



ENVIRONMENT AND HEALTH

Issue Brief

Endocrine Disrupting Chemicals

Introduction

Environmental exposures contribute significantly to innumerable health problems, provoking interest in the public health community. Yet many do not fully understand the chemicals of concern, how exposure occurs, and the specific health effects of exposure. Moreover, public health professionals may lack understanding of federal and state environmental regulation of these chemicals. This Issue Brief seeks to provide basic information about a particular set of harmful chemicals and explain the relevant regulatory framework.


What are endocrine disrupting chemicals?

Most living organisms – including humans and all other mammals, birds, and fish – have endocrine systems that make and regulate hormones, and control internal responses to those hormones.¹ The endocrine system is made up of glands and receptors located throughout the body and are responsible for reproductive organ growth and function, energy production, and blood sugar control. They can affect mood, sleep, metabolism, and blood pressure.² Glands in the endocrine system create hormones, which are released into the bloodstream or other fluids in the body, where they attach to receptors that recognize and respond to those hormones.³ In other words, hormones are created as keys designed to seek out specific receptors (“locks”), to unlock and give them instructions to act.

Endocrine disrupting chemicals (EDCs) interfere with the endocrine system in myriad ways. Some EDCs mimic hormones and bind to receptors, blocking real hormones from reaching them and instructing them to act.⁴ Other EDCs decrease natural hormone levels by affecting how they are made or stored, or change how sensitive receptors are to those hormones.⁵ Well-known examples of EDCs include per- and polyfluoroalkyl substances (PFAS) and some pesticides. The common EDCs that will be discussed in this resource are listed below:^a

- Atrazine

^a Substances such as mercury, lead, and arsenic are also endocrine disruptors, but will not be included because they are widely accepted as hazardous and are strictly regulated. Other endocrine disruptors that have received relatively scrupulous regulatory and industry attention and that will not be discussed include bisphenol A (BPA), dioxins, dichloro-diphenyl-trichloroethane (DDT), perchlorates, phthalates, polybrominated diphenyl ethers (PBDE), and polychlorinated biphenyls (PCB).

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- Chlorpyrifos
 - Glycol Ethers
 - PFAS (per- and polyfluoroalkyl substances)
 - Triclosan

Where are endocrine disrupting chemicals found?

EDCs are found in plastics, pesticides, and herbicides; flame retardants, including those used in furniture; industrial processing materials; personal care products, such as liquid soaps and cosmetics; and more. They can also be byproducts of processes such as paper bleaching, waste burning, and wildfires. EDCs can make their way into water, soil, and food, and can enter the human body via air (respiration), consumption (eating or drinking), or by absorption through the skin. Different EDCs are present in different environments and products (see



Table 1: Uses of and Exposure Routes for Common EDCs

) and enter the human body through different routes.

How do endocrine disrupting chemicals impact human health?

Research^b has shown that exposure to EDCs can affect fertility and sperm quality, cause abnormalities in sex organs, and increase the risk of endometriosis, certain cancers, early puberty, respiratory issues, obesity, cardiovascular problems, diabetes, learning disabilities, stunted growth, and more.⁶ Negative health effects are especially harmful when exposures occur in sensitive stages of life.⁷ For example, the child of a person who is exposed while pregnant or breastfeeding is highly susceptible to the negative effects of EDCs.

EDCs have similar effects on other mammals, fish, and birds, with the potential for major consequences for ecosystems and human food supply.⁸ For example, as a result of EDC exposure, some species of birds have had poor reproductive success and beak abnormalities impacting their ability to eat, female mollusks have developed male genitalia, and alligators in Florida and turtles in the Great Lakes have experienced reproductive abnormalities and impairment.⁹

Different EDCs can have different health effects based on their chemical structure and route of exposure. For each of the EDCs discussed in this resource there is a brief description of the EDC's specific health effects.


Roadmap

First, the main federal regulatory schemes applicable to the EDCs covered in this resource are summarized. Next, each of the five EDCs is explained in detail, each including (where relevant) a description of where they are commonly found and specific health effects, an overview of federal and state regulatory environments, description of litigation related to health effects, and overviews of the regulatory environments in Canada and the European Union and industry self-regulation and recent developments.

Federal Regulatory Schemes Applicable to EDCs

Federal regulation of EDCs in the United States is a patchwork of exposure- and use-specific laws either enacted by Congress or adopted by a federal administrative agency under a broad grant of authority from

^b Research on health effects in humans has only been observational because case-control studies would be unethical. Case-control studies have been conducted on animals. Observational studies on the effects of EDCs in humans are considered reliable.



