

Raincoats, undies, school uniforms: Are your clothes dripping in 'forever chemicals'?

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There could be more than just fashion risks involved when buying a pair of leggings or a raincoat.

Just how much risk is still not clear, but [toxic chemicals](#) have been found in hundreds of [consumer products](#) and clothing bought off the racks nationwide.

Thousands of perfluoroalkyl and polyfluoroalkyl substances, or PFAS, exist since the first ones were invented in the 1940s to prevent stains and sticking. PFAS chemicals are used in nonstick cookware, water-repellent clothing, and firefighting foam. Their manufacture and persistence in products have contaminated drinking water nationwide. Also known as "forever chemicals," these substances do not break down in the environment and can accumulate in our bodies over time.

Drinking water is widely considered the greatest source of potential exposure and harm. And, in March, the Environmental Protection Agency proposed the first national standard for PFAS levels in drinking water. But the chemicals can also pollute soil, fish, livestock and food products. Researchers say they are present in the blood of nearly all Americans.

Until now, federal regulations on PFAS in consumer products have largely focused on a handful of the older-generation forever chemicals, such as PFOA, or perfluorooctanoic acid. But new state-level laws are targeting all forever chemicals.

Consumers concerned about clothing are also turning to the courts. A torrent of recent class-action lawsuits claim brands falsely advertise their products as environmentally sustainable or healthy while containing toxic levels of PFAS chemicals. In January, Thinx, which makes reusable period underwear, agreed to pay up to \$5 million to settle a suit. Another lawsuit, against REI, largely targeting its raincoat line, is proceeding in court.

From production to being worn, washed, and then disposed, "PFAS in

clothing and textiles can lead to harmful exposures," claimed Avinash Kar, a senior attorney at the National Resources Defense Council, an international nonprofit environmental advocacy organization.

Although the full health risks of wearing togs alleged to be toxic are still unknown, the potential implications are wide-reaching. A report from the National Academies of Sciences, Engineering, and Medicine linked PFAS exposure to cancer, thyroid dysfunction, small changes in birth weight, and high cholesterol, among other concerns.

So how concerned should consumers be about wearing clothing with forever chemicals in them?

PFAS have been found in a wide variety of garments such as rain jackets, hiking pants, shirts, and yoga pants and sports bras made by popular brands like Lululemon and Athleta.

Forever chemicals are used as surface treatments to block water and stains. In fact, a 2022 report by Toxic-Free Future, an environmental health research and advocacy organization, found that nearly three-quarters of products labeled as water- or stain-resistant tested positive for them.

The group points to research demonstrating that fabrics with that type of PFAS, called side-chain fluorinated polymers, emit volatile chemicals into the air and, when washed, into the water. "What you can expect is that a raincoat that has this surface treatment, over time, is releasing PFAS to the environment," said Erika Schreder, Toxic-Free Future's science director.

PFAS can also be used as a membrane—a thin layer sandwiched in the fabric that blocks water from passing through. This technology is found in products made with Gore-Tex. Such breathable yet waterproof layers

of fabric are used in jackets, pants, boots, and gloves in dozens of brands of outdoors wear. Sometimes, garments have both membranes and surface treatments.

A study published last year by the American Chemical Society found textile products sold in the U.S. and Canada contained high concentrations of PFAS in materials used in children's uniforms marketed as stain-resistant.

"This was concerning to us because these uniforms are on up to eight or 10 hours a day, every day, by children during their [school year](#)," said Marta Venier, an assistant professor at Indiana University-Bloomington and co-author of the study. "Children are particularly susceptible to exposure to chemicals because their organs are still developing."

But skin-touching fabric is only one way people are likely to be exposed to these chemicals. PFAS have found their way into most households through water, air, dust, and soap. PFAS can also shed from carpeting or furniture, as well as fabric treatments sprayed on furniture and clothing.

Studying skin or "dermal exposure" from wearing fabric is particularly tricky. Just because a product contains PFAS doesn't mean the chemical will travel from that jacket or pair of shorts across the skin into the bloodstream, said Stuart Harrad, a professor of environmental chemistry at the University of Birmingham.

So far, Harrad has found that PFAS can end up—either from fabric or dust particles—in the skin's oil and sweat. But more research needs to be done to examine whether those chemicals transfer into the blood. "From what we've seen, it's certainly something that we shouldn't be ignoring," he said.

In general, however, it's harder for PFAS chemicals to enter the body

through transdermal exposure than through the digestive system, said Dr. Ned Calonge, associate dean for public health practice of the Colorado School of Public Health who co-authored the national academies' report.

Levi Strauss has halted using the chemicals. Other brands, such as Patagonia, L.L. Bean, Lululemon, and Eddie Bauer, have pledged to phase them out in the next few years. In late February, REI released updated standards that require most cookware and textile products to be PFAS-free by fall 2024. The retailer said in a statement last year that it has been "working for years to phase out PFAS" and is "testing new alternatives."

W.L. Gore & Associates, inventor of Gore-Tex and a giant manufacturer of weather-repellent fabric, said it plans to "transition the vast majority of its consumer portfolio by end of 2025." Last year, the company debuted a membrane that uses non-fluorinated materials and can be found in jackets sold by Arc'teryx, Patagonia, and other brands.

Still, without oversight, corporate commitments are not a guarantee, and there's always concern of contamination, PFAS experts said. Gore, for example, said years ago that the company had eliminated PFOA from its materials. But in its testing last year, Toxic-Free Future found it in REI Gore-Tex rain jackets. Gore spokesperson Amy Calhoun rebutted those findings and said the company considers itself a leader in "responsible chemical management."

People in the [chemical](#) field view this as an inflection point and are watching closely as companies phase out forever chemicals and pressing for transparency about what alternatives are chosen and how safe they might be.

The EPA has set out to regulate some older-generation chemicals generally found in imported products. Those have also been banned in

the European Union and phased out by major U.S. manufacturers, often replaced by newer-generation PFAS, which leave the body more swiftly and are less likely to build up in organs. "When discussing the broad group of chemicals known as PFAS, it is important to note not all PFAS are the same," said Calhoun. Some Gore products use PTFE, a polymer the company says is "of low concern." According to a growing body of research, though, these newer PFAS often have similar levels of toxicity.

Stricter, state-level bans targeting apparel are rolling out. Maine now requires companies to report PFAS in their products to state officials. The chemicals will be fully banned there by the start of 2030, while Washington state will restrict PFAS in apparel as well as in other consumer products by 2025.

The most important legislation has come in two states with large consumer markets that manufacturers would be loath to avoid, effectively setting a standard for the nation. A New York law signed in late December bans the sale of garments with PFAS by the end of 2023. A California law passed last year restricts companies from manufacturing, distributing, or selling PFAS-containing clothing beginning in 2025, but those rules won't apply to extreme weather and personal protective apparel until 2028.

So where does that leave consumers? Calonge said that people who already have high levels of PFAS in their blood serum should have a heightened sense of awareness about the clothing they wear. Community-level blood testing is underway in areas with known PFAS exposure, but individuals can also seek it out by asking their doctors.

"That's when I would make a decision to not wear clothing that I know has PFAS in it," he said.

Without sound evidence linking skin exposure from clothing to upticks

in PFAS in blood serum levels, Calonge said, for now, decisions are largely left up to risk tolerance.

He personally draws the line at using dental floss brands shown to contain forever chemicals.

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