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ISSUE BRIEF

NOT JUST DIRT: TOXIC CHEMICALS IN INDOOR DUST

On average, people in the United States spend more than 90 percent of their time indoors—in places like homes, schools, offices, gyms, and cars.[1] These places are usually full of dust, which is more than just dirt. Household items like televisions, furniture, beauty products, cleaning products, and flooring materials shed chemicals that end up in the air and in the dust on our floors.[2,3] These chemicals can enter our bodies from air and dust when we breathe, touch contaminated surfaces, and accidentally transfer them to our food or mouth with our dusty hands.[4,5,6,7] And some of these chemicals can contribute to health problems.[8,9,10]

Because indoor dust contains chemicals from a wide variety of products, it is like a parking lot for chemicals in the home. Analysis of dust reveals a picture of the types and levels of chemicals present indoors. We can use this information to estimate our potential exposure—how much of each chemical might be entering our bodies.[11,12]

Young children are at higher risk for exposure to chemicals in indoor dust because they come into much more contact with this dust when they crawl, play on the floor, and put their hands in their mouths.[13] Children may also be more vulnerable to the effects of toxic chemicals because their brains and bodies are still developing.

In 2015, scientists from George Washington University, Silent Spring Institute, NRDC, Harvard University, and the University of California–San Francisco embarked on the first study to comprehensively assess consumer product chemicals of concern in U.S. indoor dust, provide a picture of the toxic chemicals in the home, and estimate potential exposures for children.

We compiled information from every published study since the year 2000 that analyzed current consumer product chemicals in U.S. indoor dust. We used that information to calculate average chemical levels and estimate how much enters our bodies. We also summarized health hazard

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FIGURE 1: CHEMICALS FOUND IN INDOOR DUST

The classes of chemicals in our study are commonly added to household products and building materials. Like a human family, chemical classes are groups of related chemicals.

PHTHALATES

Used to make plastic softer and more flexible, especially vinyl (PVC) materials such as vinyl flooring, vinyl blinds, and food packaging. They may also be found in personal care products and fragranced products.

Total number of chemicals from this class in our study: 8

Example chemicals: DEHP (di-2-ethylhexyl phthalate); BBzP (butyl benzyl phthalate)

ENVIRONMENTAL PHENOLS

Used as preservatives in personal care products like shampoo, lotions, cosmetics; as part of plastic materials such as reusable water bottles and in cleaning products such as detergents.

Total number of chemicals from this class in our study: 10

Example chemicals: MeP (methyl paraben), BPA (bisphenol A)

FLAME RETARDANTS

Used in furniture, baby products, electronics and building insulation in order to meet flammability standards.

Total number of chemicals from this class in our study: 15

Example chemicals: TCEP (tris (2-chloroethyl) phosphate); BEH-TEBP (a tetrabromophthalate)

FRAGRANCES

Used as scent in a wide variety of products including personal care products, cleaning products, perfumes, candles, and air fresheners.

Total number of chemicals from this class in our study: 1

Example chemical: HHCB (Galaxolide)

FLUORINATED CHEMICALS

Also known as PFCs or PFASs, these chemicals are used as stain and water repellant treatments for upholstery, carpets, clothes and shoes; in non-stick cookware; and to make food papers like pizza boxes and popcorn bags grease proof.

Total number of chemicals from this class in our study: 11

Example chemicals: PFOA (perfluorooctanoic acid); PFOS (perfluorooctane sulfonic acid)

information from government agencies and other expert bodies. Scientists and policymakers can use this information to improve future exposure research and prioritize chemicals for health studies and regulatory action.

TOXIC CHEMICALS IN DUST = PUBLIC HEALTH THREATS

Our study found that U.S. indoor dust contains a wide variety of consumer product and building material chemicals that are linked to hazards for children's health. We identified 45 chemicals from five chemical classes that have been measured in U.S. indoor dust in three or more datasets (Figure 1 and Figure 2). These commonly measured chemicals in the home are associated with health hazards such as cancer, endocrine/hormone disruption, or reproductive toxicity (Table 2).

