RESINTECH® INC.

INNOVATIONS IN ION EXCHANGE

PFAS: Review and Update 2023

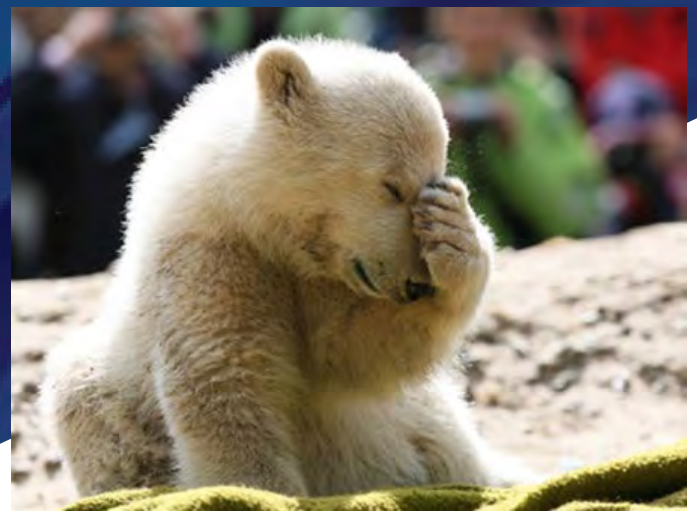
Larry Gottlieb
ResinTech, Inc.

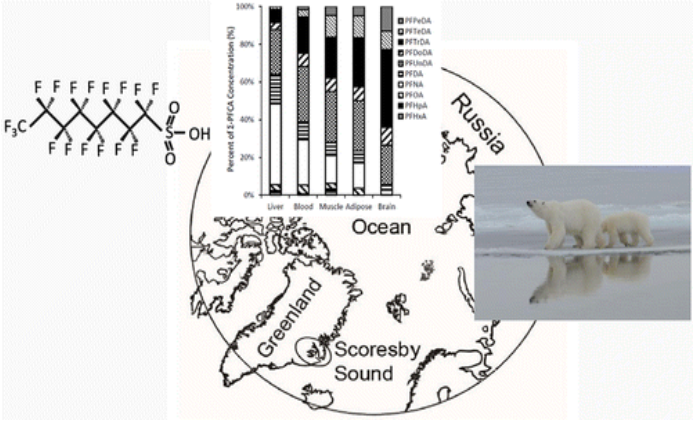
Larry Gottlieb, ResinTech, Inc

- 30 years at ResinTech® manufacturing ion exchange resins, activated carbons and selective adsorbents.
- New Filter and Resin Manufacturing in Camden, NJ USA
- Member of the Board of Governors at the Water Quality Association
- Hosted the PFAS Symposium

What do **airplanes**, **polar bears**, and **frying pans** have in common?

Measurable amounts of perfluoroalkyl substances (PFAS)





Tissue-Specific Concentrations and Patterns of Perfluoroalkyl Carboxylates and Sulfonates in East Greenland Polar Bears. Alana K. Greaves, Robert J. Letcher, Christian Sonne, Rune Dietz, and Erik W. Born. *Environmental Science & Technology* **2012** 46 (21), 11575-11583
DOI: 10.1021/es303400f

Agenda

Every Good Meeting has an Agenda –
Whose gonna take the minutes….

- History of PFAS
- Chemistry and The Environment
- PFAS in the News and Toxicology
- Regulations
- Treatment Technologies
- Q&A

WQP Interview – Kerry Stackpole, PMI CEO

- Kerry Stackpole, CEO & executive director of Plumbing Manufacturers International provides an update on PMI, goals for 2024 and upcoming legislative priorities.

- Lead and Copper Rule
  - Fixtures / Behind The Wall

- Water Conservations- Low Flow Toilets

- PFAS
  - Is it contained in your products –
    - Not clear where exactly PFAS is when it comes to plumbing products.
    - Where is this stuff?
  - It Flows through your products

- ReThink Water Initiative – Clean Safe Water for future generations
  - How do we remove PFAS from our Environment

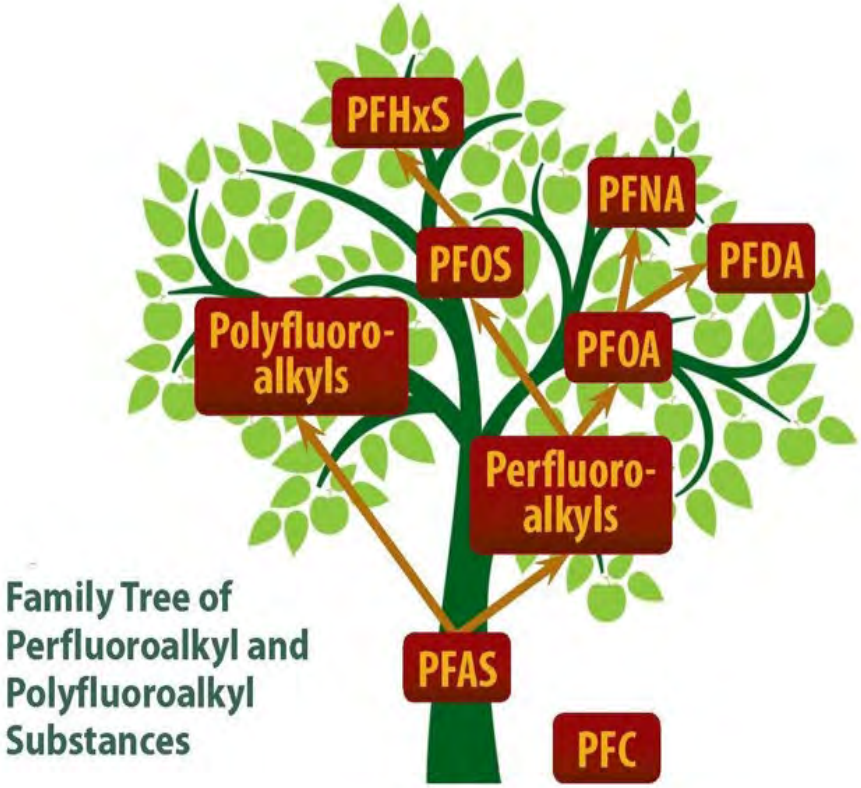
The History of PFAS

Worldwide Contamination in only 60 years!

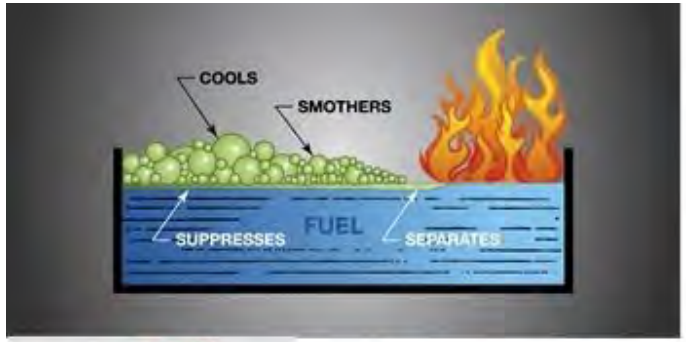
- Forever Chemicals
- In Use Since the 1940's
- Thousands of Compounds
- 97% of Americans have it in their blood
- 2000 - 3M stopped making PFOS and PFOA
- It is everywhere

Great idea at the time…

In the 1940's



Todays Commercial Uses of PFAS



SCOTCHGARD™
PROTECTOR
3M

For Leather

GUARANTEED TO KEEP YOU DRY
GORE-TEX

SIMONIZ®

STAINMASTER Live well

Teflon
Industrial Coatings
DUPONT

1940-2000: This is the best stuff EVER!

