Starting Soon: PFAS Roundtable Session 1

- Download slides for today
  - CLU-IN training page at https://www.clu-in.org/conf/itrc/PFAS-Round under "Download Training Materials"
- Using Adobe Connect
  - Related Links (on right) - Select name of link, then click "Browse To"
  - Full Screen button near top of page

Future PFAS Roundtables

Session 2 (October 6)
- Physical & Chemical Properties
- Site Characterization
- Fate & Transport

Session 3 (Date TBD)
- Treatment Technologies
- AFFF

Session 4 (Date TBD)
- Human and Eco Health Effects
- Risk Assessment and Regulations
- Risk Communication
- Stakeholder Perspectives

Advancing Environmental Solutions

ITRC PFAS Team

ROUNDTABLE WEBINAR SESSION 1:

Naming Conventions
Sampling and Analytical Approaches
History and Sources

Sponsored by: Interstate Technology and Regulatory Council (www.itrcweb.org)
Hosted by: US EPA Clean Up Information Network (www.cluin.org)

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PFAS Roundtable Webinar

- Introduction
- ITRC PFAS Resources
  - PFAS document, fact sheets and videos published April 2020
  - Find everything online at: https://pfas-1.itrcweb.org
- Roundtable format
- Topic highlights
- Roundtable Q&A

Thank you for joining this ITRC PFAS Roundtable!

ITRC – Shaping the Future of Regulatory Acceptance

- Host Organization
- Network - All 50 states, PR, DC
- Federal Partners
  - DOE
  - DOD
  - EPA
- ITRC Industry Affiliates Program
- Academia
- Community Stakeholders

- Disclaimer
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ITRC PFAS Resources

https://pfas-1.itrcweb.org

- Final web document posted April 15, 2020
- Seven Fact Sheet updates (April 2020) posted
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Housekeeping

- Session time is 2¼ hours
- All participants are on mute
- This event is being recorded
- Download slides for today at the CLU-IN training page https://www.clu-in.org/conf/itrc/PFAS-Round Under "Download Training Materials"
- If you have technical difficulties, please use the Q&A Pod to request technical support
- Need confirmation of your participation today?
  - Fill out the online feedback form and check box for confirmation email and certificate

Roundtable Format

- The moderator will read questions for a response by the panelist(s)
- Questions are selected from those submitted with:
  - the participant registration
  - prior PFAS training classes
  - PFAS team members
- Today you may submit additional questions by typing in the Q&A pod
- It will not be possible to answer all questions during the live webinar
- A Q&A digest with references to the PFAS Technical and Regulatory Guidance Document will be made available

Session 1 - Topics

- Naming Conventions
- Sampling and Analysis
- History and Sources

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Naming Conventions – PFAS Family Tree

