_final.pdf
24. "Mercury pollution remains a problem in Europe and globally." European Environment Agency. 2018. Available at https://www.eea.europa.eu/highlights/mercury-pollution-remains-a-problem
25. Zhang, Q et al. "Transboundary health impacts of transported global air pollution and international trade." Nature. March 2017; 543(7647): 705-709. Available at https://www.ncbi.nlm.nih.gov/pubmed/28358094
26. Zhang, Xin and Xiaobo Zhang. "The impact of exposure to air pollution on cognitive performance." PNAS. Sept 11, 2018; 115(37): 9193-9197. Available at http://www.pnas.org/content/early/2018/08/21/1809474115
27. Saenen, Nelly D. et al. "Children's urinary environmental carbon load. A novel marker reflecting residential ambient air pollution exposure?" American Journal of Respiratory and Critical Care Medicine. Oct 1, 2017; Vol. 196, No. 7. Available at https://www.atsjournals.org/doi/10.1164/rccm.201704-0797OC
28. Drevnick, Paul and Barbara Brooks. "Mercury in tunas and blue marlin in the North Pacific Ocean." Environmental Toxicology and Chemistry. March 6, 2017; 36(5). Available at https://doi.org/10.1002/etc.3757
29. Waldman, Ayelet. "My Toddler's Mercury Poisoning from Tuna." Moms Clean Air Force. Last Accessed Nov 2018. Available at https://www.momscleanairforce.org/my-toddlers-mercury-poisoning-from-tuna/
30. "Global Mercury Assessment 2013." United Nations Environment Programme. 2013. Available at https://wedocs.unep.org/bitstream/handle/20.500.11822/11401/

GlobalMercuryAssessment2013.pdf?sequence=1&isAllowed=y

31. IBID.
32. Paddock, Richard C. "The Toxic Toll of Indonesia's Gold Mines." The Pulitzer Center. May 24, 2016. Available at https://pulitzercenter.org/reporting/toxic-toll-indonesias-gold-mines
33. Dallaire, Renee et al. "Growth in Inuit children exposed to polychlorinated biphenyls and lead during fetal development and childhood." Environmental Research. Oct 2014, 1234: 17-23. Available at https://www.sciencedirect.com/science/article/pii/S0013935114002199?via%3Dihub
34. Boucher, Olivier et al. "Altered fine motor function at school age children exposed to PCBs, methylmercury, and lead." Environmental International. Oct 2016; 95:144-151. Available at https://www.sciencedirect.com/science/article/pii/S0160412016303002
35. "Food safety and authenticity in the processed meat supply chain." UK National Audit Office. Oct 2013. Available at https://www.nao.org.uk/wp-content/uploads/2014/10/10255-001-Food-safety-and-authenticity.pdf
36. Guilford, Gwynn. "If China is using rotten fruit to make juice, there's a chance you're drinking it." Quartz. Sept 24, 2013. Available at https://qz.com/127809/if-china-is-using-rotten-fruit-to-make-juice-theres-a-chance-youre-drinking-it/
37. Moller-Gulland, Jennifer, J. Carl Ganter and Cody Pope. "Toxic Water, Toxic Crops: India's Public Health Time Bomb." Circle of Blue. 2018. Available at https://www.circleofblue.org/2018/india/toxic-water-toxic-crops-indias-public-health-time-bomb/
38. Wallace, RB and M Oria, eds. "Enhancing Food Safety: The Role of the Food and Drug Administration." National Research Council Committee on the Review of FDA's Role in Ensuring Safe Food. 2010. Available at https://www.ncbi.nlm.nih.gov/books/NBK220404/
39. Lunder, Sonya. "EWG's 2018 Shopper's Guide to Pesticides in Produce." EWG. April 10, 2018. Available at https://www.ewg.org/foodnews/summary.php
40. "Imported Seafood Safety: FDA And USDA Could Strengthen Efforts To Prevent Unsafe Drug Residues." US Government Accountability Office. Sept 2017. Available at www.gao.gov/assets/690/687183.pdf
41. Hirsch, Jessie, "Heavy Metals in Baby Food: What You Need to Know. Consumer Reports' testing shows concerning levels of arsenic, cadmium, and lead in many popular baby and toddler foods." Consumer Reports, August 16, 2018 Available at https://www.consumerreports.org/food-safety/heavy-metals-in-baby-food/
42. Rothenberg, Sarah et al. "Exposure to methylmercury and inorganic arsenic in baby rice cereals and rice-containing teething biscuits." Environmental Research. Nov 2017; 159: 639-647. Available at https://www.sciencedirect.com/science/article/pii/S0013935117306564?via%3Dihub
43. "CLP Infant Formula & Baby Food Test." Clean Label Project. Oct 25, 2017. Available at https://www.cleanlabelproject.org/clp-infant-formula-baby-food-test/
44. "Which Everyday Products Contain Palm Oil?" World Wildlife Fund. Last Accessed Nov 2018. Available at https://www.worldwildlife.org/pages/which-everyday-products-contain-palm-oil
45. Hore, Paromita, et al. "A Spoonful of Lead: A 10-Year Look at Spices as a Potential Source of Lead Exposure." Journal of Public Health Management and Practice. January/February 2019. Available at https://journals.lww.com/jphmp/

