NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Looking Back, Moving Forward: Reducing Per- and Polyfluoroalkyl Substances (PFAS) Sources and Exposure

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2023 NH ENVIRONMENTAL HEALTH CONFERENCE
October 26, 2023 | GRAPPONE CONFERENCE CENTER

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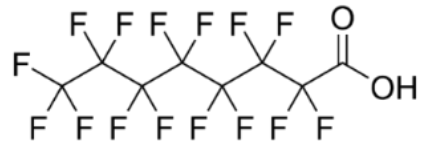
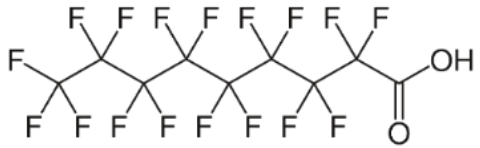
What the F (Fluorine) are PFAS?

- "**PFAS**" stands for **Perfluoroalkyl & Polyfluoroalkyl Substances**.
- > 4,000 compounds, formerly called Perfluorochemicals (PFCs).
- Different functional groups & carbon-chain lengths determine names.
- Short- (<5-6 carbons) versus Long-chain (>5-6 carbons)
- Currently no universal or international definition for "PFAS"

Perfluorocarboxylic Acids (PFCAs)

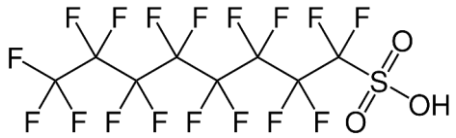


Perfluorooctanoic acid (PFOA)
8 carbon

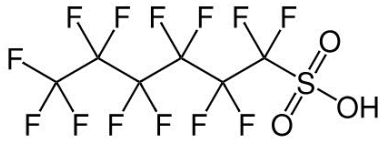


Perfluorononanoic acid (PFNA)
9 carbon

Perfluorosulfonic Acids (PFSAs)

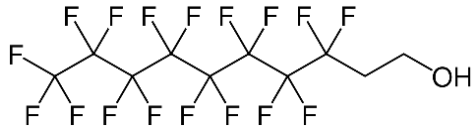


Perfluorooctane sulfonic acid (PFOS)
8 carbon

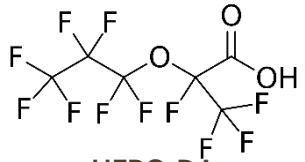


Perfluorohexane sulfonic acid (PFHxS)
6 carbon

"Other" PFAS and Precursors



Fluorotelomer alcohol (8:2)



HFPO-DA
(2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid)

How do we use PFAS?

Industrial Applications

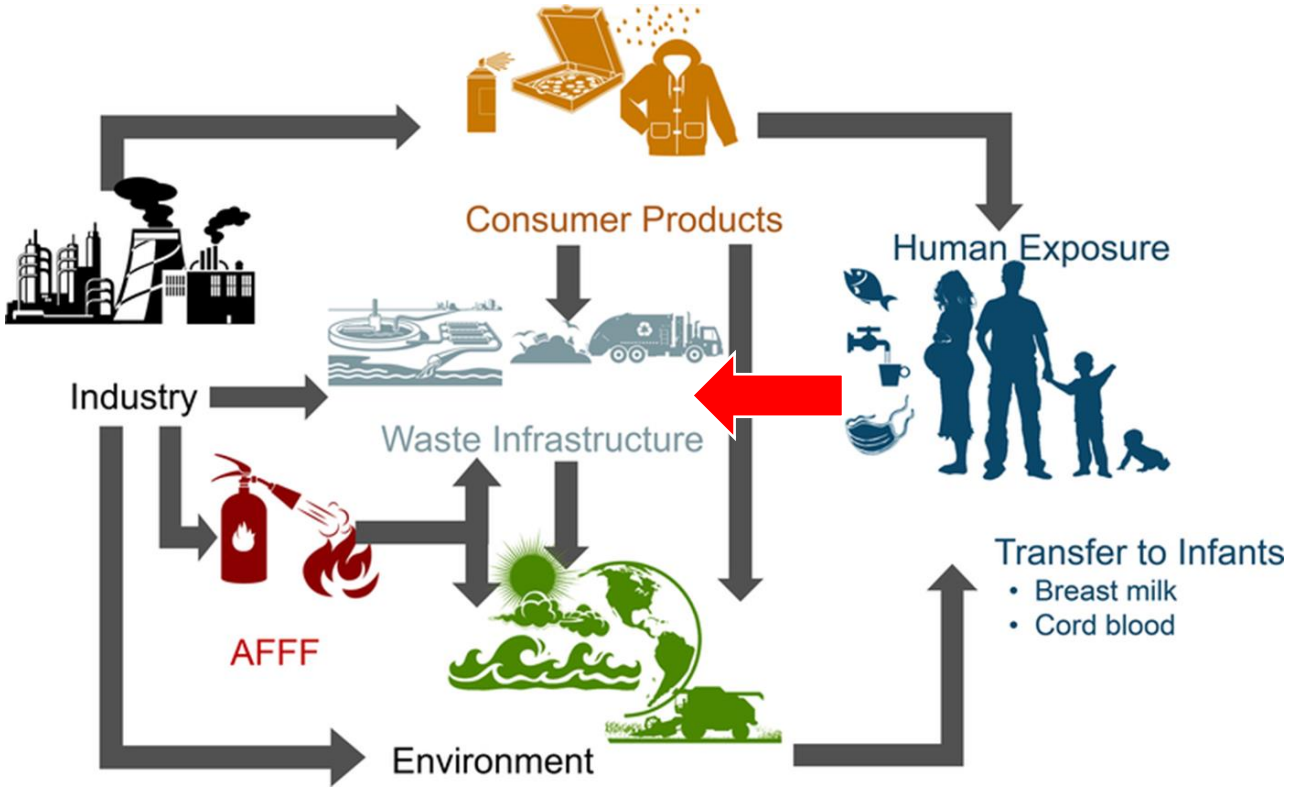
- Aqueous Film-Forming Foam (AFFF)
- Chemical production
- Metal plating
- Textiles, upholstery, apparel, carpets
- Paper and packaging
- Rubber and plastics
- Medical devices
- Insect baits
- Semiconductor manufacturing
- Photoimaging