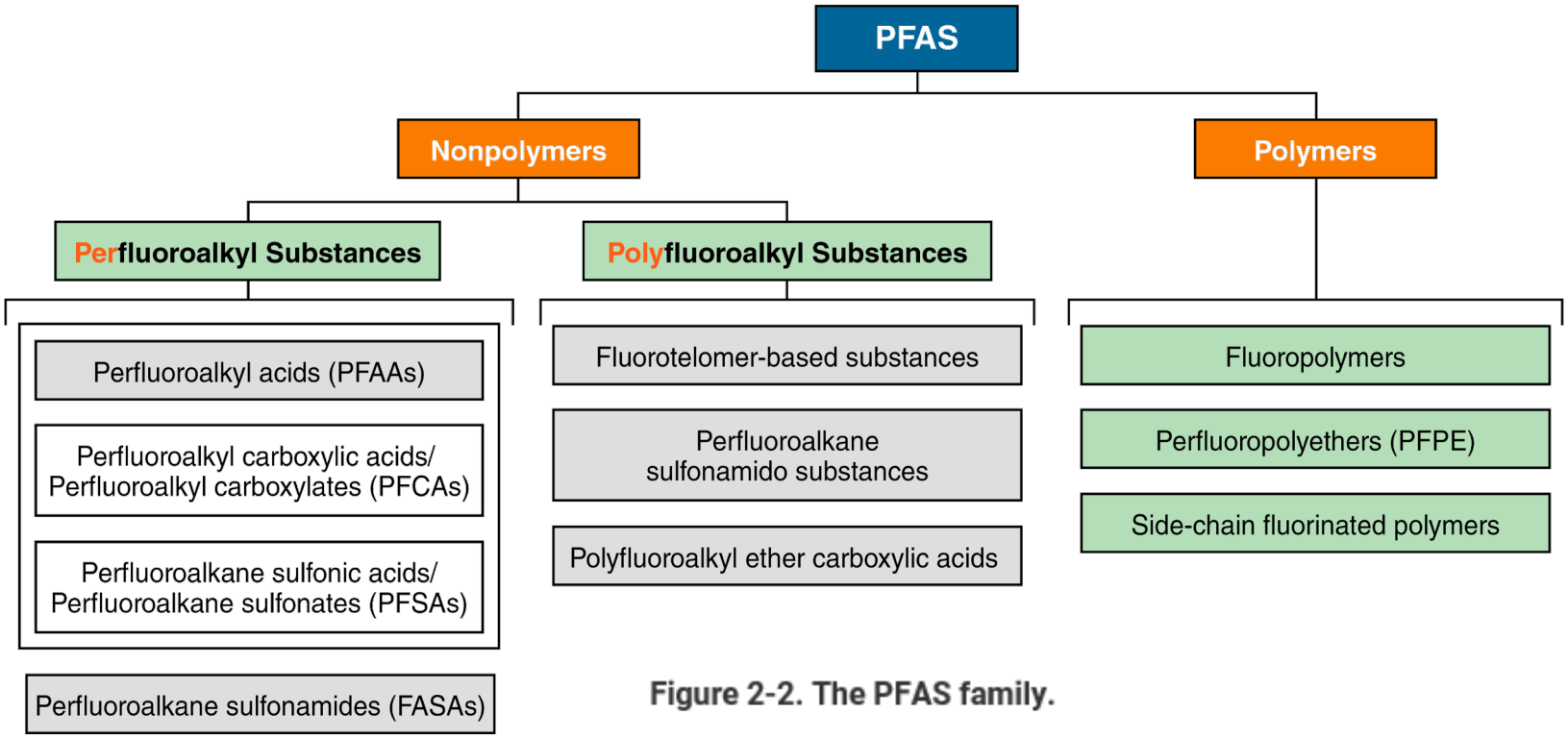

Figure 2-2. The PFAS family.

Sampling and Analysis

- Increased risk of contamination requires PFAS-specific sampling procedures and field QC
- Communication with laboratory is key to plan a sampling event
- A number of PFAS analytical methods are published
  - Significant differences between methods need to be evaluated to select a method to achieve project DQOs
  - Additional methods are currently in development
- Less-standardized analytical techniques can be helpful qualitative or screening tools

History and Sources

- Commercial-scale production since the 1950s, and continues today
- Number of PFAS and their uses has expanded with time
  - More than 4,700 PFAS are/may have been on the global market
  - Specific applications for all PFAS are not well documented in the public realm
  - Alternate PFAS chemistries are emerging as certain PFAS are phased out of production and/or use
- Different PFAS products and sources differ in their relative environmental significance
  - Production and use in manufacturing
  - Use in industrial products, including fluorine-containing firefighting foams
  - Use in consumer products
  - Related waste management activities

Session 1 Panelists

- Jeff Wenzel, Missouri Dept of Health and Senior Services
- Elizabeth Denly, TRC Environmental
- Robert Buck, Chemours
- Janice Willey, Navy
- Charles Neslund, Eurofins

