

HANDBOOK ON REDUCING CHEMICAL FOOTPRINTS

Chapter 3. Chemicals of Concern

Our chemical footprints include many different kinds of chemicals. This chapter focuses on chemicals in common consumer products that raise human health and environmental concerns. The goal of this chapter is to describe specific chemicals of concern that individuals can reduce or remove from their own individual chemical footprints. Starting with general discussion and definition of these chemicals of concern, the chapter then reviews several categories of consumer products where these chemicals of concern are found: personal care, household and home gardening products. Various chemical compounds are described in each product category, such as antibacterial agents, plasticizers and pesticides, with specific chemicals of concern identified.

Defining Chemicals of Concern

Chemicals of concern are unregulated substances with known or suspected harmful effects on human and ecological health. These chemicals are introduced through a variety of human activities and have been found in human tissues, wildlife, and water systems. Despite growing human health and environmental concerns, these chemicals are not routinely monitored, measured, or treated in the water supply. In most cases, no risk standards have been set and the consequences of long-term exposure at very low levels is not well understood. Many such chemicals have been identified and under study for decades.

Unregulated chemicals of concern are referred to differently depending on who is researching and communicating the issues. “Contaminants of emerging concern” (CECs) has been adopted by many in the scientific community to describe chemicals that “are being discovered in water that previously had not been detected or are being detected at levels that may be significantly different than expected.”¹ Others use the same CEC acronym to refer to “constituents of emerging concern,” focusing on “a diverse group of relatively unmonitored chemicals” found in the water supply.² Still others use phrases such as “emerging contaminants” or “contaminants of

Chemicals of Concern Criteria

Contained in **common** personal care, household products and home gardening **products**
Linked with known or suspected **negative human health** and/or **environmental impacts**
Unregulated
Not removed from the water system under current water treatment processes

¹ US Environmental Protection Agency (EPA), Office of Water: Science & Technology, “Contaminants of Emerging Concern,” updated May 8, 2014 (<http://water.epa.gov/scitech/cec/>).

² Association of California Water Agencies (ACWA), Water Quality, Regulatory Affairs, “Constituents of Emerging Concern” (see <http://www.acwa.com/content/water-quality/contaminants-emerging-concern>).

concern” to refer to hazardous substances that are currently unregulated.³ These terms will be used interchangeably in this document to refer to the set of unregulated substances found in many common consumer products that have been associated with harmful effects on human and environmental health.

Unregulated harmful chemicals in common consumer products are the primary focus of this handbook. Consumers are the pivotal decision makers with regard to this set of chemicals. While chemicals of concern have countless applications in modern society, individual consumers have the opportunity to make direct decisions about only some of them. Specifically, consumers make choices about what kinds of personal care items, household products, cleaning supplies and garden care products that they purchase and use. Chemicals of concern also appear in manufacturing and industrial processes, broad-scale agricultural applications, and general business practices. Sometimes we are in a position to influence these larger operational decisions as well, including what kinds of chemicals will be used and how they will be applied and discarded. However, in most cases we have the greatest control over our direct consumer choices – what we buy.

Unregulated chemicals of concern are not generally removed under existing wastewater treatment processes and have been detected in stream water samples collected across the US.

Source:

<http://en.wikipedia.org/wiki/Effluent>

The chemicals of concern of primary interest in this handbook are those for which convenient alternatives exist. Knowledge of problems for which there are no solutions has little effect. Many chemicals of concern are contained in products for which there are no alternatives. For example, pharmaceuticals that make their way into the water system are often cited as a major source of concern. Trace levels of pharmaceuticals have been measured in various water bodies. In some cases, physiological changes have been found in the fish that live in those waters (e.g., transex fish).⁴ However, in most cases, people are using pharmaceuticals to address medically defined needs, and to go without those treatments can result in personal health consequences. Thus, focusing on pharmaceuticals does not yield easy options for reducing one’s chemical footprint. The problem of pharmaceuticals in the water supply is a serious one. New methods for addressing this issue are urgently needed. But that is the subject of a different kind of analysis.

³ The European Chemicals Agency (ECHA), an agency of the European Union, defines “chemicals of concern” as “Substances with certain hazardous properties [that] can be of concern for human health and/or the environment. Such substances can be identified and subsequently regulated to make sure that the risks associated with these substances are properly controlled.” (<http://echa.europa.eu/addressing-chemicals-of-concern>).

⁴ Natasha Gilbert, “Drug Waste Harms Fish: Discharges from pharmaceutical factories contaminate rivers on three continents,” *Nature* 476, 265 (published online August 15, 2011; available at <http://www.nature.com/news/2011/110815/full/476265a.html>).

For these reasons, pharmaceuticals will be introduced in this discussion but will not be emphasized.

History of Chemicals of Emerging Concern Research

In the late 1970s, a scientific paper was published that mentioned the presence of aspirin in the Missouri river. Not much was done with this research. More lab studies were conducted prior to 2000 that saw cause and effect of CECs such as pharmaceuticals (e.g., estrogenic effects). In early 2002 the U.S. Geological Survey (USGS) released a study that highlighted the issue that CECs were a problem in our water supply. This study was mentioned in the New York Times. This media coverage led to social awareness and, in turn, generated more funding for CEC research.

Chemicals of concern can be found in many common consumer products.

