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A PFAS Primer

Water Reuse Nor Cal Chapter Meeting

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Green Science Policy Institute

Feb. 21, 2020



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Education

Research

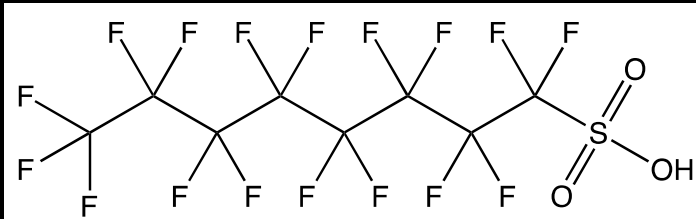
Retreats

Policy & Purchasing Change

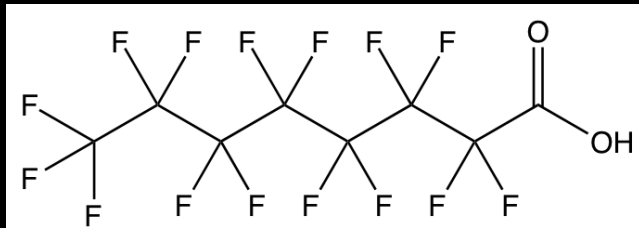
PFAS

(Per and Polyfluoroalkyl Substances)

PFOS



PFOA



Carbon-Fluorine bond strength:

- Leads to oil and water repellency
- “Forever chemicals” -- last for geologic time!

Common Uses



CARPETS



CARPET CLEANING
PRODUCTS



FOOD PACKAGING



FURNISHINGS



COSMETICS



OUTDOOR GEAR



CLOTHING



ADHESIVES AND SEALANTS



PROTECTIVE COATINGS



NON-STICK COOKWARE



CARSEATS



FIREFIGHTING FOAM

May 2000

3M Employee Bulletin

Date: 05/16/2000

3M Phasing Out Some of its Specialty Materials

3M will phase out of the perfluorooctanyl chemistry in certain repellents and surfactant products by the end of this year. We thank the people in these business units for their hard work. They have consistently given the company and our customers their best efforts. For more information, below is a news release issued this morning:

ST. PAUL, Minn -- May 16, 2000 -- 3M today announced it is phasing out of the perfluorooctanyl chemistry used to produce certain repellents and surfactant products.



Ohio River Valley: West Virginia Manufacturing Plant

- PFOA used to manufacture Teflon
- Releases to water & air
- 70,000 + residents with contaminated drinking water
- C8 Health Study

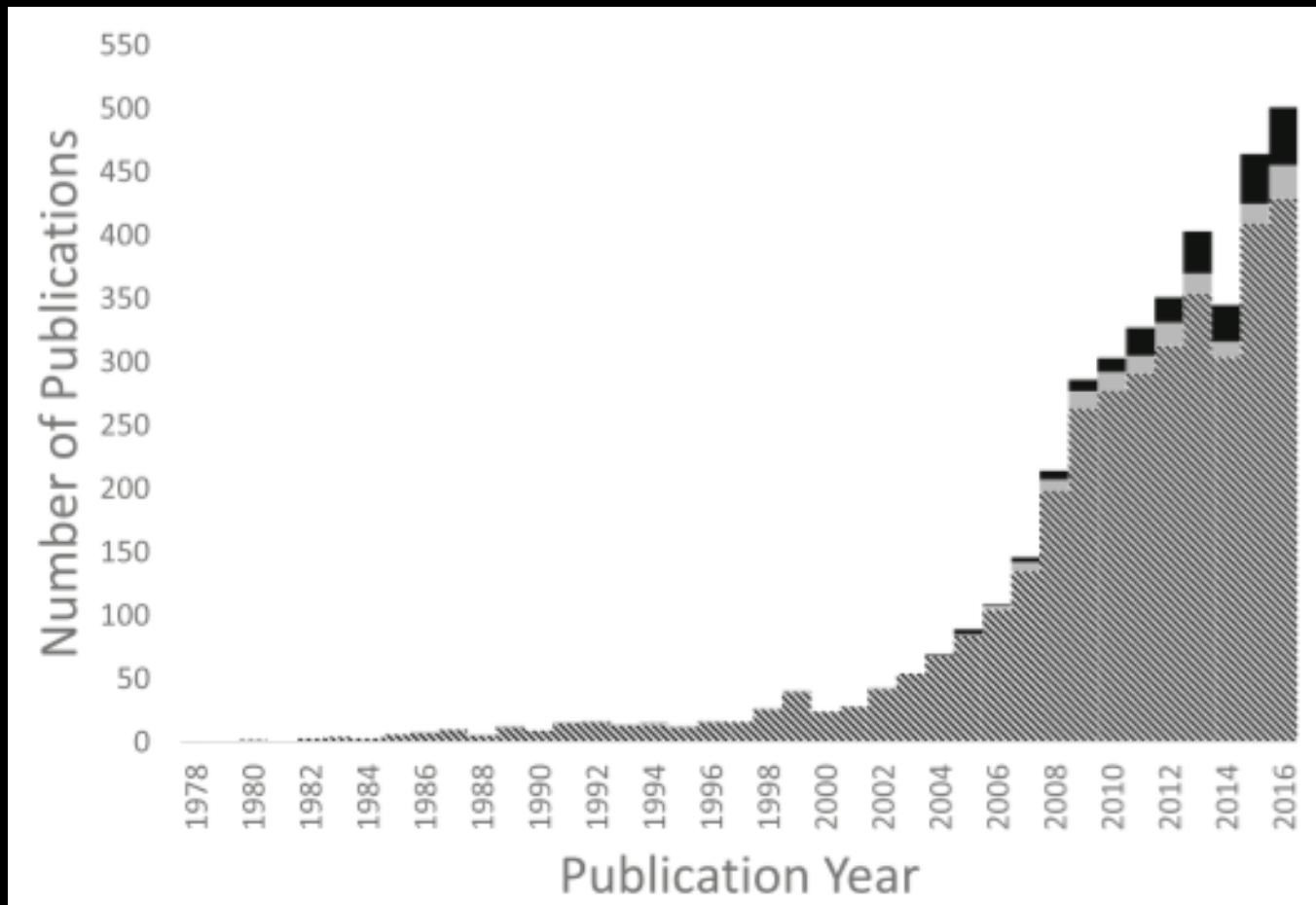


Movie: Dark Waters

- The story of attorney Rob Bilott, who uncovered massive PFOA contamination from a DuPont factory in WV



