PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) AND SURFACE WATER

PRESENTED TO: CALIFORNIA STORMWATER QUALITY ASSOCIATION (CASQA) MONITORING AND SCIENCE SUBCOMMITTEE

June 20, 2019

WESTON SOLUTIONS

AGENDA

- *Introductions*
- *PFAS Background/Health Effects*
- *Fate and Transport*
- *Federal Regulatory Status*
- *CA State Regulatory Status*
- *Sampling and Analytical Methods*

PFAS BACKGROUND

- PFAS - large group of persistent man-made chemicals.
  - Do not occur naturally in environment.
- Manufactured and used world-wide since 1940s.
- Used in non stick coatings, textiles, paper products, some firefighting foams, and many other products.
  - Resistant to heat, water and oil, and reduce friction.
- Most Studied
  - Perfluorooctanoic acid - $C_8HF_{15}O_2$ (PFOA)
  - Perfluorooctanesulfonic acid - $C_8HF_{17}O_3S$ (PFOS)

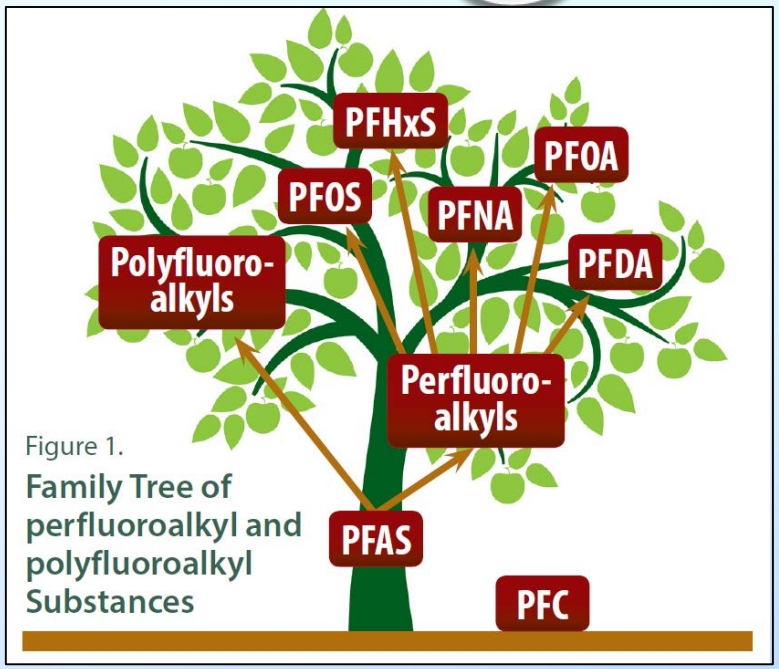
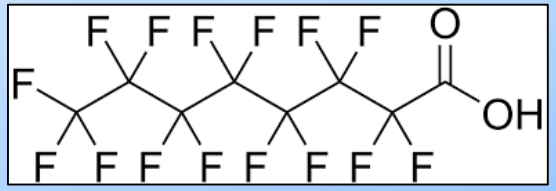
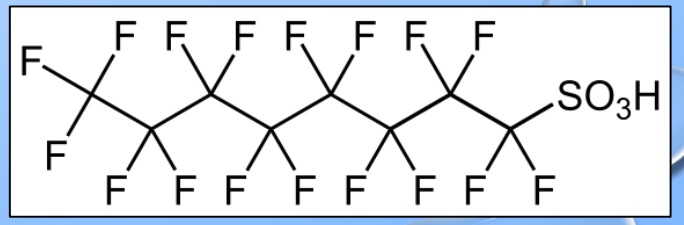