Chemicals of Concern in Common Consumer Products

Several revelations in the past two decades have heightened interest in harmful chemicals found in common consumer products. New developments include greater ability to detect and measure contaminants at very small concentrations and increased interest in tracing contaminants from common household and personal care products to the water system. The 2002 landmark USGS study caught the attention of the scientific community and the public by showing that a broad range of chemicals from residential, industrial, and agricultural sources – including human and veterinary drugs, natural and synthetic hormones, detergent metabolites, plasticizers, insecticides, and fire retardants – was found in detectable quantities in water samples collected from streams across the United States.⁵ Since then, numerous meetings and reports have documented the growing field of research focused on these chemicals, including studies of toxic potential and persistence in the environment.⁶

The review that follows identifies several different types of common consumer products containing chemicals of concern. Chemicals found in personal care products are the first to be examined, followed by household products, then home gardening products. The listing of specific chemicals and product types is not comprehensive. The goal is to focus on some of the most common chemicals of concern, provide guidance to where these chemicals might be found, and suggest that alternatives to these kinds of products are available and could be sought. For more specific discussion of human health and environmental concerns associated with these chemicals, see Chapter 4.

⁵ Dana W. Kolpin et al., “Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000 – A national reconnaissance,” *Environmental Science and Technology* 36, 6 (2002): 1202-1211 (available at <http://pubs.acs.org/doi/abs/10.1021/es011055j>).

⁶ See the American Chemical Society (ACS) 2010 book, *Contaminants of Emerging Concern in the Environment: Ecological and Human Health Considerations*, documenting key developments in this research agenda and some of the findings to date (edited by Rolf U. Halden, ACS Symposium Series, Vol. 1048, American Chemical Society; available online at <http://pubs.acs.org/doi/pdf/10.1021/bk-2010-1048.ch001>).

Personal Care Products

Personal care products encompass a diverse range of merchandise that consumers use for bathing, grooming, skin protection and cosmetic enhancement. These are items that we come into intimate contact with and include products such as soap, hand sanitizers, body washes and hair products; toothpastes and mouthwashes; lotions, sunscreens and insect repellents; deodorants and fragrances; and make-up products such as lipstick, eye shadow and fingernail polish.

As discussed in Chapter 2, the FDA has prohibited or restricted very few cosmetic ingredients. However, manufacturers of these products must comply with FDA product labeling rules.⁷ The Fair Packaging and Labeling Act requires the “declaration of ingredients except flavor, fragrance, and trade secret ingredients in descending order of predominance” on retail packaging materials.⁸ Thus, consumers generally have at least some of the information needed to avoid particular chemicals of concern in these products. Labeling exceptions, such as those applied to “fragrance,” still keep many chemical ingredients hidden from consumers.



To compete for profit and market share, manufacturers frequently introduce new products and “new and improved” formulas of the already wide array of personal care products. Many of these products include chemicals of concern.

Some of these chemicals are “active ingredients,” selected because they are biologically active in addressing a need. Active ingredients might, for example, serve as cleaning agents in body cleansing products, or they might directly block ultraviolet rays from reaching the skin in sunscreen products. Personal care products also contain numerous “inactive ingredients,” which do not increase the intended effect but are added to address other manufacturer interests. Inactive ingredients include preservatives, dyes, fragrances, flavoring and binding substances. Some of these added ingredients do little more than enhance marketing interests or product appeal while increasing the chemicals of concern introduced into the environment.

Regulatory Authority for Personal Care Products

The US Food and Drug Administration has authority for regulating “cosmetics” (or personal care products), defined under law as “articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body... for cleansing, beautifying, promoting attractiveness, or altering appearance.”

Federal Food, Drug, and Cosmetic Act, Sec. 201(i)

⁷ See FDA’s “Cosmetic Labeling Guide” for a complete listing of cosmetic labeling requirements (available at <http://www.fda.gov/Cosmetics/Labeling/Regulations/ucm126444.htm#clga>).

⁸ Ibid. Cosmetic ingredient labeling rules are detailed in the *Code of Federal Regulations*, title 21 (“Food and Drugs”), Sec. 701.3.

Antibacterials

Antibacterial substances interfere with bacterial growth and reproduction. Unlike antibiotics, which are medicines taken internally to attack bacteria, antibacterial agents are used to disinfect surfaces, including skin. Antibacterials are found in a variety of personal care products. Traditional antibacterials, including alcohols and peroxides, act quickly and leave no active residue behind. Some newer antibacterial compounds, such as triclosan, leave long-acting residues.⁹

Triclosan is an active ingredient in many personal care products, including antibacterial soaps and body washes, hand sanitizers, deodorants, and makeup.¹⁰ It is also added to some toothpaste as an antigingivitis or gum disease-fighting ingredient. Widely used since the 1970s, triclosan has been the subject of increasing scrutiny. Based on mounting safety questions, the US Food and Drug Administration (FDA) issued a draft rule in December 2013 revoking the “generally regarded as safe” (GRAS) status of triclosan and other common antibacterial chemicals found in soaps and body wash products (but excluding most other applications including hand sanitizers, hand wipes and toothpaste) while more study is conducted of possible endocrine, developmental and carcinogenic effects, as well as bacterial resistance impacts.¹¹ Pending a final rule, there are no current restrictions on its use.¹²

Fragrance

Synthetic fragrances are common in countless personal care products ranging from soaps, shampoos, and after-shave lotions to perfumes, colognes, and body sprays. Some of these products include trace amounts of natural scents, but most contain potentially harmful synthetic chemicals, some derived from petroleum. Manufacturers are allowed to withhold fragrance ingredients from labeling requirements to protect trade secrets. With 3,100 stock chemical ingredients compiled by the fragrance industry, consumers typically have no idea what fragrance chemicals are included in their personal care products.¹³ A product label listing “fragrance,”

⁹Alliance for the Prudent Use of Antibiotics (APUA), affiliated with Tufts University School of Medicine, “General Background: Antibiotic Agents,” updated 2014 (http://www.tufts.edu/med/apua/about_issue/agents.shtml).

