



Fighting Against Forever Chemicals

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■ SUCRALOSE AND OTHER ARTIFICIAL SWEETENERS

■ MICROPLASTICS

■ NANOMATERIALS

■ DRINKING WATER AND SWIMMING POOL DISINFECTION BYPRODUCTS

■ PER- AND POLYFLUOROALKYL SUBSTANCES

■ SUNSCREENS/UV FILTERS

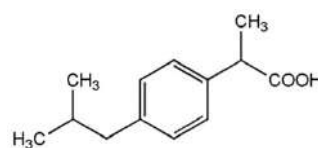
■ ALGAL TOXINS

■ PHARMACEUTICALS AND HORMONES

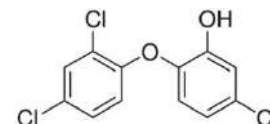
■ BROMINATED AND EMERGING FLAME RETARDANTS

Water Analysis: Emerging Contaminants and Current Issues

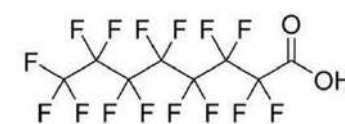
Susan D. Richardson^{*,†} and Susana Y. Kimura[‡]



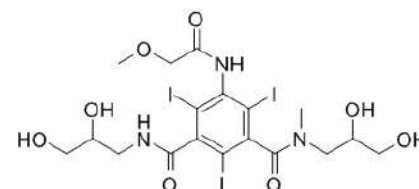
Ibuprofen



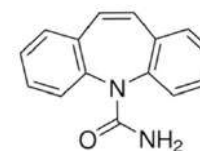
Triclosan



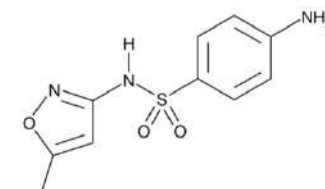
Perfluorooctanoic acid



Iopromide



Carbamazepine



Sulfamethoxazole

What are their problems?

Increasing Concentrations

Persistent

Toxic



: +80,000 Compounds are registered in the US

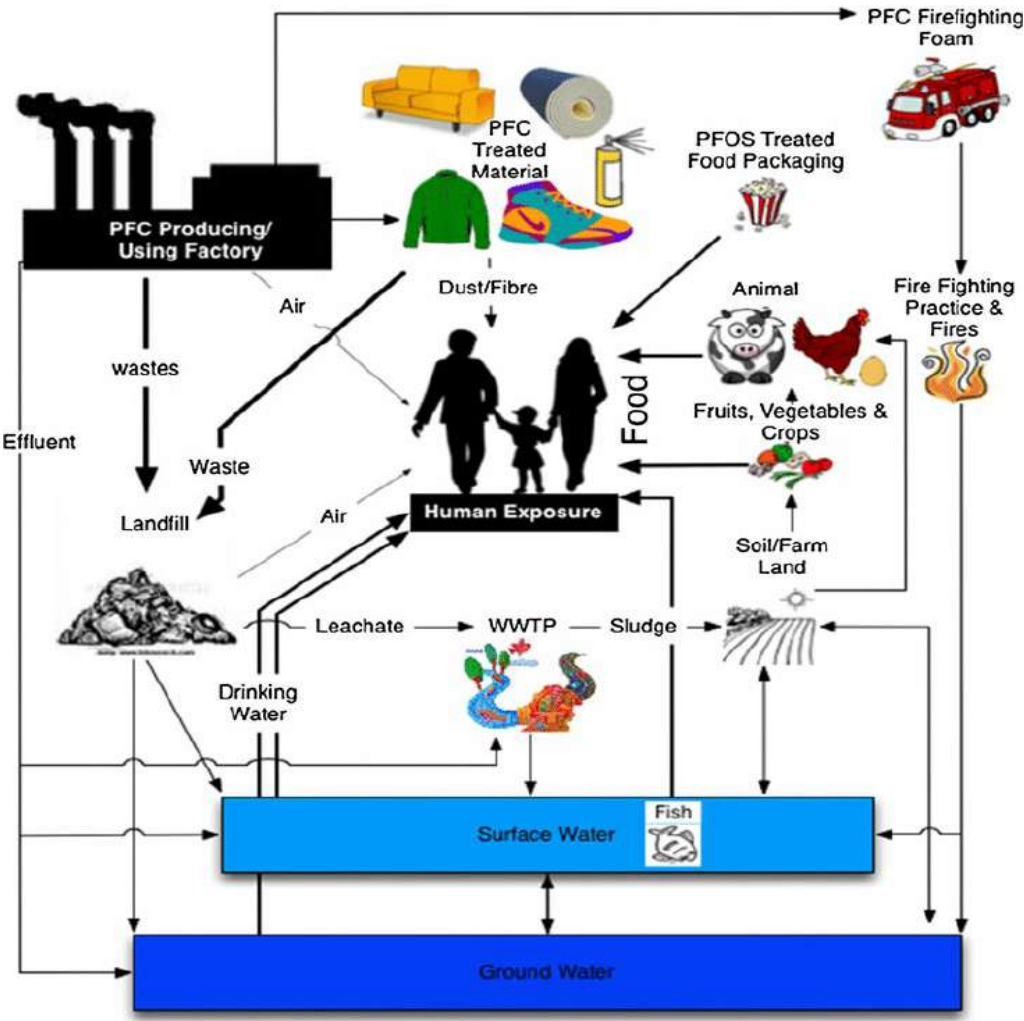


: +100,000 Compounds are registered in Europe

There is no **one-size-fits-all** solution

EPA Press Release on 02/19/2019; European Chemical Agency, 2020

Figure 1. PFAS cycle in the water environment. (Oliaei et al., 2012)