Jeff Wenzel, MO Dept of Health

Kate Emma Schlosser,
NH Dept of Env. Services

Elizabeth Denly, TRC Environmental

Janice Willey, US Navy

Charles Neslund, Eurofins

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Naming Conventions

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Polymer vs Non-Polymer PFAS

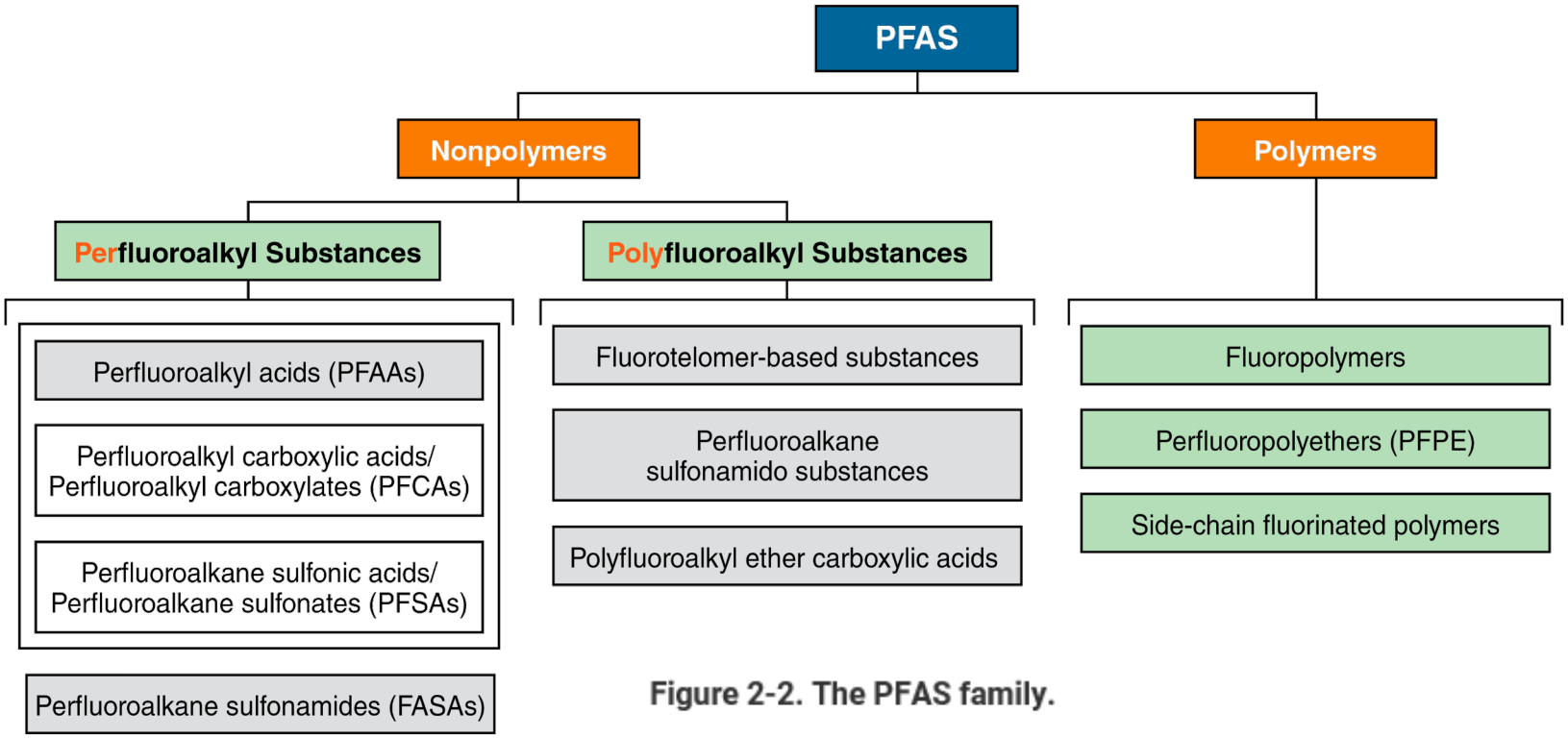


Figure 2-2. The PFAS family.

PFAS Definition

- Buck et al. (2011) provides a definition of PFAS
  - all PFAS contain within their molecular structure a straight or branching (but not cyclic) chain of carbon atoms in which one or more of the carbon atoms have fluorine atoms attached at all bonding sites not occupied by another carbon atom and the fluorinated part of the molecule (the "perfluoroalkyl moiety") can be expressed as C_nF_{2n+1}-.