- Fire Fighting Foams
- Non-Stick Food Wrappers
- We have Spread this around the Planet, and it is showing up everywhere
  - Water
  - Clothing
  - Carpet
  - Toilet Paper
  - ‘All Natural’ OJ

2000-2006: Phasing out the "Long Chain"

3M Voluntarily phased out legacy PFAS

- PFOA
- PFOS
- PFHxS

EPA's PFOA Stewardship Program

- Encouraged 8 Manufacturers to eliminate PFOA & similar eight chain in products and emissions

McDonalds phases out fluorotelomers in food packaging

- Imported compounds still allowed for CPG manufacturing
- PFAS containing fire foam stored required for emergencies

2000 → 2006

2002: Introducing the “Short-Chain”

No one knows what this will do you to you, but hey

- Used as alternatives to PFOA & PFOS
- Emerging Contaminants
  - Gen X
  - 6:2 FTOH
    - Toxicity testing for this compound was based upon a breakdown chemical PFHxS
    - Used in plastic food packaging
    - Used in textiles

Today - PFAS will remain in the environment until we remove it

- Some PFAS have a longer half life than plutonium
- The only places that haven't found PFAS are ones that haven't looked for it
- Processes that address PFAS must remove it from the environment
  - Concentration, IX, GAC, RO
  - Encapsulation IX, GAC
  - Disposal / Destruction

Chemistry and The Environment

PFC's are the "perfect" molecule creating the "Perfect Storm"

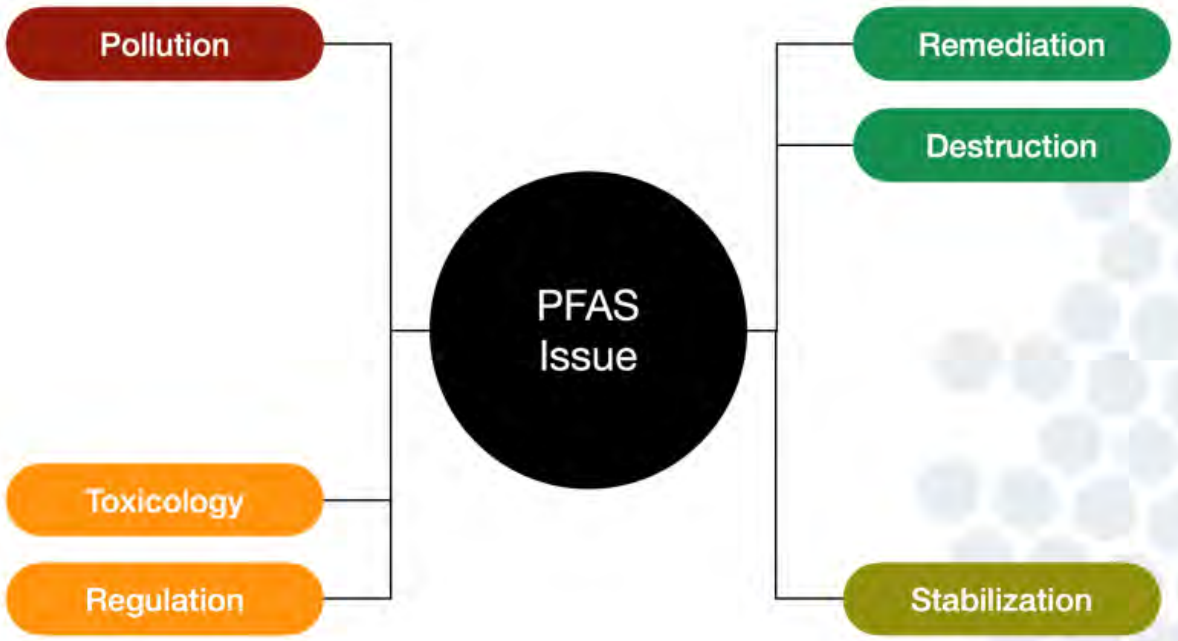
-They don't burn readily

-They are Bio-Accumulating
-don't degrade (easily)

-They Are Everywhere

-Create Adverse Health Effects

-Solutions/Experiences/Regulations Are All Evolving



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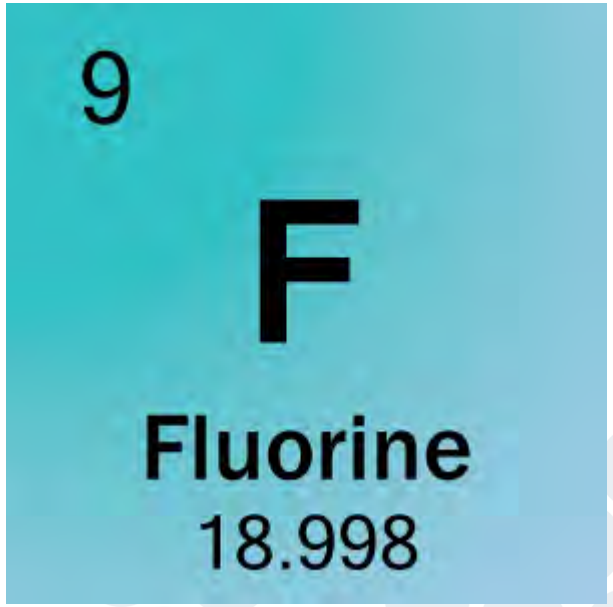
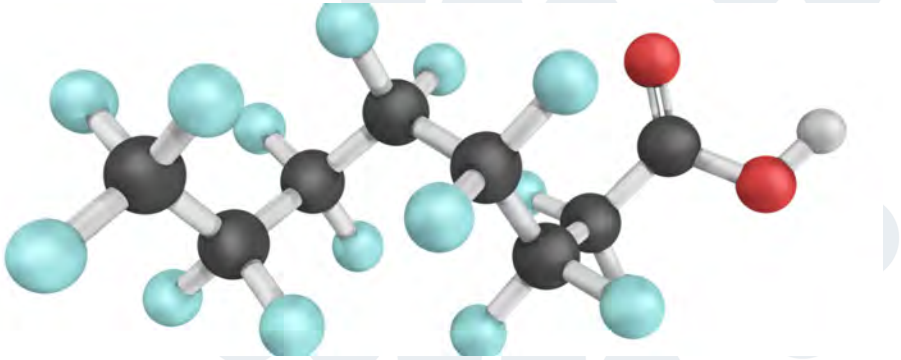
What are PFAS?

-Compound's that contain FLUORINE

- Per (Every)- fully fluorinated carbon chains
- Poly (Many)- partially fluorinated
  - PFOA – specific PFAS
    - Perfluorooctanoic acid (carboxylic acid, COOH)
  - PFOS – specific PFAS
    - Perfluorooctane sulfonic acid, SO3-
  - PFBS – Specific PFAS
    - Perfluorobutane sulfonic acid. SO3-





