COOKWARE SUSTAINABILITY ALLIANCE

Non-Stick Cookware
Claims vs Facts

Claims on Environmental and Health Impacts:

- Independent science and regulatory bodies in the U.S. and abroad classify PFAS, including PTFE, as harmful and highly persistent in the environment. These chemicals are linked to cancer, hormone disruption, reduced fertility, developmental harm, liver disease and weakened immunity.
- PFAS from PTFE-coated pans can end up in food and the air.
- PFAS contamination has already polluted the drinking water of an estimated 25 million Californians, and the public will pay for the exposure and cleanup, through higher water and health care bills.

Fact:

Global public health authorities consistently regard PTFE as inert, non-bioaccumulative, insoluble in water, and therefore safe for consumers. Further, PTFE is considered immobile in the environment. The Interstate Technology Regulatory Council (ITRC) reinforces this distinction, noting that "[…] a stable, insoluble fluoropolymer such as PTFE may pose little environmental/ecological or health risk once it is in a product."[1]

Both Delaware and West Virginia have recognized the fact that fluoropolymers are not a concern for drinking water. In their PFAS laws concerning drinking water, the definition of PFAS in statute specifically excludes fluoropolymers like PTFE (see below).

- **Delaware (and West Virginia**) -
  - Delaware:§ 8092. Definitions.
    (4) "PFAS" means **non-polymeric** perfluoroalkyl and polyfluoroalkyl substances that are a group of man-made chemicals that contain at least 2 fully fluorinated carbon atoms, excluding gases and volatile liquids....
  - West Virginia: §22-11C-2. Definitions.
    "Perfluoroalkyl and polyfluoroalkyl substances" or "PFAS" means **non-polymeric** perfluoroalkyl and polyfluoroalkyl substances that contain at least two fully fluorinated carbon atoms, excluding gases and volatile liquids. . .

Since the 1960s, the FDA has authorized PTFE and other fluoropolymers for use in food-contact applications and cookware.[2] As recently as early January 2025 under the Biden Administration, the FDA

[1] https://pfas-1.itrcweb.org/wp-content/uploads/2023/12/Full-PFAS-Guidance-12.11.2023.pdf
[2] https://www.fda.gov/food/environmental-contaminants-food/and-polyfluoroalkyl-substances-pfas

reaffirmed that the use of PTFE and similar fluoropolymers in non-stick (cookware) coatings remains approved:

> "*Some PFAS are approved for use in the manufacture of non-stick cookware coatings. These coatings are made of molecules that are polymerized (i.e., joined together to form large molecules) and applied to the cookware through a heating process that tightly binds the polymer coating to the cookware. . . Similarly, the PFAS used in manufacturing of gaskets that come into contact with food* ***do not pose a safety risk because they are also made of molecules that are polymerized***."

It is noteworthy that the FDA partnered with ECRI to conduct an independent safety review. ECRI, designated as a Patient Safety Organization by the U.S. Department of Health and Human Services, collected data from over 1,800 healthcare provider organizations across the country. The review, delivered in 2021, used over 1,750 published, peer-reviewed scientific articles, as well as ECRI's real-world surveillance network of clinics and healthcare providers through its Patient Safety Organization. The findings concluded that there is no conclusive evidence of patient health risks associated with PTFE as a material.[3]

Bruno Ameduri, who is an international recognized scientist,[4] states that PFASs (per- or polyfluoroalkyl substances) represent a large family of synthetic fluorinated compounds widely used in industry and consumer products. Some of these substances are toxic, bioaccumulative, and can penetrate human cells, raising significant environmental and health concerns. However**, fluoropolymers**—a specific subgroup of PFASs with high molecular weight—are **safer, more stable, and less mobile**, and are widely used in high-performance technologies. These materials meet the 13 criteria of the OECD "Polymers of Low Concern" (PLC) and cannot cross gastrointestinal membranes.[5]