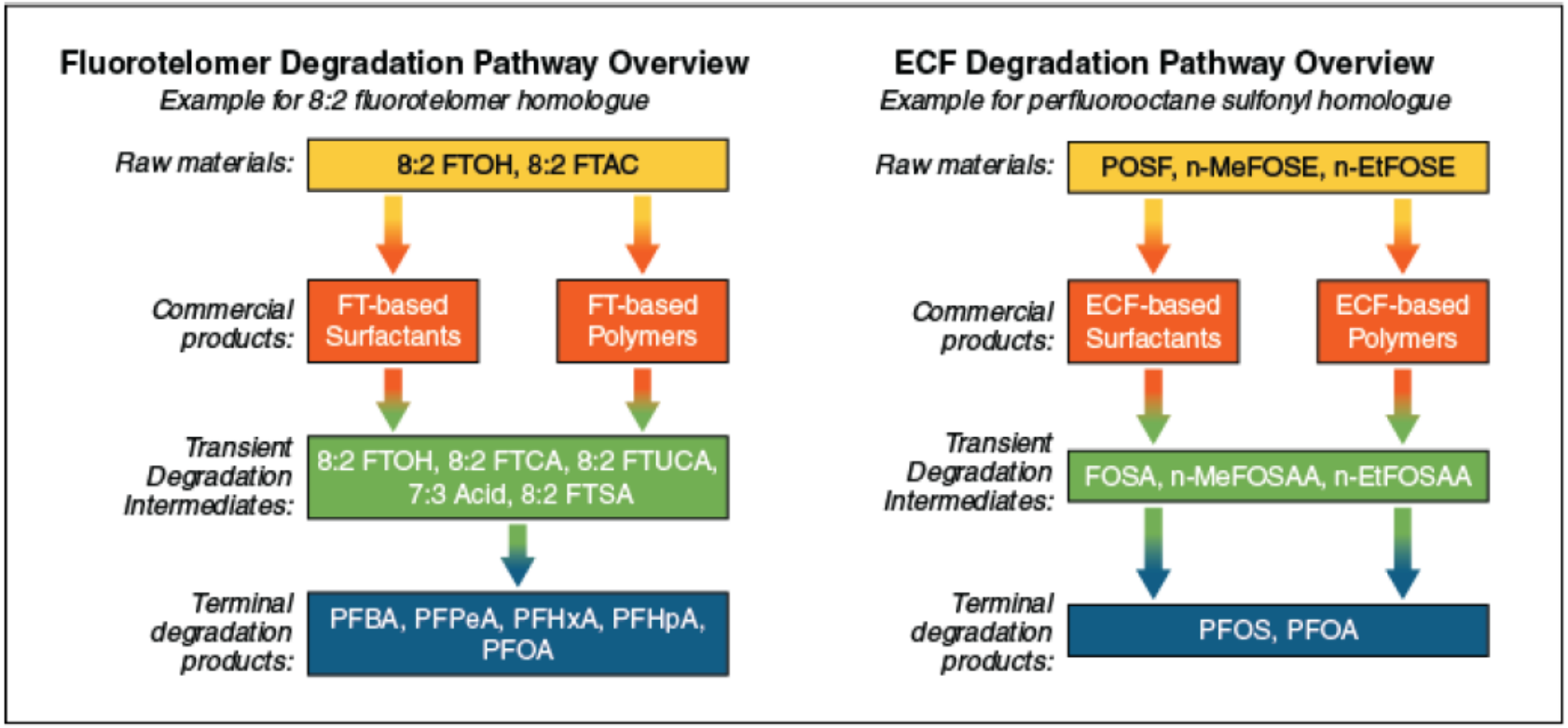


Figure 2-8. Example polyfluoroalkyl substance degradation pathways.

(Note that degradation of POSF-based products is for the terrestrial environment, but transformation into lower homologues of PFCAs and PFSAs in the atmosphere is also possible.)

Sampling and Analysis

https://pfas-1.itrcweb.org

Lab Methods

- Quantitative
  - Instrument type – LC/MS/MS
  - USEPA Methods 537.1 and 533
- Qualitative
  - Total oxidizable precursor (TOP) Assay
  - Particle-induced gamma-ray emission (PIGE) spectroscopy
  - Adsorbable organic fluorine (AOF) or Combustion Ion Chromatography
  - quadrupole time-of-flight (qTOF) MS/MS

Sampling Materials

Due to the ubiquitous nature of PFAS, sampling crews must review all materials and sampling protocols to avoid contamination and possible **adsorption** issues. Materials that may come into contact with samples and therefore could potentially introduce bias include, but are not limited to:

- Teflon, polytetrafluoroethylene (PTFE)
- waterproof coatings containing PFAS
- fluorinated ethylene-propylene (FEP)
- ethylene tetrafluoroethylene (ETFE)
- low-density polyethylene (LDPE)
- polyvinylidene fluoride (PVDF)
- pipe thread compounds and tape.