Fulltext/2019/01001/A_Spoonful_of_Lead___A_10_Year_Look_at_Spices_as_a.11.aspx

46. Handley, Margaret A., et al. "Examining Lead Exposures in California through State-Issued Health Alerts for Food Contamination and an Exposure-Based Candy Testing Program." Environmental Health Perspectives, October 26, 2017. Available at https://doi.org/10.1289/EHP2582
47. Marin-Martinez, R et al. "Aluminum, nickel, cadmium, and lead in candy products and assessment of daily intake by children in Spain." Food Addit Contam Part B Surveill. 2016; 9(1): 66-71. Available at: https://www.ncbi.nlm.nih.gov/pubmed/26684054
48. Bryce Cooke and Hui Jiang. Outlook for U.S. Agricultural Trade, AES-106, U.S. Department of Agriculture, Economic Research Service, November 29, 2018, Available at https://www.ers.usda.gov/webdocs/publications/90902/aes-106.pdf?v=3468.1
49. "Sustainable Seafood: The Global Picture" NOAA Fisheries, National Oceanic and Atmospheric Administration. Accessed Dec 2018. Available at https://www.fishwatch.gov/sustainable-seafood/the-global-picture
50. "USDA Agricultural Projections to 2027." Accessed Dec 2018. Office of the Chief Economist, World Agricultural Outlook Board, https://www.ers.usda.gov/webdocs/publications/87459/oce-2018-1.pdf
51. Karp, David. "Most of America's Fruit Is Now Imported. Is That a Bad Thing?" New York Times, March 13, 2018. Available at https://www.nytimes.com/2018/03/13/dining/fruit-vegetables-imports.html .
52. "U.S.-India Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/south-central-asia/india
53. U.S.- Bangladesh Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/south-central-asia/bangladesh
54. U.S.- China Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/china-mongolia-taiwan/peoples-republic-china
55. U.S.- Philippines Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/southeast-asia-pacific/philippines
56. U.S.- Brazil Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/americas/brazil
57. U.S.- Mexico Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/americas/mexico
58. U.S.- Peru Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/americas/peru
59. U.S.- Ghana Bilateral Trade and Investment." Office of the US Trade Representative. Accessed Nov 2018. Available at https://ustr.gov/countries-regions/africa/west-africa/ghana
60. "EU trade in food." European Commission Eurostat. Oct 16, 2017. Available at https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20171016-1
61. Moller-Gulland, Jennifer, J. Carl Ganter and Cody Pope. "Toxic Water, Toxic Crops:

India's Public Health Time Bomb." Circle of Blue. 2018. Available at https://www.circleofblue.org/2018/india/toxic-water-toxic-crops-indias-public-health-time-bomb/