The German Federal Institute for Risk Assessment (BfR), which is highly recognized in Europe, found that there are **no adverse health effects to be expected from cookware with PTFE non-stick coating**.[6]

Other recognized and trusted authorities in this field have likewise confirmed that PTFE is suitable and approved for use in food-contact applications:

- American Cancer Society: "While some PFAS can be used in making some non-stick cookware coatings, they are joined together in large molecules (polymerized) and are tightly bound to the cookware, so very little is capable of getting into food, according to the FDA."
- EFSA: "These studies concluded that fluoropolymer food contact materials were not likely to be a major source of PFASs" and further clarified that a high molecular weight fluoropolymer poses no risk if ingested.
- International Agency for Research on Cancer (IARC), created by the World Health Organization: IARC concluded that after ingestion of 25% PTFE for 90 days, PTFE had no toxicological impact.

[3] https://www.fda.gov/medical-devices/products-and-medical-procedures/pfas-medical-devices?utm_medium=email&utm_source=govdelivery
[4] https://www.icgm.fr/bruno-ameduri/
[5] https://scijournals.onlinelibrary.wiley.com/doi/10.1002/pi.70006?af=R
[6] https://www.bfr.bund.de/en/service/frequently-asked-questions/topic/selected-questions-and-answers-on-cookware-ovenware-and-frying-pans-with-a-non-stick-coating-made-of-ptfe/

IARC also specified that the material did not produce skin irritation and did not act as an allergen.

Claim That PTFE is a Problem With Cooking Heat:

- When overheated, PTFE releases fumes so toxic that manufacturers warn owners not to keep pet birds in the kitchen. These same fumes can sicken people.
- Independent science, including research cited by California's Department of Toxic Substances Control, shows that PFAS — including PTFE polymers used in cookware —are highly persistent, can persist and spread in the environment and can transform into other forms of PFAS that are well documented as being toxic.

Fact:

Most forms of cooking occur at temperatures below 450°F. Measurable and noticeable decomposition of PTFE does not occur until temperatures well above this threshold (750°F).[7] Moreover, the temperature of smoke points of common cooking oils is lower than the temperature at which PTFE degrades, at which point consumers would likely stop cooking to stop the oil from smoking. For powered products with cook surfaces, they contain temperature controls that prevent the cook surface from overheating.

Regarding pet birds, avian respiratory consequences do not equate to human health effects. Birds have unidirectional air flow through their lungs, unlike humans. Also, a simple example in which avian and human health effects differ is that avocados are toxic to most birds due to the presence of the chemical compound persin, but persin (and avocados) are non-toxic to humans. In fact, the authors of one study, specifically on pyrolysis and fry pans coated with Teflon and exposure to birds, states that "[n]either should [this] paper be cited as evidence that the proper use of cookware coated with Teflon finish presents undue hazards" and concludes that their results "support the FDA conclusion concerning the safety of cookware coated with Teflon finish in normal use."[8]

Claim: As pans wear down, the coating can flake or degrade into PFAS-laden microplastics, which researchers have detected in human urine and semen and which have been linked to health harms, including reduced sperm count.

Fact: PTFE is distinguished by its highly stable molecular structure: it is immobile, non-bioaccumulative, and unable to cross the gastrointestinal barrier or enter human cells. When ingested, PTFE passes through the body unchanged. These properties underpin its long-standing recognition as safe for use in food-contact applications, with no identified risks to human health.

Claim: California, 23 other states and the European Union regulate PFAS as a class, including polymers like PTFE.

Fact: The definition of PFAS includes an estimated 14,000 molecules and compounds that significantly vary in their physiochemical properties and should not be regulated in the same manner. For example, PTFE and PFOA have different chemical structures and properties. PTFE is a stable, inert, non-polar polymer mainly used for its chemical resistance and non-stick properties, while PFOA is a

[7] https://www.sciencedirect.com/science/article/abs/pii/S0165237007000083

[8] Griffith, F. D., Stephens, S. S., & Tayfun, F. O. (1973). Exposure of Japanese quail and parakeets to the pyrolysis products of fry pans coated with Teflon® and common cooking oils. *American Industrial Hygiene Association Journal 34*(4), 176-178.

bioaccumulative, amphiphilic surfactant with environmental mobility concerns and has been phased-out due to its potential health risks. (See the appendix for a thorough discuss of this.)