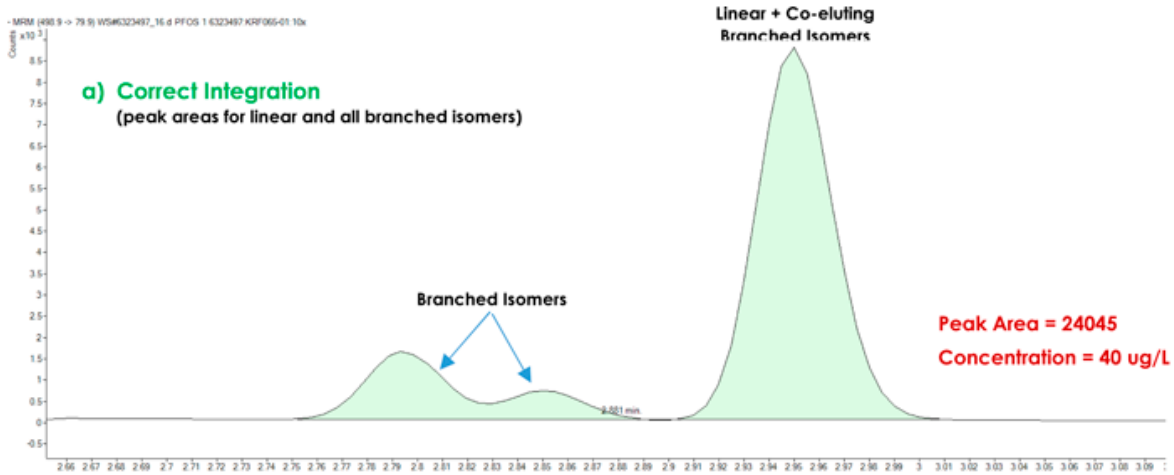
Section 11.1.2 Equipment and Supplies

Table 11-1. Typical field QC samples

QC Sample	Description	Minimum Suggested Frequency
Field reagent blank (field blank)	Laboratory-provided reagent water containing preservative (if required) that, in the field, is poured into an empty sample bottle	One per day per matrix per sample set
Source water blank	Water collected from potable water source that is utilized during the sampling processes (such as decontamination and drilling processes)	One per site, preferably prior to sampling event (if possible) and at least once during sampling event
Equipment rinse blank (decontamination blank)	Final rinse of nondedicated sampling equipment with laboratory-verified PFAS-free water	One per day per type of sampling equipment used for each day of sampling and each matrix sampled
Field duplicate	Two samples collected at the same time and location under identical circumstances	One per day per matrix up to 20 samples
Performance evaluation (PE) sample	A sample containing known concentrations of project analytes	One per project per matrix

Linear and Branched Isomers

Figure 2-13. Linear and one branched isomer of PFOS.



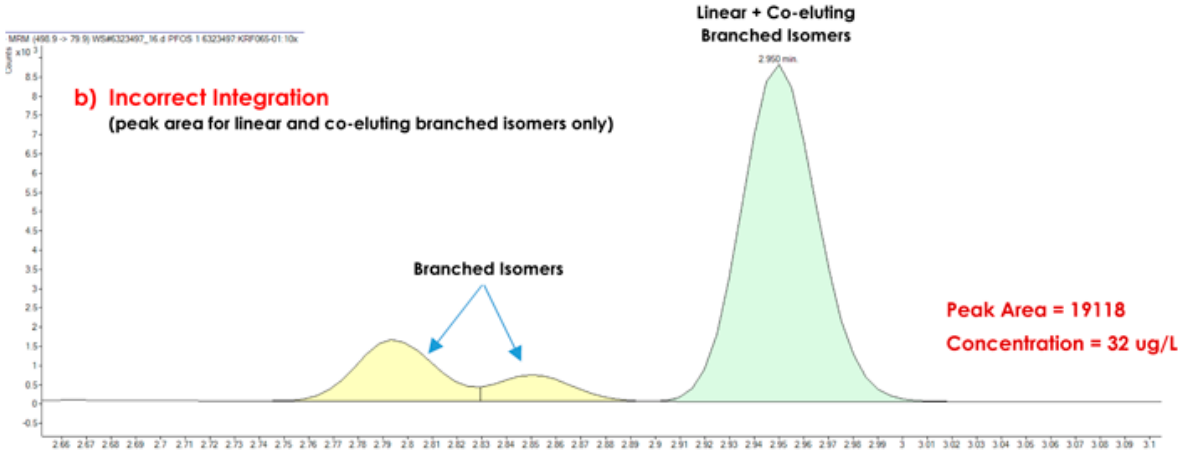


Figure 11-3. LC/MS/MS data illustrating a) complete integration of linear and branched PFOS, and b) partial integration of PFOS. Discrepancies in concentration will depend on the fraction of branched versus linear PFAS present, but in the current example PFOS concentrations in b) were 20% lower than in a).