62. Bhatia, Arti et al. "Heavy Metal Contamination of Soil, Irrigation Water and Vegetables in Peri-Urban Agricultural Areas and Markets of Delhi". Water Environment Research. Nov 2015; 87(11): 2027-2034. Available at https://www.ingentaconnect.com/contentone/wef/wer/2015/00000087/00000011/art00010
63. "Heavy metal health risk assessment and microbial menaces via dietary intake of vegetables collected from Delhi and national capital regions Peri urban area, India." Journal of Food Agriculture and Environment. March 2015; 13(2):82-88. Available at https://www.researchgate.net/publication/275876745_Heavy_metal_health_risk_assessment_and_microbial_menaces_via_dietary_intake_of_vegetables_collected_from_Delhi_and_national_capital_regions_Peri_urban_area_India
64. Zhang, Xiuying et al. "Impact of Soil Heavy Metal Pollution on Food Safety in China." PLOS One. Aug 7, 2017. Available at https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0135182
65. Vatvani, Chandni. "The toxic waste that enters Indonesia's Citarum River, one of the world's most polluted." Channel News Asia. April 14, 2018. Available at https://www.channelnewsasia.com/news/asia/indonesia-citarum-river-worlds-most-polluted-toxic-waste-10124436
66. Wambaugh, J.F. et al. "High-Throughput Models for Exposure-Based Chemical Prioritization in the ExpoCast Project." Environmental Science & Technology. 2013; 47: 8479–8488.
67. Susitaival P, Winhoven S, Williams J, et al. "An outbreak of furniture related dermatitis ('sofa dermatitis') in Finland and the UK: History and clinical cases." Journal of the European Academy of Dermatology and Venereology. 2010; 24: 486-489. https://www.ncbi.nlm.nih.gov/pubmed/19796087
68. Beeby, Dean. "Huge gap in Health Canada's ability to flag imported goods treated with pesticides." CBC News. Dec 19, 2017. Available at www.cbc.ca/news/politics/health-canada-pesticides-environment-consumer-toys-textiles-sofa-toxic-1.4445227
69. "Endocrine-Disrupting Chemicals." Endocrine Society. Last Accessed Nov 2018. Available at https://www.endocrine.org/topics/edc/what-edcs-are/common-edcs
70. Landrigan, Philip and Lynn Goldman. "A Bad Move That Could End Up Exposing Kids to Chemicals." New York Times. Oct 2, 2018. Available at https://www.nytimes.com/2018/10/02/opinion/chemicals-epa-children-health.html
71. "Inspectors find phthalates in toys and asbestos in second-hand products." European Chemicals Agency. Feb 13, 2018. Available at https://echa.europa.eu/-/inspectors-find-phthalates-in-toys-and-asbestos-in-second-hand-products
72. Hardach, Sophie. "This is what the US imports from China." World Economic Forum. Mar 26, 2018. Available at https://www.weforum.org/agenda/2018/03/this-is-what-the-us-imports-from-china
73. "International trade in goods." European Commission Eurostat. Oct 2018. Available at http://ec.europa.eu/eurostat/statistics-explained/index.php/International_trade_in_goods#Analysis_of_main_trading_partners_for_goods
74. "Protecting European consumers: toys and cars top the list of dangerous products detected." European Commission. March 12, 2018. Available at http://europa.eu/rapid/press-release_IP-18-1721_en.htm