- A Department of Defense report states "A variety of broad molecular structure descriptors, without regard to the individual substance's toxicity profile and hazard characterization, are used to define the chemical class "PFAS." These structural definitions do not inform whether a substance is harmful but only communicate that the substances share common structural traits to varying degrees."
- The EPA's National PFAS Testing Strategy states "Most of the hundreds of PFAS currently in commerce have limited or no toxicity data."
- The Organisation for Economic Co-operation and Development (OECD) issued a report stating, "As PFAS are a chemical class with diverse molecular structures and physical, chemical and biological properties, it is highly recommended that such diversity be properly recognized and communicated in a clear, specific and descriptive manner. The term "PFASs" is a broad, general, non-specific term, which does not inform whether a compound is harmful or not, but only communicates that the compounds under this term share the same trait for having a fully fluorinated methyl or methylene carbon moiety."
- The Federal Government of Canada's PFAS risk management approach excludes fluoropolymers.
- This year (2025), the **Vermont** legislature delayed its effective date by 2.5 years to July 2028 so they could study the cookware prohibition.
- **Connecticut Governor Lamont** was quoted in the press raising concerns about the "unintended consequences" and "expressed misgivings about banning popular household products such as Teflon." And stated in the press – "Teflon non-stick pans could be unavailable in Connecticut . . . there may be challenges in the wide-spread manufacture and distribution of affordable cookware. . ." In his signing statement on June 5, 2024, the Governor wrote "I ask that the Legislature continue to discuss this issue in the next regular session and carefully consider whether there is a need to exempt PTFE." As a result, a bill was introduced to roll back the cookware exemption, but it was not enacted before the legislature adjourned.
- In **New York,** a bill to ban cookware in PFAS was not enacted. Last year, cookware was removed from a larger PFAS prohibition bill during the legislative process.
- **New Mexico Governor Lujan Grisham** signed a PFAS product ban bill, championed by her Secretary of the Environment, James Kenney, that specifically excludes all fluoropolymers from the PFAS ban bill.
- **Illinois Governor Pritzker** approved a bill on August 15 that is a PFAS product ban and specifically removed the cookware prohibition during the legislative process.
    - **Delaware and West Virginia** - In PFAS laws concerning drinking water that are already in place in both Delaware and West Virginia, the definition of PFAS in statute specifically excludes fluoropolymers like PTFE.
        - Delaware:§ 8092. Definitions.
          (4) "PFAS" means **non-polymeric** perfluoroalkyl and polyfluoroalkyl substances that are a group of man-made chemicals that contain at least 2 fully fluorinated carbon atoms, excluding gases and volatile liquids....
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Claim: PTFE production involves PFOA, PFOS and GenX (which are known to be PFAS chemicals of significant concern).
Fact: PFOA has been phased out since 2013. The cookware industry uses and always has used PTFE for the non-stick coating. PFOA was used by chemnicals manufacturers to produce PTFE. This production method by chemical producers has long since been discontinued. The PTFE used in non-stick cookware uses *one-half of one percent* of global "PFAS" production; banning cookware does little to solve concerns about practices of chemical producing companies.

Claim: Scratched up non-stick pans can flake off dangerous PTFE particles that can be ingested.
Fact: Fluoropolymer coatings are solid. They are also non-toxic, do not bioaccumulate, cannot bind to organic matter (any part of a human body), and are not water soluble—meaning they cannot enter drinking water. Even if a small number of fluoropolymer molecules were to be scratched off a pan and somehow ingested, they would pass through the human body and cause no harm.