Source: Bureau Veritas Laboratories, Mississauga, Ontario, Canada. Used with permission.

Some target PFAS, such as PFHxS and PFOS, are not available as acids, but rather as their corresponding potassium or sodium salts (K+ or Na+). These salts are acceptable starting materials for the stock standards provided the measured mass is corrected for the salt content according to the equation below. Note that this correction will result in a minimal change to the mass of the acid but still must be performed for consistency and comparability with other results to ensure the data user that the correct form of PFAS is represented in the final concentration.

$mass_{acid}$ = measured $mass_{salt}$ * (MW_{acid}/MW_{salt})

MW_{acid} = molecular weight of PFAA

MW_{salt} = molecular weight of purchased salt

CAS numbers will change depending on if the acid or anion form of the PFAS is reported (Table 11-6).

Table 11-6. Example of CAS number differences between acid and anion

Chemical	CAS Number
PFOA: Perfluorooctanoate (anion)	45285-51-6
PFOA: Perfluorooctanoic acid (acid)	335-67-1

Session 1

History and Sources

https://pfas-1.itrcweb.org

A Brief History of PFAS Discovery and Manufacture

- Two major production processes
  - Electrochemical fluorination (ECF)
    - ~70% linear and 30% branched PFAS
  - Fluorotelomerization
    - Primarily even numbered, linear PFAS

PFAS[1]	Development Time Period							
	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
PTFE	Invented	Non-Stick Coatings			Waterproof Fabrics			
PFOS		Initial Production	Stain & Water Resistant Products	Firefighting foam				U.S. Reduction of PFOS, PFOA, PFNA (and other select PFAS[2])
PFOA		Initial Production		Protective Coatings				
PFNA					Initial Production	Architectural Resins		
Fluoro-telomers					Initial Production	Firefighting Foams		Predominant form of firefighting foam
Dominant Process[3]		Electrochemical Fluorination (ECF)						Fluoro-telomerization (shorter chain ECF)
Pre-Invention of Chemistry /			Initial Chemical Synthesis / Production			Commercial Products Introduced and Used		

ITRC. 2020. *PFAS Technical and Regulatory Guidance Document and Fact Sheets* PFAS-1. Washington, D.C.. https://pfas-1.itrcweb.org/.