PFOA - Green is F, Black is C, Red is O and Grey is H

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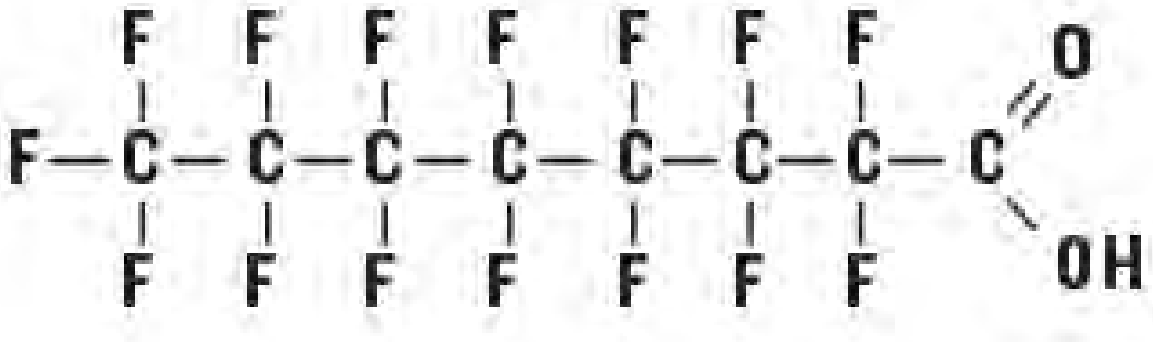
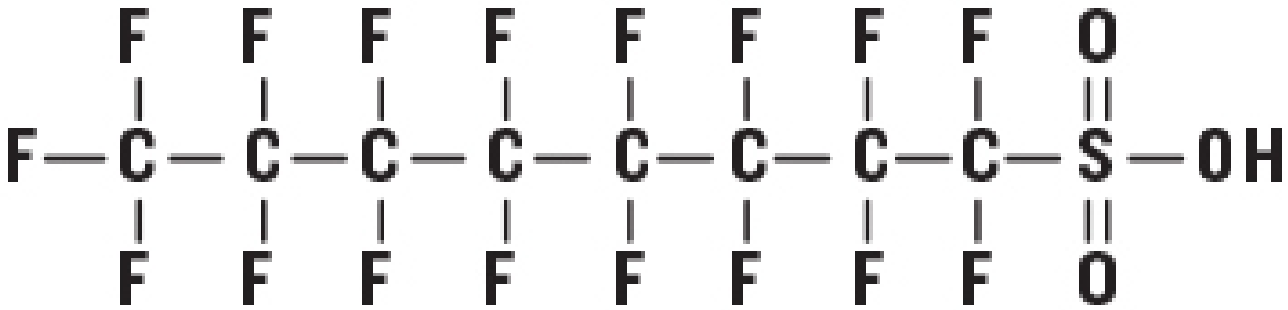
Most Common Base Structure - 8 carbons



PFOA



PFOS

It's So Confusing!

And its in my house

- Literally thousands of compounds
- Long Chain, Short Chain
- PFOS / PFOA / PFNA / PFBS / PFHxS / PFHxA
- GenX *

**But only if you live in the Carolinas – Chemours Fayetteville Plant had a spill*

Sample Name:

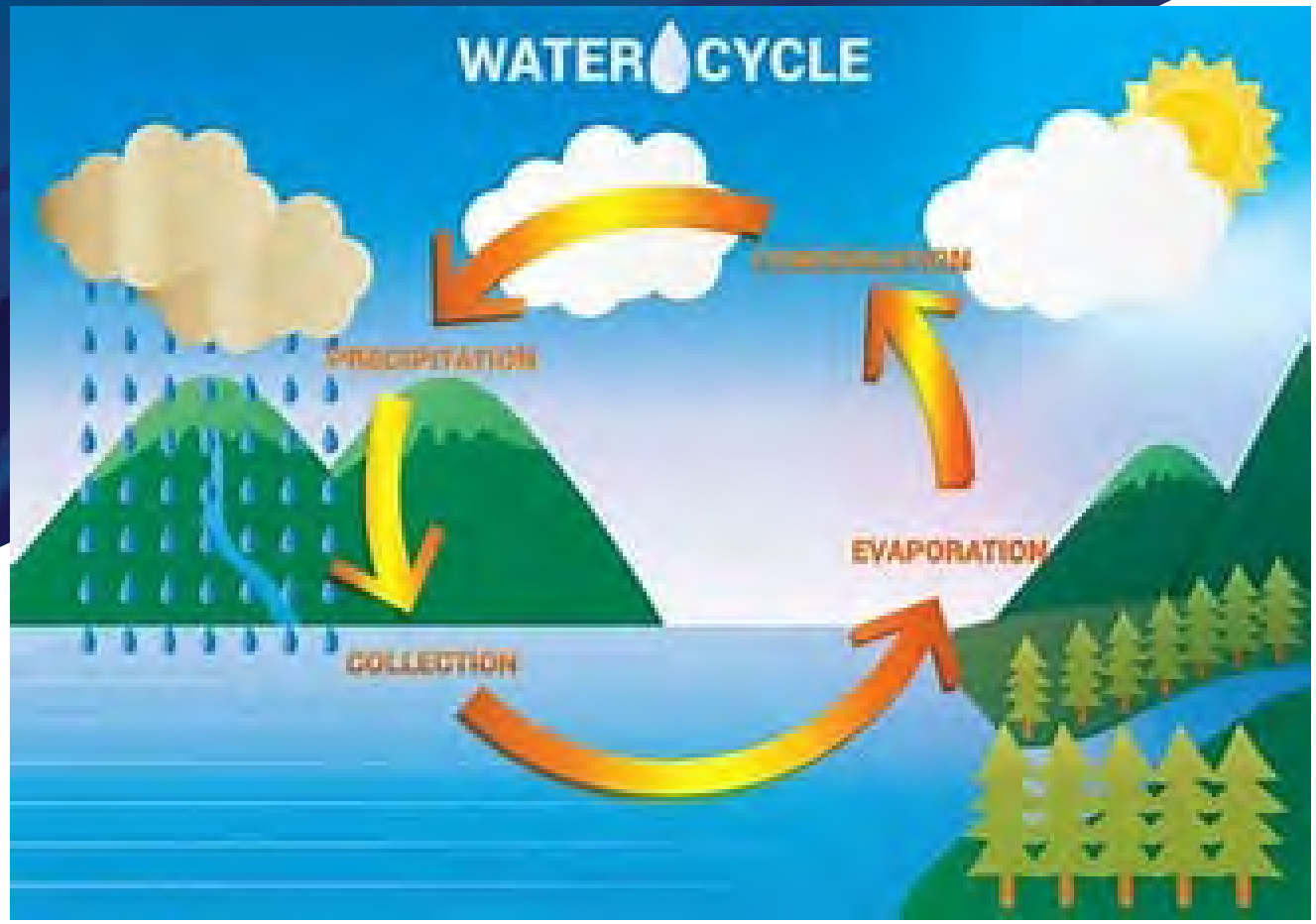
Larry Gottlieb Kitchen Sink

sample before receipt at the lab and is responsible only for the tes requested.