Congress. The major federal acts responsible for regulation of the EDCs covered in this resource are summarized below.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) was passed in 1976 and has since been updated five times, with the most recent update coming from the Lautenberg Act in 2016.¹⁰ TSCA grants the Environmental Protection Agency (EPA) the authority to require reporting, record-keeping, and testing, and to set restrictions related to chemicals.^c Some major provisions of TSCA are described below.

- If the Administrator of EPA determines that the manufacture, distribution, processing, use, or disposal of a chemical (1) could present an unreasonable risk of injury to health or the environment or (2) will be so substantial that the chemical is likely to enter the environment in substantial quantities, and insufficient information exists to determine its effects on health or the environment, then the Administrator *must* require testing to this effect.¹¹
- Manufacturers must notify EPA of “new chemical substances” and “significant new uses” before manufacture.¹² To determine if something is a significant new use, EPA considers projected volume of manufacture, extent to which the new use changes the form, magnitude, and/or duration of exposure to humans or the environment, and anticipated manufacturing, distribution, and disposal methods.¹³ For new chemicals and significant new uses, EPA must make an affirmative finding of safety before they can be allowed to enter the marketplace.¹⁴
- Anyone who manufactures, processes, or distributes chemicals and obtains information reasonably supporting a conclusion that the chemical carries a substantial risk of injury or health to the environment *must* immediately inform EPA, unless EPA already has this knowledge.¹⁵


Safe Drinking Water Act

The Safe Drinking Water Act (SDWA), originally passed in 1974, is the key federal law aimed at keeping harmful contaminants out of drinking water.¹⁶ It regulates all piped water systems that provide water for human consumption and serve at least 25 people or 15 service connections, a total of 144,650 private and public water systems throughout the country.¹⁷

Under SDWA, EPA is required to promulgate a drinking water regulation for a contaminant if it determines that the following three criteria are met:

- The contaminant may have adverse health effects;
- There is a substantial likelihood, or it is known that the contaminant will be present in the public water systems with a frequency at levels of public health concern;
- Regulation of the contaminant presents a meaningful opportunity to reduce health risks for those served by the public water systems.

^c Except those chemical substances and mixtures that qualify as food, drugs, cosmetics, or pesticides.



For each contaminant that meets these criteria, EPA must set two standards: a non-enforceable maximum contaminant level goal, and an enforceable maximum contaminant level. The non-enforceable maximum contaminant level goal (MCLG) is a level of exposure at which no known or anticipated negative health effects will occur, with an adequate margin of safety. The enforceable maximum contaminant level (MCL) is a standard as close as feasible to the MCLG with use of the best technology, treatments, and other means available, while taking cost into consideration. EPA must propose the MCLG and MCL for a contaminant within two years of determining that the contaminant should be regulated and must promulgate a final rule within 18 months of the proposal. For contaminants that do not yet meet the criteria listed above, EPA must periodically publish lists of candidates for regulation and contaminants that must be monitored by public water systems.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) gives EPA broad authority to control hazardous waste from generation to disposal.¹⁸ Under RCRA, EPA adopts regulations that create explicit legally enforceable requirements for waste management.

Food Quality Protection Act of 1996¹⁹

The Food Quality Protection Act of 1996 directs the Secretary of Agriculture to collect data on pesticide residues on food products most frequently consumed by infants and children.²⁰ The Act also requires EPA to set tolerance levels for pesticides after making a finding of safety considering aggregate risk from exposure.²¹ In other words, tolerance levels set by EPA must mean that the pesticide can be used with a “reasonable certainty of no harm.”

Toxics Release Inventory

The Toxics Release Inventory (TRI), managed by EPA, “tracks the management of toxic chemicals that may pose a threat to human health and the environment.”²² It requires certain facilities (large manufacturers, metal miners, electric power generators, etc.) to report the amounts of each covered chemical that are released into the environment, treated, recovered, or recycled.


Individual EDC Analyses

Atrazine

Description

Atrazine is an herbicide used widely on row crops including most corn crops and sugarcane. It is also sometimes used on residential lawns and turf.²³ People can be exposed to atrazine through inhalation when it enters the air after application, through drinking water contaminated when atrazine is washed from soil into water sources by rain or it seeps into groundwater, through contact with soil containing atrazine, and by eating food treated with atrazine (though this is rare).²⁴ People at highest risk of exposure are those working with atrazine (production, disposal, application), and those who live near common application sites.