Scientific publications on PFAS



Perfluorochemical Surfactants in the **Environment**

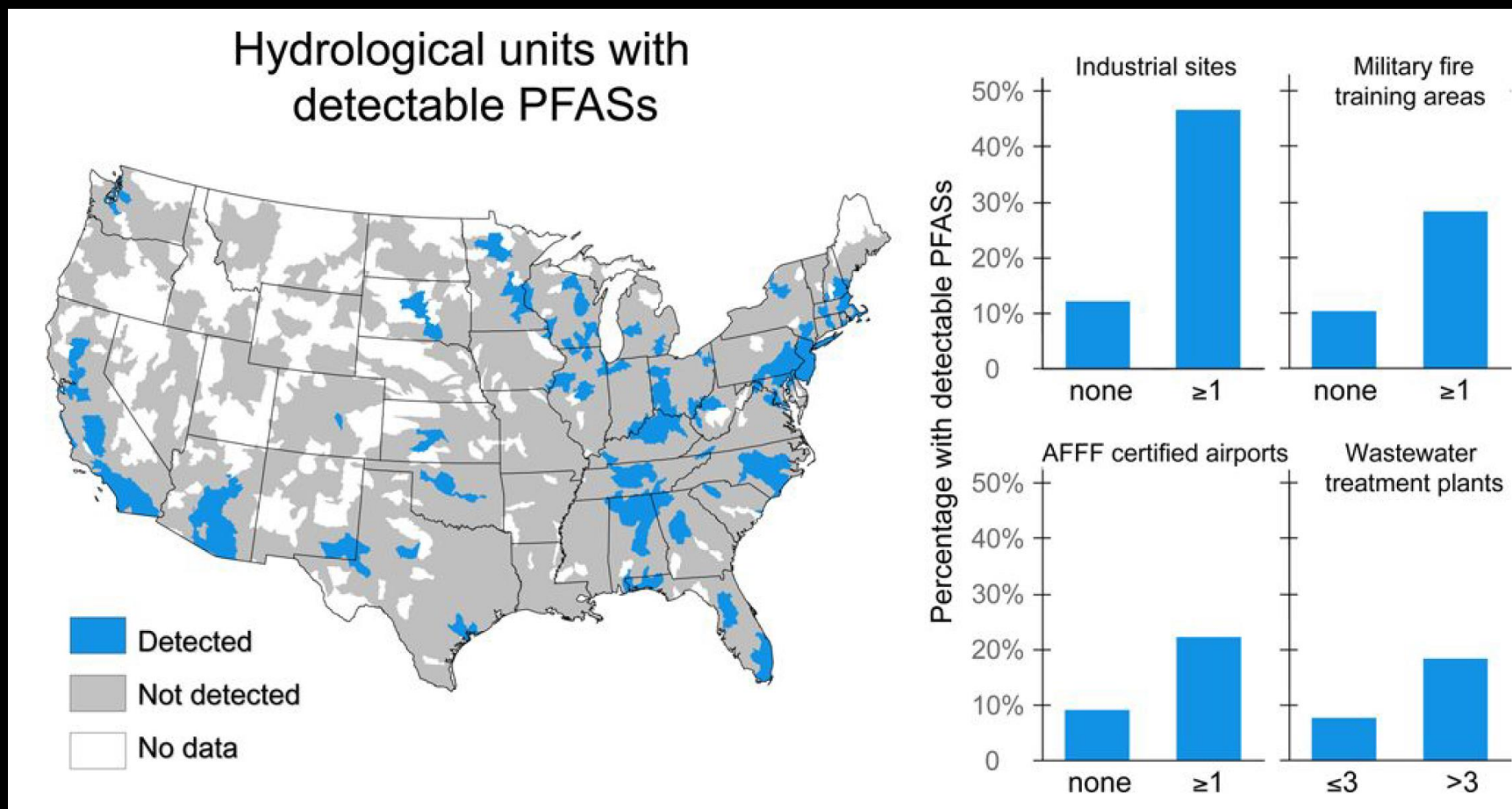
**These bioaccumulative compounds
occur globally,
warranting further study.**