We found that many chemicals in dust had the potential to cause the same health harm, which is concerning because the impacts from multiple chemicals can add up (Table 2).[14] People are likely exposed to multiple chemicals at the same time in dust, but most studies evaluate the health effects of only one chemical on its own. We need more research to understand how many chemicals from household products are entering our bodies, and how being exposed to all of them affects our health.

Generally, phthalates were found at the highest levels in dust (Figure 2). This is concerning because these chemicals are associated with multiple health hazards, are linked to reproductive and developmental problems in human studies,[15] and came out on the top of the list when we estimated kids' chemical intakes. The chemical classes found at the next-highest levels in dust were environmental phenols, flame retardants, and fragrances. Fluorinated chemicals were found at the lowest levels.

Some phthalates, fragrance, flame retardants, and phenols are consistently found in 90 percent or more of dust samples across multiple studies (Table 1). This finding suggests ubiquitous exposure to these chemicals. Their presence may be due to common sources such as building materials, wires, cables, electronics, and furniture in all indoor environments.

For some of the chemicals commonly found indoors, especially fragrances, there have been very few studies related to their potential health hazards. This is a concern because it is likely that many people are being exposed to these chemicals, but we don't know if they are safe.

There are some limitations to our study. The data came mostly from the East and West Coasts, so our findings may

TABLE 1: THESE 10 CHEMICALS ARE PROBABLY IN YOUR DUST			
CHEMICAL (CHEMICAL CLASS)	PERCENT OF SAMPLES THAT CONTAINED THE CHEMICAL	HEALTH HAZARDS	COMMON PRODUCTS CONTAINING THIS CHEMICAL
DEHP (phthalate)	100%	Reproductive system and developmental toxicity, hormone disruption	Vinyl flooring, food contact materials[16,17]
DEHA (phthalate)	100%	Reproductive system and developmental toxicity	Vinyl flooring, food packaging[18]
HHCB (fragrance)	100%	?[19]	Scented products[20]
BBzP (phthalate)	98-100%	Reproductive system and developmental toxicity, hormone disruption	Vinyl flooring[21]
TPHP (flame retardant)	98-100%	Reproductive and nervous system toxicity	Treated furniture, baby products, carpet padding, electronics[22,23,24]
TDCIPP (flame retardant)	95-100%	Cancer	Treated furniture, baby products, carpet padding[25,26,27]
DnBP (phthalate)	95-100%	Reproductive system and developmental toxicity, hormone disruption	Nail polish, paints[28,29]
DiBP (phthalate)	95-100%	Reproductive system and developmental toxicity, hormone disruption	Vinyl products, personal care and beauty products[30,31]
HBCDD (flame retardant)	92-100%	Reproductive and nervous system toxicity, hormone disruption	Polystyrene building insulation[32]
MeP (phenol)	90-100%	Reproductive system toxicity, hormone disruption	Cosmetics, lotions, deodorants[33]

Chemicals with highest detection frequencies, selected health hazards identified by government lists, and common products that contain the chemical.

not be nationally representative. The dust samples came largely from home (residential) environments, and other indoor environments may have different profiles. While we relied on authoritative sources to determine whether a chemical can cause harm, we did not have the information necessary to determine the specific health risks of the chemicals at the average levels found in dust.

THE ROLE OF PUBLIC POLICY

Current practices of using toxic and untested chemicals in consumer products and building materials result in these chemicals' widespread presence in the indoor environment and are inadequate to protect health.

Governments and companies should advance policies to remove hazardous chemicals from products and replace them with safer alternatives. Some have already done so. For example, the California Safer Consumer Products program requires companies to carefully choose the safest alternative to toxic chemicals in order to avoid "regrettable substitution" replacement chemicals that are also harmful.[34] Washington State requires reporting of hazardous chemicals in children's products so that consumers can choose safer products.[35]

At the national level, the U.S. Consumer Product Safety Commission (CPSC) has banned some phthalates from children's products and child care articles and is proposing to ban additional phthalates. The U.S. Food and Drug Administration (FDA) is accepting public comments on a petition to ban all phthalates from food.