Analytical Method: EPA 537.1

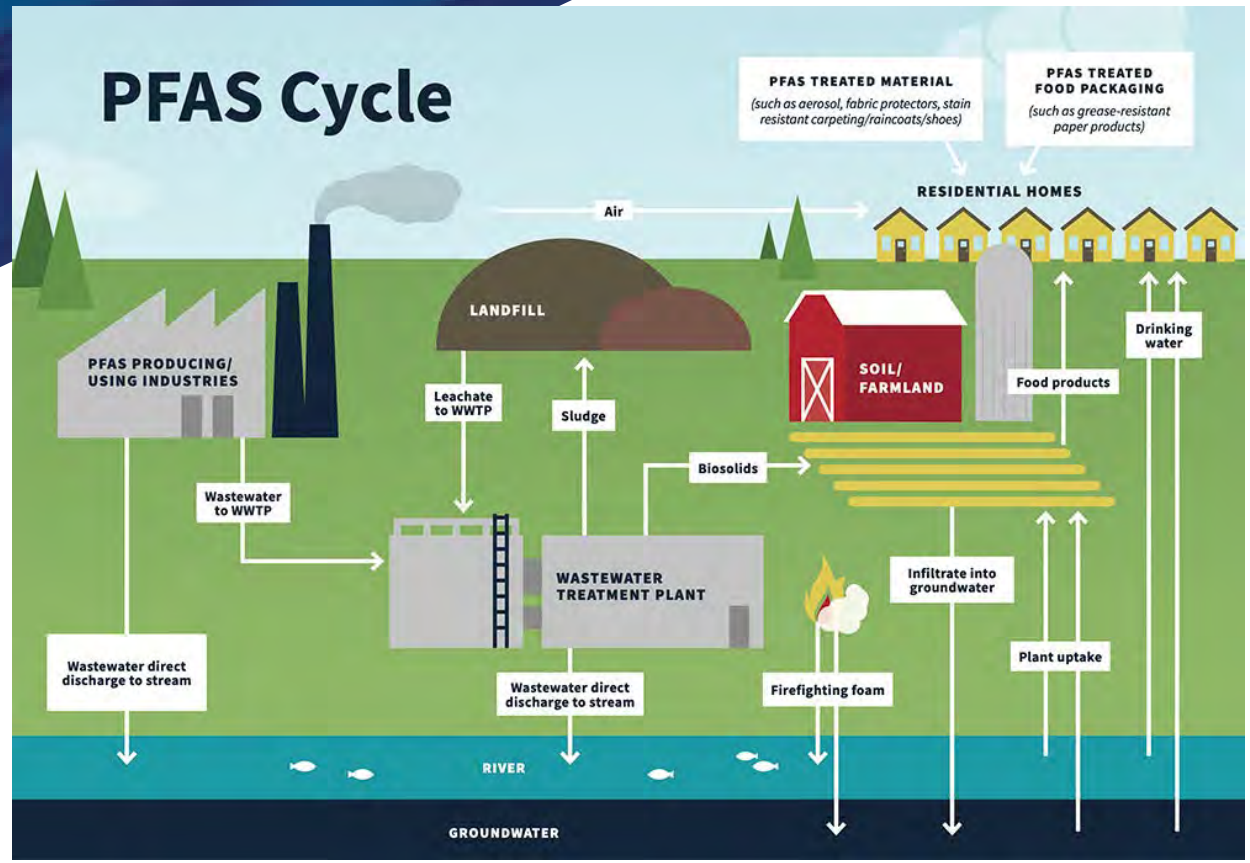
Name	Amount	Units	Date/ Time
11CL-PF3OUdS	< 4.0	ng/L	07/17/19 09:29
9C1-PF3ONS	< 4.0	ng/L	07/17/19 09:29
ADONA	< 4.0	ng/L	07/17/19 09:29
HFPO-DA	< 4.0	ng/L	07/17/19 09:29
NetFOSSA	< 4.0	ng/L	07/17/19 09:29
NMeFOSSA	< 4.0	ng/L	07/17/19 09:29
PFBS	< 4.0	ng/L	07/17/19 09:29
PFDA	< 4.0	ng/L	07/17/19 09:29
PFDoA	< 4.0	ng/L	07/17/19 09:29
PFHpA	< 4.0	ng/L	07/17/19 09:29
PFHxA	< 4.0	ng/L	07/17/19 09:29
PFHxS	< 4.0	ng/L	07/17/19 09:29
PFNA - LIMIT 13	12	ng/L	07/17/19 09:29
PFOA – PROPOSED LIMIT 14	6	ng/L	07/17/19 09:29
PFOS – PROPOSED LIMIT 13	17	ng/L	07/18/19 19:29
PFTA	< 4.0	ng/L	07/17/19 09:29
PFTrDA	< 4.0	ng/L	07/17/19 09:29
PFUnA	< 4.0	ng/L	07/17/19 09:29

Remember This



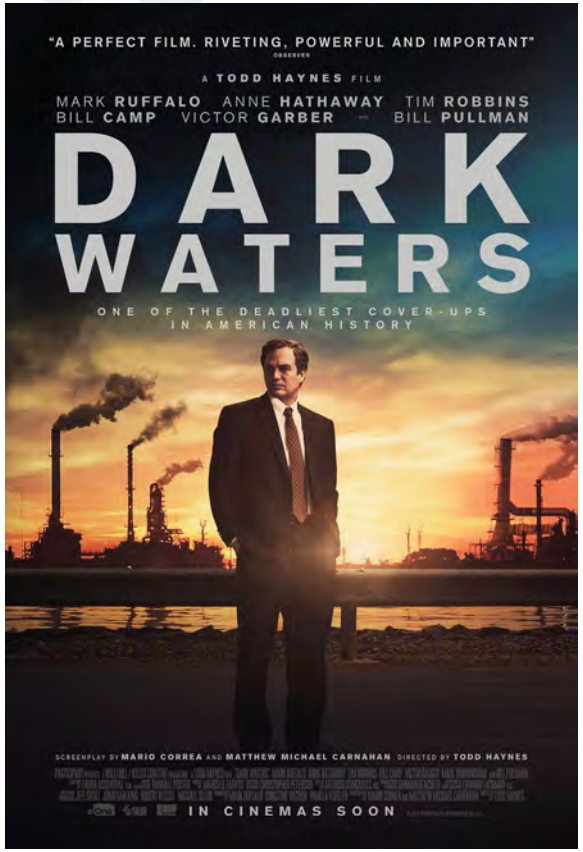
Now it look like this - Endless Cycle

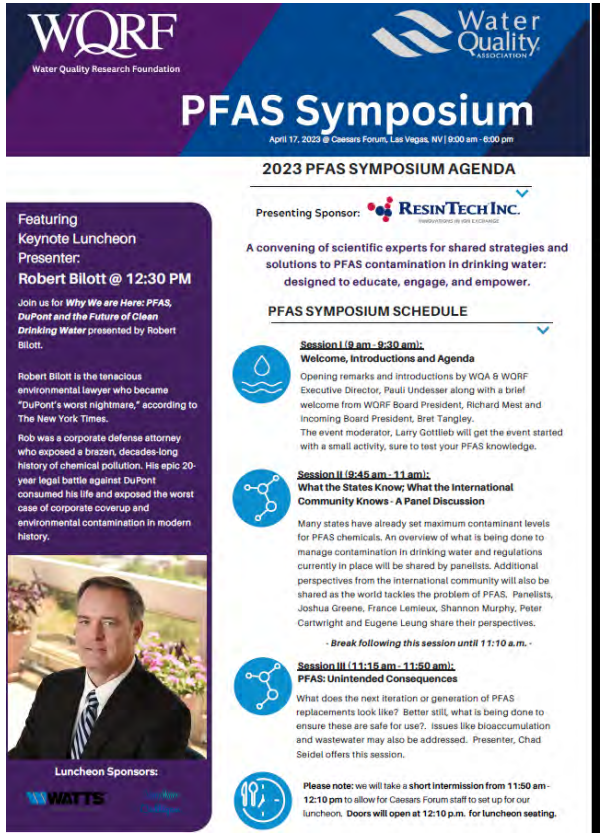
- PFAS is found in
  - Groundwater
  - Near Airports and Military sites
  - Consumer Products
- Does Not Break Down
- Mass is Conserved



PFAS – In the News and Toxicology

It's in the Movies, Real Life Thrillers





WQRF
Water Quality Research Foundation

Water Quality Association

PFAS Symposium

April 17, 2023 @ Caesars Forum, Las Vegas, NV | 9:00 am - 6:00 pm

2023 PFAS SYMPOSIUM AGENDA

Presenting Sponsor: RESINTECH INC.

A convening of scientific experts for shared strategies and solutions to PFAS contamination in drinking water: designed to educate, engage, and empower.