Figure 1.
Family Tree of perfluoroalkyl and polyfluoroalkyl Substances

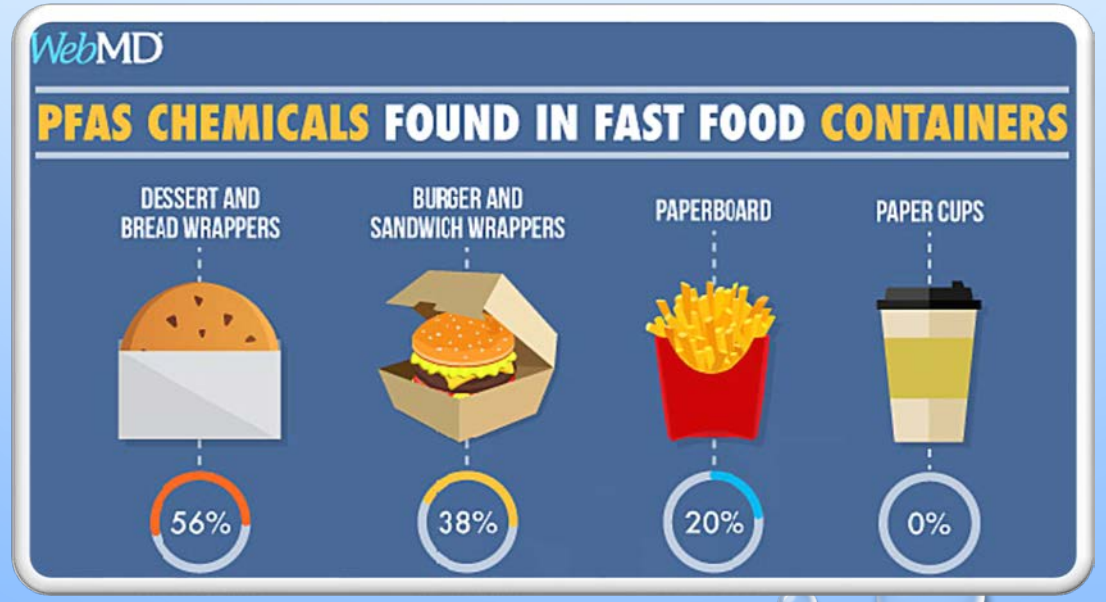
Source: ATSDR





PFAS BACKGROUND
(CONTINUED)

- Used and/or found in:
  - **Food:** Food wrappers and packing with PFAS-containing materials; food process equipment, and food grown in PFAS-contaminated soil/water.
  - **Household products:** Stain- and water-repellent fabrics, nonstick products (e.g., Teflon®), polishes, waxes, paints, cleaning products, and shampoo.



PFAS BACKGROUND
(CONTINUED)

- Used and/or found in
  - **Fire-fighting foams.** Major source of **groundwater contamination** at airports and military bases from firefighting training with AFFF.
  - **Workplace.** Including production facilities or industries (e.g., chrome plating, electronics manufacturing, or oil recovery) that use PFAS.
  - **Drinking water/Surface Water.** Typically localized and associated with a specific facility (e.g., manufacturer, landfill, wastewater treatment plant, firefighter training facility).
  - **Living organisms.** Found in fish, animals, and humans where PFAS build up and persist over time.

PFAS HEALTH EFFECTS

- Most people in U.S. have one or more specific PFAS in their blood.
- Geometric mean concentration of PFOA in Americans' blood serum was 1.56 parts per billion (ppb); PFOS 4.72 ppb*.
- Health effects – limited numbers of studies.
  - Increased cholesterol levels; infant birth weight and skeletal development; immune system effects; cancer (PFOA); thyroid disruption (PFOS)
  - Also possible reproductive, developmental kidney and liver, and immunological effects (based on laboratory animal tests)