¹⁰ For an extensive list of specific products containing triclosan, see the information page provided by Beyond Pesticides: Protecting Health and the Environment with Science, Policy and Action, “Products Containing Triclosan,” available at <http://www.beyondpesticides.org/antibacterial/products.php>.

¹¹ US Food and Drug Administration, Dept. of Health and Human Services, Proposed Rule, “Safety and Effectiveness of Consumer Antiseptics; Topical Antimicrobial Drug Products for Over-the-Counter Human Use; Proposed Amendment of the Tentative Final Monograph; Reopening of Administrative Record,” Federal Register 78, 242 (December 17, 2013): 76444 (<http://www.gpo.gov/fdsys/pkg/FR-2013-12-17/pdf/2013-29814.pdf>).

¹² US Food and Drug Administration (FDA), “Triclosan: What Consumers Should Know,” FDA Consumer Updates page, updated Nov. 25, 2013 (available at <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm205999.htm>).

¹³ Roddy Scheer and Doug Moss, “Scent of Danger: Are There Toxic Ingredients in Perfumes and Colognes?” EarthTalk, September 29, 2012 (<http://www.scientificamerican.com/article/toxic-perfumes-and-colognes/>). In this article, the authors site the Environmental Working Group as their primary information source.



What is that??

“aroma” or “parfum” represents any number of combinations of these various synthetic fragrance chemicals.

Fragrance is a very large product category with numerous substances of potential human health and environmental concern. Many of these substances can be absorbed through the skin or breathed in with negative respiratory and allergy effects. One chemical of particular concern is **musk-ketone**, a synthetic musk aroma at the foundation of many perfume

formulas. Though some companies have voluntarily reduced their reliance on this substance due to potential toxicity concerns, it is still widely used in US cosmetic products. **Formaldehyde**, a known carcinogen, is a derivative of some synthetic fragrances. Plasticizers (such as phthalates, discussed below) are often added to help bind and disperse fragrances. So long as these various substances are part of the “fragrance” formula, individual ingredients do not require individual label listing.

Insect Repellent

Protection against mosquitos, ticks, fleas and many other biting insects is very important. Bug repellents discourage insects from landing on surfaces such as skin and clothing and help prevent the spread of insect-borne diseases. Both synthetic and plant-based repellents in the form of sprays, wipes, and lotions have been developed. In the US, the synthetic chemical **N,N-diethylmetatoluamide (DEET)** is the most common active ingredient in insect repellents, often combined with other insecticides. There are many concerns about the safety of this substance, including possible skin damage and neurological effects.

Learn more about DEET here:

http://www.lookfordiagnosis.com/mesh_info.php?term=deet&lang=1

With insect-borne illnesses on the rise, such as Lyme disease and West Nile fever, having potent and proven repellents is a major interest. As the Environmental Working Group asks in its review of bug repellents, “Which is worse, bug bites or bug repellent?”¹⁴ This is often unclear. DEET is recognized as very effective in repelling disease-carrying mosquitoes, ticks and other insects. However, other substances, including the plant-based oil of lemon eucalyptus, have been shown in some cases to be equally effective in repelling biting and disease-carrying insects.¹⁵ It is possible in many circumstances to greatly reduce or forego the chemical solution altogether by wearing long sleeves, long pants, and other protective clothing to minimize the amount of exposed skin. One can reduce exposure by avoiding being outside when insects are most active.

Plasticizers

Plasticizers are used to stabilize, lubricate and bind ingredients, and add flexibility to a variety of consumer products. **Phthalates** are versatile and widely produced chemical plasticizers with both industrial and direct consumer applications. In personal care products, phthalates are used to hold

¹⁴ Environmental Working Group, “EWG’s Guide to Better Bug Repellents,” July 2013 (<http://www.ewg.org/research/ewgs-guide-bug-repellents>).

¹⁵ Ibid.

color and scents, and to dissolve substances to form a well-mixed solution. They are added to perfumes, eye shadow, lotions, shampoos, hairspray and soaps. They are also added to nail polish to make it flexible and resistant to chipping. Phthalates have been banned in cosmetics sold in the European Union (EU) and are listed by the EU as endocrine-disrupting compounds of high concern. The EPA is concerned, but no US regulations have been adopted to date.¹⁶ Some US companies have voluntarily reduced their use of some phthalates in cosmetics.

10 ways to choose safer cosmetics and personal care products:

<http://divinegoddesscoaching.com/10-ways-to-choose-safer-cosmetics-and-personal-care-products>

Preservatives

Parabens are a broad class of synthetic preservatives added to both cosmetics and processed foods. In personal care products, they address a very important concern, which is to prevent fungus, bacteria and other microbes from growing in your cosmetics and spreading harm to skin, eyes and mucous membranes. Such microbial contaminants thrive in warm, moist conditions typically found in the bathroom where personal care products are often kept. Parabens are common in products such as facial and body cleansers, shampoos, lotions and creams, foundation and mascara.