JOHN P. GIESY AND KURUNTHACHALAM KANNAN

- Ubiquitous
- Long-range transport



UCMR₃ Data



EPA Lifetime Health Advisory Level of 70 ng/L PFOA + PFOS

PFASs exposure is a health concern



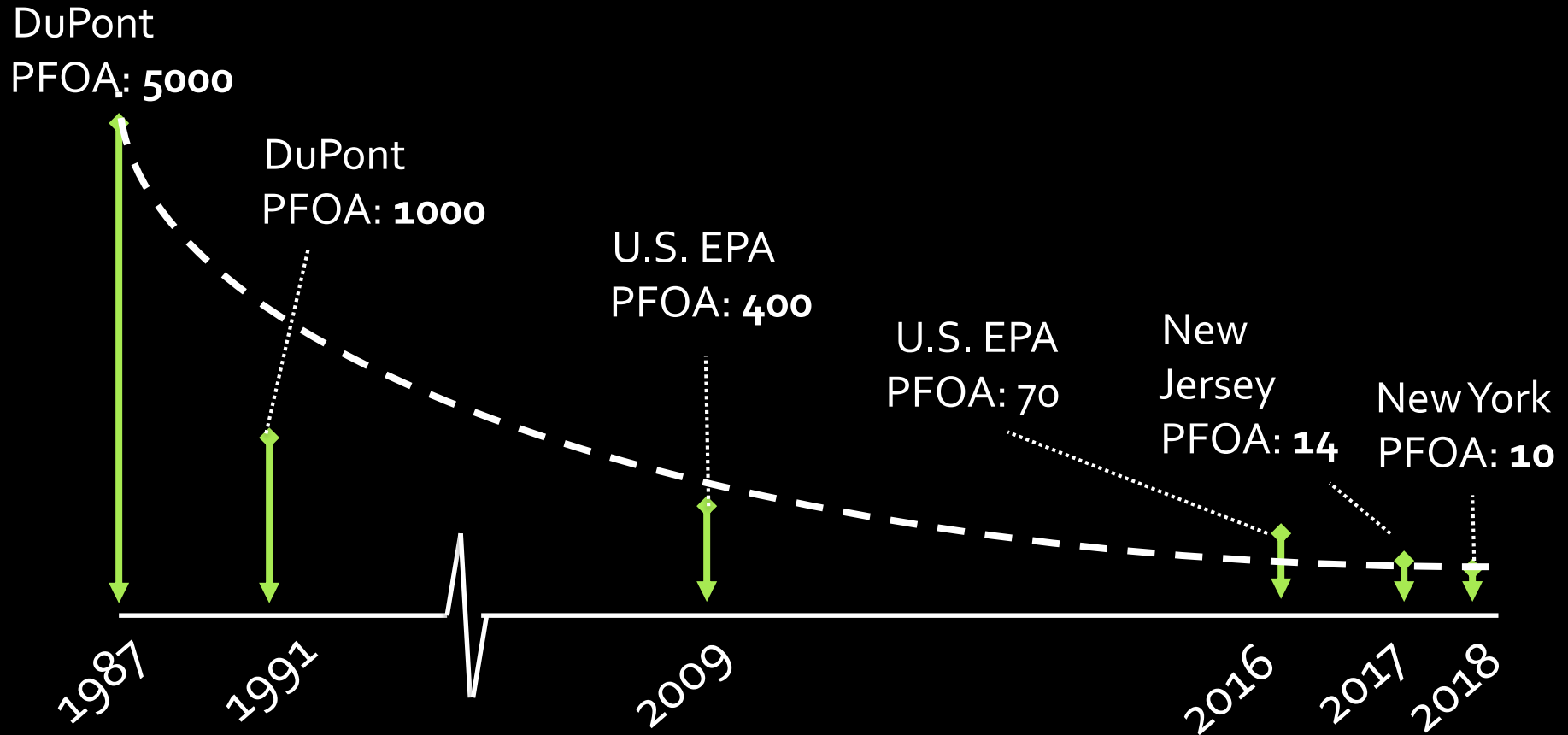
Exposure linked to health risks:

Cancer, elevated cholesterol, obesity, immune suppression, and endocrine disruption