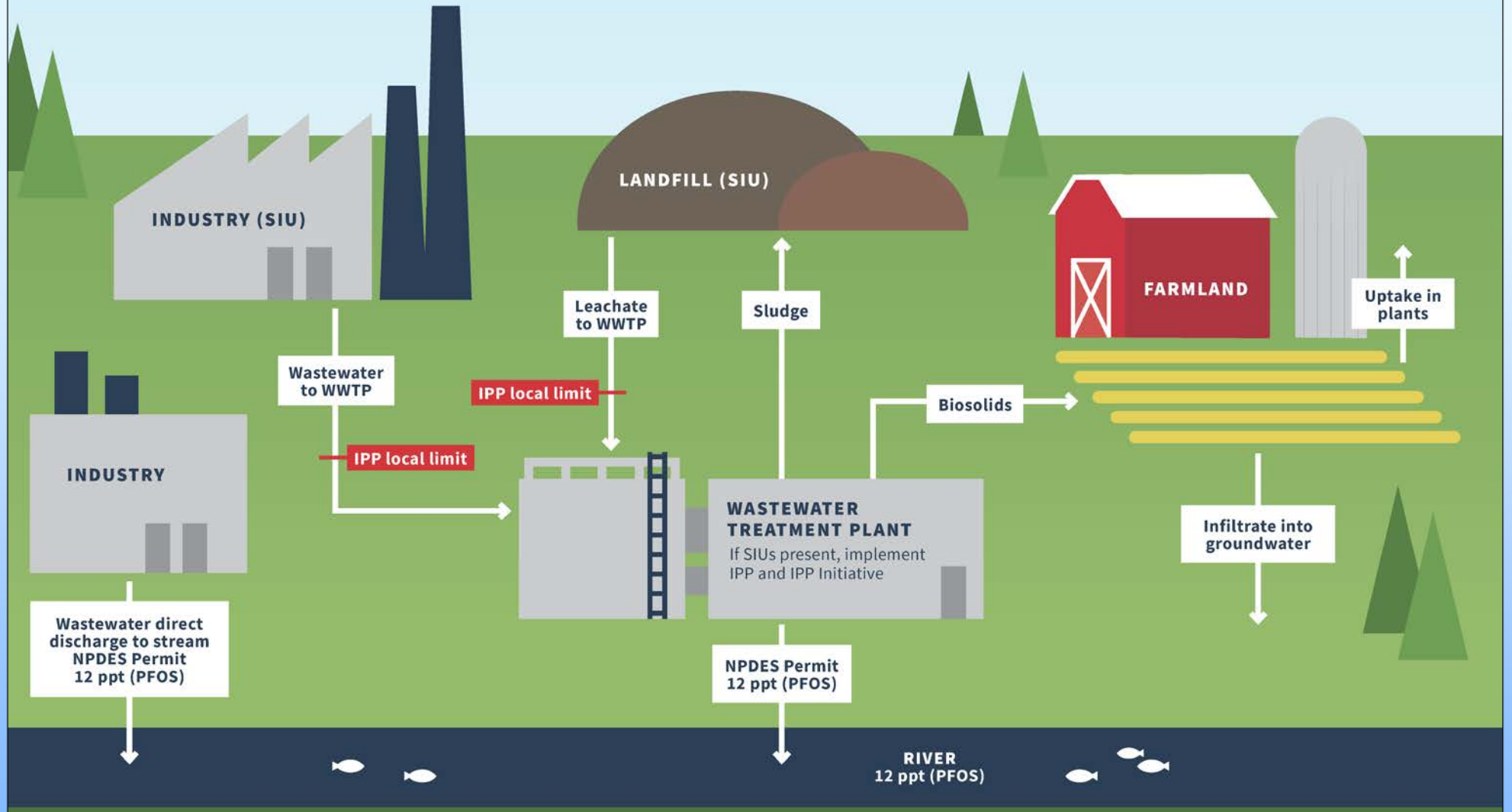
* Centers for Disease Control 2015-2016 national biomonitoring results

FATE AND TRANSPORT

- Highly stable, do not break down in the environment - most PFAS resistant to biotic or abiotic degradation; physical transport processes are critical.
- Widely distributed in environment due to high solubility in water, low/moderate sorption to soils/sediments, resistance to degradation.
- PFAS have been found to migrate to surface water in runoff from landfills, in areas with compost/biosolids applications or AFFF usage for firefighting/fire training, and in wastewater treatment plant discharges.
- Releases from surface applications of PFAS-containing materials or AFFF usage or atmospheric deposition, migrate through unsaturated soils, then to surface water or groundwater due to runoff/downward leaching during precipitation or irrigation events.

PFAS Water Cycle

IPP = Industrial Pretreatment Program
SIU = Significant Industrial User
NPDES = National Pollutant Discharge Elimination System
PPT = Parts Per Trillion
WWTP = Wastewater Treatment Plant



EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

800-662-9278 | *www.michigan.gov/pfasresponse*

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FATE AND TRANSPORT
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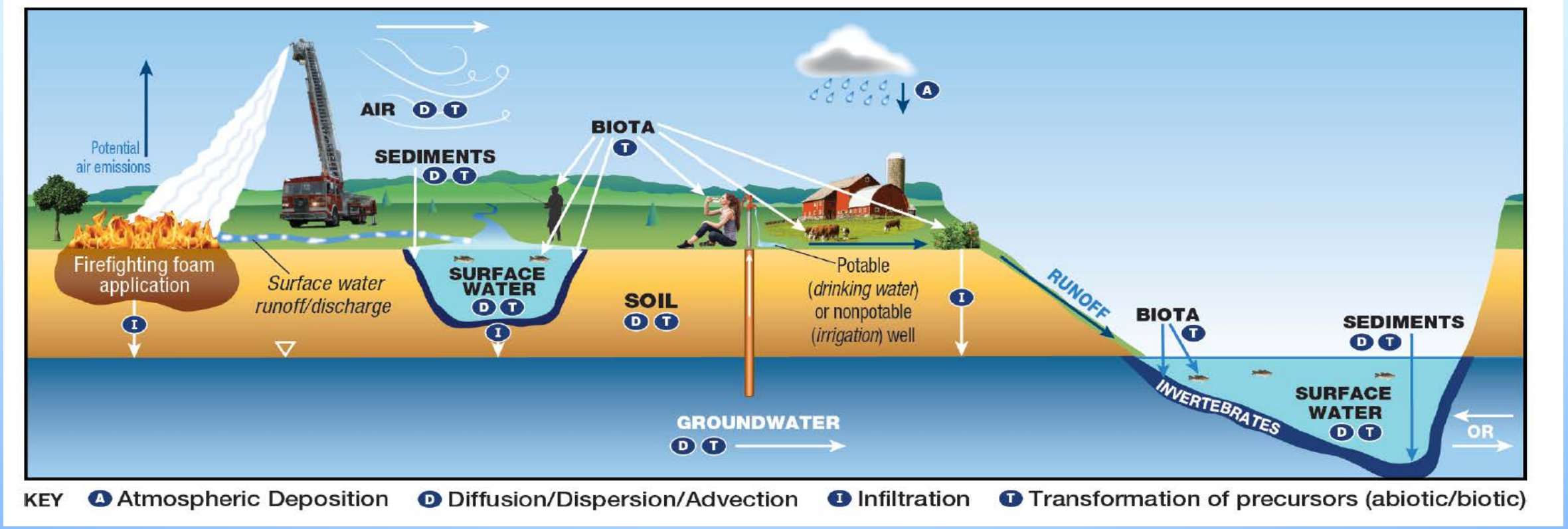

Source: ITRC - https://pfas-1.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_fate_and_transport__3_16_18.pdf

FEDERAL REGULATORY

- ***2006:*** *EPA asked eight major companies to commit to working toward the elimination of production/use of PFOA; and chemicals that degrade to PFOA, from emissions and products by the end of* ***2015.***
- ***2012:*** *PFOA and PFOS listed by EPA - water systems required to monitor under 3rd Unregulated Contaminant Monitoring Rule (UCMR 3) in 2012.*
- ***May 2016:*** *EPA issued drinking water health advisory level (HAL) 70 ppt (or ng/L) for PFOA and PFOS individually or combined. Protection against adverse health effects for most sensitive populations.*
- *EPA Regional Screening Levels(RSLs) exist for PFOA, PFBS, and PFOA.*
- ***November 2018:*** *Agency for Toxic Substance and Disease Registry (ATSDR) Minimum Risk Levels (MRLs) adult/child for PFOA, PFOS, PFHxS, and PFNA – screening levels to identify environmental exposures that might harm people's health.*

FEDERAL REGULATORY
(CONTINUED)

PFAS Compound	CAS Number	Units	EPA RSL	ATSDR MRL Child	ATSDR MRL Adult
Perfluorobutanesulfonate (PFBS)	375-73-5	ng/L	400,000	NA	NA
Perfluorohexanesulfonate (PFHxS)	355-46-4	ng/L	NA	140	517
Perfluorononanoic acid (PFNA)	375-95-1	ng/L	NA	14	78
Perfluorooctanesulfonate (PFOS)	1763-23-1	ng/L	40 70 (HAL)	14	52
Perfluorooctanoic acid (PFOA)	335-67-1	ng/L	40 70 (HAL)	21	78

HAL = health advisory level RSL = regional screening level MRL = minimum risk level

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FEDERAL REGULATORY
(CONTINUED)

- ***February 2019:*** *EPA announced PFAS action plan - EPA's approach to identifying/understanding PFAS, addressing current contamination, preventing further contamination, and communicating with public.*
- *EPA intends to establish an MCL for PFOA/PFOS (sometime after 2019 public comment).*
- *Interstate Technology Regulatory Council (ITRC) - repository for federal and state fact sheets, regulations, guidance and advisories.*
  - *https://pfas-1.itrcweb.org/fact-sheets/*
  - *ITRC will be publishing risk communication tool kit*

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CA STATE REGULATORY

- **June 2018** - State Water Resource Control Board (SWRCB) Division of Drinking Water (DDW) established notification levels (NLs) for PFOS (13 ppt) and PFOA (14 ppt).
- If PFOA or PFOS concentrations exceed their respective NLs, CA DDW recommends treating impacted wells (when possible).
- DDW established response level equal to EPA HAL (70 ppt). Recommends removing contaminated wells from service when cannot be reduced to < 70 ppt.
- No CA surface water criteria currently exists.