Atrazine can have negative impacts on reproduction in humans. Studies of couples living on farms that used atrazine as an herbicide found a correlation between atrazine exposure and pre-term delivery, and pregnant people exposed to atrazine in drinking water have experienced low fetal weight and heart, urinary, and limb



defects.²⁵ In federal regulations, the standard health effects language for public notification when water is over-contaminated with atrazine is: “Some people who drink water containing atrazine well in excess of the [maximum contaminant level] over many years could experience problems with their cardiovascular system or reproductive difficulties.”²⁶

Federal Regulation

Use of atrazine is permitted at the federal level with some restrictions. It is subject to reporting under TRI, and liquid fertilizers containing certain concentrations of atrazine are limited to supervised use and may only be used by qualified professionals.²⁷ Pursuant to the Food Quality Protection Act, EPA has established residue tolerance levels for atrazine in agricultural products ranging from 0.02 to 15 parts per million.²⁸ Federal law also sets a maximum contaminant level of 0.003 mg/L, or 3 parts per billion (ppb) for atrazine in drinking water and bottled water.²⁹

State Regulation

Most states have regulations governing the use and monitoring of atrazine beyond federal standards. For example, Wisconsin law prohibits (1) the use of atrazine on non-agricultural crops (e.g., residential lawns), (2) application of atrazine between April and July, and (3) application via an irrigation system.³⁰ Iowa limits application rates in certain areas, and Ohio lists atrazine as a toxic air contaminant subject to permitting requirements.³¹

EU and Canada


The European Union (“EU”) banned the use of atrazine in 2004, citing concerns over ubiquitous water contamination, toxicity in wildlife, and negative health effects in humans; in many EU countries, including Germany and Italy, its use has been banned since at least 1991.³² A sample of water taken in 2013 from the south coast of Sweden, which has banned atrazine since 1989, showed a concentration of only 0.008 ppb, while 1,457 utilities in 24 US states had water samples showing a concentration of at least 0.1 ppb^d between 2017 and 2019 – 12.5 times higher than the 2013 sample from Sweden, but still within the legal concentration for the US.³³ The greatest contamination was found in four utilities in Missouri and two in Kansas that showed concentrations of 2.17 ppb.

Regulation of atrazine in Canada resembles regulation in the US.

Industry Self-Regulation and Recent Developments

A 2020 publication from EPA indicates that entities registered to produce atrazine agreed to prohibit all uses of atrazine in Hawaii, Alaska, and the U.S. territories, remove and restrict certain uses of the product, and require buffers for application.³⁴ Additionally, while atrazine is not currently regulated under the Safe Drinking Water Act, it does appear on the most recent draft list of candidates for regulation, published on July 19, 2021.³⁵ Upon receipt of a petition alleging the agency was not fulfilling its duties with respect to atrazine, in June 2022, EPA also proposed new labeling requirements for atrazine products aimed at reducing runoff. Proposed

^d The Environmental Working Group (EWG) is a US nonprofit organization that conducts research and advocates for law and policy change to protect public health in the environmental space. Based on epidemiological studies, EWG developed a “health guideline” of 0.1 ppb in drinking water to protect reproductive health and hormone disruption.



measures include (1) prohibiting application when land is saturated, (2) prohibiting application during rain or when a storm is forecasted within 48 hours following planned application, (3) prohibiting aerial applications, and (4) restricting annual application rates on sorghum and corn.³⁶ The proposal is receiving backlash from farmers' groups and states with robust agricultural industries who claim that the science supports atrazine's safety, and that the herbicide is necessary to their operations.³⁷

Chlorpyrifos

Description

Chlorpyrifos is a pesticide that has been used in the US since 1965 to control foliage and soil-born insect pests in both agricultural and non-agricultural areas, and for mosquito control.³⁸ It was used inside homes to control cockroaches, fleas, and termites until 2001, and is sometimes used in flea and tick collars for pets and to control ticks on cattle.³⁹ Chlorpyrifos is used on a wide variety of crops including apples, oranges, strawberries, peaches, peppers, wheat, and more.⁴⁰ It is sprayed on more than half of all apple and broccoli crops, and is used on crops used for animal feed, resulting in residues in milk, eggs, and meat.

Chlorpyrifos can remain in soil and water for years and drift long distances - it has been detected in arctic surface water, ice, fog, and snow.⁴¹ People can be exposed to chlorpyrifos through inhalation, skin contact, or ingestion. People at highest risk of exposure to chlorpyrifos are those directly involved in its use including farmers, applicators, and employees involved in manufacturing; and people living near agricultural areas.⁴² Children also tend to have higher exposure levels relative to their body weight than adults because they put their hands in their mouths and eat more fruits and vegetables.⁴³