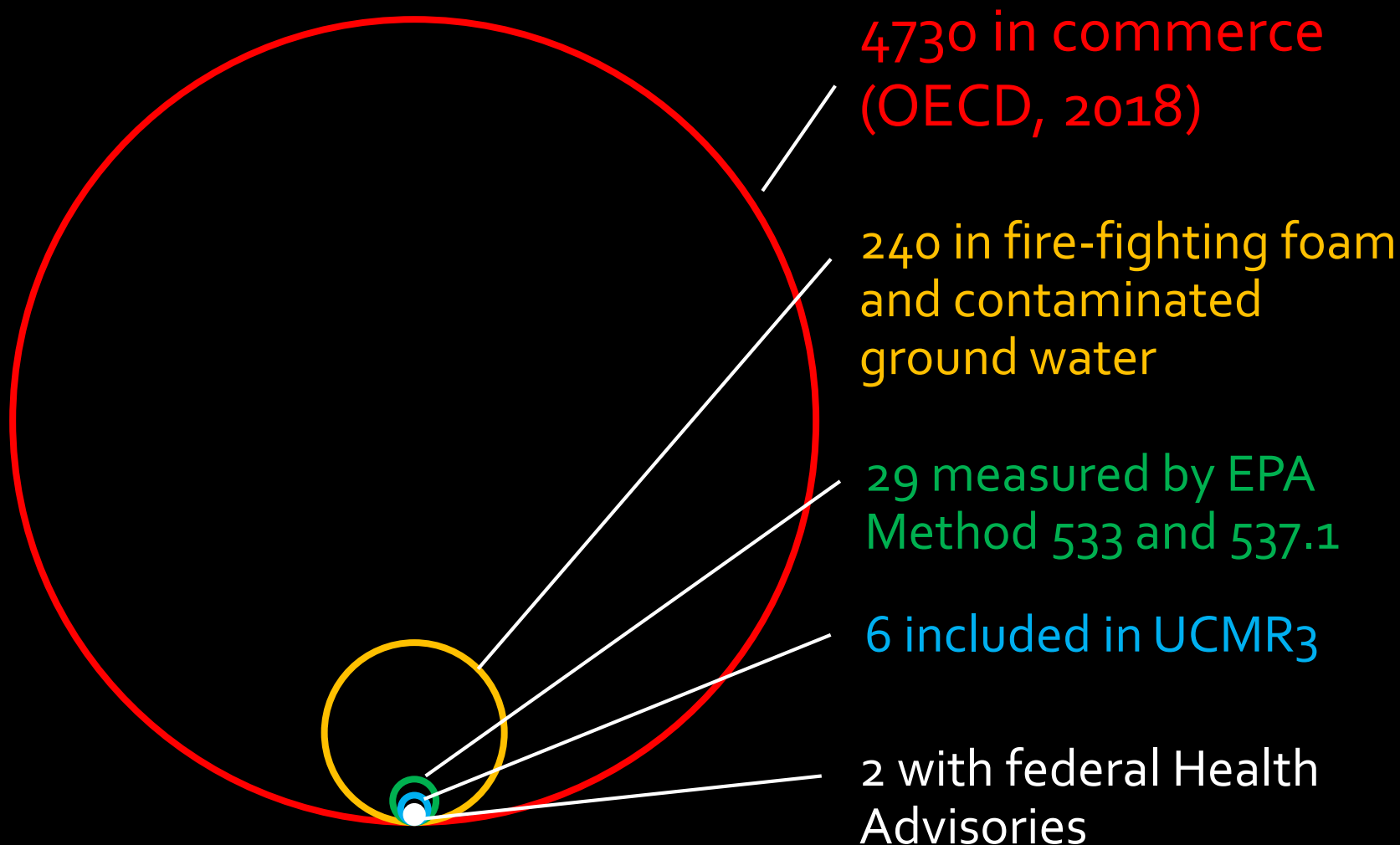
Courtesy, Cindy Hu, Harvard University

(Ref: Lewis et al., 2015; Grandjean et al., 2012; Braun et al., 2016; Barry et al., 2013)

Drinking Water Health Guidelines (ng/L)



PFAS

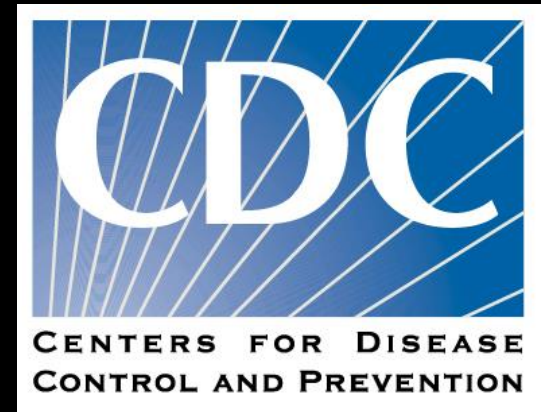


Recent comments from CDC

Patrick Breysse, Director of the CDC's National Center for Environmental Health:

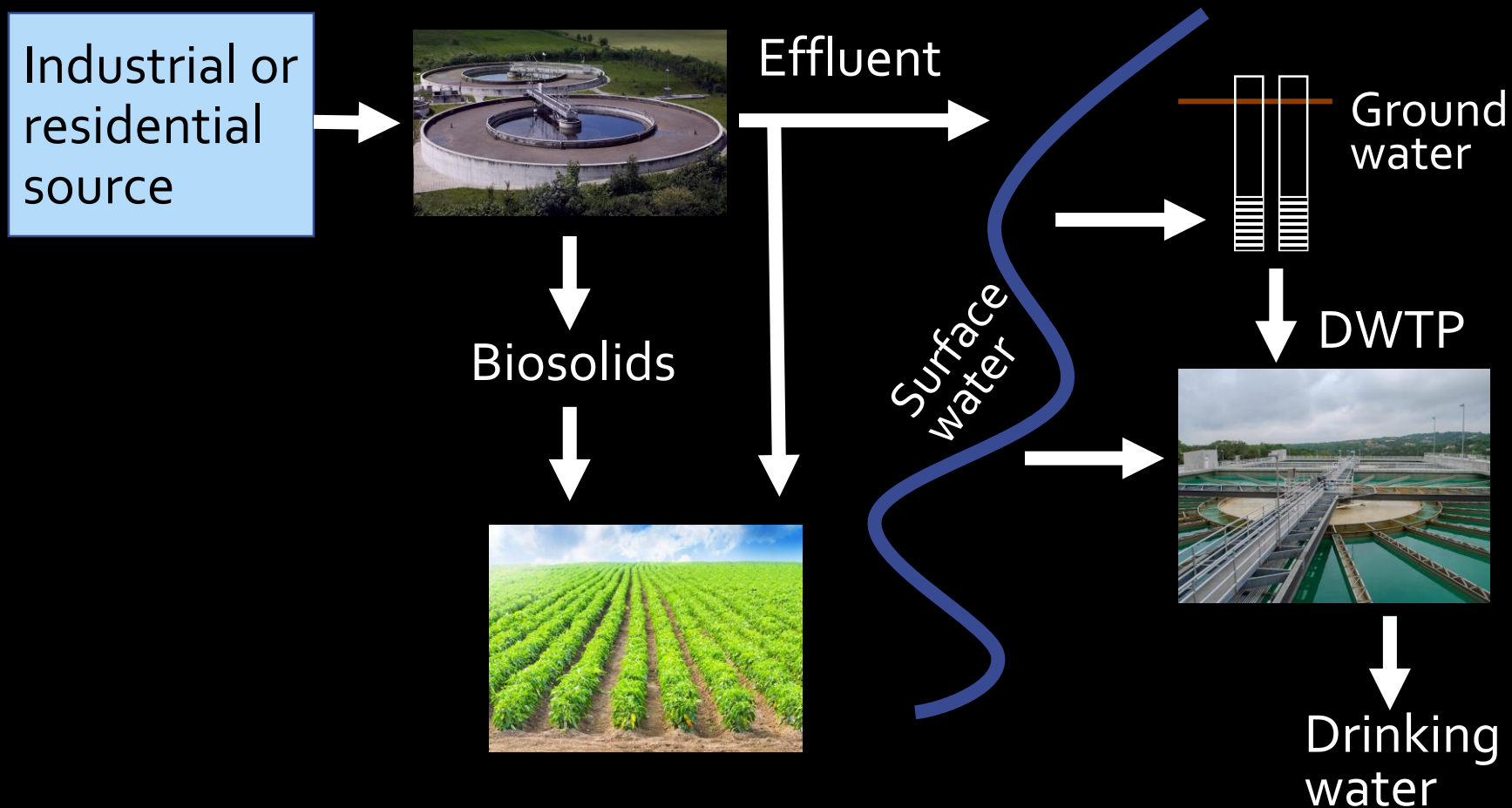
The presence of perfluorinated chemicals in U.S. drinking water is "one of the most seminal public health challenges for the next decades."

