7 HARMFUL CHEMICAL TYPES IN PLASTICS

BISPHENOLS

What they are: Bisphenols, such as bisphenol A (BPA), are used as chemical building blocks in polycarbonate plastics and epoxy resins and are used in reusable food and beverage containers, re-usable water bottles, the linings of food cans, medical and sports equipment, eyeglass lenses, thermal paper receipts, and plastic water pipes.

Exposure routes: A high production volume chemical, most people are exposed to BPA when it leaches from food contact materials into foods and beverages they consume. BPA leaches from landfills to contaminate wastewater, groundwater, and freshwater, and has been found around the world in beach sand from plastic marine waste. BPA, listed as a substance of very high concern by the European Union, and has been demonstrated to be toxic by hundreds of chemicals studies. Many countries have moved to ban PBA from baby bottles, but there is strong evidence that replacement chemicals exhibit the same health impacts.

Health impacts: A large body of evidence confirms that BPA can affect brain development and behavior. Exposure can increase anxiety, depression, hyperactivity, inattention, behavioral problem, and is also associated with adverse reproductive outcomes affecting cell division in eggs. BPA is associated with Polycystic Ovary Syndrome (PCOS)—a complex hormonal condition associated with irregular menstrual cycles, reduced fertility, and increased risk of diabetes. In men, BPA affects fertility and is associated with sexual dysfunction among men exposed to high occupational levels. BPA is associated with breast, prostate, ovarian, and endometrial cancers.

ALKYLPHENOLS

What they are: Commonly used in latex paints, pesticides, industrial cleaners, detergents, personal care products, and many different kinds of plastics as UV stabilizers, alkylphenols are used to spread substances like paints and coatings over surfaces.

Exposure routes: Alkylphenols are used in numerous applications that contribute to human exposures, including cleaners and degreasers, adhesives, emulsifiers, cosmetics, and personal care products, paints, and dust control agents. Some alkylphenols are approved for use as indirect food contact substances, and others are used as heat stabilizers for PVC in water pipes and flooring.

Health Impacts: These chemicals mimic estrogen and disrupt reproductive systems. Alkylphenols are linked to male infertility, low sperm count, and disrupted prostate development. Studies have shown occupational exposures is associated with heightened risk of male and female breast cancers.

PHTHALATES

What they are: Phthalates are chemical additives widely used to produce or promote flexibility and to reduce brittleness in plastics. Phthalates are used as plasticizers in PVC consumer, medical, and building products, as matrices and solvents in personal care products, and as fillers in medications and dietary supplements, food and beverage packaging, and children's toys. The phthalate DEHP is common in medical devices such as plastic tubing. Some phthalates are restricted in the European Union and are classified as substances of very high concern.

Exposure Routes: Daily human exposures via oral ingestion, inhalation, and skin contact are common. Phthalates frequently leach from items such as food packaging, cosmetics, body care products, and toys into the environment and into products that humans use and consume. The most common routes of exposure are via oral ingestion from food packaging and the use of cosmetic products, but high levels

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of phthalates are also present in household dust. They are metabolized quickly and are present in 90-100% of amniotic fluid samples from second-trimester fetuses, cord blood samples from newborns, breast milk from nursing mothers, and even in human ovarian follicular fluid.

Health Impacts: Phthalates reduce testosterone and estrogen levels, block thyroid hormone action, and have been identified as reproductive toxicants. Decreased pregnancy and high miscarriage rates, anemia, toxemia, pre-eclampsia, early menopause, and abnormal sex steroid hormone levels are associated with phthalates. Phthalate exposures are not only associated with reduced fertility but can affect fertility across multiple generations. Developmental exposure to phthalates affects gene expression, and perinatal phthalate exposure affects asocial behaviors. Phthalate exposure increases the risk of insulin resistance and has been persistently linked to diabetes. Phthalates are associated with elevated blood pressure, obesity, elevated levels of triglycerides.

