

Forever Chemicals Found in 88% of Kale Tested

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STORY AT-A-GLANCE

- › Conventionally grown and organic kale may be contaminated with toxic per- and polyfluoroalkyl chemicals (PFAS)
- › Out of eight kale samples purchased in four U.S. states, only one had no detectable PFAS
- › Among the others, the highest level of total PFAS was found in conventionally grown kale purchased in a Georgia Publix store
- › Overall, PFAS levels were higher in organic kale samples than conventional samples
- › Kale is just one example – albeit a surprising one – of where you may come into contact with PFAS; concerning levels of PFAS have also been found in peanut butter, pasta sauce, freshwater fish, cooking oil and many other consumer goods

Conventionally grown and organic kale, considered by many to be the quintessential superfood, may be contaminated with toxic per- and polyfluoroalkyl chemicals (PFAS),¹ also known as “forever chemicals” because they’re so persistent in the environment. This isn’t so much a kale problem as it is an agricultural one – a harbinger of systemic problems with food production. As agronomy consultant Sam Knowlton tweeted:²

“A recent pilot study found that 88% of tested kale was contaminated with PFAS, aka forever chemicals ... It’s safe to assume that PFAS contamination is in no way limited to kale and is likely widespread throughout our food system.”

The way we produce our food is a critical determinant of our health, both in terms of providing quality nutrition and eliminating the stream of toxins otherwise destined for our food system.”

PFAS Contain One of the Strongest Bonds, Making Them Extreme Hazards

More than 12,000 chemicals make up the PFAS class. Heralded for their grease- and water-resistant properties, the chemicals are commonly found in nonstick cookware, plastics, cosmetics, stain-resistant and waterproof materials, fire-fighting foam and more. Even dental floss and tampons contain them.³

“What unites these chemicals is the presence of a carbon-fluorine bond which is one of the strongest in chemistry. This strength is also the source of these chemicals’ hazard: PFAS chemicals are highly persistent in the environment and have been accumulating in soils, waterways and oceans over decades,” according to Alliance for Natural Health USA (ANH-USA).⁴

Exposure is so widespread that PFAS have been found in 97% of Americans.⁵ In the human body, PFAS have half-lives of from a few days to over 10 years.⁶ The chemicals have been detected in drinking water, animals, food and even in remote areas of the Earth.⁷ Further, they’re linked to significant human health effects, including increased risk of cancer⁸ and decreased immune system function.

They’re also known to affect hormones and metabolism, interfering with fertility, growth and development,⁹ raising concerns that the chemicals are putting future generations at risk.¹⁰ Yet, despite the grave outlook, U.S. regulatory agencies have done little to address the extensive environmental contamination known to exist. ANH-USA reported:¹¹

“U.S. regulatory agencies have proven themselves incapable or unwilling to meaningfully address the extensive contamination of our world and bodies with PFAS. The EPA’s approach to PFAS has largely been to monitor and report. The

few actions that have been taken have mostly been limited to PFOA and PFOS, which have been voluntarily phased out of production in the US.

This is in deep contrast to the approach being taken in Europe, where there is a concerted effort being taken by regulators, environmental scientists, and industry stakeholders to phase out PFAS of all kinds ... The American people deserve more.”

Toxic PFAS Found in Most Kale

To uncover more about just how widespread PFAS contamination is in the food supply, ANH-USA analyzed conventionally grown and organic kale samples from four states – New York, Georgia, Pennsylvania and Arizona. Two samples were purchased from a store in each state, some of them loose leaves and others prepackaged in a plastic bag or container.

Out of the eight samples, only one had no detectable PFAS. Among the others, the highest level of total PFAS was found in conventionally grown kale purchased in a Georgia Publix store. However, overall, PFAS levels were higher in organic kale samples than conventional samples.¹² What does this mean for your health?

The European Food Safety Authority (EFSA) set a tolerable weekly intake of 4.4 ng/kg bodyweight for PFAS. “Disturbingly, this is the equivalent of consuming two portions (67 g each) of kale with the same level as that found in the Publix store (GA) a week, implying any intake above this amount (from all sources) would equate to a potential health risk,” according to ANH-USA.¹³

The report also referenced an Environmental Working Group (EWG) study, which found high levels of PFAS in freshwater fish.¹⁴ EWG revealed that consuming a single serving of freshwater fish annually equates to a month of drinking water contaminated with PFOS – one type of PFAS – at a concentration of 48 parts per trillion. In terms of kale, the ANH-USA report noted:¹⁵

“We must also consider that eating kale tainted with PFAS is just one route of many routes of exposure in a given day – the diverse range of foods we eat, the water we drink, the air we breathe, the cookware we use, the lubricants we apply to our vehicles, and even the clothes we wear, are among the many possible points of exposure for one or more PFAS.