HOW TOXIC CHEMICALS CAN AFFECT HEALTH

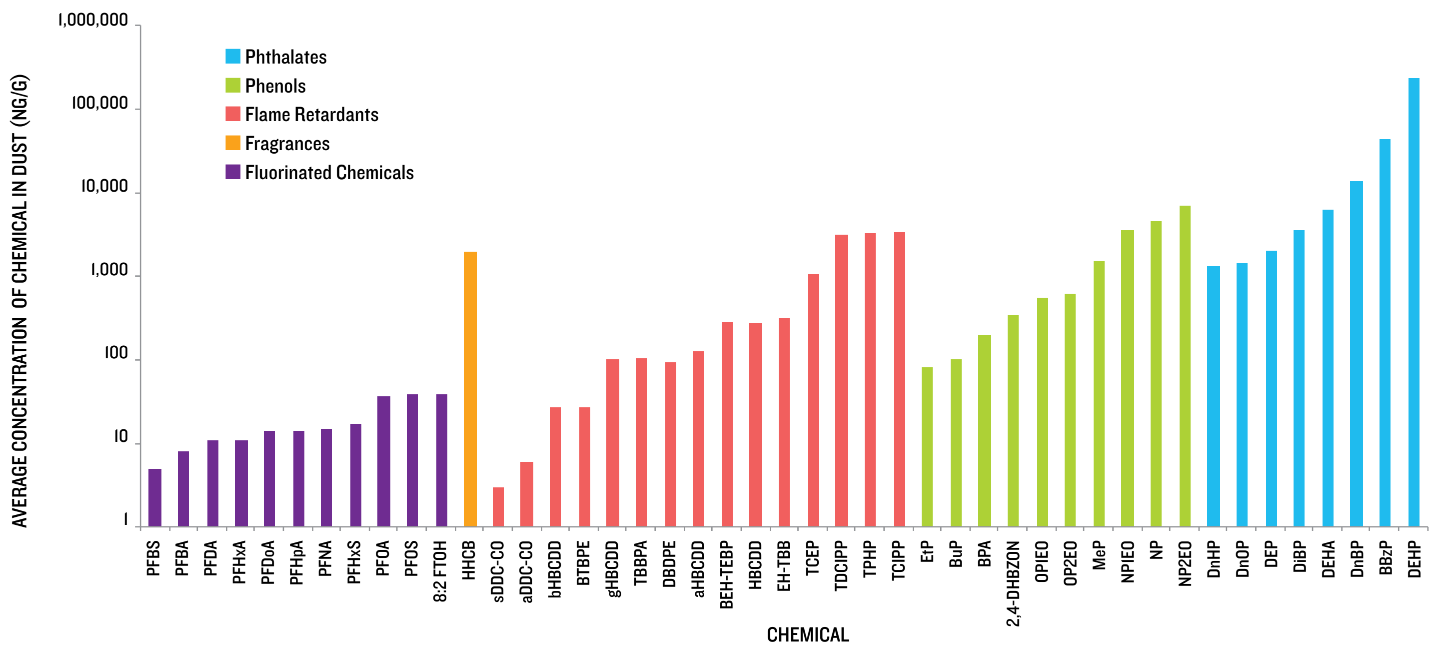
Chemicals can be toxic to different systems in the body. Here are some examples of the kinds of health problems we're worried about in each category of health hazard. Note that these health problems are just examples and that the chemicals in our study are not necessarily linked to all of them.