Commercial Products

- Non-stick cookware
- Fast food containers
- Candy wrappers
- Microwave popcorn bags
- Personal care and cosmetic products
- Paints and varnishes
- Stain-resistant carpet and chemicals
- Water-resistant apparel
- Cleaning products
- Electronics
- Ski wax

Problematic Lifecycle of Per- and Polyfluoroalkyl Substances (PFAS)

- **Persistent** & **mobile** in the environment.
- **Bioaccumulative** in people and wildlife.
- Importantly, certain PFAS can **accumulate to toxic levels** in people.



Sunderland et al. J Expo Sci Environ Epidemiol. 2019 Mar;29(2):131-147.

How are you exposed to PFAS?

- **Primary route of exposure is ingestion** (e.g., drinking water or food).
- Certain PFAS **transfer from the placenta/breastmilk** to infants.
- **Inhaling/ingesting PFAS-containing dusts** may contribute to exposure.
- **Certain PFAS are less efficiently absorbed across the skin**.
- **Certain PFAS are bioaccumulative**, meaning they "build-up" in the body.




Health Risks Associated with Exposure to Per- and Polyfluoroalkyl Substances (PFAS)

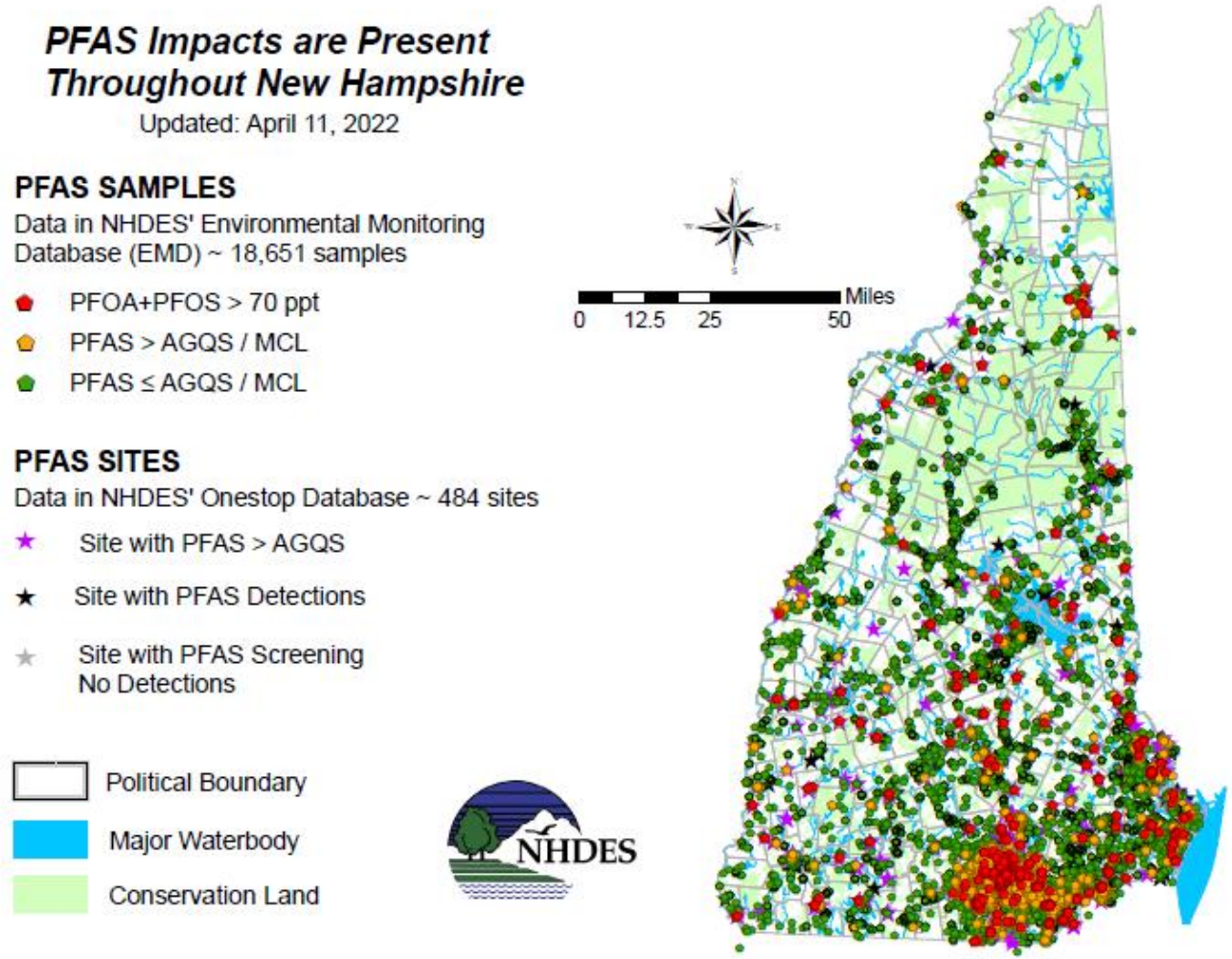
- ↑ cholesterol levels
- ↑ liver enzyme levels
- ↑↓ in infant birth weight
- ↑↓ immune system function
- ↑ risk of high blood pressure or pre-eclampsia in pregnant women
- ↑↓ in thyroid and/or reproductive hormones
- ↑ increased risks for kidney or testicular cancer

These and other health outcomes are currently studied nationwide by the **Agency for Toxic Substances and Disease Registry (ATSDR)**, as well as private and academic institutions.