75. "Norway bans 'slime' toy products containing lead, arsenic." Chemical Watch. April 10, 2018. Available at https://chemicalwatch.com/register?o=65807&productID=1&layout=main
76. Guney, M and G.J. Zagury. "Contamination by ten harmful elements in toys and children's jewelry bought on the North American market." Environmental Science Technology. June 4, 2013; 47(11):5921-30. Available at https://www.ncbi.nlm.nih.gov/pubmed/23621131
77. Uding, N. and E. Schreder. "Chemicals Revealed: Over 5,000 Kids' Products Contain Toxic Chemicals." Washington Toxics Coalition. 2013. Available at https://toxicfreefuture.org/science/research/chemicals-revealed/
78. "Safe Shopping Guide for Back-To-School Supplies." U.S. PIRG. Aug 7, 2018. Available at https://uspirg.org/news/usp/safe-shopping-guide-back-school-supplies
79. Povtak, Tim. "Asbestos Found in Children's Makeup." Asbestos.com. Last Accessed Nov 2018. Available at https://www.asbestos.com/news/2017/07/19/asbestos-found-in-childrens-makeup/
80. Walker, Bill and Sonya Lunder. "Tests Find Asbestos in Kids' Crayons, Crime Scene Kits." Asbestos Nation. Accessed Nov 2018. Available at http://www.asbestosnation.org/facts/tests-find-asbestos-in-kids-crayons-crime-scene-kits/#fullreport
81. "Dollar Store Report, 2015." Ecology Center. Accessed Nov 2018. Available at https://www.ecocenter.org/healthy-stuff/reports/dollar-store-report
82. Landrigan, Philip J. and Mary M. Landrigan. "Children and Environmental Toxins: What Everyone Needs to Know." Oxford University Press. Feb 2010.
83. IBID.
84. "State of the science of endocrine disrupting chemicals - 2012." World Health Organization, United Nations Environment Programme. 2013. Available at http://www.who.int/ceh/publications/endocrine/en/
85. "Toxic Wastes Annual Report." UN Human Rights. Last Updated 2018. Available At https://www.ohchr.org/EN/Issues/Environment/ToxicWastes/Pages/Annual.aspx
86. "Understanding Reach." European Chemicals Agency. Accessed Nov 2018. Available at https://echa.europa.eu/regulations/reach/understanding-reach
87. Denison, Richard. "5 ways chemical safety is eroding under Trump." Environmental Defense Fund. May 1, 2018. Available at https://www.edf.org/blog/2018/05/01/5-ways-chemical-safety-eroding-under-trump
88. "Toward a Pollution-Free Planet; Report of the Executive Director" United Nations Environment, Dec. 2017, Available at http://wedocs.unep.org/bitstream/handle/20.500.11822/22251/k1708347e.pdf?sequence=2&isAllowed=y
89. "Be The Solution to Soil Pollution; Outcome Document of Global Symposium on Soil Pollution." Food and Agriculture Organization of the United Nations. May 2018. Available at http://www.fao.org/3/ca0362en/CA0362EN.pdf.
90. "WHO Global Conference on Air Pollution and Health; Note for the media." Geneva, Switzerland, 1 November 2018. Available at https://www.who.int/phe/news/note-conference-air-pollution-1november2018/en/.
91. Landrigan PJ, Fuller R, Acosta NJR, et al. The Lancet Commission on pollution and health. The Lancet. 2017; 391: 462–512.

APPENDIX: ADDITIONAL SOURCES ON TRANSBOUNDARY POLLUTION

- Abudabos, AM et al. "A survey of mycotoxin contamination and chemical composition of distiller's dried grains with solubles (DDGS) imported from the USA into Saudi Arabia." Environmental Science and Pollution Research. June 2017; 24(18):15401-15405. Available at: https://www.ncbi.nlm.nih.gov/pubmed/28508334.

- Al-Saleh, Iman et al. "Heavy metals (lead, cadmium, methylmercury, arsenic) in commonly imported rice grains (Oryza sativa) sold in Saudi Arabia and their potential health risk." Hygiene and Environmental Health. Oct 2017; 220(7): 1168-1178. Available at https://www.sciencedirect.com/science/article/pii/S1438463917301323?via%3Dihub.

- Baqar, M et al. "Organochlorine pesticides across the tributaries of River Ravi, Pakistan: Human health risk assessment through dermal exposure, ecological risks, source fingerprints and spatio-temporal distribution." Science of the Total Environment. March 2018; 618: 291-305. Available at: https://www.ncbi.nlm.nih.gov/pubmed/29131997 .

- Bliss, Susan. "Bangladesh Leather." Geography Bulletin. Aug 2017; 49(3).

- Esposito, M et al. "Total mercury content in commercial swordfish (Xiphias gladius) from different FAO fishing areas." Chemosphere. April 2018; 197:14-19. Available at: https://www.ncbi.nlm.nih.gov/pubmed/29328987.

