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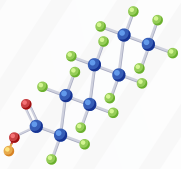
# Forever Chemicals

## Investigating the Persistence and Impact of Per- and Polyfluoroalkyl Substances in the Environment and Food



**Per- and polyfluoroalkyl substances (PFAS)** are a group of highly inert and heat-resistant human-made chemicals known for their water and grease-resistant properties

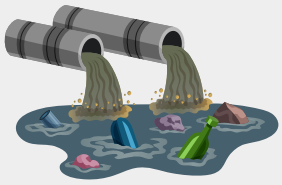
PFAS have been widely used in the manufacturing and food packaging industries since the 1940s

### They can be found in:

- Non-stick cookware manufacturing
- Food packaging
- Waterproof clothing
- Firefighting foam

Growing evidence suggests that exposure to these chemicals may have adverse short-term and long-term health effects

- Coughing, wheezing, and shortness of breath
- Serious health issues including hormone disruption, liver damage, kidney disease, immune system dysfunction, and an increased risk of certain types of cancers



**PFAS in water**

### PFAS can enter water through various pathways

- Industrial discharges
- Use of firefighting foam containing PFAS near water sources
- Disposal of PFAS-containing materials in water bodies

PFAS do not break down easily and can travel long distances, leading to their widespread presence in water bodies

They have been found to bioaccumulate in fish and other aquatic organisms, which can then be passed on to humans through consumption

### Efforts are being made to monitor and treat PFAS-contaminated water sources

- Testing for PFAS levels in drinking water supplies
- Implementing treatment technologies to reduce PFAS levels
- Research to better understand the transport and fate of PFAS in water systems

In communities where PFAS contamination is detected, mitigation and remediation measures are taken, including providing alternative drinking water sources and treating contaminated water supplies

*Poster*: A Comprehensive Workflow for the Analysis of PFAS in Wastewater per EPA Method 1633

*Poster*: Strategies for Ultimate Sensitivity of Per-and Polyfluoroalkyl Substances (PFAS) in Water

## PFAS in air

### PFAS can enter air through various pathways

- Volatilization of PFAS-containing products
- Burning of PFAS-containing materials
- Release of PFAS from industrial emissions

Once airborne, these chemicals can travel long distances and settle in both rural and urban areas

PFAS have been detected in indoor air, outdoor air, and even in remote regions such as the Arctic!

### ⚠ Who is at risk of exposure?

- Individuals working in industries that manufacture or use PFAS-containing products
- Individuals living near industrial sites where PFAS are produced or used
- Military bases where PFAS-containing firefighting foam is used

PFAS can persist in the environment for long periods, making it difficult to minimize exposure

### Steps to minimize exposure

- Avoid products that contain PFAS
- Use ventilation systems to filter the air indoors

*On-demand webinar*: Measuring PFAS in Air Using Thermal Desorption Gas Chromatography-Mass Spectrometry

## PFAS in soil

### PFAS can enter soil through various pathways

- Disposal of PFAS-containing materials in landfills
- Use of PFAS-containing fertilizers or biodegradable products
- Settling of airborne particles contaminated with PFAS onto soil surfaces

PFAS can persist for a long time in soil, given their high chemical stability and inertness

They can also bind to soil particles and organic matter, reducing their mobility

### Contamination in soil can occur:

- Near industrial sites where PFAS are produced or used
- Landfills where PFAS-containing products are disposed of
- Areas where firefighting foam containing PFAS has been used

### ⚠ Associated risks

- Leaching of PFAS-containing chemicals from the soil into groundwater can contaminate drinking water sources
- PFAS-contaminated soil and uptake by plants poses a risk to agriculture and plant health
- PFAS-contaminated soil poses a threat to biodiversity and increases the risk of bioaccumulation

Remediation techniques, such as soil washing or thermal treatment are being explored to reduce PFAS levels in contaminated soil

### Minimizing exposure to PFAS in soil can be achieved through:

- Proper management and disposal of PFAS-containing products
- Avoiding the use of PFAS-containing fertilizers or biodegradable products

*Article collection*: Solutions for the Analysis of PFAS Forever Chemicals

*On-demand webinar*: Simultaneous Measurement of over 50 PFAS Compounds in the Environment