This is a **constantly evolving area of scientific research**. For more information from ATSDR, follow this link: https://www.atsdr.cdc.gov/pfas/index.html

What does PFAS occurrence look like in New Hampshire?

- If you test for PFAS, you will find it.
- Major state investigations include:
  - **Pease Trade Port Wells**
  - **Merrimack & Southern NH**
  - **Several community sources**



NEW HAMPSHIRE FUNDING SOURCES FOR ADDRESSING PFAS

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- PFAS-FOCUSED CONSOLIDATION STUDY & ASSISTANCE GRANTS (*closed March 31st, 2023*)
  - **$800,000,** initially two different programs with different specifications
  - 1st-come-1st-served grants for schools, childcare centers, transient and non-transient public water systems (PWSs) reimbursement up to 26% project cost
- PFAS REMEDIATION LOAN & GRANT FUND (*on-going*)
  - **$87 M (combination of grants and loans)**
  - Loan with 10% forgiveness (if eligible) and contingent reimbursement
  - Potential grant for $1.5 M or 30% of project costs, whichever is higher
- PFAS PRIVATE WELL TESTING & REMOVAL REBATE PROGRAMS (*on-going*)
  - **Testing ($3.7 M)** and **treatment rebates ($17.5 M)**
  - Supports statewide testing of private wells for PFAS, as well as VOCs and other standard analytes for private wells (e.g., arsenic, manganese, uranium)
  - **Up to $5,000 for the installation of PFAS treatment** (point-of-use or point-of-entry) or **up to $10,000 for a service connection** to a public water system **per household**
- **PFAS Response Program's PFAS Response Fund** (ended June 2023)

  $6 M to investigate the occurrence, fate and transport, and environmental impacts of PFAS.