"...it won't be too long before we think hundreds of millions of Americans will be drinking water with levels of these chemicals above levels of concern."

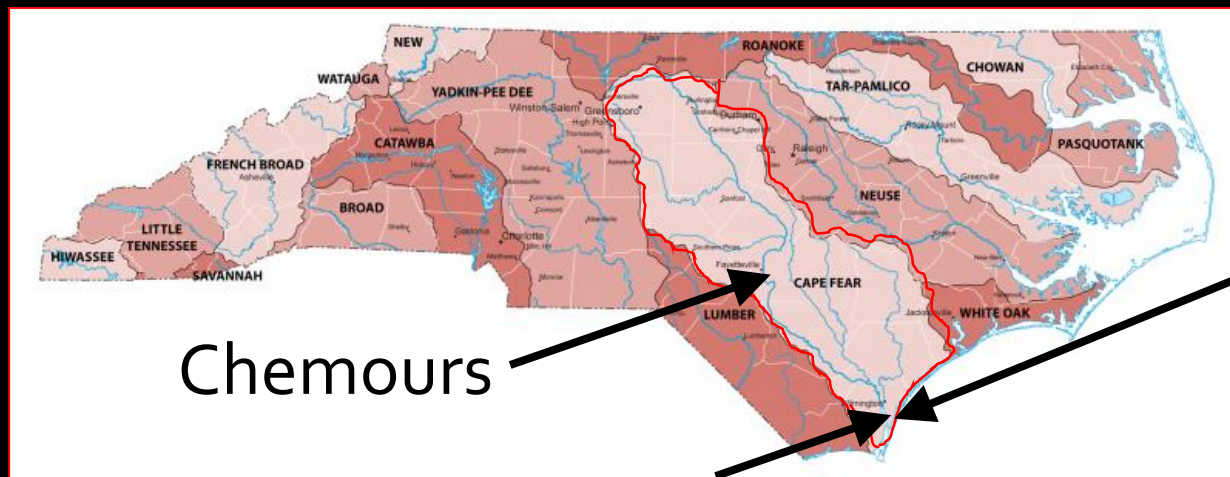


- BNA News, Oct. 17, 2017

PFAS Fate



Water Treatment Costs: North Carolina



Chemours

Brunswick County:
reverse osmosis
filtration:

- \$99M to build
- \$2.9M to operate

Cape Fear Public Utility Authority
activated carbon filtration:

- \$46M to build
- \$2.7M to operate each year

Wilmington Star News, May 9th & 10th, 2018

PFAS are Problematic
& Difficult to Clean Up

Prevention is preferable!
Only use when necessary

Congressional PFAS Task Force

- Launched 1/24/19

- Goals

- Educate
- Elevate
- Legislate
- Appropriate



- Accomplishments

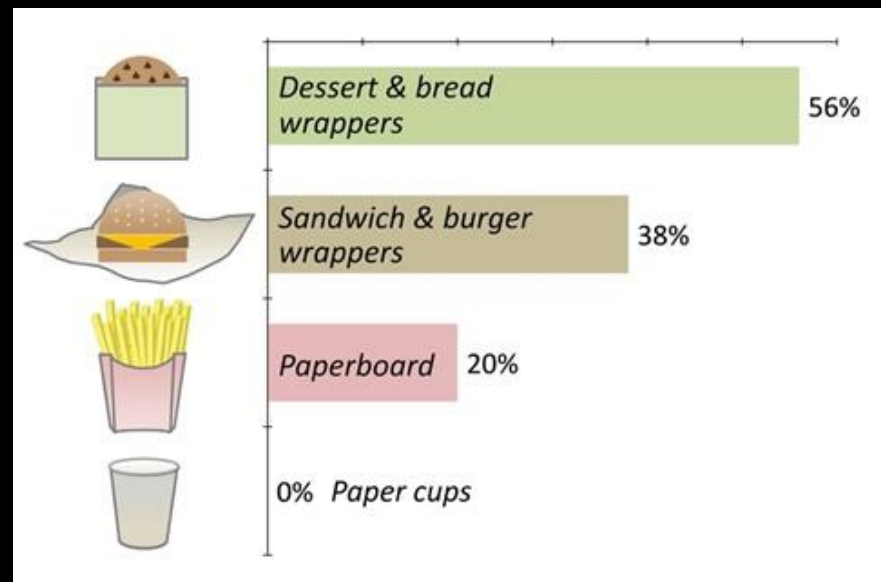
- CDC Health Studies
- USGS monitoring
- Stop DoD and FAA use of PFAS firefighting foam

Reducing PFAS in food packaging

- 2017 - GSP research & workshops
- 2018 - WA state ban
- 2019 - City of SF ban
- NGO pressure



- Retailer decisions to remove PFAS



Schaider et al., Environ. Sci. Technol. Lett. 2017

Carpet industry phasing out PFAS

- GSP workshops
 - Demand from large purchasers
 - Potential CA regulation
 - Potential liability
- ↓
- Major manufacturers decide to stop using PFAS



Home Depot plans to phase out selling rugs and carpets containing PFAS

By VIRGINIA GORDAN • SEP 17, 2019

[Share](#) [Tweet](#) [Email](#)



The Home Depot announced Tuesday that it will stop buying from its suppliers any rugs and carpets that contain [PFAS chemicals](#).