Source: ITRC "History and Use" PFAS fact sheet

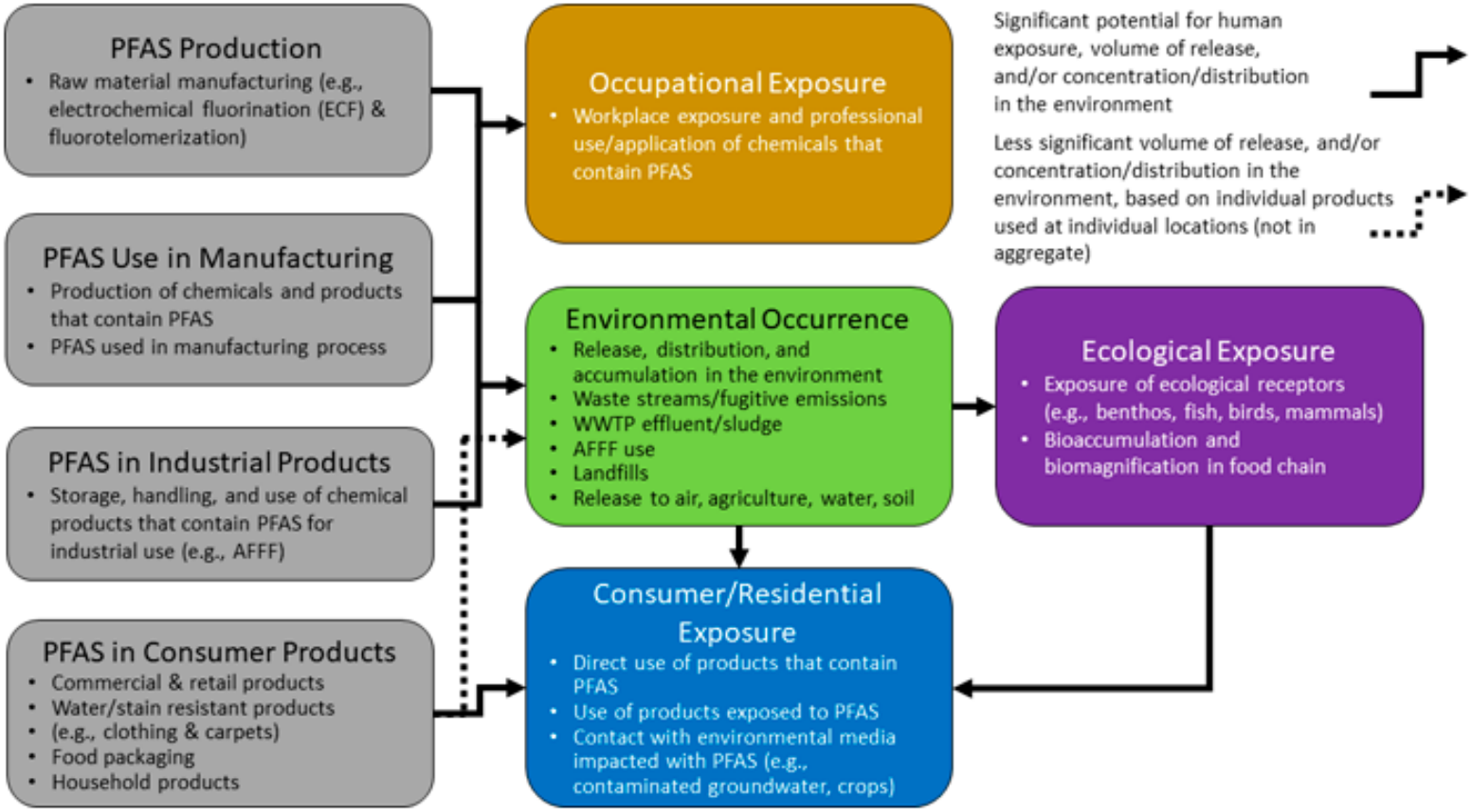


Figure 2-1. Generalized PFAS uses and relative exposure and environmental impact potential from PFAS life cycle.

Major Uses of PFAS

- Industrial (primary production and secondary manufacturing)
  - Surfactants, resins, molds, plastics
  - Plating and etching (esp., chrome)
  - Coatings (textiles, leather, paper, carpets)
- Aqueous Film Forming Foam (AFFF) to fight fires involving flammable, combustible liquids and gases; petroleum greases, tars, oils and gasoline; and solvents and alcohols
  - Military installations and civil airports
  - Petroleum refineries and chemical facilities
  - Fire fighting training and response areas

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Technical and Regulatory Guidance Document

- https://pfas-1.itrcweb.org

What are PFAS?	How do they behave in the environment?	Why are we concerned about PFAS?	How do we evaluate PFAS in the environment?	How do we remediate PFAS?	What are the major concerns and how do we share what we know?
• Introduction • History and use • Naming conventions • PFAS releases to the environment • Firefighting foams	• Physical and chemical properties • Fate and transport processes • Media-specific occurrence	• Human and ecological health effects • Site risk assessment • Regulations, guidance and advisories	• Site Characterization • Sampling and Analytical Methods • Case Studies	• Treatment technologies • Case studies	• Stakeholder perspectives • Risk communication

Document Information: External files

- Twelve external files for additional detailed information
  - PFAS Water and Soil Values – updated regularly, includes US and some International values
  - Basis for PFOA and PFOS drinking water values in the US
  - Physical and chemical properties
  - Bioconcentration factors tables
  - Ecological toxicity data summary
  - Analytical methods
  - Treatment technologies
  - Water treatment case studies operation summaries
  - Toxicological effects in mammalian species for some PFAS
  - Social Factors vision board

PFAS Team Schedule

- Team has been extended to December 2021
  - Continue work on updating technical information and regulatory approaches in this rapidly evolving subject
  - New work on small updates and reference additions
  - New content
- New surface water quality overview section – in progress
- Fact sheet reconciling and republishing – 4-page versions

Thank you for attending!

- Email further questions to training@itrcweb.org
- Feedback Form: https://clu-in.org/conf/itrc/PFAS-Round/feedback.cfm
- *Please use the Feedback Form to ask questions for the future ITRC PFAS Roundtable Sessions*

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