ON-GOING HUMAN HEALTH & ECOLOGICAL RISKS RELATED INVESTIGATIONS

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1. **Again, Private Well Testing across New Hampshire**
   - Residents can request testing or view our map of PFAS results.
2. **Estuary bivalves, finfish, surface water & sediments.**
   - Collaboration with Dartmouth College, Chen & Romano Labs (Webinar).
   - Literature review on PFAS in shellfish (Giffard et al., 2022).
   - Presented preliminary results at EPA Fish Forum 2023.
3. **Freshwater lakes investigation of bioaccumulation in invertebrates, fish, surface water & sediments.**
   - Sampled 14 lakes in 2020 and issued PFOS fish consumption advisories.
4. **Analysis of loon eggs from multiple lakes and years.**
   - Collaboration with Loon Preservation Committee.
5. **Testing of biosolids & training facility operators to conduct PFAS sampling.**
6. **Greenhouse & community garden study of PFAS into common vegetables.**
7. **AFFF Take Back Program**
   - Evolving program in progress.
8. **Development of PFAS Soil Standards**
   - In process and based on PFAS that have NH MCLs/AGQSs.

National Level Update on EPA's Regulation of PFAS in Drinking Water

- Proposed **National Drinking Water Limits** for PFAS
- Announced March 14, 2023, and EPA plans to finalize the regulation by the end of 2023.
- More information available at: https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas
- Rule is required to weight health risk assessment, projected costs, and projected benefits.
- EPA is considering listing PFOA and PFOS as CERCLA Listed Substances.

Compound	Proposed	
	MCLG	MCL
PFOA	Zero	4.0 ng/L (ppt)
PFOS	Zero	4.0 ng/L
PFNA	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index
PFHxS		
PFBS		
HFPO-DA*		

MCL – Maximum Contaminant Level
MCLG – Maximum Contaminant Level Goal
*commonly referred to as GenX Chemicals

Regulation Meets Investigation

Identifying additional **sources of PFAS** discharged to the environment through targeted PFAS sampling of **domestic** and **non-domestic** wastewater

Reduce sources to **protect resources**

Non-domestic wastewater

- Industrial and commercial, including wastewater derived from:
  - Marinas
  - Cleaning businesses
  - Schools during floor stripping/waxing
  - Auto detailers

Do these waste streams contain PFAS?

- Can be discharged to groundwater without a permit (registration only) unless it contains a **regulated contaminant**, e.g. PFOA, PFOS, PFNA, PFHxS…

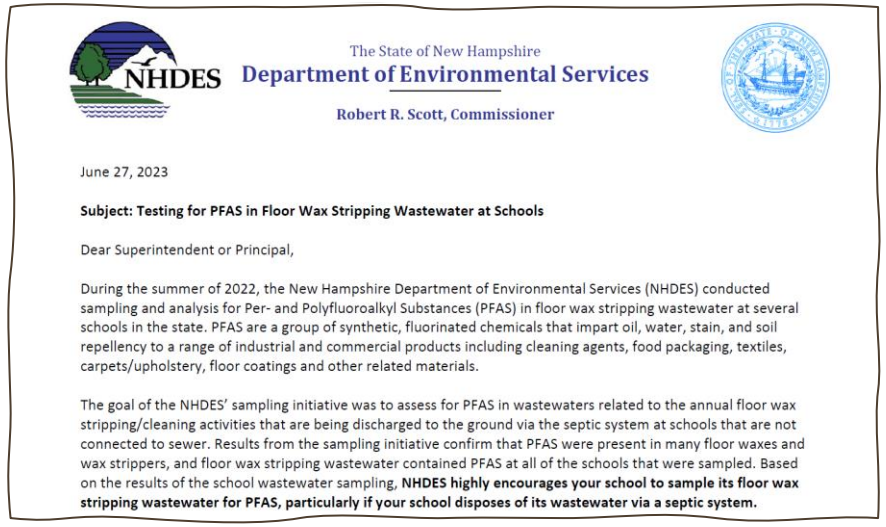
Non-domestic wastewater

- **Occurrence studies:** Are there PFAS in wastewater associated with:
  - Marinas? **YES** – up to **1,000 ng/L***
  - Cleaning businesses? **YES** – up to **28,000 ng/L***
  - Schools during floor stripping/waxing? **YES** – up to **229,000 ng/L***