- Ferranteli, V et al. "Evaluation of mercury levels in pangasius and cod fillets traded in Sicily (Italy)." Food Additives and Contaminants. 2012; 29(7):1046-2051. Available at https://www.tandfonline.com/doi/abs/10.1080/19440049.2012.675595?journalCode=tfac20.

- Gao, P et al. "Bioaccessible trace metals in lip cosmetics and their health risks to female consumers." Environmental Pollution. July 2018; 238: 554-61. Available at https://www.sciencedirect.com/science/article/pii/S0269749117307571?via%3Dihub.

- Geyikçi, F et al. "Monitoring of organochlorine pesticides in the surface waters from Mid-Black Sea Region, Turkey." Environmental Monitoring Assessment. Feb 2011; 173(1-4):127-137. Available at https://www.ncbi.nlm.nih.gov/pubmed/20217219.

- Gilmore, T et al. "A comparison of the prevalence of lead-contaminated imported Chinese ceramic dinnerware purchased inside versus outside Philadelphia's

Chinatown." Medical Toxicology. March 2013; 9(1): 16-20. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3576496/.

- Gould, H.L. et al. "Outbreaks of Disease Associated with Food Imported into the United States, 1996-2014." Emerging Infectious Diseases. March 2017; 23(3): 525-528. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5382743/#FN1.

- Guney, M et al. "Children's exposure to harmful elements in toys and low-cost jewelry: characterizing risks and developing a comprehensive approach." Journal of Hazardous Materials. April 2014 ;271: 321-330. Available at https://www.ncbi.nlm.nih.gov/pubmed/24641994.

- Guney, M. and G.J. Zagury. "Heavy metals in toys and low-cost jewelry: critical review of U.S. and Canadian legislations and recommendations for testing." Environmental Science & Technology. April 2012; 46(8): 4265- 4274. Available at https://www.ncbi.nlm.nih.gov/pubmed/22443256.

- Gunsey, M and GJ Zagury. "Contamination by ten harmful elements in toys and children's jewelry bought on the North American market." Environmental Science Technology. June 2013; 47(11): 5921-30. Available at https://www.ncbi.nlm.nih.gov/pubmed/23621131.

- Haller, Christine. "Made in China." Toxicology in the News. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3550137/pdf/13181_2009_Article_BF03160969.pdf.

- Handley, M.A. et al. "Examining Lead Exposures in California through State-Issued Health Alerts for Food Contamination and an Exposure-Based Candy Testing Program." Environmental Health Perspectives. Sept 2017. Available at https://ehp.niehs.nih.gov/EHP2582/#tab2.

- Hepp, M.N. et al. "Survey of cosmetics for arsenic, cadmium, chromium, cobalt, lead, mercury, and nickel content." Journal of Cosmetic Science. May-June 2015; 65(3): 125-145. Available at https://www.ncbi.nlm.nih.gov/pubmed/25043485.

- Houlihan, Jane. "Arsenic in 9 brands of infant rice cereal." Healthy Babies Bright Futures. Dec 2017. Available at http://www.healthybabycereals.org/sites/healthybabycereals.org/files/2017-12/HBBF_ArsenicInInfantCerealReport.pdf.

- Hullah, H et al. "Comparative study of heavy metals content in cosmetic products of different countries marketed in Khyber Pakhtunkhwa, Pakistan." Arabian Journal of Chemistry. Jan 2017; 10(1): 10-18. Available at https://www.sciencedirect.com/science/article/pii/S1878535213003195.

- Jensen, P. et al. "Nickel and cobalt release from children's toys purchased in Denmark and the United States." Dermatitis. Nov 2014; 25(6): 356-365. Available at https://www.ncbi.nlm.nih.gov/pubmed/25384229.

- Kim, Dong-Gyu et al. “Cadmium and lead in animal tissue (muscle, liver and kidney), cow milk and dairy products in Korea.” Food Additives and Contaminants. 2016; 9(1):33-37. Available at https://www.tandfonline.com/doi/abs/10.1080/19393210.2015.1114032?journalCode=tfab20&.