Between 1999 and 2002, the Centers for Disease Control and Prevention (CDC) found evidence of chlorpyrifos in 93% of sampled US residents.⁴⁴ Low-dose exposures can cause short-term symptoms such as headaches, difficulty concentrating, tiredness, nausea, and blurred vision, while higher-dose exposures can cause severe muscle tremors, loss of bowel control, seizures, coma, and respiratory paralysis and death.⁴⁵ Long-term effects of exposure include negative effects on neurodevelopment, smaller birth size, altered hormone levels and sex-specific behaviors, and possible links to lung and prostate cancer.⁴⁶ Studies in California and New York found the children of pregnant people exposed to high levels of chlorpyrifos during pregnancy had lower IQs than people who were exposed to lower levels.⁴⁷ A study of the effects of chlorpyrifos exposure on rodents showed neurodevelopmental disorders varying based on sex, and a study of the chemical's effect on ewes showed increased levels of cortisol (the "stress hormone").⁴⁸ EPA has categorized chlorpyrifos as a possible human carcinogen, though it has not been shown to cause cancer in animals.⁴⁹

Federal Regulation

Federal regulation of chlorpyrifos focuses on chlorpyrifos in water and on food. It is subject to reporting under TRI,⁵⁰ and appears in the most recent draft list of candidates for SDWA regulation published in July 2021.⁵¹ Chlorpyrifos is a hazardous substance for water programs, is subject to reporting under the Clean Water Act, and is designated as a chemical of concern for the water quality of the Great Lakes.⁵²

EPA had also established residue tolerance levels for chlorpyrifos on food, but recent litigation and agency action has revoked these tolerances and effectively banned use of the chemical on food products (see below).⁵³



State Regulation

Forty-six jurisdictions in the US regulate chlorpyrifos beyond federal law. Most impose guidelines for use – how to use it, when it may be used, where in the jurisdiction it may be used, on which crops, etc. At least six states (California, Hawaii, New York, Maine, Maryland, and Oregon) have banned or severely limited the use of chlorpyrifos.⁵⁴ Maryland has banned its use since 2020, but allows limited particular use authorizations, and Hawaii has banned its use since 2019, but allowed temporary use permits until the end of 2022.⁵⁵

Case Law

Some litigation on the health harms of chlorpyrifos has arisen in the context of worker’s compensation and state tort claims. In *Carawan v. Carolina Tel. & Tel. Co.*, the court ruled that an employee’s allergic reaction to an insecticide containing chlorpyrifos that was sprayed at work was a compensable occupational disease.⁵⁶

Litigation regarding state tort claims often centers on the issue of federal preemption – whether the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which imposes registration and labeling requirements on pesticide manufacturers, preempts some state law claims. Courts in California and Montana have considered the issue, ruling that states have the power to regulate pesticides more strictly than the federal government, and that product safety claims can still be brought despite the fact that the product is labeled in accordance with FIFRA.⁵⁷

EU and Canada

The EU banned chlorpyrifos beginning in February of 2020, with seven member countries implementing bans before the EU-wide vote.⁵⁸

Regulation of chlorpyrifos in Canada mirrors regulation in the US. Canada had imposed specific use restrictions and set tolerance and release levels, and just recently announced a three-year plan to cancel all remaining registrations of the chemical.⁵⁹ Effective in December 2021, almost all uses of the chemical were cancelled, retail sales ended in December 2022, and remaining permissible agricultural uses will be cut off in December 2023. Canada phased out chlorpyrifos because manufacturers “failed to satisfy the data requirements” for continued use.⁶⁰

Industry Self-Regulation and Recent Developments

In 2000, entities registered to produce and apply chlorpyrifos voluntarily entered into an agreement with EPA to eliminate, phase out, and modify certain uses of the product, including most uses in private residences.⁶¹ In response to anticipated regulation and decreasing consumer demand, Corteva, Inc. (formerly Dow Chemical and Dupont), the largest producer of chlorpyrifos in the country, stopped the sale of chlorpyrifos by the end of 2020.⁶² Under the Obama administration, EPA began the process of revoking all uses of chlorpyrifos in 2015, but the Trump administration ignored the recommendations - setting off a wave of legal challenges asking courts to require EPA to make a decision based on its data.⁶³ On April 29, 2021, a federal court ordered EPA to issue a final rule regarding chlorpyrifos tolerances. After determining that the risk from aggregate exposure to chlorpyrifos does not meet applicable safety standards, EPA issued a final rule revoking all tolerances as of February 28, 2022, effectively banning its use on agricultural commodities.⁶⁴

Glycol Ethers



Description

Glycol ethers are a class of chemicals used as solvents and ingredients in cleaners and cosmetics.⁶⁵ They are often found in paint, varnish, gum, perfume, ink, sunscreen, hair dye, nail polish, and home cleaning products. Examples of glycol ethers are ethylene glycol, 2-methoxyethanol, 2-ethoxyethanol, and 2-butoxyethanol.