*Sum of 70 PFAS

Non-domestic wastewater

- **What now?**
  - Site-specific response
    - Letters to businesses to cease discharges
    - Neighboring private well sampling
  - Outreach and best management practices
    - Presentations to trade groups, stakeholders, and state partners
    - Letters, fact sheets, reports



NHDES

The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

June 27, 2023

Subject: Testing for PFAS in Floor Wax Stripping Wastewater at Schools

Dear Superintendent or Principal,

During the summer of 2022, the New Hampshire Department of Environmental Services (NHDES) conducted sampling and analysis for Per- and Polyfluoroalkyl Substances (PFAS) in floor wax stripping wastewater at several schools in the state. PFAS are a group of synthetic, fluorinated chemicals that impart oil, water, stain, and soil repellency to a range of industrial and commercial products including cleaning agents, food packaging, textiles, carpets/upholstery, floor coatings and other related materials.

The goal of the NHDES' sampling initiative was to assess for PFAS in wastewaters related to the annual floor wax stripping/cleaning activities that are being discharged to the ground via the septic system at schools that are not connected to sewer. Results from the sampling initiative confirm that PFAS were present in many floor waxes and wax strippers, and floor wax stripping wastewater contained PFAS at all of the schools that were sampled. Based on the results of the school wastewater sampling, **NHDES highly encourages your school to sample its floor wax stripping wastewater for PFAS, particularly if your school disposes of its wastewater via a septic system.**

Domestic wastewater

- **Occurrence study:** Are there PFAS in domestic wastewater?
  - Monthly sampling of residential septic tank effluent

YES – about **300 ng/L***

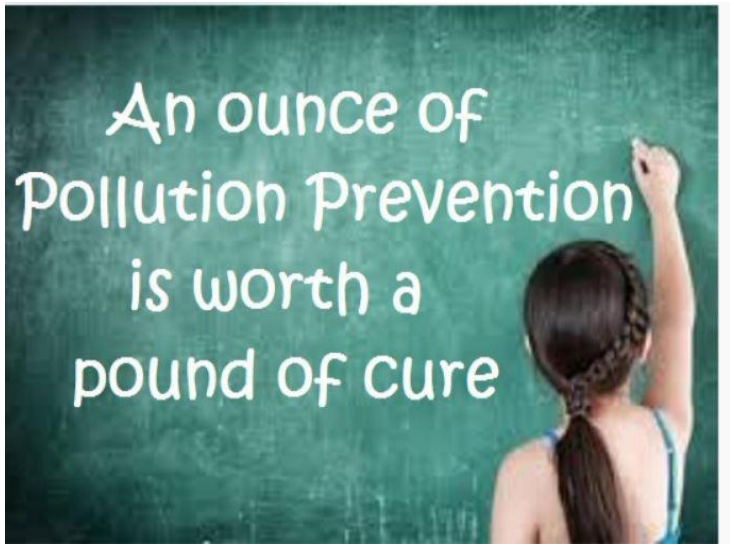
- **Source study:** From what?
  - Laundering
  - Carpet/floor cleaning
  - Showering
  - Dishwashing

PFAS in **consumer products** enter our **waste stream** and may impact **drinking water**.

Reduce sources to **protect resources**

*Sum of 70 PFAS

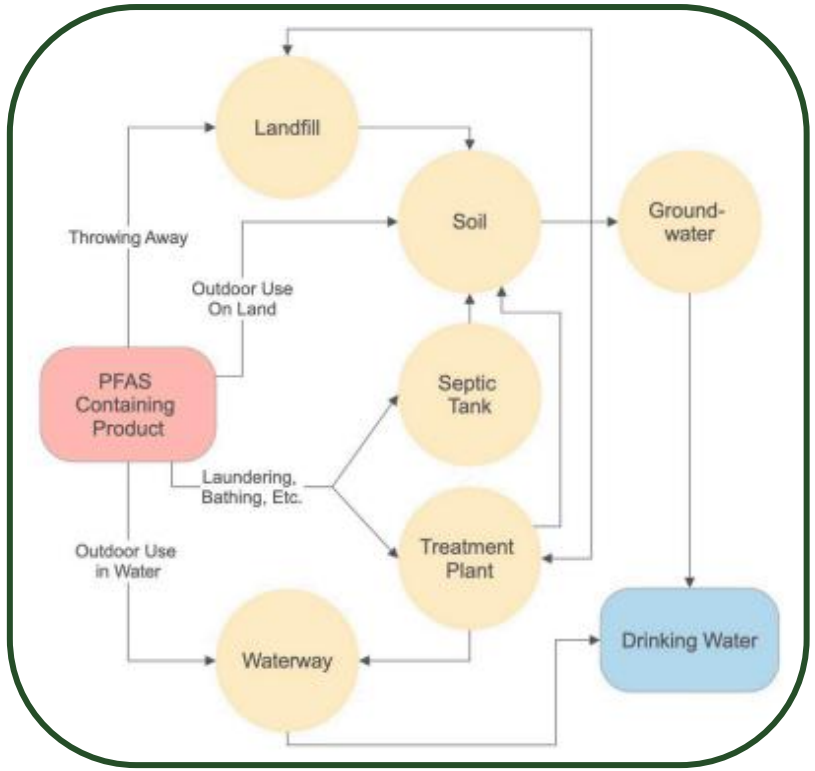
Regulation & Investigation Meet Prevention