In a recent study, scientists at the Environmental Working Group (EWG) calculated eating one 8 ounce serving of fish at 20 ng/kg PFOS is equivalent to consuming one month of drinking water contaminated with PFOS at 0.1 parts per trillion (ppt), or 5.7 times the interim U.S. EPA health advisory.

Using this model, eating one serving (67 g) of kale with 0.033 ng/g PFOS is equivalent to one month of drinking water at 0.05 ppt, which is 1.5 times higher than the EPA’s interim health advisory for PFOS.”

How Does PFAS Wind Up in Kale?

Kale is just one example – albeit a surprising one – of where you may come into contact with PFAS. It’s far from the only route of exposure. Concerning levels of PFAS have been found in peanut butter, pasta sauce and cooking oil, for instance.¹⁶ In another study, leafy greens grown within 10 miles of a PFAS plant contained very high amounts, but even chocolate cake was contaminated.¹⁷

How is PFAS getting into food, including organics? One way, Knowlton tweeted, is via compost made with biosolids:¹⁸

“One reason the organic kale may have more PFAS than conventional kale is the use of higher rates of compost in organic production.

Most compost is poorly made and more of a waste management endeavor than one geared for producing high-quality inoculum/fertilizer. Often, undesirable materials like biosolids and other toxin-laden industrial waste are composted but not adequately decomposed. Many farms rely on this type of compost because it is cheaper.”

In fact, PFAS on farmland is a major issue, one that's been called a "slow-motion disaster."¹⁹ The source of the contamination on many agricultural lands is biosolids — toxic human waste sludge — that's marketed as an affordable fertilizer. Fred Stone, a farmer in Maine, applied biosolids to his hayfields intended to feed his dairy cattle for decades, not knowing it could be contaminated with PFAS.

Milk from Stone's cows later tested positive for PFAS, forcing him to dump hundreds of gallons of milk a day.²⁰ In 2022, Maine became the first U.S. state to ban the use of PFAS-contaminated sewage sludge as fertilizer,²¹ but it's still allowed elsewhere. An estimated 20 million acres of U.S. farmland may be contaminated with PFAS as a result.²²

The Ecology Center of Michigan and Sierra Club tested nine home fertilizers made from biosolids, many of which were labeled "natural."

All but one exceeded Maine's screening limits for PFOS and PFOA, and each product contained 14 to 20 PFAS compounds. "The chemicals were measured at levels that would not be acceptable for the state's agricultural soils," according to Sierra Club, which noted that many home gardeners aren't aware that the compost or soil amendments they buy may expose them to PFAS. Further, it explained:²³

"In most places, industries are currently allowed to flush PFAS-containing waste into wastewater drains that flow to treatment plants. The chemicals are not removed during sewage treatment and instead settle in solid materials that are separated out from liquids in the treatment process.

Americans generate massive quantities of sewage waste each day. Nearly half of sewage sludges are treated to kill pathogens and then spread on farms, pastures, and wildlands for disposal, where nutrients like nitrogen improve soil productivity. The wastewater industry and EPA call these 'biosolids.'

Unfortunately, biosolids carry a variety of persistent and toxic chemicals, in addition to PFAS, which can threaten our food supply and contaminate water sources."

Contaminated CAFO Manure Is Allowed as ‘Organic’ Fertilizer

The Organic Materials Review Institute (OMRI) is an international nonprofit organization responsible for determining which products are allowed in organic production and processing.²⁴ Manure is among them,²⁵ but this “natural” fertilizer has a dark side when it’s sourced from concentrated animal feeding operations (CAFOs).

When chickens are raised on pasture, their manure is spread across the land and worked into the soil naturally via pecking and scratching.²⁶ This beneficial practice that works in concert with nature bears little resemblance to the use of poultry litter – or chicken feces, sometimes mixed with urine, sawdust, feathers and other materials – and other CAFO animal waste as fertilizer. Yet, this latter practice is common, even among some organic farms.²⁷

Chicken litter used as an organic fertilizer is considered “the cheapest and most environmentally safe method of disposing of the volume generated from the rapidly expanding poultry industry worldwide.”²⁸

But a review, published in the International Journal of Environmental Research and Public Health, raises an important point – “little is known about the safety of chicken litter for land application and general release into the environment.”²⁹ In addition to being contaminated with pathogenic strains of E. coli, avian influenza and salmonella, chicken litter contains antibiotics, pesticide residues and heavy metals,³⁰ along with PFAS.

According to The University of Maine, “Composts or fertilizers containing manure from animals fed PFAS-contaminated feed or water” are among the top “products of most concerns for their potential to contribute PFAS to your garden.”³¹ Until CAFO manure is no longer allowed in organics, it’s likely that organic kale and other produce will continue to face a PFAS problem.