People can be exposed to glycol ethers through inhalation or skin contact. People at highest risk of exposure to glycol ethers are those directly involved in manufacturing processes creating or using glycol ethers. Short term exposure to high levels of glycol ethers can cause narcosis (drowsiness or unconsciousness), pulmonary edema (fluid in the lungs), and severe kidney and liver damage.⁶⁶ Chronic exposure can cause negative neurological and blood effects. Reproductive effects from exposure have been observed in both humans and animals, including testicular degeneration, spontaneous abortion, and reduced sperm count.⁶⁷

Federal Regulation

Glycol ethers are subject to significant new use reporting under TSCA.⁶⁸ A “significant new use” is *any* use in a consumer product, except in for some inks, adhesives, and coatings. Glycol ethers are also considered hazardous air pollutants for purposes of air pollution prevention and control and are subject to reporting under TRI.⁶⁹

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as “Superfund,” was enacted by Congress in 1980 to respond to releases or threatened releases of hazardous substances.⁷⁰ Glycol ethers are included as hazardous substances eligible for funding support from CERCLA for clean-up and remediation.⁷¹

Finally, the Occupational Safety and Health Administration (OSHA) has set “permissible exposure limits” for occupational exposure to glycol ethers based on reports of toxicity in animals and case reports of human exposure.⁷²

State Regulation

Most states have regulations classifying glycol ethers as “toxic” or “hazardous” air pollutants regulated under state pollution control and emission standards laws.⁷³

Case Law

Courts have considered the effect of glycol ethers on human health in a few cases, primarily concerning civil liability in worker’s compensation and products liability disputes, and criminal liability for violations of environmental regulations. For example, in *Byrne v. SCM Corp.*, a man employed as a painter developed severe neurological and respiratory conditions after an exposure to glycol ethers in paint, and was entitled to recovery for products liability despite the fact that the manufacturer labeled the paint with warnings.⁷⁴ In *The Bullen Companies v. W.C.A.B (Hausmann)*, a man who worked in a manufacturing plant producing cleaning products was entitled to worker’s compensation when, after 17 years of respiratory and skin exposure to glycol ethers, he developed kidney disease.⁷⁵ Finally, in *People v. M&H Used Auto Parts & Cars*, a vehicle dismantling business was convicted of releasing industrial waste containing ethylene glycol and other hazardous substances into state waters because they knew the waste contained hazardous substances, and knew that discharging it via sump pump would cause it to end up in state waters.⁷⁶



EU and Canada

Like their status in the US, glycol ethers are legal but subject to regulation by the EU. However, since 1996 the European Producers of Glycol Ethers and involved distributors annually sign a voluntary agreement to stop commercializing certain “reprotoxic” forms of glycol ethers.⁷⁷ Individual countries may also have stricter requirements; for example, France banned glycol ethers in cosmetic products in 1999.⁷⁸

Canada has banned a common type of glycol ether (2-methoxyethanol) from manufacture, import, sale, and use since at least 2013.⁷⁹

Industry Self-Regulation and Recent Developments

In 1982, most manufacturers of two common glycol ethers adopted exposure guides more restrictive than current OSHA guidelines.⁸⁰

PFAS

Description

PFAS stands for “per- and polyfluoroalkyl substances” and refers to a class of over 4,700 chemicals, including two relatively well-known forms, PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulfonic acid). Commonly called “forever chemicals,” PFAS have been used in stain- and water-resistant products including cookware, food packaging, raincoats, cosmetics, dental floss, shampoo, and more.⁸¹ PFAS are referred to as forever chemicals because they persist in the environment for long periods of time – some can last up to eight years in the human body, and PFOA and PFOS never naturally break down in the environment.⁸²

Most exposure to PFAS for both humans and animals occurs through consumption of contaminated water, though exposure is also possible through breathing contaminated air or consuming food grown or raised in contaminated soil or water.⁸³ Studies have shown that exposure to PFAS can reduce vaccine response and ability to fight infection, interfere with natural hormones, increase cholesterol, and increase risk of obesity, reproductive issues such as decreased fertility and high blood pressure in pregnant people, and developmental effects in children including low birth weight, accelerated puberty, and behavioral changes.⁸⁴