PFAS SYMPOSIUM SCHEDULE

Session I (9 am - 9:30 am):
Welcome, Introductions and Agenda

Opening remarks and introductions by WQA & WQRF Executive Director, Pauli Undesser along with a brief welcome from WQRF Board President, Richard Mest and Incoming Board President, Bret Tangley.
The event moderator, Larry Gottlieb will get the event started with a small activity, sure to test your PFAS knowledge.

Session II (9:45 am - 11 am):
What the States Know; What the International Community Knows - A Panel Discussion

Many states have already set maximum contaminant levels for PFAS chemicals. An overview of what is being done to manage contamination in drinking water and regulations currently in place will be shared by panelists. Additional perspectives from the international community will also be shared as the world tackles the problem of PFAS. Panelists, Joshua Greene, France Lemieux, Shannon Murphy, Peter Cartwright and Eugene Leung share their perspectives.

- Break following this session until 11:10 a.m. -

Session III (11:15 am - 11:50 am):
PFAS: Unintended Consequences

What does the next iteration or generation of PFAS replacements look like? Better still, what is being done to ensure these are safe for use?. Issues like bioaccumulation and wastewater may also be addressed. Presenter, Chad Seidel offers this session.

Please note: we will take a **short intermission from 11:50 am - 12:10 pm** to allow for Caesars Forum staff to set up for our luncheon. **Doors will open at 12:10 p.m. for luncheon seating.**

Featuring
Keynote Luncheon
Presenter:
Robert Bilott @ 12:30 PM

Join us for ***Why We are Here: PFAS, DuPont and the Future of Clean Drinking Water*** presented by Robert Bilott.

Robert Bilott is the tenacious environmental lawyer who became "DuPont's worst nightmare," according to The New York Times.

Rob was a corporate defense attorney who exposed a brazen, decades-long history of chemical pollution. His epic 20-year legal battle against DuPont consumed his life and exposed the worst case of corporate coverup and environmental contamination in modern history.

Luncheon Sponsors:
WATTS

PFAS - In the News

March 2, 2023 EXTRA! EXTRA! Read all about it!!!

- There was little question that PFAS would turn up in Toilet paper
- The PFAS Most present was 6:2 diPAP
- Linked to impaired testicular function in Men
- TP could be a potential Major Source of PFAS in Sewage and Wastewater Systems
- Every day there seems to be something new

PFAS - It's in your Orange Juice

All Natural –
How to Join the Simply Orange Lawsuit?

- How can something that claims to be "ALL NATURAL" contain PFAS?
- It the PFAS from Contaminated Water or from the packaging
- Currently unknown

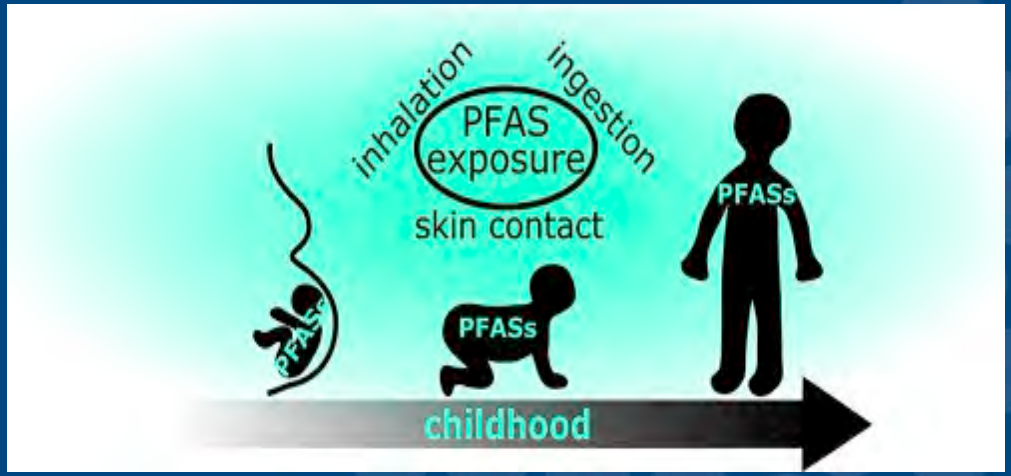
Toxicology - Why the concern?

PFC's are "Emerging contaminants"

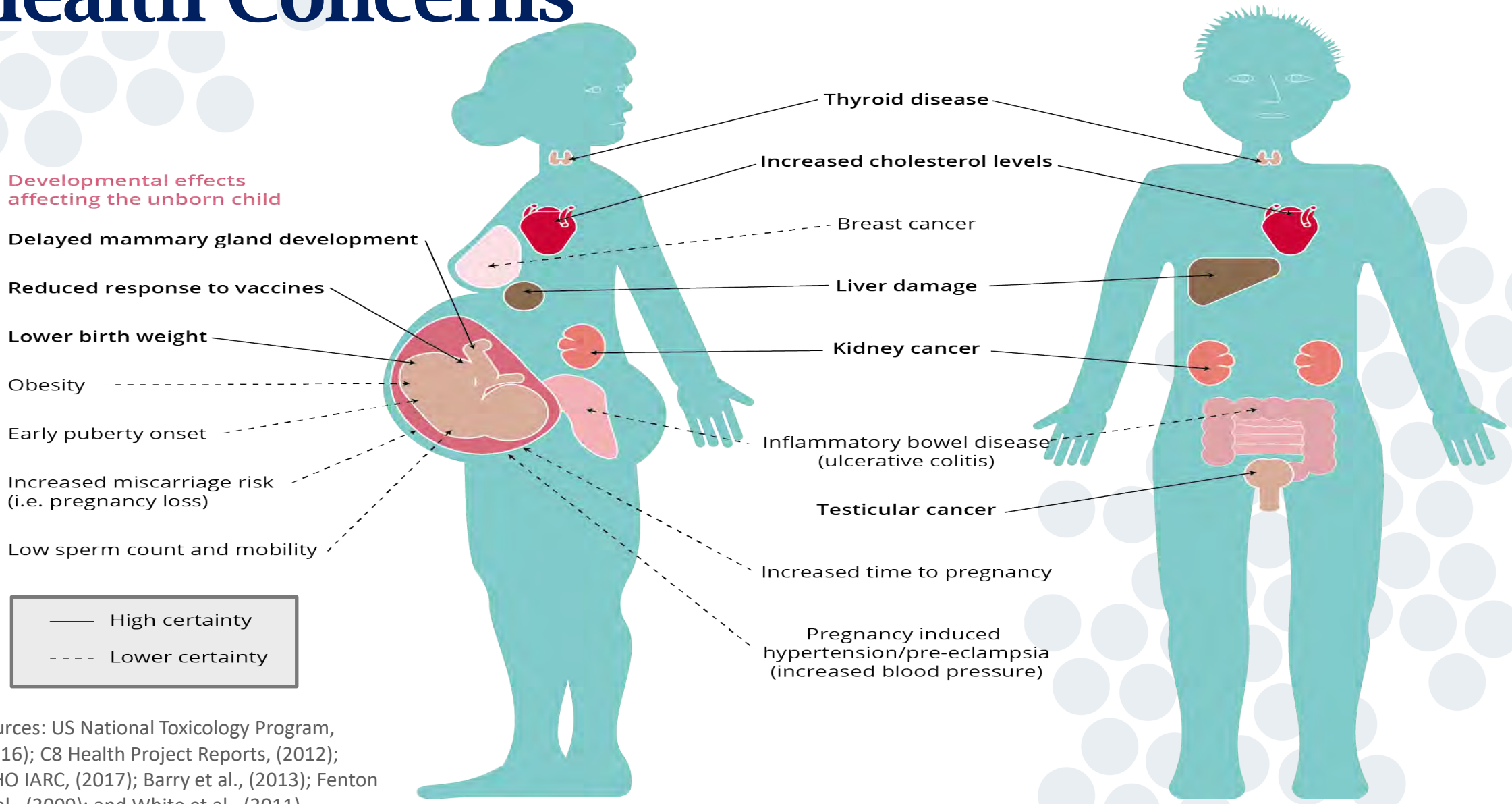
- Get into groundwater
- Do not break down in the environment
- Accumulate in human blood
- Pose health concerns

PFAS Health Concerns

- Due to widespread use over decades, PFAS is found in most of population's blood
- Studies indicate exposure to PFOA and PFOS may result in adverse health effects, including:
  - developmental effects
  - immunity deficiencies
  - cancer (kidney, testicular)
  - thyroid issues
- **Pregnant women most at risk**



Health Concerns



Sources: US National Toxicology Program, (2016); C8 Health Project Reports, (2012); WHO IARC, (2017); Barry et al., (2013); Fenton et al., (2009); and White et al., (2011).