- Toxicity to the reproductive system: compromised fertility, decreased sperm quality, decreased testes size
- Toxicity to the hormone system: altered hormone levels, thyroid disease, obesity, diabetes
- Toxicity to development/birth defects: low birth weight, developmental delays
- Cancers: breast, testicular, prostate, kidney, and others
- Toxicity to the immune system: allergies, compromised immunity
- Toxicity to the digestive system: liver inflammation, irritable bowel
- Toxicity to the lungs and respiratory system: asthma
- Toxicity to the nervous system: attention deficit hyperactivity disorders (ADHD), learning disabilities, poor coordination

SIMPLE STEPS TO REDUCE YOUR EXPOSURE

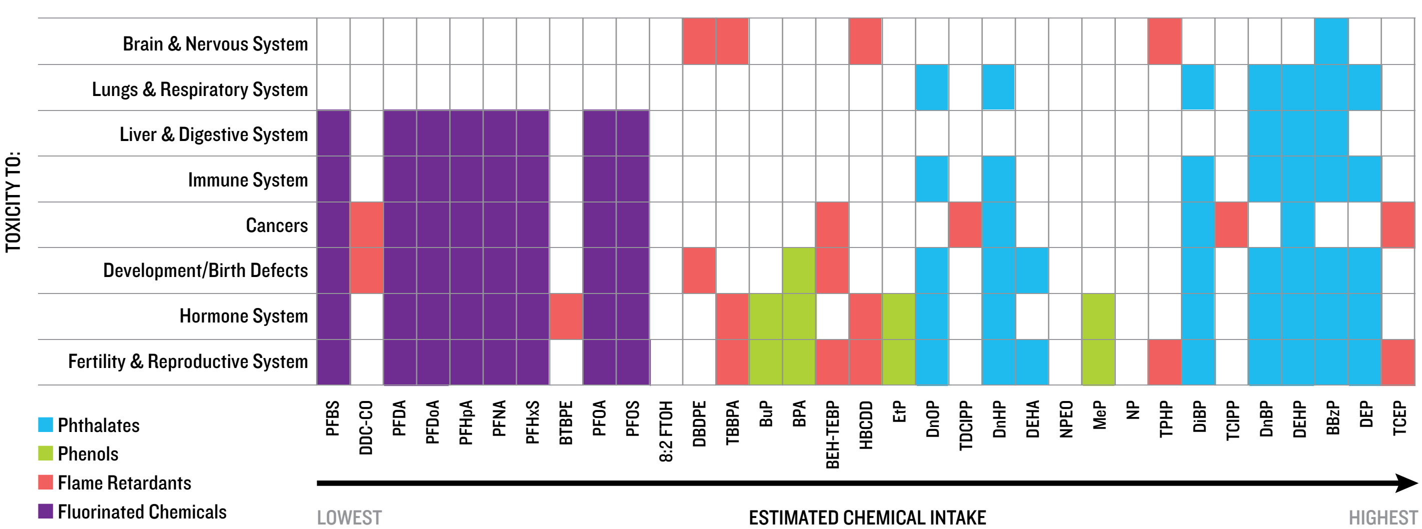
- Remove dust from your hands. Wash your hands and your children's hands frequently, and always before eating. Use plain soap and water, avoiding fragranced and antibacterial soaps.
- Keep household dust to a minimum. Dust with a damp cloth, regularly go over floors with a wet mop, and use a vacuum with a high-efficiency particulate air (HEPA) filter.
- Use the Silent Spring Detox Me app, available at www.silentspring.org/detoxme. This free smartphone app walks you through simple, research-based tips on how to reduce your exposure to potentially harmful chemicals where you live and work, and it keeps track of your progress.
- Explore further resources to find safer products:
  - Environmental Working Group Skin Deep: www.ewg.org/skindeep
  - Healthy Babies, Bright Futures parents' resource: hbbf.org/product-finder

FIGURE 2: INDOOR DUST CONTAINS NUMEROUS CHEMICALS



Average (geometric mean) dust levels in nanograms of chemical per gram of dust for the 45 chemicals reported in at least three data sets. The average concentration of DEHP is about 45,000 times higher than PFBS.

TABLE 2: HEALTH HAZARDS OF CHEMICALS IN DUST



The health hazards associated with each chemical, according to the California Safer Consumer Products Candidate Chemicals List. A filled box means the chemical poses the hazard. We estimated how much of each chemical would enter a person's body through air and dust, and the chemicals are listed in order of intake, with the lowest intake on the left-hand side.

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