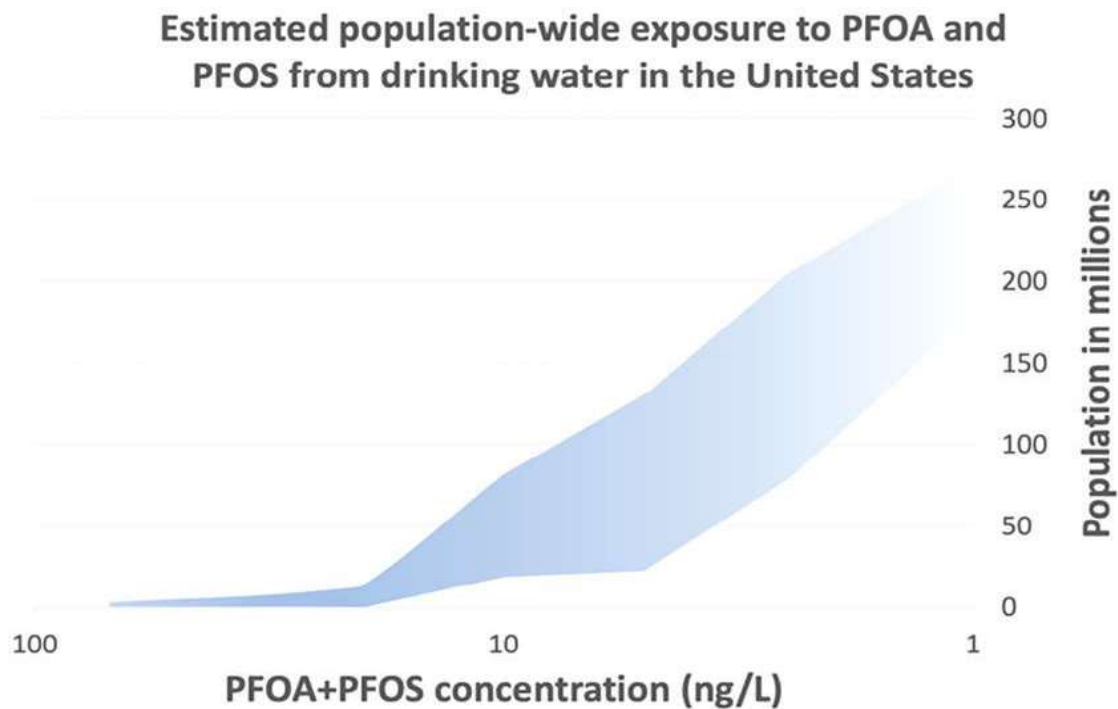


Per- and polyfluoroalkyl substances (PFAS) are a large group of environmentally persistent man-made chemicals used in industrial applications and commercial household products.

American Water Works Association

Population-Wide Exposure to Per- and Polyfluoroalkyl Substances from Drinking Water in the United States

David Q. Andrews* and Olga V. Naidenko



How to Remove PFAS from water?

Separation

Activated Carbon

Polymers

Foam Fractionation

Ion Exchange

RO/NF

Electro-coagulation

Incineration

Electro-chemical Oxidation

Activated Persulfate

Sonolysis

Photocatalysis

Plasma

Fungal / Enzymes

Merino et al., 2016; Ateia et al., 2019

PFAS Strategic Roadmap: EPA's Commitments to Action 2021–2024



States With Numerical PFAS Limits

Washington

- Banned in firefighting foam and food packaging
- Proposed drinking water standard

Vermont

- 20 PPT (PFAS)
- Drinking water health advisory for 5 PFAS

Massachusetts

- 70 PPT (PFAS)
- State guidance for concentrations of 5 PFAS in drinking water

New Jersey

- Set PFNA standard at 13 ppt
- Weighing proposed standards for: PFOA at 14 ppt, PFOS at 13 ppt

California

- 14 PPT (PFOA)
- 13 PPT (PFOS)
- Drinking water notification guidance

Colorado

- PFOA/PFAS listed as hazardous waste
- 70 PPT (Combined PFOA/PFOS)
- Groundwater quality standard for El Paso County only

Minnesota

- 35 PPT (PFOA)
- 27 PPT (PFOS)
- Health-based guidance values

Michigan

- 70 PPT (Combined PFOA/PFOS)
- State standard for concentrations in drinking water



Science
AAAS

REVIEW

CHEMICAL POLLUTION

Per- and polyfluoroalkyl substances in the environment

Marina G. Evich^{1†}, Mary J. B. Davis^{1†}, James P. McCord^{2†}, Brad Acrey¹, Jill A. Awkerman³,
Detlef R. U. Knappe^{4,5}, Andrew B. Lindstrom⁶, Thomas F. Speth⁷, Caroline Tebes-Stevens¹,
Mark J. Strynar², Zhanyun Wang⁸, Eric J. Weber¹, W. Matthew Henderson^{1*}, John W. Washington^{1,9*}

Evich et al., *Science* 375, eabg9065 (2022)