Claim: One study found increased levels of PTFE in semen, and the people in the study had reduced sperm counts.
Fact: There was no control group presented in this study. The validity of its findings therefore are considered very weak in scientific vigor, according to most accepted science standards, especially in matters involving human health.

Claim: Just because chemicals are used in a medical setting doesn't mean they are safe (regarding the fact that pacemakers have been coated with fluoropolymers since 1957).
Fact: "Clinical studies of patients receiving permanently implanted PTFE cardiovascular medical devices demonstrate no chronic toxicity or carcinogenicity and no reproductive, developmental, or endocrine toxicity." (Henry, et al)

Claim: Alternatives exist, such as ceramics, stainless steel or cast iron.
Fact: Ceramic alternatives cost more than traditional non-stick cookware. The cost difference on average, based on publicly available retail information, is that an average set of mid-range ceramic cookware would cost $200-350 more than the current, traditional non-stick cookware. In addition to the retail price increase, the alternative (ceramics) has a shorter estimated average useful life (see more details on this aspect below), which would require consumers to purchase cookware more frequently.

The alternative to the traditional non-stick cookware material is known as "ceramic," but it is not fired clay material or traditional pottery. The term ceramic for non-stick cookware is used to describe a silica-based sol-gel coating that cures into a hard, glass-like layer. Modifiers (resins or sacrificial oils) are embedded in the silica matrix during curing to provide the "slipperiness." Overtime with heat and washing, these additives degrade, leaving mostly a hard silica network. Consumer studies comparing ceramic and fluoropolymer non-stick cookware reveal that ceramic-coated cookware wear out more quickly, requiring more frequent replacement. This reduced durability increases costs for consumers and leads to a greater overall negative environmental impact (Palermo, A., 2020).

The alternatives also require oils to reduce food sticking to the pan. Oil can be a very useful and tasty part of cooking foods. However, the American Heart Association (AHA) has a web page devoted to "healthy cooking oils" and a web page on "cooking to lower cholesterol." On these web pages it states the following:

- *Replacing "bad" fats (saturated and trans) with "good" fats (monounsaturated and polyunsaturated) is smart for your heart.*
- *Try cooking vegetables in a tiny bit of vegetable oil and add a little water during cooking, if needed.*

The usage of fat in cooking is prevalent in the US -- 60% of all recipes prepared by US cooks use fat. Olive oil is the most used (51%) and butter is the second highest use (32%) followed by Canola oil (15%). And most US cooks do home-made cooking for health reasons (63%) and half (52%) cook at home because it is healthier than eating out.

Appendix

Per- and poly-fluoroalkyl substances (PFAS) are a large group of compounds composed of fluorinated carbons. Importantly, the physical and chemical properties of the individual chemicals within this large group of compounds vary widely. Their use, how they behave in the environment, and their potential risk to human health vary significantly as well.

Non-stick cookware contains a specific subfamily of PFAS called fluoropolymers. The fluoropolymers used by our industry, primarily polytetrafluoroethylene (PTFE), do not have the same characteristics of non-polymeric PFAS of concern, which should be the focus of environmental and public health policy. Fluoropolymers are extremely large and stable compounds. Today, fluoropolymers used in cookware that come into contact with food are not a concern for human health or the environment for the following reasons:

- They have a decades-long history of safe and essential use, including in the healthcare industry where fluoropolymer coatings are used on medical implantation devices such as pacemakers and catheters.
- They are not water-soluble and potential exposure through drinking water is not a concern.
- Fluoropolymers like PTFE are highly stable and are not shown to degrade under normal conditions of use into their monomeric component chemicals.
- They are no longer manufactured with fluorosurfactants like perfluorooctanoic acid (PFOA), a primary PFAS of concern.