PFAS Bioaccumulation

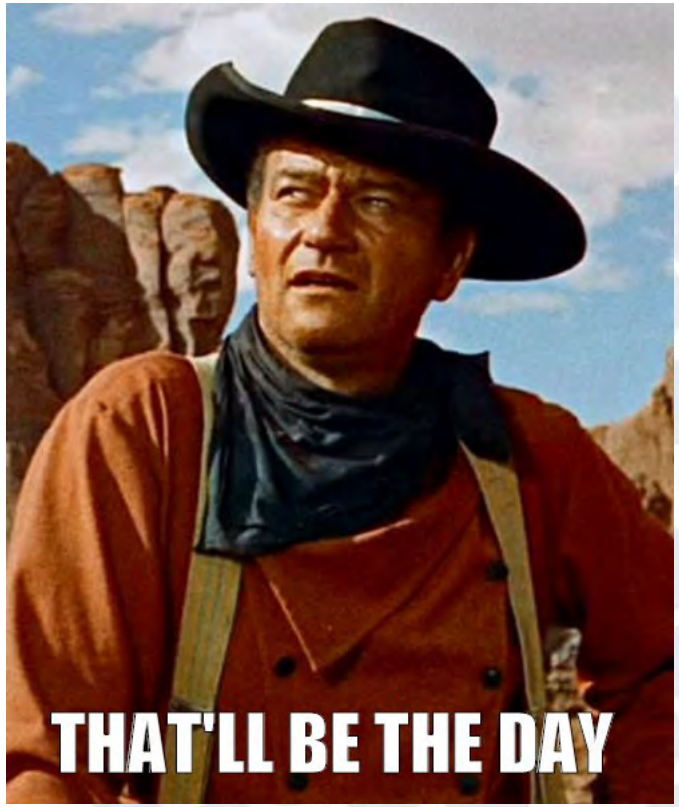
Persistence in the Human Body by Chain Length

Compound	Chain Length (# of Carbons)	Half-life in Humans
perfluorobutanoic acid (PFBA)	4	1 month
perfluorooctanoic acid (PFOA)	8	3 years
perfluorooctanesulfonic acid (PFOS)	8	3.5 - 5 years
perfluorohexanesulfonic acid (PFHxS)	6	7-8 Years

Regulation –

What are We Doing about it?

- 2009 the US EPA sets a health advisory for PFOA and PFOS
- 2019 the US EPA announces plans to regulate PFAS
- 2023 Toxic Substances Control Act (TSCA)
- 2024 – USEPA PFAS LIMITS, TBD

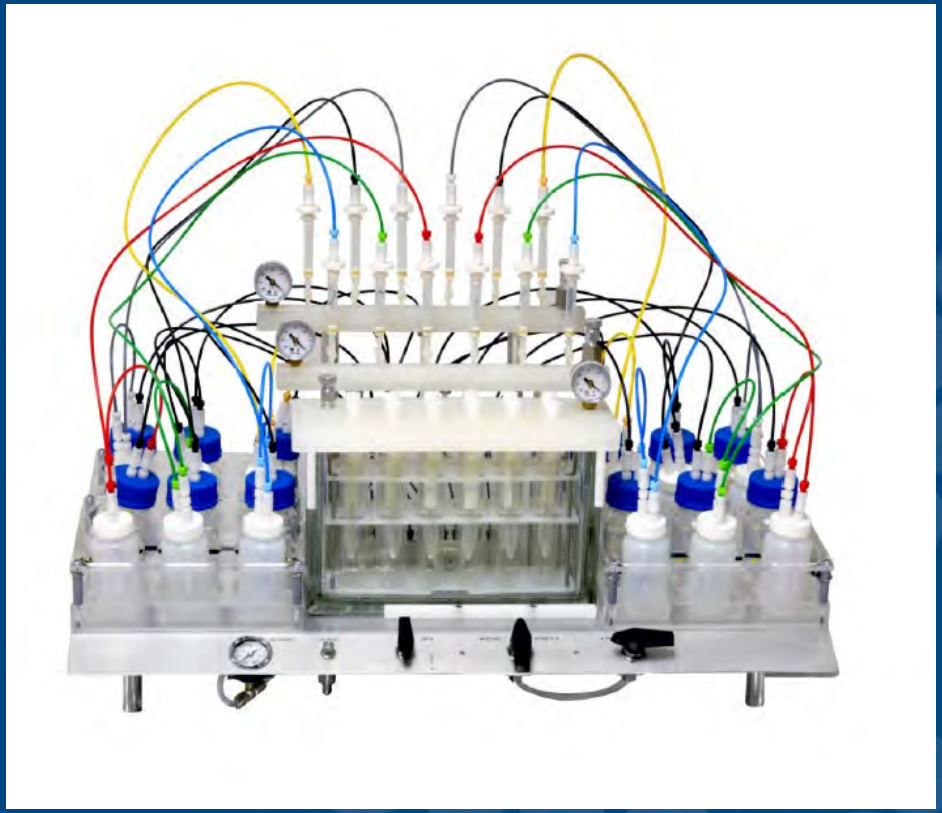


2009 Drinking Water Health Advisories for PFOA and PFOS

- EPA has established health advisories for PFOA and PFOS based on the agency's assessment of the latest peer-reviewed science to provide drinking water system operators, and state, tribal and local officials who have the primary responsibility for overseeing these systems, with information on the health risks of these chemicals, so they can take the appropriate actions to protect their residents. EPA is committed to supporting states and public water systems as they determine the appropriate steps to reduce exposure to PFOA and PFOS in drinking water. As science on health effects of these chemicals evolves, EPA will continue to evaluate new evidence.
- To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOA and PFOS from drinking water, **EPA has established the health advisory levels at 70 parts per trillion.**

The 70 ppt Threshold

Solid-phase extraction (SPE) Analytical laboratories use solid phase extraction to concentrate and purify samples for analysis. For samples under 70 ppt



<u>2022</u> – Health advisories are non-regulatory

- EPA Announces New Drinking Water Health Advisories for PFAS Chemicals
- ‘Concentrations… at or below which adverse health effects are not anticipated to occur’
  - 0.004 ppt for PFOA
  - 0.02 ppt for PFOS
  - 4 and 20 PPQ, QUADRILLION
- ***<u>Effectively saying NO SAFE LEVEL of PFAS</u>***