"Excluding PFAS from the carpets and rugs we sell is another example of our shared commitment to building a better

BRANDS ARE ELIMINATING HIGHLY FLUORINATED CHEMICALS

IKEA

H&M

Crate&Barrel

LEVI STRAUSS & CO.

PUMA

benetton

ESPRIT

adidas

MARKS &
SPENCER

MANGO

BURBERRY[®]
LONDON

ZARA


Moving away from PFAS



Thank you!

PFAS CENTRAL
A PROJECT OF GREEN SCIENCE POLICY

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PFAS Central: sharing notable news, scientific papers & events

NEWS

PFAS Chemicals to be Banned in Firefighting Foam Used on Military Bases

U.S. Senator Kirsten Gillibrand today announced that a provision she cosponsored to prohibit the Department of Defense from procuring firefighting foam that contains per- and polyfluoroalkyl substances (PFAS) passed the Senate Armed Services Committee as part of the annual National Defense Authorization Act (NDAA).

[LEARN MORE](#)

SCIENCE

Larval amphibians rapidly bioaccumulate poly- and perfluoroalkyl substances.

Toxic frogs lead to bioaccumulation in predator species.

[LEARN MORE](#)

POLICY

The Cost of Inaction: A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS

A recent Nordic Council study, The Cost of Inaction: A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS, estimates the very high cost of harm to human health and the environment from PFAS exposure in Europe.

[LEARN MORE](#)

To learn more:
Sign up for our newsletter

tom@GreenSciencePolicy.org

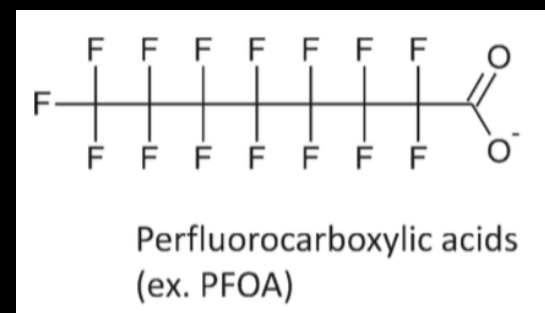
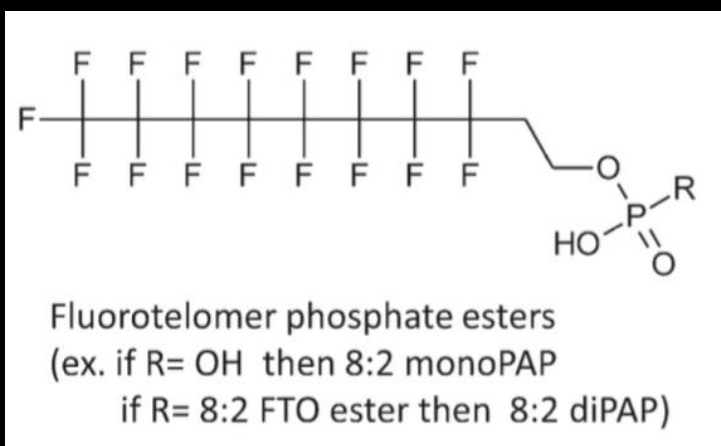
PFASCentral.org

Sources of PFAS Emissions

- Industrial
 - Plants that produce PFAS
 - Plants that use PFAS: metal finishing, paper mills, etc.
- Firefighting foam
 - Military bases, airports, etc.
- Landfills
- Consumer products* – carpets, apparel, food packaging, cosmetics, other

Conventional treatment trains not effective

- Perfluoroalkyl acids (PFOA, PFOS, etc.) resistant to biodegradation
- Aerobic treatment oxidizes precursor compounds, generating more perfluoroalkyl acids
- Effluent > Influent