PFAS regulation has been ramping up in recent years after landmark legal action brought its pervasiveness and significant health harms to light. In the late 1990s, a corporate lawyer named Robert Bilott took the case of a farmer whose animals were mysteriously dying after drinking water that had been contaminated by DuPont chemical company.⁸⁵ While reviewing the documents DuPont provided him, Bilott discovered that the company had been studying the PFAS it was using for years and had found negative health effects in both humans and animals. Bilott’s discovery ended with a class action suit and settlement from DuPont, providing 70,000 people with medical testing and a thorough study of PFAS’ health effects, water filtration plants in their community, and cash settlements. Once the medical testing and proceeding study determined in 2011 that there was a link between exposure to PFAS and negative health outcomes, personal injury lawsuits against DuPont started rolling in – with 3,535 lawsuits filed by October 2015. The story of Robert Bilott and DuPont’s PFAS contamination was published in *The New York Times Magazine* on January 6, 2016, and as a documentary titled *The Devil We Know* in 2018.⁸⁶ *The New York Times Magazine* article then served as inspiration for the 2019 drama *Dark Waters*, which grossed over \$23 million at the box office.⁸⁷



Federal Regulation

TSCA has prohibited the manufacture and import of some forms of PFAS since 2010 and requires reporting of manufacture and import of other forms.⁸⁸ Additionally, since 2020, 66 PFAS chemicals have been added to the list of chemicals subject to reporting under TRI.⁸⁹

In response to a petition from New Mexico's Governor in 2021, EPA announced that it would initiate rulemaking to add four PFAS chemicals to its list of hazardous substances subject to regulation under RCRA.⁹⁰

While SDWA does not yet regulate PFAS, it appears on the most recent draft list of candidates for regulation, and the National Defense Authorization Act for fiscal year (FY) 2020 directed EPA to require public water systems to monitor PFAS and publish interim guidance on destruction and disposal, and authorized grants for water systems to address PFAS contamination.⁹¹ EPA also received \$15 million per year for FYs 2020-2024 to examine the effects of PFAS, make its findings available to the public, develop tools for characterization and identification in the environment, evaluate remediation approaches, and develop tools to communicate with the public about its findings.⁹² In 2021, EPA published a strategic roadmap outlining its plan for this funding, which includes measures to prevent PFAS pollution, hold polluters accountable, and prioritize protection of disadvantaged populations from pollution.⁹³

A law adopted in 2021 directed the White House Office of Science and Technology to put together a working group to coordinate the rapidly increasing federal activities related to PFAS.⁹⁴

State Regulation


Many states have recently adopted laws banning or partially banning the use of PFAS in certain products. For example, Maine's legislature adopted a law directing the Department of Environmental Protection to find a safe alternative to PFAS in food packaging (which it did in February 2021), and subsequently adopt regulations banning the use of PFAS.⁹⁵ Starting in 2024, manufacturers in Minnesota and Hawaii will be prohibited from manufacturing or knowingly selling or distributing a food package with intentionally added PFAS.⁹⁶ California has a similar law which also requires manufacturers to use the least toxic alternative to PFAS, which became effective January 1, 2023.⁹⁷

Colorado, Maryland, New York, Ohio, and Vermont prohibit or restrict the use of PFAS in firefighting foams.⁹⁸ Beginning in 2024, Colorado will prohibit the sale or distribution of carpets, fabric treatments, food packaging, juvenile products, and oil and gas products with intentionally added PFAS.⁹⁹ Cookware containing PFAS will also be required to carry a label with a link to information on PFAS. Beginning in July 2023, California will prohibit the sale or distribution of juvenile products containing PFAS and in 2025, Maryland will begin banning PFAS in cosmetic products.¹⁰⁰

Finally, Maine and New Hampshire have established funds to remediate PFAS contamination.¹⁰¹

Case Law

Robert Bilott's case against DuPont was just the beginning of the litigation surrounding PFAS. Plaintiffs across the country filed over 6,400 PFAS-related lawsuits between 2005 and 2022, with one manufacturer (3M) on the receiving end of an average of *three lawsuits per day* in 2021.¹⁰²



Much of the PFAS litigation involves private plaintiffs seeking medical monitoring or bringing personal injury claims for compensation from manufacturers. State attorneys general and water utilities have brought claims against manufacturers to recover for diminished property values due to PFAS contamination and cost of remediation, and for water testing and data collection. Shareholders of companies involved in PFAS manufacture and use have also filed suits alleging failure to disclose important information about potential liability for PFAS contamination.¹⁰³ These legal actions often have potential for large settlements and verdicts. For example, the Minnesota Attorney General secured an \$850 million settlement in 2018, \$720 million of which will be invested in local drinking water and natural resource projects.¹⁰⁴

EU and Canada

The EU is currently considering a restriction on PFAS in firefighting foams, as well as a broad ban on PFAS in all products.¹⁰⁵ The broad ban was proposed by the Netherlands, Denmark, Germany, Norway, and Sweden in February 2023.¹⁰⁶

Canada began regulating PFAS in 2008, with a ban on PFOS.¹⁰⁷ In 2016, Canada adopted the *2016 Toxic Substances Regulation*, which prohibits the use, manufacture, and sale of PFOA, PFOS, and a third type of PFAS.¹⁰⁸ However, evidence has indicated that the alternative types of PFAS being substituted for the banned chemicals are also harmful, so the government is continuing to study alternatives and considering additional action.