Pollution prevention =

Reducing waste at the source

- Avoid purchasing & using products that contain PFAS
- Read labels
- Limit exposure



Regional partnerships & national collaboration

Regional partners

- Northeast Waste Management Officials Association (NEWMOA)

National collaboration

- Toxics in Packaging Clearinghouse
- Extended Producer Responsibility Workgroup
- Interstate Chemicals Clearinghouse (IC2)

Legislation

PFAS enacted bills for food/food packaging and consumer products

- CA, CO, CT, HI, ME, MD, MN, NY, OR, RI, TN, VT, WA

Fish consumption advisories

- AK, AL, IN, MA, ME (deer too), MI (deer too), NH, NJ, NY, NC, OR, WA, and WI (deer too)

Proposed food/food packaging & consumer products legislation

- GA, IL, IO, MA, MI, NV, NH, NJ, NC, OK, PA and VA

NH Legislation

- HB 242 and HB465
- New PFAS bills on the horizon for 2024

PFAS in consumer products factsheets

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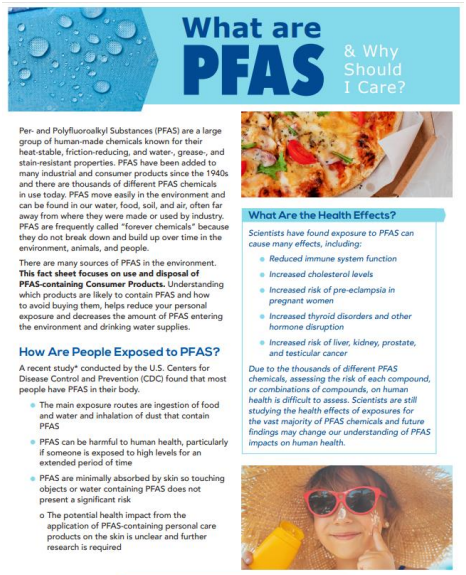

What are PFAS & Why Should I Care?

Per- and Polyfluoroalkyl Substances (PFAS) are a large group of human-made chemicals known for their heat-stable, friction-reducing, and water-, grease-, and stain-resistant properties. PFAS have been added to many industrial and consumer products since the 1940s and there are thousands of different PFAS chemicals in use today. PFAS move easily in the environment and can be found in our water, food, soil, and air, often far away from where they were made or used by industry. PFAS are frequently called "forever chemicals" because they do not break down and build up over time in the environment, animals, and people.

There are many sources of PFAS in the environment. **This fact sheet focuses on use and disposal of PFAS-containing Consumer Products.** Understanding which products are likely to contain PFAS and how to avoid buying them, helps reduce your personal exposure and decreases the amount of PFAS entering the environment and drinking water supplies.

How Are People Exposed to PFAS?

A recent study* conducted by the U.S. Centers for Disease Control and Prevention (CDC) found that most people have PFAS in their body.

- The main exposure routes are ingestion of food and water and inhalation of dust that contain PFAS
- PFAS can be harmful to human health, particularly if someone is exposed to high levels for an extended period of time
- PFAS are minimally absorbed by skin so touching objects or water containing PFAS does not present a significant risk
  - The potential health impact from the application of PFAS-containing personal care products on the skin is unclear and further research is required

What Are the Health Effects?

Scientists have found exposure to PFAS can cause many effects, including:

- *Reduced immune system function*
- *Increased cholesterol levels*
- *Increased risk of pre-eclampsia in pregnant women*
- *Increased thyroid disorders and other hormone disruption*
- *Increased risk of liver, kidney, prostate, and testicular cancer*

Due to the thousands of different PFAS chemicals, assessing the risk of each compound, or combinations of compounds, on human health is difficult to assess. Scientists are still studying the health effects of exposures for the vast majority of PFAS chemicals and future findings may change our understanding of PFAS impacts on human health.