The indiscriminate definition of PFAS in many state's bills or recently signed laws, that include any fluorinated organic chemicals containing at least one fully fluorinated carbon atom, ignores the physicochemical characteristics of fluoropolymers that make the subfamily benign from health effects and environmental impact. Fluoropolymers should not be guilty by association without fair consideration of their chemical-specific properties that make them crucial in modern society, as detailed below.

Government Agencies Have Deemed PTFE Cookware Safe

Since the 1960's, federal regulations at the U.S. Food & Drug Administration (21 CFR 175.300) have authorized specific types of PFAS substances for use in food contact applications. The FDA has determined that PTFE cookware is safe to use due to the "highly polymerized coating bound to the surface of the cookware and studies showing negligible amounts of PFAS in this coating migrating to food, and that polymerized or large molecule PFAS are not absorbed by the human body when ingested." (updated 2024).

Similarly, the European Food Safety Authority (EFSA) has found that PTFE, due to its molecular size, will not likely be absorbed through the gastrointestinal barrier, and therefore concludes it does not present a health hazard (2016).

The properties that make some non-polymer PFAS a concern for human health and the environment include their water solubility and wide-spread environmental occurrence, bioaccumulation potential, and potential toxicity. Fluoropolymers do not have these properties, as detailed below.

- **Fluoropolymers Have No Measurable Bioaccumulation Potential**
  Available empirical data indicates that fluoropolymers such as PTFE, do not bioaccumulate. Bioaccumulation potential is generally assessed on empirical evidence (bioaccumulation factor > 2000) and/or prediction using the octanol-water coefficient (e.g., log Kow > 3). Fluoropolymers such as PTFE are insoluble in octanol and water (Henry et al., 2018). Therefore, the bioaccumulation potential of fluoropolymers cannot be predicted from a log Kow measurement. Measured biota tissue, water, and sediment concentrations indicate that there is no evidence of bioaccumulation in aquatic food webs (Bour et al., 2018; Sfriso et al., 2020).

- **Fluoropolymers Show No Evidence of Toxicity**
  Fluoropolymers such as PTFE have not been shown to be toxic to humans. A summary of available data examining the toxicity of PTFE on test animals is provided in Radulovic and Wojcinski (2014). Acute oral toxicity of PTFE in rats is low/negligible with reported LD50 greater than 11,280 mg/kg. Researchers also found no adverse effects in rats exposed to up to 25% PTFE in their diet for up to 90 days (Naftalovich et al., 2016; Radulovic & Wojcinski, 2014). Additionally, a four-week repeated dose study of PTFE fed to mice in their diet reported no effects at any dose level, and no PTFE was detected in the blood (Lee et al., 2022). The dose level fed to mice without any adverse effects would be equivalent to approximately 9,720 mg/kg for a 60 kg (~132 pounds) adult. Manufacturer material safety data sheets for PTFE indicate that dermal contact with PTFE does not cause skin irritation in humans. PTFE is not genotoxic, and the World Health Organization's International Agency for Research on Cancer concluded that organic polymeric materials (such as fluoropolymers) as a group, are not classifiable as to their carcinogenicity to humans (IARC, 1999).

- **Fluoropolymers Are Not Water Soluble**
  Fluoropolymers are not environmentally mobile. Fluoropolymers such as PTFE are not water soluble (Korzeniowski, et al. 2022) and even if released to the environment, are not likely to result in widespread environmental impacts. Any potential movement of fluoropolymers in the environment will likely occur via mechanical transport.

- **Fluoropolymer Cookware Show No Significant Emissions Upon Disposal**
  Fluoropolymers from food contact applications are unlikely to result in significant environmental emissions during the end-of-life phase. Recycling and treatment of PTFE-treated metal cookware offers the greatest assurance that the used cookware is most properly controlled in the end of life. Incineration at typical temperatures of municipal waste incinerators can result in full mineralization of the fluoropolymers, thereby preventing degradation into non-polymeric PFAS. Landfilling PTFE cookware prevents PFAS emissions due to the stability of the polymer and the absence of high enough temperatures in landfills to cause polymer degradation.

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