EPA.GOV – PFAS Laws and Regulations
Currently Nothing Enforceable, Only Advisory

- **FEDERALLY - There are currently no MCLs established for PFAS chemicals**
- **Safe Drinking Water Act –**
- There are a variety of laws and regulations to protect public health and the environment. The following list relates to PFAS in the environment.
- The Safe Drinking Water Act (SDWA) protects public drinking water supplies across the United States.
- EPA initiated the steps to evaluate the need for an MCL for PFOA and PFOS under the regulatory determination process. However, EPA has issued a health advisory for PFOA and PFOS

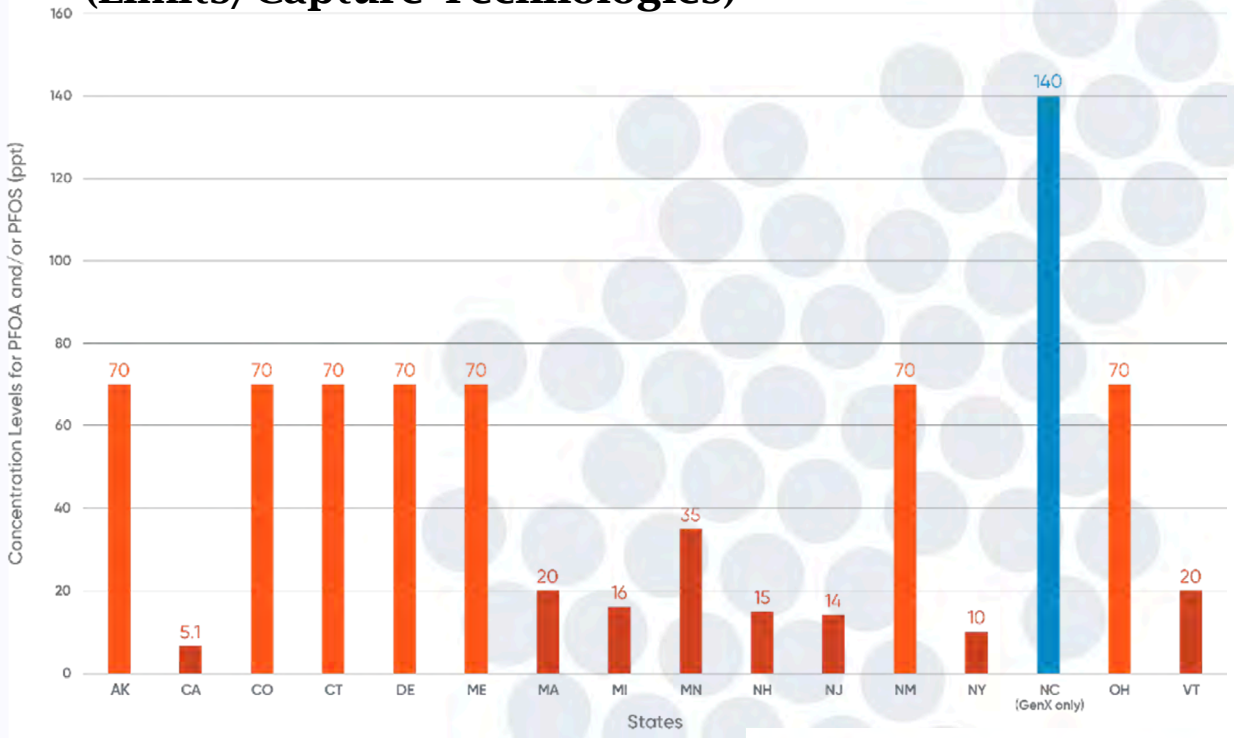
State Limits in absence of Federal

- The regulation of PFAS is complicated
- Regulation would require compliance and Compliance is expensive
- Compliance would CO$T all of us
  - Water
  - Transportation
  - Disposal

What if CARPET became a hazardous waste?

16 States Already Have Limits

State DEP's Are At Times Acting Independent from EPA in their Recommendations (Limits/Capture Technologies)



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Toxic Chemical Substances Control Act (TSCA)

- Effective November 13, 2023
- Reporting and recordkeeping requirements for Per- and Polyfluoroalkyl Substances (PFAS)
- Persons who have only processed, distributed in commerce, used, and/or disposed of PFAS **are not required** to report under this rule
- Unless they also have manufactured PFAS for a commercial purpose.
- If an entity (such as a wastewater treatment plant) is simply processing PFAS they received domestically, and not also manufacturing PFAS, including as a byproduct, then the entity is not covered by this rule.

March 14, 2023 – USEPA Proposed PFAS Limits

The proposed rule would also require public water systems to:

- Monitor for these PFAS
- Notify the public of the levels of these PFAS
- Reduce the levels of these PFAS in drinking water if they exceed the proposed standards.
- 3 years to comply
- Regulate 6 compounds
- Expected to be final in December 2023

LIMITS in ppt	
	EPA (Proposed)
PFOA	4
PFOS	4
GenX	10
PFBS	2000
PFNA	10
PFHxS	10

Formula:

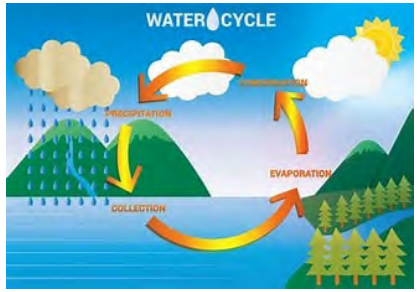
$$\left(\frac{\text{GenX water}}{10\text{ ppt}}\right) + \left(\frac{\text{PFBS water}}{2000\text{ ppt}}\right) + \left(\frac{\text{PFNA water}}{10\text{ ppt}}\right) + \left(\frac{\text{PFHxS water}}{9\text{ ppt}}\right)$$

Recommended Treatment per the USEPA

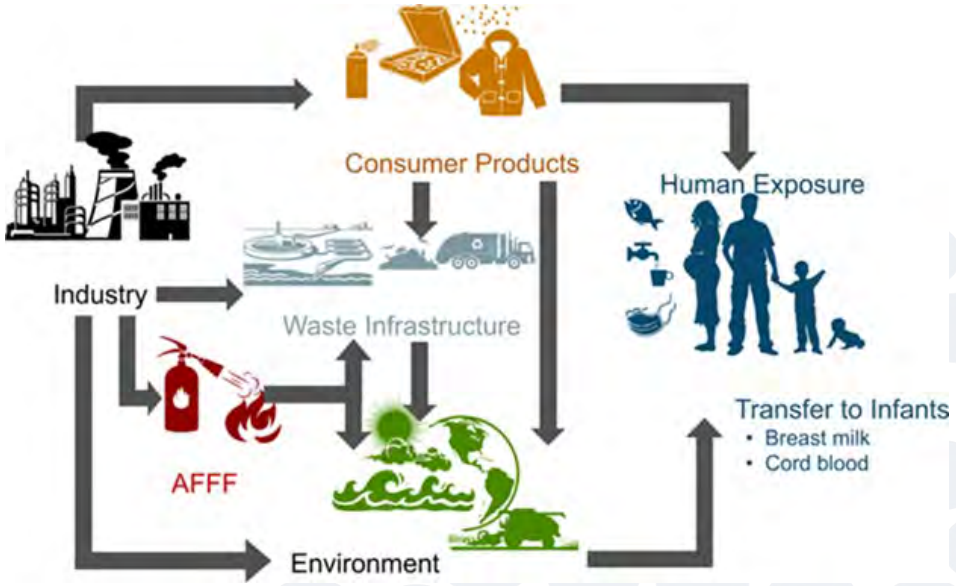
Effective technologies include:

- Anionic Ion Exchange Resins, AIX or IX
- Activated Carbon Adsorption, GAC
- High-pressure membranes, NF / RO
  - Nanofiltration
  - Reverse Osmosis