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PFAS in Personal Care Products: What You Need to Know

Per- and Polyfluoroalkyl Substances (PFAS) are a group of human-made chemicals that build up over time in the environment, animals, and humans; and can be harmful to health. Understanding which products are likely to contain PFAS and how to avoid buying them helps reduce your personal exposure and decreases the amount of PFAS entering the environment and drinking water supplies. For an introduction to PFAS, read the *"What are PFAS & Why Should I Care?"** factsheet.

Many personal care products include PFAS to achieve durability and water-resistant and oil-resistant qualities. Products that might contain PFAS include:

- Cosmetics
- Sunscreen & body lotion
- Dental floss
- Nail polish
- Hair care products
- Cleansers & shaving cream

Rules-of-Thumb

In general, items making the following claims are likely to contain PFAS:

- *Waterproof, water-resistant, or water-repellent*
- *Long-lasting cosmetics such as mascara, nail polish, and sunscreen*

Personal care products can lead to direct consumption of PFAS when used in and around the mouth. When PFAS-containing cosmetics and other personal care products are used, they get washed down the drain and pollute the discharged water. If you have a septic system, the wastewater is discharged below ground and can contaminate the groundwater. If your home is on a sewer system, the treatment plant cannot remove PFAS and it enters the environment.

PFAS from personal care products primarily contribute to human exposure from:

- Drinking water that is impacted from washing off personal care products
- Direct consumption of PFAS by placing products in and near your mouth

Ingestion Concerns

Scientists are concerned about PFAS in personal care products because we don't know the health effects of long-term, low-level PFAS exposure. Floss, lipstick, and other products used around the mouth can lead to direct consumption of PFAS.

Many types of cosmetics contain PFAS including foundation, mascara, lip products, concealer, and eye products. PFAS are added to increase durability and smoothness, achieve waterproof qualities, and change product texture. A study* conducted by the Harvard School of Public Health found 75% of waterproof mascaras, 66% of foundations and liquid lipsticks and more than 50% of eye and lip products they tested each contained at least four PFAS.

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PFAS in Foodware & Packaging: What You Need to Know

Per- and Polyfluoroalkyl Substances (PFAS) are a group of human-made chemicals that build up over time in the environment, animals, and humans; and can be harmful to health. Understanding which products are likely to contain PFAS and how to avoid buying them helps reduce your personal exposure and decreases the amount of PFAS entering the environment and drinking water supplies. For an introduction to PFAS, read the *"What are PFAS & Why Should I Care?"** factsheet.

Many foodware and food packaging are coated in PFAS to achieve water-, oil-, and grease-resistance which increases durability. Examples of packaging and foodware that may contain PFAS include:

- Nonstick cookware
- Paper plates & disposable tableware
- Coated food packaging
- Bakery bags
- Pizza boxes & takeaway containers

When PFAS-containing foodware and packaging are used, some PFAS can transfer to food leading to direct consumption of PFAS. Note that higher temperatures and longer durations of time can lead to greater amounts of PFAS in food. Once disposable products are thrown away, they enter a landfill and provide a pathway for PFAS to enter the environment. When PFAS-containing paper and fiber products are composted, PFAS remains in the compost and enters the environment when it is used.

Rules-of-Thumb

In general, items making the following claims are likely to contain PFAS:

- *Oil-, grease-, and water-resistant*
- *Nonstick cookware that cannot be heated above a certain temperature*

Foodware and packaging primarily contribute to human exposure to PFAS from:

- Direct consumption of food containing PFAS from foodware and packaging
- Drinking water that is impacted from disposing or composting of PFAS containing food packaging

Be Skeptical of PFAS-Free Claims

Some nonstick cookware have packaging labels that may lead to confusion. Some companies state that their products are PFC-free, PFOA-free and/or PFOS-free, but such statements only cover some specific PFAS chemicals. They are likely still using different PFAS in their products such as "PTFE" (polytetrafluoroethylene).

Certain cookware materials can leach compounds when heated to high temperatures or exposed to acidic foods. Although PFOA (perfluorooctanoic acid) was banned in cookware in 2014, other PFAS including "PTFE" (polytetrafluoroethylene) are still used to produce nonstick cookware today. When scratched or used at high temperatures, nonstick coatings can break down and release PFAS into food, wash water, and the air.