CA STATE REGULATORY

- SWRCB – Investigative Orders – Phased Approach
  - Source investigations and nearby drinking water well sampling
  - Phase I – Issued March 20, 2019
    - Landfills and Airports
    - Work Plans due within 60 days
  - Phase II – Planned Summer/Fall 2019
    - Primary manufacturing facilities
    - Refineries, bulk terminals, and non-airport fire training areas
    - 2017-2018 urban wildfire areas

CA STATE REGULATORY

- Phase III – Planned Fall 2019
  - Secondary manufacturing sites where PFAS-containing materials were discharged into wastewater
  - Wastewater treatment and pre-treatment plants
  - https://www.waterboards.ca.gov/pfas/

OTHER STATE REGULATORY – SURFACE WATER

- Some states already have surface water criteria and fish advisories

Location	Year First Listed	Standard / Guidance	Promul-gated Rule (Y/N)	Concentration µg/L						Notes
				PFOA	PFOS	PFNA	PFBS	PFHxS	PFHpA	
AK DEC	2018	Action level	N	0.07	0.07	0.07	2	0.07	0.07	Individual and sum for 5 except PFHpA
MI DEQ	2015	Generic Cleanup Criteria	Y	12 (ambient) 0.42 (drinking water)*	0.012 (ambient) 0.011 (drinking water)*	-	-	-	-	
Oregon DEQ	2011	Initiation Level	Y	24	300	1	-	-	300	

Values are for protection of human health

- Aquatic life values are available and are significantly higher

PFAS SAMPLING – AVOID CROSS-CONTAMINATION

- Use Nitrile gloves only and change frequently.
- Apply only certain sunscreens and insect repellants (organic/natural and some others including DEET are ok).
- Wear cotton clothing for field activities; clothing should **not** be laundered with fabric softeners.
- AVOID Teflon®-containing materials, waterproof field books, plastic clip boards, Post-It® Notes, moisturizers, certain food packaging (e.g., fast food).
- AVOID clothing/boots containing Gore-Tex™, Tyvek®, or other waterproof/water resistant coating.

Photo source: Weston Solutions, Inc.

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PFAS SAMPLING
(CONTINUED)

- **Field reagent blanks (FRBs).** Collect to assess possible introduction of PFAS; FRB frequency based on project-specific parameters; 1 FRB/day/person may be required.
- **CA sampling guide.** Specifies allowable and prohibited equipment for protective clothing and sampling field equipment.
- **Allowable materials.** Include high-density polyethylene (HDPE), polypropylene, silicone, stainless steel, nylon, PVC, acetate, and cotton.
- https://www.waterboards.ca.gov/pfas/docs/march_pfas_sampling_guidelines.pdf

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ANALYTICAL METHODS

- UCMR3 - EPA Method 537: 6 PFAS compounds in drinking water: PFOS, PFOA, PFNA, PFHxS, PFHpA, PFBS.
- CA DDW identified EPA Method 537 Rev. 1.1 - validated analytical method - 14 PFAS in drinking water: 6 PFAS by 537 plus NEtFOSAA, NMeFOSAA, PFDA, PFDoA, PFHxA, PFTA, PFTrDA, PFUnA.
- CA DDW recently identified EPA Method 537.1- validated analytical method PFAS in drinking water; 18 PFAS, 14 analytes by EPA Method 537 Rev 1.1 plus 9Cl-PF3ONS; 11Cl-PF3OUdS; ADONA.
- Laboratories often use EPA Method 537 modified for nondrinking water because only drinking water methods currently exists; EPA currently developing methods under SW 846 for other media.
- CA has list of labs accredited to analyze for PFAS. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/pfos_and_pfoa/pfas_lab_list.pdf


Discussion
Questions