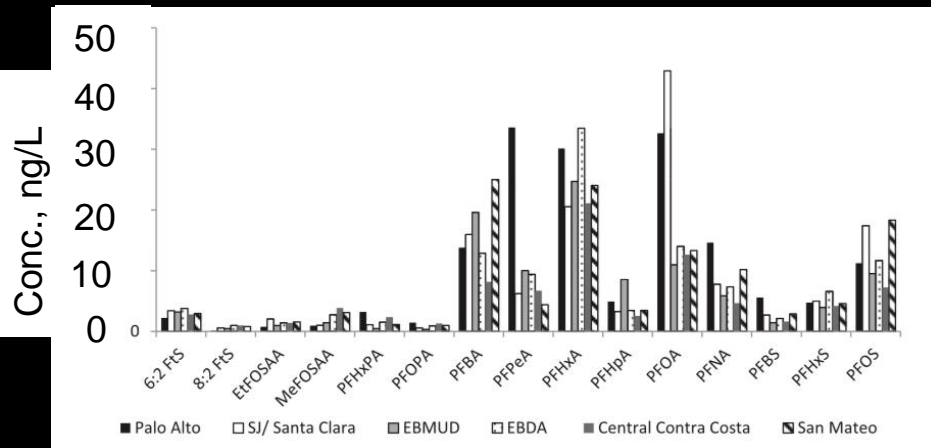


From WWTTPs to the Environment: Biosolids

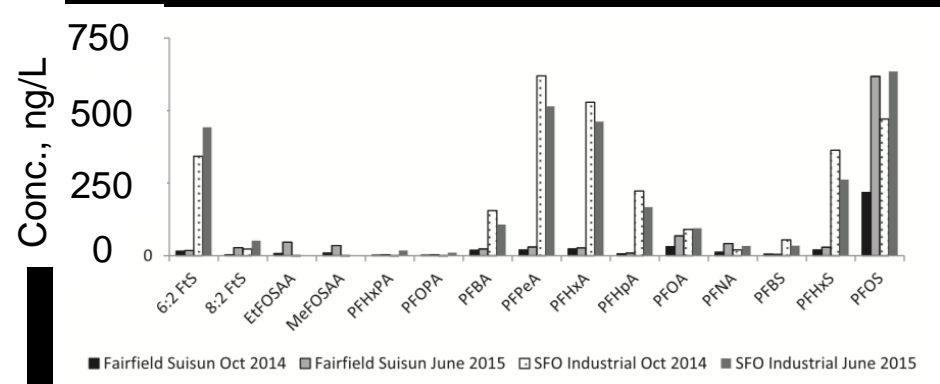
- Partitioning to biosolids
 - Long-chains > short-chains
- 2013 study: 10 out of 13 PFAS analyzed consistently detected in US municipal biosolids samples
- Potential for accumulation in agricultural soils & uptake to food crops

High input = high output. Industrial sources & firefighting foam are important.

PFAS in WWTP effluent with and without AFFF use



No known AFFF



With AFFF use (note y-axis scale)

Houtz et al., Water Res. 2016

Maine

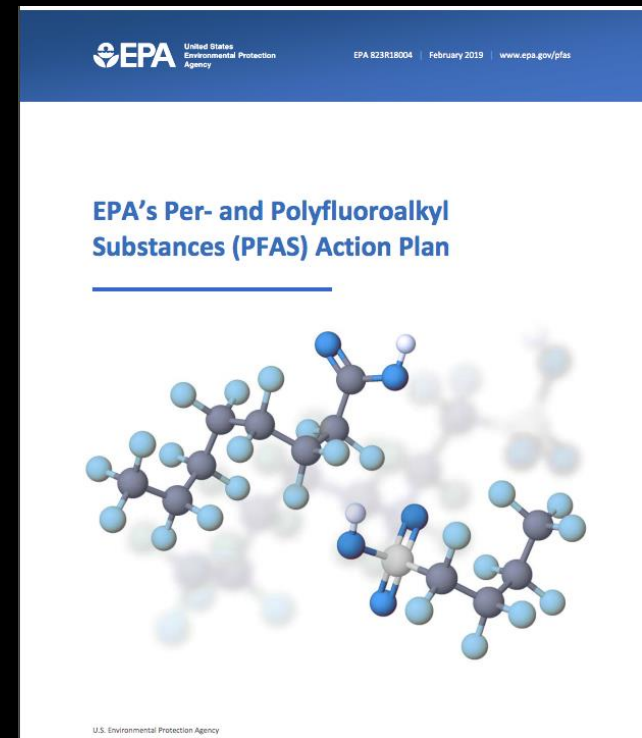
- Paper mill sludge led to contamination of
 - Local municipal supply well
 - Milk at dairy
- Maine DEP:
 - All biosolids must now be tested for PFAS prior to use
 - Initial testing: nearly all biosolids exceed state screening levels for PFOS and/or PFOA (5.2 and 2.5 ng/g)



theintercept.com/2019/06/07/pfas-chemicals-maine-sludge/

U.S. EPA

- May 2018: PFAS Summit
- Feb. 2019: PFAS Action Plan
 - Drinking water
 - Cleanup
 - Toxics
 - Monitoring
 - Research
 - Enforcement
 - Risk Communication