Naturally occurring parabens are found in many common food plants, such as blueberries, mango, strawberries, peaches, carrots, onions, cocoa beans and vanilla.¹⁷ Exposures to this chemical group have been greatly expanded with the use of synthetic parabens as a food preservative to protect against the growth of yeast and molds in products such as bakery items, beverages (soft drinks, beer, wine), fish, flavor extracts, gelatin, jams, jellies, preserves, olives, pickles, salad dressings and syrups.¹⁸ In one recent study, a team of researchers in Albany, New York, found synthetic parabens in 90 percent of the more than 250 food and beverage products they tested from local markets.¹⁹ There are many forms of this chemical, the most common being butylparaben, ethylparaben, methylparaben, and propylparaben. Estrogen disruption linked to breast cancer and reproductive issues are some of the prevailing concerns related to parabens.

Butylated hydroxyanisole (BHA) is another preservative commonly found in personal care products. BHA is valued as an effective antioxidant in medicines and cosmetics (in deodorants, shampoos and body lotions as well as makeup products such as lipstick). It is also widely used as an additive in foods and food packaging to prevent spoilage, especially fatty foods such as butter,

¹⁶ US Environmental Protection Agency, "Phthalates Action Plan," revised March 14, 2012 (available at http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates_actionplan_revised_2012-03-14.pdf).

¹⁷ Anthony C. Dweck, "Natural Parabens," Natural Ingredient Resource Center, accessed 2015 (<http://www.naturalingredient.org/Articles/toni1.html>).

¹⁸ M. Stratford and T. Eklund, "(Organic Acids and Esters," Chapter 4 in *Food Preservatives*, 2nd ed., N.J. Russell and G.W. Gould, editors (New York: Kluwer Academic/Plenum Publishers, 2003): 72, Table 4.5.

¹⁹ C. Liao, F. Liu and K. Kannan, "Occurrence of and Dietary Exposure to Parabens in Foodstuffs from the United States," *Environmental Science & Technology* 47, 8 (April 16, 2013): 3913-25 (<http://www.ncbi.nlm.nih.gov/pubmed/23506043>).

potato chips, baked goods and packaged nuts, as well as items such as beer, chewing gum, breakfast cereals and dried pet food. Oils in cosmetics and foods have a tendency to go rancid when exposed to air, spoiling the products with bad tastes and odors and potentially toxic reactions. The antioxidant effect of BHA (and a related chemical substance, BHT, or butylated hydroxytoluene) slows this process. The goal is to increase product shelf life. Though BHA is not subject to regulatory limits under US law, the State of California has listed it as a carcinogen. Vitamin E is considered an effective antioxidizing alternative.

Sun Protection

Substances designed to provide protection from sun exposure come in the form of physical (mineral-based) formulas or synthetic chemical filters. Physical sunscreens (using zinc or titanium) block UV rays from reaching the skin but do not penetrate the skin. More common in the US are chemical sunscreens, including **avobenzone** and **oxybenzone**, which soak through skin. Oxybenzone is associated with allergic skin reactions and is suspected of hormone disruption, among other negative effects.²⁰

Benzophenone is another chemical added to many products to protect against damaging UV light. This chemical is used both as a skin-protecting sunscreen as well as an additive to protect products from the effects of sunlight. Among other things, benzophenone is used to prevent UV light from damaging fragrances and colors in products such as perfumes, soaps and sunscreens. It is also added to plastic packaging as a UV blocker to prevent photo degradation of the packaging. Like other chemical sunscreens, benzophenone is easily absorbed into the skin and has been associated with skin allergies and other human health and environmental effects. There is little information on the long-term effects of continued exposure to this chemical.

Pharmaceuticals

Human and veterinary pharmaceuticals are subject to close review by the FDA, which is responsible for protecting public health and regulating both human and animal drugs. The focus is on treatment and dose effectiveness. The emerging concern focuses on what happens to those pharmaceuticals (whether effective in medical treatment or not) once they pass through the body or are disposed unused and end up in the water system as trace contaminants. Presumably most people are carefully adhering to correct dosages of appropriate pharmaceutical substances and are reaping the rewards of drug therapies to address their medical needs. The issue is recognizing that the best treatment options at the individual level can have negative consequences for human health and the environment at large because these chemicals can make their way into source water bodies and end up in drinking water supply.

Prescription and over-the-counter drugs and their degradation products are found in many sources of public water supply. As summarized in a recent *New Republic* review article, “Doctors prescribe hydrocodone for pain. They recommend ranitidine for acid reflux, a diuretic called hydrochlorothiazide for congestive heart failure. But you do not need a prescription to get these drugs in tiny doses. They’re found already in our nation’s water supply and... in higher

²⁰ Environmental Working Group, EWG’s 2014 Guide to Sunscreens, “The Trouble with Sunscreen Chemicals” (<http://www.ewg.org/2014sunscreens/the-trouble-with-sunscreens-chemicals/>).

amounts than drug companies anticipated.”²¹ High blood pressure medications were measured at highest concentrations and greatest frequency across the 56 active pharmaceutical ingredients tested in samples from the fifty large wastewater treatment plants nationwide included in this study.²² A wide array of other drugs have been found in stream samples across the US, including a long list of antibiotics, antidepressants, blood thinners, heart medications, hormones (estrogen, progesterone, testosterone), and painkillers.²³

This is not an easy issue to address. People want and need the best pharmaceuticals to address their medical conditions, which means these contaminants will continue to enter the water system. Better management can slow the rate of drug release – such as prescribing only as needed and changing practices for disposing of unused drugs. However, this is not enough to stem the flow.