- Kumar, A. and Prashant Pastore. “Lead and cadmium in soft plastic toys.” Current Science. Sept 2007; 93(6): 818-822. Available at https://www.jstor.org/stable/24099126?seq=1#page_scan_tab_contents.

- Massadeh, M et al. “Determination of selected elements in canned food sold in Jordan.” Environmental Science and Pollution Research. Feb 2018; 25(4): 3501-3509. Available at https://link.springer.com/article/10.1007%2Fs11356-017-0465-5.

- Naser, J. and I. Kirm. “Mercury content in cost skin lightening cream products.” Environmental Science & Engineering. April 2012; 54(2): 245-8. Available at https://www.ncbi.nlm.nih.gov/pubmed/24749377.

- Naseri, M et al. “Concentration of some heavy metals in rice types available in Shiraz market and human health risk assessment.” Food Chemistry. May 2015; 175: 243-248. Available at https://www.sciencedirect.com/science/article/pii/S030881461401838X?via%3Dihub

- Negev, M. et al. “Concentrations of trace metals, phthalates, bisphenol A and flame-retardants in toys and other children’s products in Israel.” Chemosphere. Feb 2018;192: 217-224. Available at https://www.sciencedirect.com/science/article/pii/S0045653517317204?via%3Dihub.

- Pesavento, G et al. “Mycotic and aflatoxin contamination in Myristica fragrans seeds (nutmeg) and Capsicum annum (chilli), packaged in Italy and commercialized worldwide.” Preventative Medicine and Hygiene. June 2017; 57(2):102-109. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4996038/ .

- “Protein Powder, Our Point of View.” Clean Label Project. June 2018. Available at https://www.cleanlabelproject.org/protein-powder-white-paper/.

- Ritchie, J.A. et al. “An evaluation of lead concentrations in imported hot sauces.” Environmental Science and Health. 2013; 48(7):530-538. Available at https://www.ncbi.nlm.nih.gov/pubmed/23581685.

- Thyssen, J.P. et al. “The prevalence of chromium allergy in Denmark is currently increasing as a result of leather exposure.” British Journal of Dermatology. Nov 2009. Available at https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2133.2009.09405.x.

- Villalobos, M. et al. “Lead (II) detection and contamination routes in environmental sources, cookware and home-prepared foods from Zimatlán,

Oaxaca, Mexico." Science of the Total Environment. April 2009; 407(8):2836-2844. Available at https://www.sciencedirect.com/science/article/pii/S0048969709000072?via%3Dihub.

- Volpe, M.G. et al. "Determination and assessments of selected heavy metals in eye shadow cosmetics from China, Italy, and USA." Microchemical Journal. March 2012; 101: 65-69. Available at https://www.sciencedirect.com/science/article/pii/S0026265X11002086.

- Weidenhamer, J.D. "Lead contamination of inexpensive seasonal and holiday products." Science of the Total Environment. March 2009; 407(7): 2447-2450. Available at https://www.sciencedirect.com/science/article/pii/S0048969708011479?via%3Dihub.

- Weidenhamer, J.D. et al. "Metal exposures from aluminum cookware: An unrecognized public health risk in developing countries." Science of the Total Environment. Feb 2017; 579: 805-813. Available at https://www.sciencedirect.com/science/article/pii/S0048969716324548.

- Yost, J.L. and J.D. Weidenhamer. "Accessible and total lead in low-cost jewelry items." Integrated Environmental Assessment and Management. July 2008; 4(3): 358-61. Available at https://www.ncbi.nlm.nih.gov/pubmed/18393573.

- Yu, S et al. "Relationship between urbanisation and pollutant emissions in transboundary river basins under the strategy of the Belt and Road Initiative." Chemosphere. July 2018; 203:11-20. Available at https://www.ncbi.nlm.nih.gov/pubmed/29604425 .

BACK COVER PHOTO:

INDIA

Women recycling used lead acid car batteries.

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