PERFLUORINATED COMPOUNDS

What they are: Perfluorinated chemicals are widely used in water and stain-resistant clothing, food contact wrappers, lubricants, carpet treatments, paints, cookware, and as a dispersant in firefighting foams, as well as other industrial and consumer applications. PFAS and PFOA are listed under the Stockholm Convention on Persistent Organic Pollutants, and PFHxS, used as a substitute, has been recommended for listing by the convention's technical experts. Perfluorinated chemicals are used to make fluoropolymers for plastics.

Exposure routes: PFAS chemicals contaminate local water sources. The use of PFAS chemicals in industry and firefighting foam used in airports and military bases are sources of pervasive drinking water and groundwater contamination throughout the world. Most people are exposed to PFAS from drinking tap water. PFAS also leaches into local water systems from PFAS containing waste in landfills. In addition, PFAS leaches from wrappers and cookware into our food.

Health Impacts: PFAS are metabolism disrupting chemicals affecting the immune systems, liver, and thyroid function. They alter puberty, raise breast cancer risk, and are associated with kidney, testicular, prostate, and ovarian cancers, and non-Hodgkin's lymphoma.

BROMINATED FLAME RETARDANTS, BFRS

What they are: Brominated flame retardants (BFRs) are a class of chemicals used to reduce flammability in plastic products and prevent the spread of fires. They are used in foams, polystyrenes, and epoxy resins that are used to manufacture electronic casings and wire coatings (examples include the plastic casings for computers, TVs, and home appliances), textiles, furniture foams, carpets, building materials, and are commonly found in plastic children's toys.

Exposure Routes: BFRs leach from products and are present in household dust. Small children ingest BFRs from hand to mouth behavior, and from mouthing toys made from recycled plastics that contain BFRs. Processing of plastic waste is a significant source of human BFR exposure because although BFRs are controlled, the Stockholm Convention allows some BFRs in plastic materials for recycling. Global sampling has demonstrated that the widespread presence of BFRs in plastic children's toys made from recycled plastics are available in stores throughout the world.

Health Impacts: BFRs disrupt male and female reproductive development, alter thyroid development, and affect neurodevelopment. BRF exposure is associated with psychomotor and attention-related IQ performance in children.

DIOXIN

What they are: Dioxins, considered the world's most toxic substances, are byproducts of industrial and combustion processes and occur in the production of plastic products with BFRs and when plastics with BFRs are incinerated or heated in a recycling process to be re-molded into new products. There is no safe level of dioxin exposure. They are fat soluble, bind to soils, and can accumulate in animal and human fatty tissues.

Exposure Routes: Dioxin exposures can occur through oral, dermal and inhalation routes. Children mouthing toys made of recycled plastic that derives from e-waste are at risk of dangerous health effects from the toxic material. Dioxin contamination of local food chains has been documented in communities where e-waste shipments are dumped and incinerated, landfills where plastic waste accumulates, and where plastic waste is incinerated for fuel at levels that are comparable to dioxin hotspots.

Health Impacts: Dioxin exposures affect brain development, disrupt thyroid and immune system functions, and are associated with increased risk of multiple cancers, and immune system damage.

UV STABILIZERS

What they are: UV stabilizers are chemical additives used to protect plastic building materials, automotive parts, waxes, and paints from deterioration due to UV radiation. Several UV stabilizers are on the Candidate List of Substances of Very High Concern by the European Chemicals Agency (ECHA) because of their persistent, bio-accumulative, and toxic nature. The Swiss government has recently submitted a proposal to the Stockholm Convention to list UV-328, for listing as a Persistent Organic Pollutant under provisions of the Stockholm Convention.

Exposure Routes: UV stabilizers can leach from food packaging materials into our food. The chemicals also have been found in house dust.

Health Impacts: Several studies demonstrate that UV stabilizers disrupt endocrine function, impeding normal development and inducing estrogenic effects.