Household Products

Consumers find great value in products that help maintain and improve living spaces. These include household products such as laundry detergent and dryer sheets, air fresheners and deodorizers, dishwashing soap and drain cleaners, floor and furniture polish, paints and stains. Similarly, household goods, including furniture, toys and clothing, are often treated with flame retardants, antibacterial substances and plasticizing compounds intended to make them safer and more durable. These products and treatments introduce many more chemicals of concern into our homes and daily lives. Unlike personal care products, which are subject to FDA product ingredient labeling requirements, most household products are exempt from listing specific ingredients.²⁴ What this means is that, for most household products, from laundry detergents and air fresheners to children’s toys and furniture, consumers have no information on specific chemical content.

21 Dawn Fallik, “This New Study Found More Drugs in Our Drinking Water Than Anybody Knew. And no one’s doing anything about it,” *New Republic*, December 11, 2013 (available at <http://www.newrepublic.com/article/115883/drugs-drinking-water-new-epa-study-finds-more-we-knew>). The article based its assessment on an EPA study by Mitchell S. Kostich, Angela L. Batt and James M. Lazorchak, “Concentrations of prioritized pharmaceuticals in effluents from 50 large wastewater treatment plants in the US and implications for risk estimation,” published in *Environmental Pollution* 184 (January 2014): 354-359 (available at http://www2.epa.gov/sites/production/files/2014-09/documents/50_large_wwtp_effluent.pdf).

22 Kostich, Batt and Lazorchak, *op. cit.*, Table 1.

23 Kolpin et al., *op. cit.*, Table 1, 1204-1205.

24 The US Consumer Product Safety Commission (CPSC) is responsible for protecting the public from unreasonable risks from consumer products. This includes requiring some hazardous household products to have warning labels. However, it does not require full listing of product ingredients. For an overview of laws passed by Congress guiding consumer product safety, see the CPSC document “Statutes,” available at <http://www.cpsc.gov/en/Regulations-Laws--Standards/Statutes/>.

The benefits of consumer convenience and choice often come with a price: Homes are filled with synthetic chemical products that are harmful to our bodies and the environment.

Safe Spring Cleaning Tips: <http://atyourservice.seattle.gov/2013/05/24/safe-spring-cleaning-tips-2/>

Antibacterials in Household Products

Many common household products contain antibacterial compounds, including **triclosan**. Some manufacturer labels will advertise the antibacterial features of their merchandise, but most household products do not require specific ingredient labeling. This often leaves consumers unaware of the presence of antibacterial and other chemical additives. In fact, triclosan is largely hidden in household products. As the Personal Care Products Council explains, “Triclosan is added to consumer products that are often exposed to excessive bacteria, such as athletic wear, socks, and cutting boards or in products that are difficult to wash, such as trash cans, plastic shower curtains and other plastic items.”²⁵ Triclosan is added in the production process or applied as a surface coating. The EPA recognizes a long list of triclosan applications in household consumer products and the materials used to make those products, including home furnishings (blankets, draperies, linens), carpets and flooring, sponges, adhesives, paints, ice making equipment, playground equipment, and a wide range of plastics and textiles.²⁶ As the European Commission’s Scientific Committee on Consumer Safety found, triclosan “is incorporated on the surface of medical devices, plastic materials, textiles, kitchen utensils, etc., from which it might slowly leach for a long period of time during their use, to perform its biocidal action.”²⁷ As discussed above with reference to triclosan in personal care products, there are numerous human health and environmental concerns associated with exposure to this substance.

Antibacterial Products Around the House

All of these commercial goods are labeled “antimicrobial,” but no information is provided on specific chemicals (including triclosan) added for this purpose.

²⁵ Personal Care Products Council, “Consumer Information” website, Cosmeticsinfo.org. The triclosan information page can be found at <http://www.cosmeticsinfo.org/ingredient/triclosan>.

²⁶ US Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, “Reregistration Eligibility Decision for Triclosan” (EPA 739-RO-8009), September 2008, now archived. For the list of triclosan uses, see “Triclosan Appendix A: Use Patterns Eligible for Reregistration,” beginning on p. 49 (<http://www.epa.gov/oppsrrd1/reregistration/REDs/2340red.pdf>).

²⁷ European Commission, Scientific Committee on Consumer Safety (SCCS), “What are the Main Uses of Triclosan?,” Response to question 2 in the SCCS “Opinion on Triclosan (antimicrobial resistance),” June 22, 2010 (http://ec.europa.eu/health/scientific_committees/opinions_layman/triclosan/en/1-3/2-uses-cosmetics-disinfectant.htm).