Treatment Points, in the Water Cycle



- Municipal
- POU / POE (Point of Use / Point of Entry)
- Wastewater
- Repeat - Unless or until PFAS is REMOVED



Treatment Summary

- GAC – Activated Carbon is a well know traditional technology having good removal but requiring more media due to lower capacity and slower operating conditions.
- AIX - Anion Exchange Resin – Excellent at removing a wide variety of PFAS compounds with fast kinetics and high operating capacity resulting.
- RO – Reverse Osmosis – Reduces PFAS by Rejecting compounds into a concentrated Waste Stream. Energy intensive to boost pressure for operation.
- Both GAC and IX remove and retain PFAS from the environment
- RO Reject is becoming problematic for large uses of this technology

Remediation Media and Systems
POU, POE, Municipal

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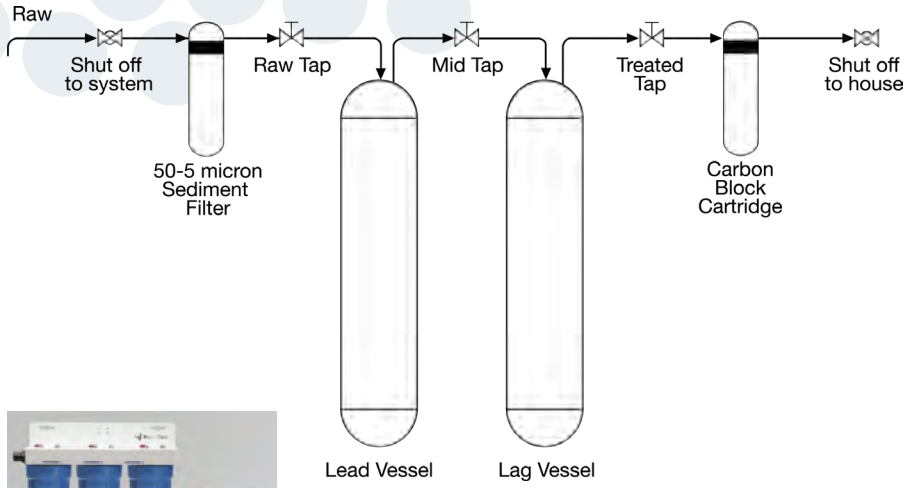
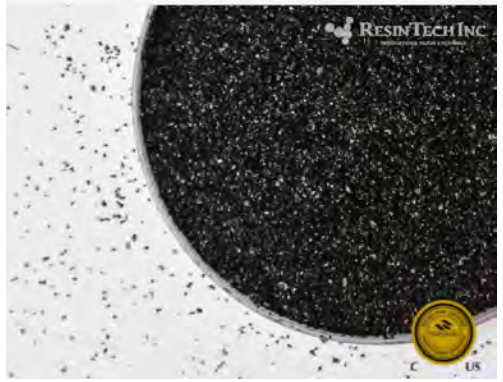
Product Recommendations: www.resintech.com





AGC-PFx

COCONUT SHELL CARBON

ResinTech AGC-PFx is a premium grade, semi-moist, acid-washed, coconut shell-based granular activated carbon. It has chemically enhanced pore size to facilitate the removal of Per- and Polyfluoroalkyl compounds (PFCs) such as PFOS, PFOA, and others. AGC-PFx is intended for use as a stand alone media bed or as a top layer with other medias to facilitate PFC removal. AGC-PFx is Gold Seal Certified by the WQA for use in potable water applications.

SIR-110-HP

Media Sub Category	Selective Exchanger
Polymer Matrix	Styrenic Gel

Applications:

- Perchlorate Reduction
- Nitrate Reduction
- Iodide Reduction
- Pertechnetate Reduction
- PFAS Reduction

SIR-110-MP-HP

Media Sub Category	Selective Exchanger
Polymer Matrix	Styrenic Macroporous

Applications:

- Perchlorate Reduction
- Nitrate Reduction
- Iodide Reduction
- Pertechnetate Reduction
- PFAS Reduction

Remediation Filters

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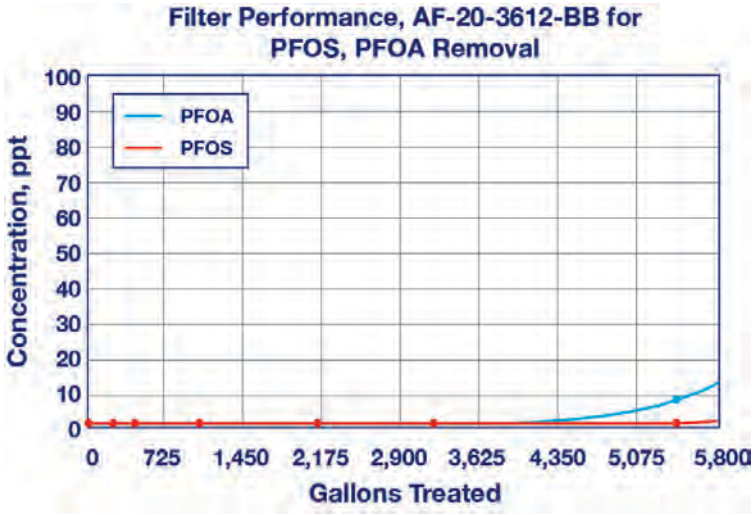
Product Recommendations: www.resintech.com

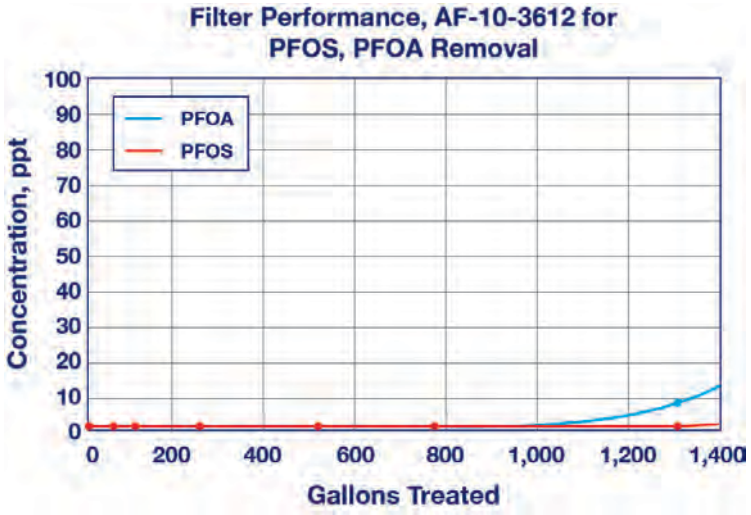
DIMENSIONS	MAX FLOW gpm	MAX FLOW lpm	CAPACITY* Gallons	PART NUMBER
2.5 x 10 in. (Slim Line)	0.4	1.51	1,302	**AF-10-3612**
2.5 x 20 in. (Slim Line)	0.6	2.27	2,315	**AF-20-3612**
4.5 x 10 in. (Big Blue)	0.7	2.65	2,589	**AF-10-3612-BB**
4.5 x 20 in. (Big Blue)	1.6	6.06	5,731	**AF-20-3612-BB**

*Capacity measured to 90% removal based on maximum industry standards.

PFAS Filters!

- Up to 10x the capacity of carbon!*
- Made in America
- Available in 4 sizes to fit standard housings





THANK YOU

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Greetings FROM CAMDEN NEW JERSEY USA

I sincerely appreciate your time. It has been a pleasure to meet you.

Any Questions ?

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INNOVATIONS IN ION EXCHANGE