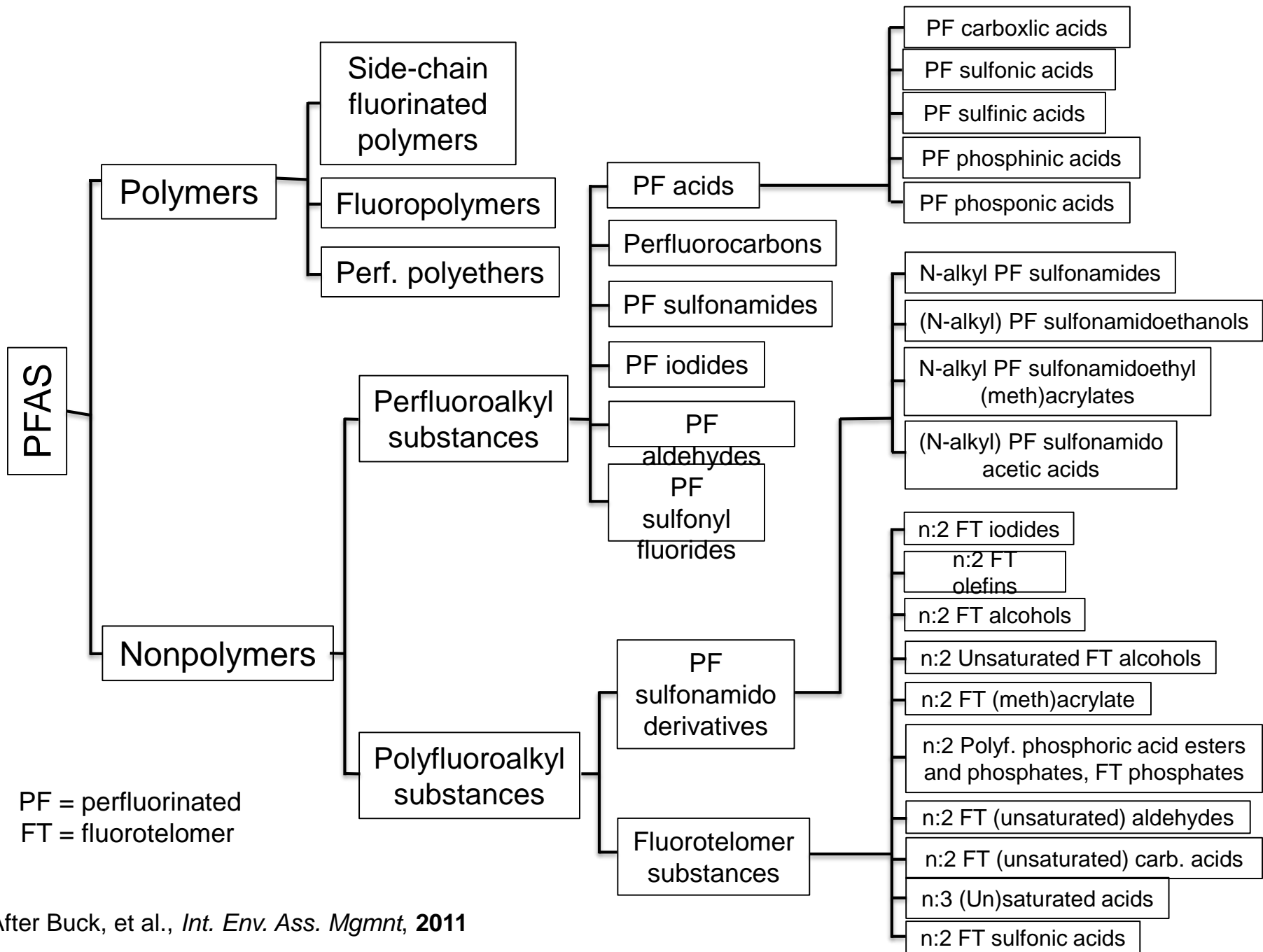


Drinking water: US states

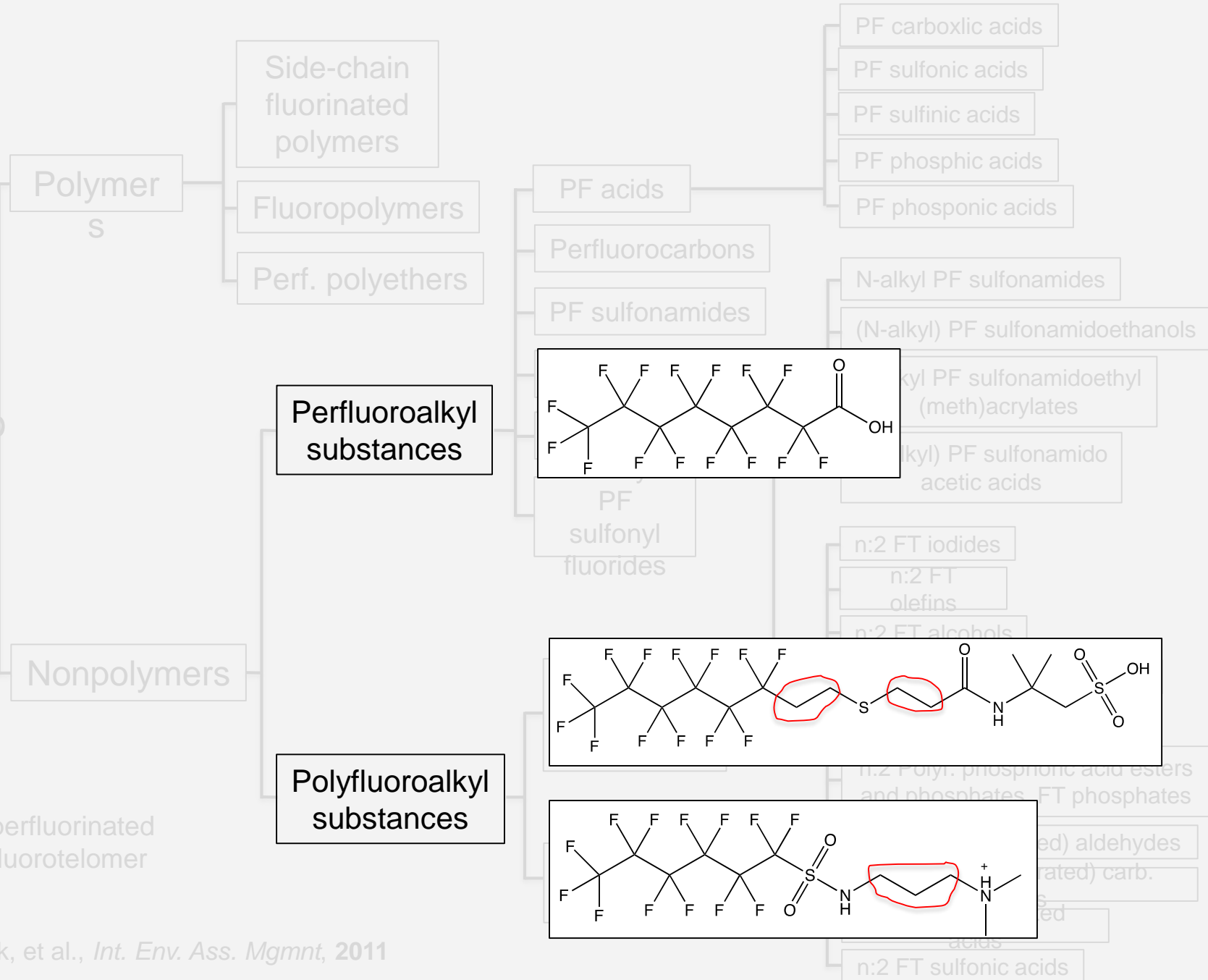
Adopted or proposed standards & guidelines

- MN
- MI
- NJ
- VT
- CA
- NC
- NH
- NY
- PA
- WA





PFA



PF = perfluorinated
FT = fluorotelomer