Synthetic Fragrance in Household Products

Synthetic fragrances are very common in household products. The rising popularity of air fresheners has greatly expanded the use of synthetic fragrance in the home. According to market researchers, “The worldwide market for air fresheners is expected to reach the value of US\$ 8.2 billion by 2015. This growth is expected to be driven by increasing consumer inclination towards various fragrant products such as candles, fragrance gels, sprays, and others.”²⁸

Manufacturers have successfully created demand for fresh and novel scents for the home, car and office. Many products are offered in multiple and creative fragrance mixtures designed to evoke a variety of positive olfactory responses from “violet bloom” and “Greek seaside” to “quiet jasmine” and “warm milk & honey,” as some of the current air fresheners are labeled. In addition to air fresheners and scented candles, synthetic fragrance mixtures are added to household cleaners, laundry detergents, dishwashing soaps and a variety of other products used in the home.

Learn about how air fragrances are harmful to human health at:

<http://www.federaljack.com/how-air-fresheners-are-killing-you/>

As noted above in discussing fragrances in personal care products, this is a very broad category of substances over which manufacturers have discretion to formulate, combine and add to their products without disclosure of specific chemical ingredients. Synthetic fragrances cause known immune system and allergy effects.

Plasticizers

Plastics have made our lives easier in countless ways. Most are synthetic and derived from petrochemicals with additives for durability, flexibility and appearance. **Phthalates** are one such additive, widely used in personal care products (discussed above) and in diverse household product applications. They are added to increase pliability, stability and binding in products such as food packaging, vinyl shower curtains, household air fresheners and cleaning products. Exposure occurs through direct contact as well as leaching of the chemicals into food, water and air.

Bisphenol A (BPA) is valued for making plastics tough and clear. BPA plastics are common in water bottles and sports equipment. Research increasingly links BPA exposures to hormonal and reproductive effects in humans and other species. In response to growing consumer interest and demands, manufacturers are replacing BPA-containing polycarbonate as the plastic of choice in some products, including most reusable water bottles. BPA-free plastics are now commonly marketed.



²⁸ Transparency Market Research, “Air Fresheners Market – Global Industry Size, Share, Trends, Analysis and Forecast, 2012-2018,” description accessed 2015 (<http://www.transparencymarketresearch.com/air-fresheners-market.html>).

However, even these alternative plastics are raising chemical exposure concerns based on recent studies.²⁹

BPA is also very common in food and beverage cans to keep the can material from corroding or reacting with the food. Manufacturers assert that BPA epoxy resins provide the best shelf-life performance for food- and beverage-can liners with few viable alternatives.³⁰ Researchers have measured BPA from canned foods far exceeding government safety levels, with a single serving from 1 in 10 cans tested in one study yielding a BPA measure “more than 200 times the government’s traditional safe level of exposure for industrial chemicals.”³¹ FDA acknowledges that small, measurable amounts of BPA may migrate from food packaging to food that is consumed. However, the agency finds that “the available information continues to support the safety of BPA for the currently approved uses in food containers and packaging.”³² BPA has been banned as a liner in infant formula packaging, but this was due to industry abandonment of the application and not due to safety considerations.³³

Many cash register receipts contain BPA. A thin coating of BPA powder is applied to the thermal paper used for many receipts and carbonless copy paper, which changes color when exposed to heat in thermal printers. Researchers have found that BPA from store receipts can be absorbed through the skin, with measurable increases in urine BPA levels after just two hours of handling.³⁴ BPA is transferred from hands to food and then to mouth after handling receipts. Using hand sanitizers before handling the receipts has been found to enhance dermal penetration of chemicals and increase the transfer of BPA from hands to food.³⁵

29 Cassandra D. Kinch, et al., “Low-dose exposure to bisphenol A and replacement bisphenol S induces precocious hypothalamic neurogenesis in embryonic zebrafish,” *Proceedings of the National Academy of Sciences of the United States of America*, published online January 12, 2015 (<http://www.pnas.org/content/early/2015/01/07/1417731112>).

30 Stephen K. Ritter, “Debating BPA’s Toxicity,” *Chemical & Engineering News (C&EN)* 89, 23 (June 6, 2011): 14-19 (<https://pubs.acs.org/cen/coverstory/89/8923cover2.html>).

31 Environmental Working Group, “Bisphenol A – Toxic Plastics Chemical in Canned Food,” Research Report, March 5, 2007 (<http://www.ewg.org/research/bisphenol>); Environmental Working Group, “US Scientists Find BPA in Most Canned Foods,”

May 26, 2011 (<http://www.ewg.org/enviroblog/2011/05/us-scientists-find-bpa-most-canned-foods>).

32 US Food and Drug Administration “Bisphenol A (BPA): Use in Food Contact Application,” updated January 6, 2015 (available at <http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm064437.htm>).

33 US Food and Drug Administration, “FDA Regulations No Longer Authorize the Use of BPA in Infant Formula Packaging Based on Abandonment; Decision Not Based on Safety,” July 11, 2013 (available at <http://www.fda.gov/food/newsevents/constituentupdates/ucm360147.htm>).

34 Shelley Ehrlich, Antonia M. Calafat, Olivier Humblet, Thomas Smith and Russ Hauser, “Handling of Thermal Receipts as a Source of Exposure to Bisphenol A,” *Journal of the American Medical Association* 311, 8 (February 2014): 859-860 (<http://jama.jamanetwork.com/article.aspx?articleid=1832525>).