‘Death From a Thousand Cuts’

PFAS is linked to a wide range of health effects, from cancer and weakened immune systems to weight gain. Problems with liver, kidney and thyroid function have also been found in relation to PFAS, along with reproductive issues.³²

PFAS may also trigger declines in fertility and fecundability, the probability of getting pregnant within one menstrual cycle. In a study of 382 women of reproductive age trying to conceive, a 5% to 10% reduction in fecundability per quartile increase of exposure to PFAS was found, specifically from exposure to PFDA, PFOS, PFOA and PFHpA.³³

PFAS may also lead to cancer by causing changes in epigenetics, immunosuppression, oxidative stress, inflammation or via hormone and metabolomic pathways. An accumulation of epigenetic events induced by PFAS exposure can “synergistically amplify tumorigenicity and cancer progression,” researchers explained, adding that immune system suppression and chronic inflammation also likely play a role.³⁴

Part of the dangers of PFAS come from its ubiquitous and persistent nature. In addition to food, PFAS is commonly used to coat fabrics used to make raincoats or sandwiched between layers of material to create a waterproof layer — as is the case with Gore-Tex products.

Children’s school uniforms are another significant route of exposure. About 3 tonnes of PFAS are used in U.S. school uniforms annually and may expose children to 1.03 ng/kg bw/day of PFAS exposure, via skin absorption.³⁵

Drinking water is another route of exposure. The U.S. Department of Defense reported that at least 126 drinking water systems near military bases have been contaminated with PFAS, due to their use in firefighting foam.³⁶ And, according to EWG, more than 200 million Americans may be drinking water containing PFAS at a concentration of 1 part per trillion (ppt) or higher.^{37,38}

EWG has endorsed making 1 ppt the standard upper safe level for PFAS in drinking water. The proposed EPA rule would regulate PFOA and PFOS at 4 ppt.³⁹ The problem is, humans are exposed to PFAS from so many different sources that it’s virtually impossible to keep up — or understand the risks fully.

Not to mention, there are other contaminants in our daily environments as well, like glyphosate and other agricultural chemicals. Kale, for example, has been found to contain concerning levels of the poisonous metal thallium,⁴⁰ in addition to PFAS. According to ANH-USA:⁴¹

“With PFAS exposure, it’s ‘death by a thousand cuts’: small exposures from different foods and food packages, added to PFAS we inhale in dust, added to the PFAS in our drinking water, added to the PFAS we get from consumer goods like sportswear, cosmetics, and personal care products, added to PFAS unintentionally added to products during manufacturing, add up to a looming public health problem, as they are all accumulating in our body faster than we can get rid of them.”

How to Reduce Your Exposure to PFAS

It’s difficult to avoid PFAS entirely in the modern world, which is why experts are calling for a ban on the entire class of chemicals, rather than one at a time. “Less than 1% of all PFAS have been tested for their hazardous effects,” ANH-USA points out. “It has taken the EPA decades to even start the process of setting enforceable drinking water standards for just two PFAS chemicals; the agency’s current approach of assessing one chemical at a time is akin to doing nothing.”⁴²

There are, however, steps you can take to minimize your exposure. While foods grown with PFAS-contaminated sewage sludge are not labeled as such, your best bet for avoiding them is to support sustainable agriculture movements in your area.

Make it a point to only buy food from a source you know and trust, one using safe, nontoxic organic or biodynamic farming methods. Eating mostly fresh, whole foods will also help you cut down on exposure to these chemicals in food packaging. Filtering your drinking water is also important to remove PFAS.

The New Jersey Drinking Water Quality Institute recommends using granulated activated carbon “or an equally efficient technology” to remove chemicals such as PFOA

and PFOS from your drinking water. Activated carbon has been shown to remove about 90% of these chemicals.⁴³

Reverse osmosis can also remove some – but not all – PFAS.⁴⁴ You can find additional helpful tips to reduce your exposure to forever chemicals in EWG’s “Guide to Avoiding PFAS Chemicals.”⁴⁵

Pretreated or stain-repellent treatments – Opt out of these treatments on clothing, furniture and carpeting. Clothing advertised as “breathable” is typically treated with polytetrafluoroethylene, a synthetic fluoropolymer commonly known as Teflon.

Products treated with flame retardant chemicals – This includes furniture, carpet, mattresses and baby items. Instead, opt for naturally less flammable materials such as leather, wool and cotton.

Fast food and carry-out foods – The containers are typically treated.

Microwave popcorn – PFAS may be present in the inner coating of the bag and may migrate to the oil from the packaging during heating. Instead, use “old-fashioned” stovetop non-GMO popcorn.

Nonstick cookware and other treated kitchen utensils – Healthier options include ceramic and enameled cast iron cookware, both of which are durable, easy to clean and completely inert, which means they won’t release any harmful chemicals into your home.

Personal care products containing PTFE, “fluoro” or “perfluoro” ingredients such as Oral B Glide floss – The EWG Skin Deep database is an excellent source to search for healthier personal care options.⁴⁶

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