Industry Self-Regulation and Recent Developments


The largest manufacturer of PFAS, 3M, has pledged to stop producing PFAS by the end of 2025.¹⁰⁹ Cookware brands are advertising products as “PFAS-free,” and some clothing brands are eliminating the use of PFAS in their clothing.¹¹⁰

Triclosan

Description

Triclosan is an antibacterial chemical used in consumer products to prevent or stop the growth of bacteria.¹¹¹ Some textiles and pesticides contain triclosan, including clothing, shoes, carpeting, furniture, toys, and kitchen items, but over 80% of triclosan use is through personal care products.¹¹² Personal care products that contain triclosan include toothpaste, mouthwash, face and hand cleansers, deodorant, lotion, cosmetics, and dishwashing detergents.¹¹³

Contact with skin is the main route of exposure of humans to triclosan, because it can be absorbed into the body through the skin or mouth. It is so pervasive in personal care products that a CDC study of the urine of over 2,500 people found the chemical in 75% of samples.¹¹⁴ Although the U.S. Food and Drug Administration (FDA) determined that triclosan may have some benefit in “Colgate Total” toothpaste, the producers reformulated the product to eliminate the chemical in 2018.¹¹⁵ Triclosan’s effectiveness has not been proven for any other products and some studies suggest that long-term exposure to the chemical could have negative health effects.¹¹⁶ Possible negative health effects include allergies, skin irritation, and anti-bacterial resistance, and a study on animals showed a decrease in certain thyroid hormones.¹¹⁷ Exposure to triclosan can be especially concerning for people assigned female at birth who have children, because the fetus can be



exposed while in the womb and after birth through breast milk.¹¹⁸ A study of Chinese women found exposure to triclosan was associated with a higher risk of polycystic ovary syndrome.¹¹⁹

Triclosan ends up in water supplies, bioaccumulates, and is highly toxic to aquatic life including algae and fish.¹²⁰ While eating contaminated fish may not pose a risk to human health, triclosan can negatively impact fish populations, potentially leading to ecosystem disruption and food supply shortages.

Federal Regulation

In 2013, the FDA sought data from manufacturers of antibacterial soap proving that their products were safe for long-term use, and that products containing triclosan were better at preventing infections than products without triclosan.¹²¹ The manufacturers failed to prove that triclosan was safe for long-term use or that it was more effective than triclosan-free antibacterial soap at preventing infections. In 2016, the FDA issued a rule^e prohibiting the sale of consumer antiseptic products including hand soaps and body washes containing triclosan.¹²² Triclosan is also banned from use in over-the-counter products used to treat boils.¹²³

State Regulation

Because data on the health risks of triclosan are still developing, only one state currently places restrictions on use of the chemical. Minnesota prohibits retail sale of consumer cleaning products containing triclosan with slightly broader language than the FDA prohibition.¹²⁴ It also prohibits family care providers from using triclosan or its derivatives to clean diaper changing surfaces.¹²⁵

EU and Canada

A year before the US FDA took action on triclosan in some consumer antimicrobial products, the EU announced it would be phasing out the “toxic and bioaccumulative” chemical in most products in favor of safer alternatives, “due to unacceptable risks to the environment.”¹²⁶


Canada has not adopted any bans on triclosan in consumer products but does regulate its use. In 2018, the country added triclosan to its list of toxic chemicals under the Environmental Protection Act.¹²⁷ Canada also set limits on allowable concentrations of triclosan in mouthwash, over-the-counter drugs, and cosmetics and natural health products.¹²⁸

Industry Self-Regulation and Recent Developments

Continued use of triclosan in consumer products is the subject of some controversy due to uncertainty surrounding its exact health and safety risks. For example, the official information page on triclosan managed by the Canadian government states that triclosan “is not a health risk at current levels of exposure” and is not proven to cause antimicrobial resistance but does “[pose] a risk to the environment.”¹²⁹ The following sections then detail “protective measures” and provide suggestions for “[minimizing] your exposure to triclosan,” despite the minimal risk to human health described previously.