35 Annette M. Hormann et al., “Holding Thermal Receipt Paper and Eating Food after Using Hand Sanitizer Results in High Serum Bioactive and Urine Total Levels of Bisphenol A (BPA),” *PLOS ONE* 9, 10 (October 22, 2014), available at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0110509>.

Surfactants and Dispersants

Surfactants and dispersants comprise a set of potentially harmful compounds common in household products. They help to mix and disperse liquids, such as liquid detergents in water, by counteracting natural surface tension. They are typically found in laundry and dishwashing detergents and fabric softeners. As the American Cleaning Institute asserts, surfactants are one of the two major components of all cleaning products, many of which contain two or more.³⁶ Surfactants and dispersants are used in many other household applications, including paints, adhesives, pesticides, plastics and rubber products. At a larger scale, these substances are applied as dispersants in oil spills and as a component of hydraulic fracturing injection fluids used to produce oil and natural gas. Synthetic surfactants can cause long-term environmental harm by entering and exiting the wastewater system untreated. These chemicals are then discharged to rivers and streams where they can affect aquatic species and become sources of contamination to drinking water supplies. They might also cause direct human health issues through skin contact and through the residues left behind on clothing after washing. **Alkylphenols** are a family of organic compounds (including **nonylphenol** and **octylphenol**) commonly used as surfactants in household products. Concerns include toxicity to humans and other species, especially aquatic organisms.



Flame Retardants

Flame retardants are a broad class of chemical compounds added to manufactured materials to prevent the spread of fire. They are commonly found in upholstered furniture, mattresses, plastics, surface finishes, and building insulation. Baby mattresses and foam products (such as nursing pillows, nap mats, stroller liners and sleep positioners) are of particular concern because they may expose infants to high levels of chemicals with unknown health consequences.³⁷ Fire safety concerns drive continued manufacturer demand for the broad set of chemical flame retardant compounds with anticipated annual US applications reaching 938 million pounds in 2016.³⁸

Dual concerns are at play: the risk of fire versus the dangers to human health and the environment that are raised through the widespread application of fire-retardant chemicals.

³⁶ American Cleaning Institute, "Soaps & Detergents: Surfactants & Builders," 2015 (available at http://www.cleaninginstitute.org/clean_living/soaps_detergents_products_ingredients_2.aspx).

³⁷ Heather M. Stapleton, et al., "Identification of Flame Retardants in Polyurethane Foam Collected from Baby Products," *Environmental Science and Technology* 45, 12 (2011): 5323-5331 (available at <http://pubs.acs.org/doi/pdf/10.1021/es2007462>).

³⁸ Global Information, Inc., news distributed by PR Newswire iReach, "US Flame Retardant Demand to Reach 938 Million Pounds in 2016, Growing 4.6% Annually," Oct. 1, 2012 (available at <http://www.ireachcontent.com/news-releases/us-flame-retardant-demand-to-reach-938-million-pounds-in-2016-growing-46-annually-172172821.html>).

Research has shown that many of these chemicals are highly mobile and persistent, accumulating in body tissues with hormonal, reproductive, thyroid and metabolism effects. Some of the synthetic flame retardants of particular concern include **polybrominated diphenyl ethers (PBDE)**, **tris(1,3-dichlorisopropyl)phosphate (TDCPP)**, and **triphenyl phosphate (TPP)**. Some of the chemicals that were once in wide use as flame retardants have been phased out due to safety concerns, with new substances now available. However, there is a general lack of public information on which products contain which flame retardants and at what concentrations.³⁹



Finding safe alternatives is one of the biggest challenges with regard to the chemicals of concern found in flame retardants. We are surrounded in our homes by items that could lead to rapid spread of fire if not treated with agents that can suppress flammability. Because of this, states and localities have adopted flammability standards for various consumer products. The State of California has long required the toughest fire safety regulations applied to upholstered furniture. Due to its large population, meeting California regulatory decisions tend to drive manufacturing practices. A policy signed into law in September 2014 could push those practices in a different direction: Upholstered furniture sold in California must now be labeled to tell shoppers whether it contains chemical flame retardants, and flame retardants can now include physical blocks rather than just chemical blocks.⁴⁰

What to do with existing furniture and other products treated with chemical flame retardants that continue to emit noxious gases is a problem that remains to be solved.

Home Gardening Products

Numerous options are available in the local garden care center to help homeowners keep their lawns green, flowers abundant and yards neat and functional. These include chemicals directly applied in the garden (fertilizers, weed killers, insecticides, pool cleaners, rodenticides) as well as tools and accessories used to take care of the home garden (water hoses and work gloves).

Pesticides

Beetle larvae, sucking insects, borers, chewers, flying insects, spiders, mosquitos, fire ants, and crawling insects may have a hard time fending off the arsenal of products designed to kill them.⁴¹ Some pesticides, such as bug baits and traps, work by physically removing the garden-harming

³⁹ Stapleton, et al., *op. cit.*, 5323.

⁴⁰ Bill Allayaud, "California Makes It Law: Label Toxic Flame Retardants In Furniture," Environmental Working Group, September 30, 2014 (<http://www.ewg.org/enviroblog/2014/09/california-makes-it-law-label-toxic-flame-retardants-furniture>).

