Per and Poly Fluoroalkyl Substances (PFAS): Why all the Fuss?

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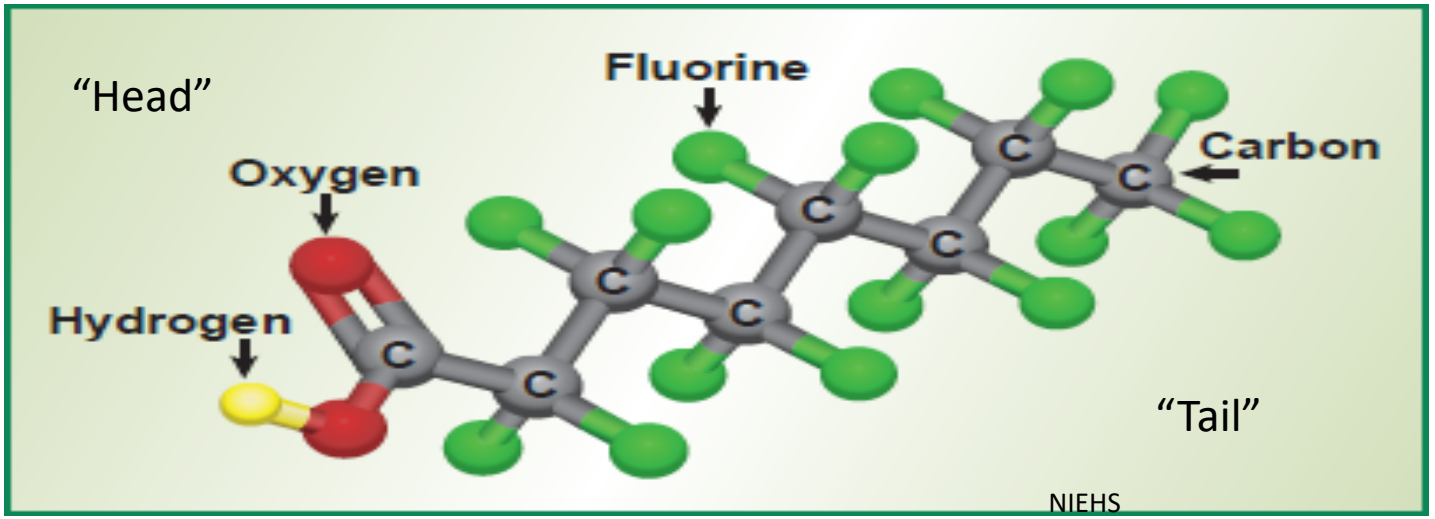
Background

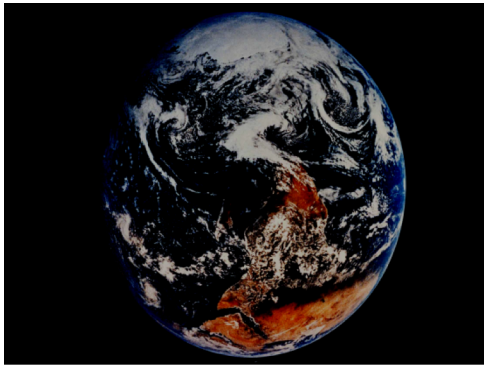
- What are PFAS?
- Chemical Properties
- PFAS Uses and Sources
- Why are PFAS a Problem?
- Possible Health Effects
- Evolving Science/Regulations

What Are They?

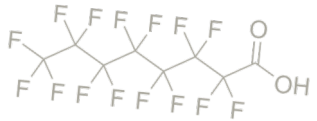
- **Poly and per fluoroalkyl substances**
- Chemical structure: A head (water soluble) and carbon chain tail with fluorine (water insoluble)

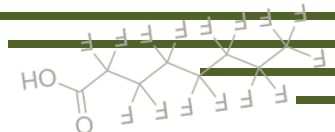


Chemical Properties



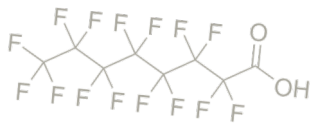
- Extremely stable
  - Heat resistant
  - Stain resistant
  - Water repellant
- “Forever chemicals”
  - Very persistent in the environment; do not readily biodegrade
    - Global impacts
- Water soluble