# PFAS in food

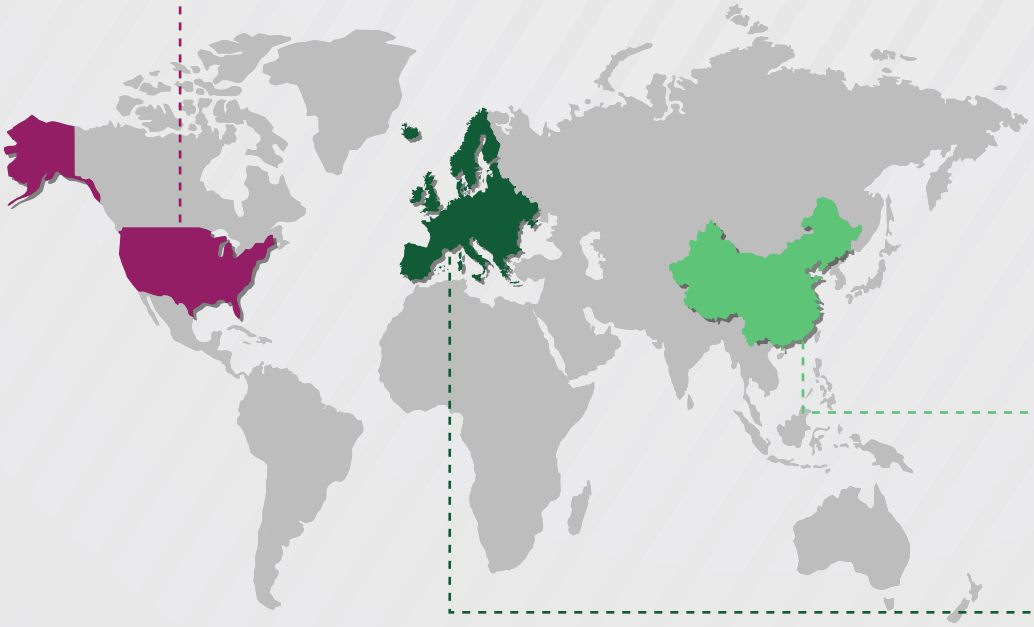
- Studies have shown that PFAS can bioaccumulate in the food chain
- The levels of PFAS can increase as they move up from plants to animals and eventually to humans

- PFAS can migrate from Food Contact Materials (FCMs) into the food itself, especially when exposed to high temperatures or foods rich in fat, acid, or salt

**Consumers can take steps to minimize their exposure to PFAS in food by:**

- Avoiding or reducing the use of PFAS-coated cookware
- Opting for alternatives such as stainless steel or cast iron as cookware material
- Choosing food products with minimal packaging
- Washing fruits and vegetables thoroughly

# Regulations



## The United States

- The EPA finalized a National Primary Drinking Water Regulation establishing legally enforceable levels for 6 PFAS in drinking water
- FDA and USDA released guidance methods for PFAS in various food matrices
- AOAC issued a standard for PFAS in food

## China

- China has standards for PFOS and PFOA in animal-derived food

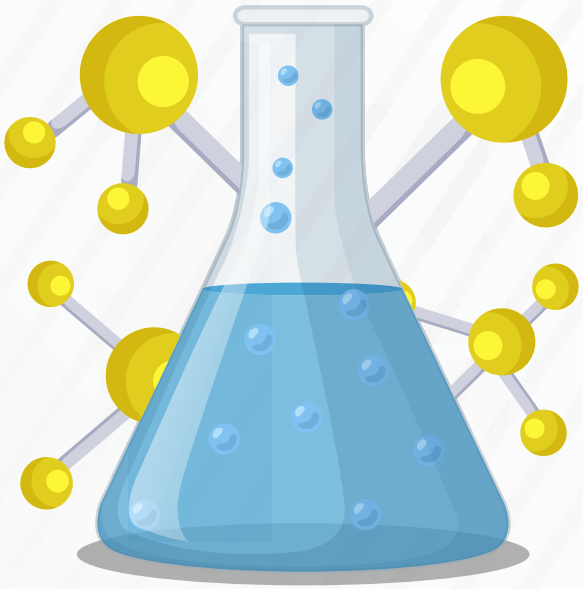
## Europe

- The EU set PFAS target levels for various food matrices and has limits for PFAS in plastic FCMs

This information is subject to change without notice

# Conclusions

- PFAS contamination is a pressing issue in various environmental media such as air, soil, water, and food
- Monitoring and regulation efforts are underway to address PFAS contamination and protect public health
- Minimizing exposure to PFAS requires proper waste management, supporting regulations that limit the use and release of PFAS, and utilizing PFAS-free alternatives
- Continued research, public awareness, and collaborative action are crucial to mitigate the presence and adverse effects of PFAS in the environment



**Discover Agilent's comprehensive solutions for testing PFAS in water, soil, and food**

## Sources


- Accurate Mass Library for PFAS Analysis in Environmental Samples Using High-Resolution GC/Q-TOF
- Analysis of Trace Perfluorinated and Polyfluorinated Organic Vapors in Air
- Environmental Testing
- Food Safety Applications in Mass Spectrometry
- Our Current Understanding of the Human Health and Environmental Risks of PFAS
- PFAS Testing in Food, Beverages & Food Packaging | Agilent



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