Researchers are continuing to study the health impacts of triclosan to inform future regulation and use. A scientist at the University of Maine¹³⁰ has found that even exposure to small amounts of triclosan can impact

^e The FDA rule does not apply to antibacterial products used in hospital or healthcare settings.



human immune systems and cell mitochondria.^f A scientist at Brown University found that triclosan exposures during pregnancy are associated with decreased IQ and behavioral disorders such as attention-deficit/hyperactivity disorder (ADHD).¹³¹

Personal care product manufacturers Johnson & Johnson, Procter & Gamble, and Colgate-Palmolive have discontinued use of triclosan in their products.¹³²

Conclusion

Endocrine disrupting chemicals are pervasive in the environment and the manufactured products people rely on in their daily lives. While scientists are still conducting studies on the impact of EDCs on human health, they have already found substantial evidence of inextricable links between EDC exposure and health effects such as cancer and neurological and reproductive issues. EDC exposure is a significant population health concern because a majority of people in the US have been exposed, and it is difficult if not impossible for people to prevent exposure at the individual level. Therefore, it is important for public health professionals to understand the current regulatory framework surrounding EDCs, the progress being made, and possibilities for further regulation and population health protection.

^f Cell mitochondria provide energy to cells so they can function.



Table 1: Uses of and Exposure Routes for Common EDCs

| Chemical or Class of Chemicals | Uses | Common Routes of Exposure | | |
|--------------------------------|--|---------------------------|------------|-------------------|
| | | Consumption | Inhalation | Contact with Skin |
| Atrazine | Herbicide used on corn, sorghum, sugarcane, and broadleaf and grassy weeds; used both commercially and residentially | ✓ | ✓ | ✓ |
| Chlorpyrifos | Insecticide used on a wide variety of crops, including half of all apple and broccoli crops, citrus, melons, wheat, etc.; used in feed crops leading to residue in milk, eggs, and meat; used outdoors to control mosquitos and indoors to control fleas, ticks, and other pests | ✓ | ✓ | ✓ |
| Glycol Ethers | Used as solvents in cleaning compounds, liquid soaps, and cosmetics (i.e., paint, varnish, gum, perfume, ink, sunscreen, hair dye, nail polish, and home cleaning products) | | ✓ | ✓ |
| PFAS | Used in stain- and water-resistant products including cookware, clothing, and food packaging | ✓ | ✓ | |
| Triclosan | Used as an antimicrobial/antibacterial agent in personal care products including hand and body soaps, cosmetics, oral hygiene products, textiles, and more | | | ✓ |

Table 2: Legal Status Summaries for Common EDCs

| Chemical or Class of Chemicals⁹ | Status – Federal | Status - State | Status – EU & Canada | Industry Self-Regulation |
|---|--|---|--|--|
| Atrazine | EPA sets residue tolerance levels for food Subject to TRI reporting requirements Maximum contaminant level of 3 ppb in drinking water | Most states set standards for use and monitoring beyond federal requirements | EU-wide ban since 2004, some countries banned as early as 1989 | Producers have agreed to minor changes including bans in some coastal regions and use and application rules |
| Chlorpyrifos | Subject to reporting under TRI, Clean Water Act; monitored under SDWA Previously EPA set residue tolerance levels for food, recently removed these levels effectively banning its use on food crops | Most states set standards for use beyond federal requirements; at least six states have banned or severely restricted its use | Canada ban becomes fully effective end of 2023; EU ban adopted in 2020, with seven member countries having earlier bans | Industry agreement in 2000 to phase out and restrict some uses; large producer stopped manufacturing in 2020 |
| Glycol Ethers | Subject to significant new use reporting under TSCA, classified as a hazardous air pollutant, eligible for CERCLA funding Subject to TRI reporting requirements Occupational exposure limits regulated by OSHA | Most states regulate as toxic or hazardous air pollutants | Banned in Canada Legal in the EU, with stricter regulations/bans in some member countries EU industry agreement not to commercialize | Most manufacturers have adopted industrial exposure guidelines more stringent than those set by OSHA |
| PFAS | TSCA prohibits some forms, requires reporting for others 66 forms are subject to TRI reporting requirements EPA in process of adding some forms to the list of | Some states beginning to regulate or ban, with many measures taking effect years after adoption to allow phase-out time | Three forms banned in Canada, with new concern over forms being used as substitutes | Largest manufacturer to cease production in 2025 Clothing and cookware brands eliminating PFAS and |

⁹ For classes that include numerous specific chemicals, not all listed laws and actions apply to every chemical in the class.



| | | | | |
|-----------|---|--|---|--|
| | hazardous substances regulated by RCRA Working group established in White House to coordinate federal activities | | | advertising products as such |
| Triclosan | Banned for use in consumer soap products | Banned for use in consumer cleaning products and as a changing table disinfectant in childcare facilities in Minnesota | Banned for most uses in the EU Monitored and limited for use in some consumer products in Canada | Some large personal care product manufacturers have discontinued use |



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SUPPORTERS

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