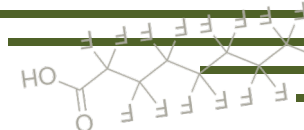





PFAS Uses

- Widely used since the 1950's: PFOS and PFOA phased out 2006
- Thousands of compounds
- Textile treatments: stain resistance/water repellency
- Paper coatings: grease resistant
- "Waxes": some floor, car, ski
- Some hairsprays
- Some "waterproof" down
- Manufacturing
- Aqueous Fire-fighting Foam (AFFF)





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Why Are PFAS a Problem?

- Slowly excreted from the body – half lives of years (1-8+ for longer-chain)
- Some can bioaccumulate into fish, wildlife
- Water solubility ⟶ drinking water contamination
- Some are very toxic
- Persistence in environment

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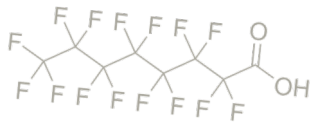
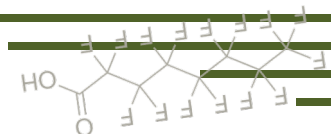
Wide Range of Health Risks

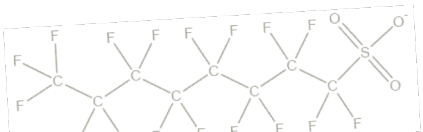
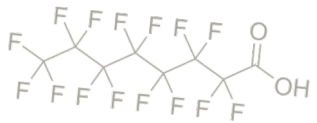
- Developmental risks to fetus/infants
  - Cross placenta; expressed in breast milk
- Reduced immune responses to vaccines in children
- Endocrine disruption
  - Thyroid hormone effects
- Cancers
  - Kidney; testes: human evidence
  - Pancreas; liver: lab animal evidence

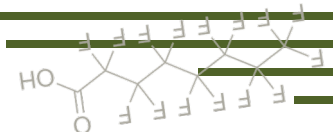



Evolving Science/Regulations

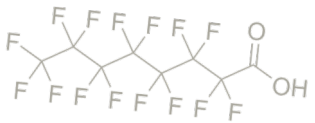
- Hundreds of publications every year
- Drinking water advisories and standards “fluid”
- EPA drinking water advisory ***only*** for PFOS and PFOA
    - 70 ppt: most states using by default
- Limited data on others
- Several states (NJ, VT, NH; MI; NY, MN, CA, CT) have lower values than EPA and/or included additional compounds

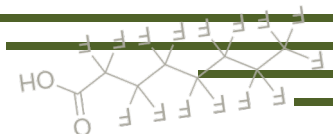





MassDEP Actions to Date

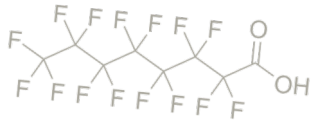
- Drinking Water
- Hazardous Waste Site Cleanup
- Wastewater Residuals
- Other

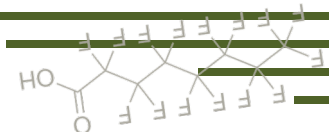





Drinking Water Program Status

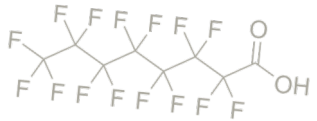
- Guideline adopted for 5 PFAS
- Drinking water standards process initiated
- New public water supply sources are required to test before they are placed on-line
- Statewide PWS testing data for PFAS posted on web
- Targeted sampling program initiated
- Drinking water lab certification
- Established “High Priority” status for treatment projects seeking Drinking Water State Revolving Fund financing