⁴¹ For a helpful listing of insecticides and their applications in home gardens, see Michael Merchant's article, "Understanding Common House and Garden Insecticides," Texas A&M AgriLife Extension (<http://citybugs.tamu.edu/factsheets/ipm/ent-4002/>). For toxicology information, see the EPA-funded National Pesticide Information Center at <http://npic.orst.edu>.

insects. But most common are chemical insecticides which create direct exposure threats to humans, pets and wildlife, are easily tracked into the house, and create dispersed and persistent threats to the environment as they spread through the air, soil and water.

Weeds are another common target of the home gardener. **Atrazine** is used as a weed killer in home lawn care products. It is similarly applied on golf courses, recreational areas and tree farms. In commercial agriculture, it is used on corn, wheat, sugarcane and pasture grasses. Once released, atrazine is slow to break down. It persists in soil, has been detected in dust, and washes into streams, rivers and lakes as runoff. Atrazine has been associated with endocrine disruption in humans and other species. Frogs and other amphibians, fish, birds and reptiles have exhibited serious hormonal changes affecting sexual development and reproductive capacity resulting from atrazine exposure.⁴²

Glyphosate is the most widely used weedkiller in the US, with about 100 million pounds applied annually in yards, farms and parks.⁴³ Much of that is included in Monsanto's Roundup® weed-killer products, which have been the subject of numerous safety studies. The EPA "considers glyphosate to have low toxicity when used at the recommended doses."⁴⁴ However, recent studies have shown that glyphosate reacts with so-called inactive ingredients, or the chemicals (such as solvents, preservatives, surfactants and other substances) that the EPA has approved for use without specific listing on product labels because they do not have direct pesticide effects. It is not just the glyphosate that raises questions but the whole chemical mix found in Roundup® that has been implicated in human and other fetal development impacts.⁴⁵

Here is a major roadblock for consumers who want to make the right choices about garden care products: Insufficient information is publicly available. Though producers of pesticides (an umbrella term that includes insecticides, herbicides, fungicides and other pest-control substances) are required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to list active ingredients and warnings under labeling rules,⁴⁶ a majority of these product ingredients are exempt as inert or inactive, and thus not required to be listed on product labels. A primary factor in protecting the inactive status of various chemical substances is to help companies guard their "secret formulas" against competitors. Approximately 4,000 pesticide ingredients are considered by the US EPA to be inert.⁴⁷ Pesticide manufacturers are committed to

42 Robert Sanders, "Pesticide Atrazine Can Turn Male Frogs into Females," UC Berkeley News Center, March 1, 2010 (<http://newscenter.berkeley.edu/2010/03/01/frogs/>).

43 Crystal Gammon, "Weed-Whacking Herbicide Proves Deadly to Human Cells," first published in *Environmental Health News*, June 23, 2009; republished by *Scientific American* (<http://www.scientificamerican.com/article/weed-whacking-herbicide-p/>). Gammon summarizes some of the key findings in a French study carried out by Nora Benachour and Gilles-Eric Seralini and appearing in the January 2009 issue of *Chemical Research in Toxicology*.

44 Ibid.

45 Ibid.

46 For pesticide registration and labeling requirements, see the EPA pesticide registration document "Label Review Manual," last updated December 24, 2014 (<http://www2.epa.gov/pesticide-registration/label-review-manual>).

47 Gammon, *op. cit.*

maintaining the rules that protect them from disclosing all of their ingredients. However, EPA is faced with growing pressure to force full listing of all pesticide ingredients to ensure better

Pest: *any insect, rodent, nematode, fungus, weed, or ... other form of terrestrial or aquatic plant or animal life or micro-organism ... which the Administrator declares to be a pest.*

Pesticide: *any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.*

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

United States Code, Title 7, Section 136, as amended May 22, 2008

health and safety information about chemicals already on the market.⁴⁸

Gardening accessories

Other chemicals of concern are found in home gardens as well. A 2012 garden products study carried out by HealthyStuff.org found that two-thirds of 179 garden tools and accessories (principally water hoses and garden gloves) tested “high concern” due to elevated levels of one or more chemical hazards, including lead, phthalates and BPA.⁴⁹ These garden accessories leach contaminants directly into the environment – around the garden and as

drainage to groundwater or runoff to surface water systems. Lead-free hoses are available, as are food-grade polyurethane hoses that do not leach phthalates and other contaminants.

Summary

Chemicals of concern encompass a set of unregulated substances with known or suspected harmful effects on human and ecological health. These chemicals are widely dispersed in modern society, with applications in manufacturing, industrial agriculture and business practices. Many of these chemicals are also found in common consumer products. This is where individuals have the greatest opportunity to influence their chemical footprints. This can be done: by choosing personal care, household and home gardening products that do not contain harmful chemicals, and by adopting strategies that reduce the need for these products. This is not always easy. Sometimes the information on chemical ingredients is not clear. Sometimes there are no good alternatives. However, sometimes both information and alternatives are available. Having that knowledge in hand creates opportunity for individuals to make new and sustainable choices.

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⁴⁸ Britt E. Erickson, “Pesticide Industry Stands Firm Amid Pressure to Reveal Identity of Inert Ingredients,” *Chemical & Engineering News* 93, 2 (January 12, 2015): 22-23 (available at <http://cen.acs.org/content/cen/articles/93/i2/Pesticide-Industry-Stands-Firm-Amid.html>).

⁴⁹ HealthyStuff.org, “2012 Garden Products Study,” <http://www.healthystuff.org/findings.050312.garden.php>.