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PFAS in Outdoor Recreation: What You Need to Know

Per- and Polyfluoroalkyl Substances (PFAS) are a group of human-made chemicals that build up over time in the environment, animals, and humans; and can be harmful to health. Understanding which products are likely to contain PFAS and how to avoid buying them helps reduce your personal exposure and decreases the amount of PFAS entering the environment and drinking water supplies. For an introduction to PFAS, read the *"What are PFAS & Why Should I Care?"** factsheet.

Many outdoor products are treated with PFAS to achieve durability and water-resistant qualities. Examples of outdoor recreation products that might contain PFAS include:

- Bike lubricants
- Boots, shoes & care products
- Rain gear & other outdoor clothing
- Ski, boat, surfboard & hockey wax
- Tents
- Backpacks
- Waterproofing & protectant sprays

When PFAS-containing outdoor products are used, some of the PFAS rub or wash off into the environment, polluting the soil and water. When gear is washed at home, some of the PFAS come out into the wash water discharged from your home. If you have a septic system, the wastewater is discharged below ground where it can contaminate the groundwater. If your home is on a sewer system, the treatment plant cannot remove PFAS and it enters the environment.

Rules-of-Thumb

Items that have a waterproof, water-resistant, or water-repellent claim are likely to contain PFAS.

Outdoor products primarily contribute to human exposure to PFAS from:

- Drinking water that is impacted from runoff and deposition containing PFAS
- Eating game and fish from PFAS polluted environments
- Breathing in and consuming dusts from textiles, waxes, and protectant sprays

Warning!

PFAS can be found in fish and game. Please check local 'Do Not Eat' advisories before consumption and recognize that bodies of water, fish, and game in many locations have not yet been tested.

Durable Water Repellant (DWR) and waterproofing treatments create a barrier by using PFAS chemicals. Many waterproofing sprays used on apparel and shoes can lead to inhalation of PFAS – a direct exposure. Rain, sweat, and dirt can cause the PFAS coating to come off and enter the environment.

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PFAS in Clothing & Other Textiles: What You Need to Know

Per- and Polyfluoroalkyl Substances (PFAS) are a group of human-made chemicals that build up over time in the environment, animals, and humans; and can be harmful to health. Understanding which products are likely to contain PFAS and how to avoid buying them helps reduce your personal exposure and decreases the amount of PFAS entering the environment and drinking water supplies. For an introduction to PFAS, read the *"What are PFAS & Why Should I Care?"** factsheet.

Many fabrics are treated with PFAS to achieve durability and water- and stain-resistant qualities. Any textiles meant to cover or protect surfaces may contain PFAS. Examples of textiles that might contain PFAS include:

- Clothing
- Bedding
- Tablecloths
- Window & shower curtains
- Upholstered furniture
- Rugs & carpeting

Rules-of-Thumb

In general, items making the following claims are likely to contain PFAS:

- *Waterproof, water-resistant, or water-repellent*
- *Stain-proof, stain-resistant, or stain release*

When PFAS-containing clothing and other textiles are washed, some of the PFAS comes out into the wash water that is discharged from your home. If you have a septic system, the wastewater is discharged below ground where it can contaminate the groundwater. If your home is on a sewer system, the treatment plant cannot remove PFAS and it enters the environment.

Textiles primarily contribute to human exposure to PFAS from:

- Drinking water that is impacted from washing PFAS-containing textiles
- Breathing in and consuming dusts from textiles, including furniture, carpets, and rugs treated with PFAS for stain-resistance

A study* of PFAS in school uniforms found that all of the water-resistant and stain-proof uniforms tested were positive for PFAS. Another study* of children's clothing found that 79% of the clothing items tested – and 100% that were labeled as water- or stain-resistant – contained PFAS.

Additional Concerns for Children

- *PFAS in carpets and other textiles can attach to dust particles. Dusts are an increased hazard for children because they are closer to the carpet surface and they put items that might have dust on them into their mouths*
- *Clothing or bedding may lead to higher exposure for children if they put PFAS-treated textiles in their mouths*

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Key take-aways

Foodware & Packaging:

* Avoid waterproof/resistant products
* Use stainless steel pots/pans
* Use wax-coated products

Personal Care Products:

* Use reusable/washable items
* Use uncoated natural fiber floss
* Use products w/ natural ingredients

Clothing & Textiles:

* Buy untreated, natural fabrics
* Consider wood or tile instead of carpet
* Spot clean PFAS textiles

Outdoor Recreation:

* Limit washing outdoor wear
* Use bees wax or petroleum-paraffin
* Check water and fish advisories

* **Use PFAS-Free products*****


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Questions?