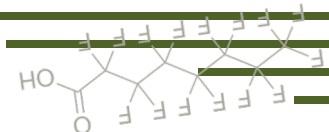





MA Drinking Water Guideline

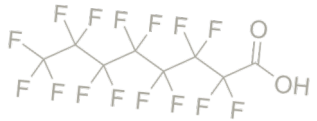
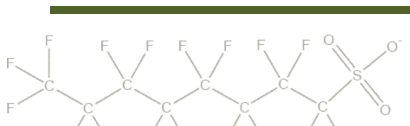
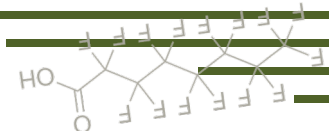
- MA Office of Research and Standards Guideline for Drinking Water (ORSG) Adopted June 12, 2018
- 70 ppt for PFOS, PFOA, plus **PFHxS, PFHpA, PFNA**
  - Relied on EPA Health Advisory values for PFOS and PFOA
  - Extended to very closely related compounds that have less extensive data
  - Based on similarities in chemical structures; half lives; toxicity
    - Approach also used by CT; VT
    - Reviewed and unanimously endorsed by MassDEP Health Effects Advisory Committee



Recent Drinking Water Developments

- CLF/TAC PFAS Petition
  - In summary, called on MassDEP to adopt a "treatment standard" for all PFAS in drinking water
  - MassDEP agreed to initiate MCL process and to further consider proposal
- ORSG under reconsideration
- MCL process initiated

What is Changing?

- On April 19th, MassDEP proposed a groundwater cleanup standard (GW-1) of 20 ppt for ∑ 6 PFAS
    - For ground water used as drinking water based on an updated review of available toxicology data
    - This value is not yet final
- Revised ORSG and drinking water standard (MCL) will be informed by this standard

Why the Selected Compounds?

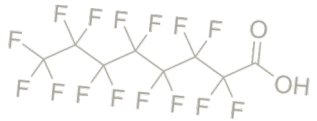
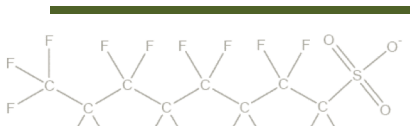
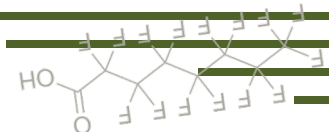
- 2018 OSRG = Considered all 6 PFAS included in UCMR 3 monitoring program
  - Five longer chain compounds (C6-C9)
  - One shorter (C4)
- Update:
  - EPA Method 537.1 analytes
    - +/- 2 carbons from PFOS/PFOA
      - 7 compounds total PFNA; PFHxS; PFHpA; PFHxA; PFDA (PFOS, PFOA)
    - PFHxA (C6) not included: much less toxic and shorter serum half-life
    - PFDA added: long $T^{1/2}$; similar tox. based on limited data

Drinking Water Values for PFAS
(parts per trillion; ppt) (Sept. 2019)

	PFOS	PFOA	PFNA	PFHxS	PFHpA	PFDA
USEPA Health Advisories	**70 Sum of two**		**NA**	**NA**	**NA**	**NA**
ATSDR Based on draft ATSDR toxicity values	**7**	**11**	**10**	**70**	**NA**	**NA**
NY Recommended MCL	**10**	**10**	**NA**	**NA**	**NA**	**NA**
NJ MCL or recommended	**13**	**14**	**13**	**NA**	**NA**	**NA**
CA Notification levels	**6.5**	**5.1**	**NA**	**NA**	**NA**	**NA**
VT GW standard/legislative	**20 Sum of five**					**NA**
MI Health-based values	**16**	**8**	**6**	**51**	**NA**	**PFNA value**
MN Drinking water guidelines	**15**	**35**	**NA**	**47**	**NA**	**NA**
NH MCLs	**15**	**12**	**11**	**18**	**NA**	**NA**
CT Action Levels	**70 Sum of five**					**NA**
MA Current ORSG	**70 (2018 ORSG) → 20 (proposed GW-1 standard) Sum of five → Sum of six (adds PFDA)**					
Most other states (EPA value by default)	**70**		**NA**	**NA**	**NA**	**NA**

Hazardous Waste Site Cleanup Program Status

- Guidance on sampling at disposal sites regulated under the Massachusetts Contingency Plan issued
- Draft MA Hazardous Waste Site Cleanup Program (MCP) standards proposed April 2019:
  - Groundwater as drinking water = 20 ppt for sum of 6 PFAS
  - Soil standards – under reconsideration due to recent data on background levels
  - Public comment period closed in July
  - MassDEP finalizing response to comments and standards by end of the year

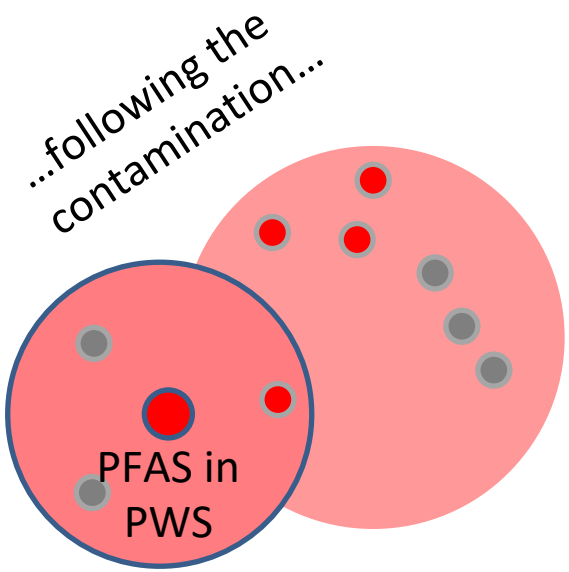
MCP PFAS Standards Public Comments

- Which PFAS Should be Regulated?
  - Include all PFAS
  - Include only PFOA and PFOS
  - Add two longer-chain PFAS
  - Delete PFHpA and PFDA
  - Don’t regulate any at this time
- Are proposed standards appropriate?
  - They are not health protective and should be lower, 1 ppt
  - They are overly protective and should be higher
  - The proposed values were not explained sufficiently

MCP PFAS Standards Public Comments

- Is MA's additivity approach appropriate?
  - No, it should be applied to all PFAS as a group
  - No, treat as individual compounds/no additive standard is warranted, the compounds are not sufficiently similar
- Other comments:
  - Soil standards are likely below background
  - Soil levels cannot be reliably detected at the specified level
  - Leaching calculations are overly conservative

MassDEP PFAS Site Cleanup Activities

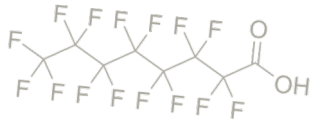


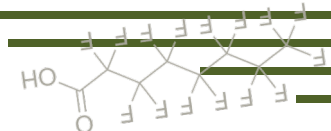
- **Source Discovery**
  Issue Requests for Information (RFIs) and
  Notices of Responsibility (NORs)
- **Sampling private wells**
  near known PFAS-contaminated public wells
  (Potential Responsible Party (PRP)-lead or MassDEP-lead)
- **Working w/EPA and Department of Defense**
  cleanup & funding issues

MassDEP has issued guidance to Licensed Site Professionals (LSPs) for PFAS investigations
Proposed draft MCP Method 1 cleanup standards for soil and groundwater – expect to be finalized in 2-3 months.

Wastewater and Residuals

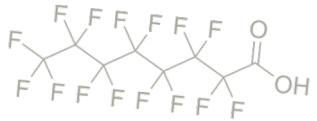
- PFAS are in WWTP residuals and wastewater
- Significance remains a question
- MassDEP following developments nationally and in other states
    - Background concentrations in soils
    - Leachability and bioavailability
    - Data from other states (e.g. ME: screening levels exceeded)
  - Initial MA data collection underway
    - Approval of Suitability renewals include required PFAS testing
    - As there is no EPA approved method; MassDEP reviewing proposed laboratory methods and data
- Efforts to identify source inputs and industrial pretreatment/ P2 options warranted?

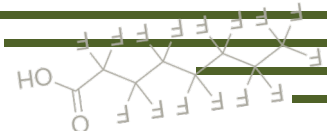





Other Efforts

- PFAS Drinking Water lab certification
- Firefighting foam collection & disposal program implemented
- Request to water bottlers for sampling results
- Interagency and interstate information sharing/coordination
- MassDEP ORS and WES following research and policy developments



Concluding Comments

- Many initiatives underway
- Developing science means standards may well change
- Public attention likely to increase (Dark Waters)
- Questions?