



GREEN SCIENCE
POLICY INSTITUTE

Understanding PFAS: For Healthy Drinking Water and Fire Safety

Arlene Blum PhD and Tom Bruton PhD
Green Science Policy Institute

More info: www.GreenSciencePolicy.org



GREEN SCIENCE POLICY INSTITUTE



Research



Education



Toxic Reduction
Retreats

Policy & Purchasing Change

"Six Classes" of Chemicals of Concern

1

Highly
Fluorinated



2

Antimicrobials



3

Flame
Retardants



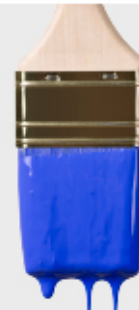
4

Bisphenols
+ Phthalates



5

Some
Solvents



6

Certain Metals



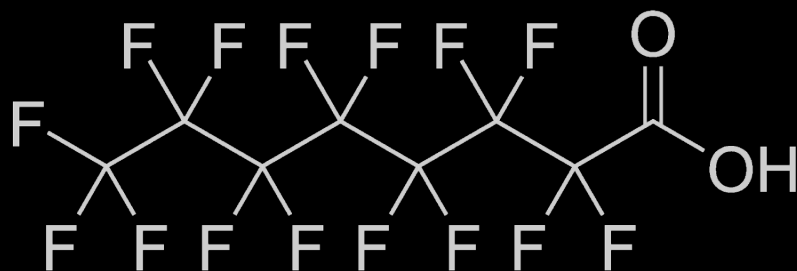
Four-minute videos at www.SixClasses.org

Is it necessary?

Is it worth it?

Is there a safer alternative?

Class 1: Highly Fluorinated Chemicals



PFOA or C8



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

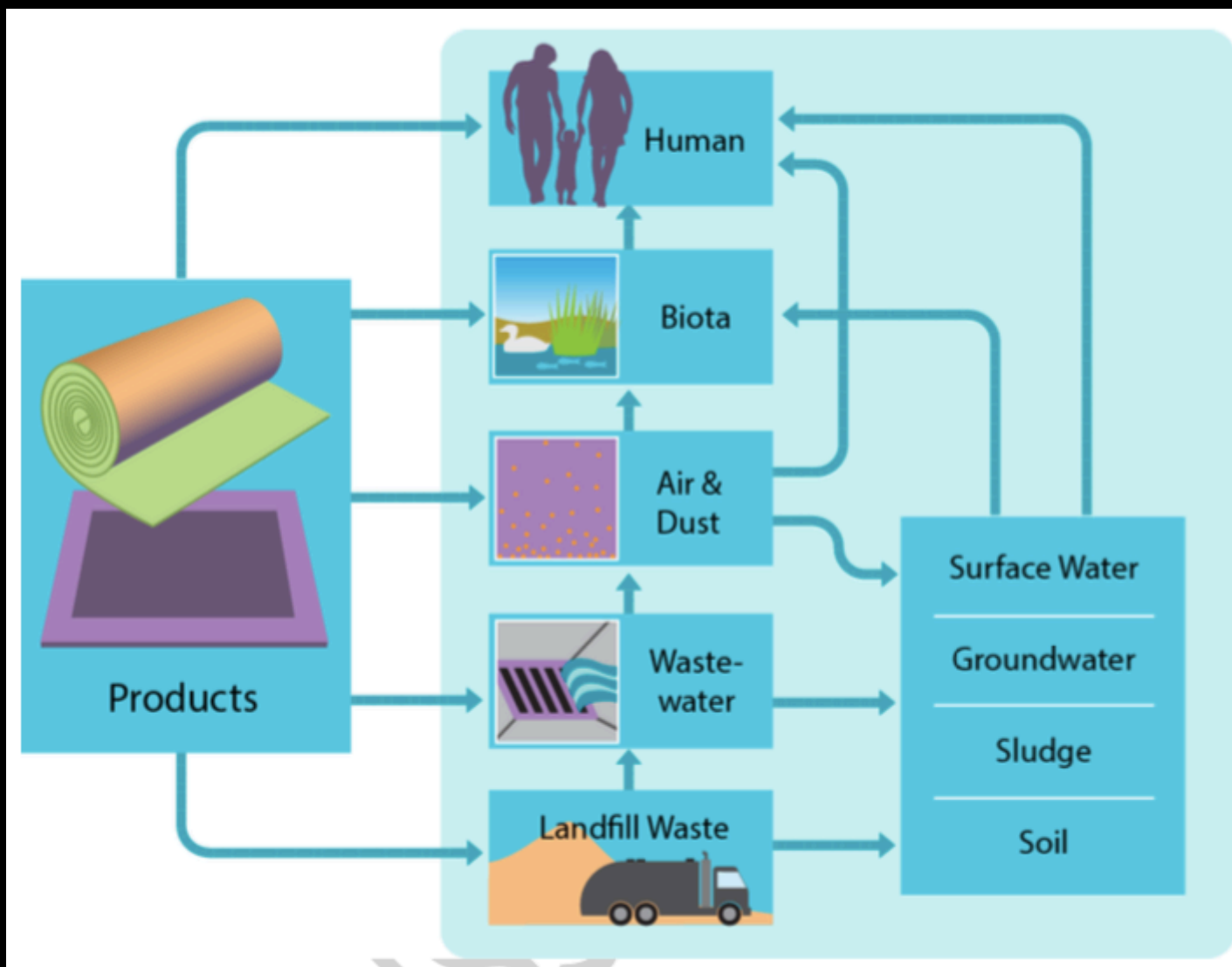


CARSEATS



FIREFIGHTING FOAM

Pathways to the Environment



PFASs exposure is a health concern



Exposure linked to health risks:

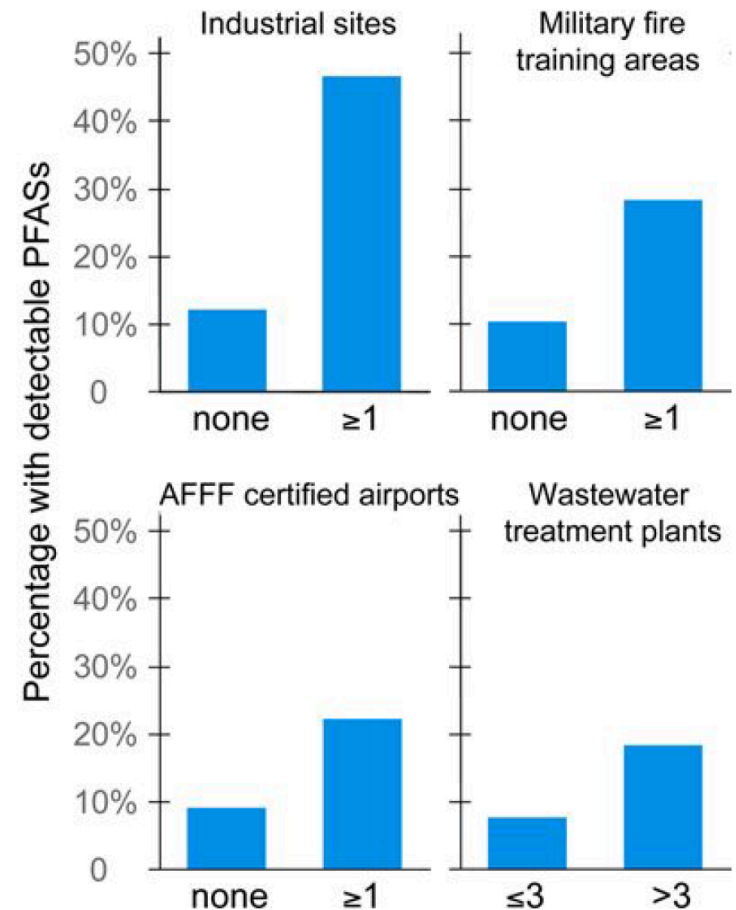
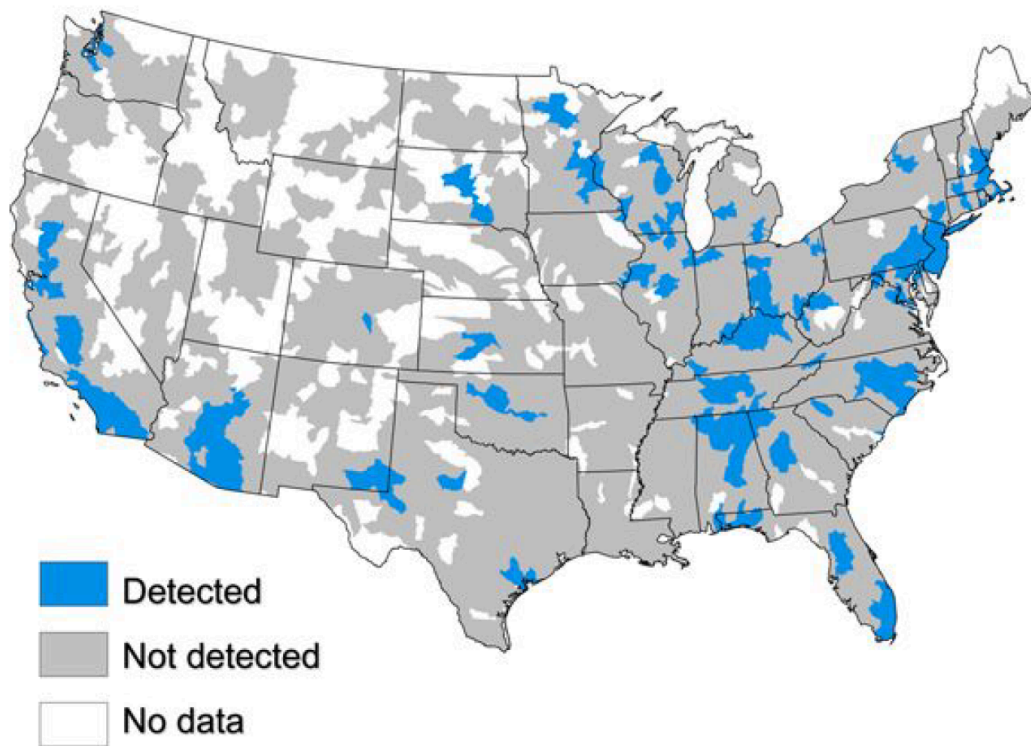
Cancer, elevated cholesterol, obesity, immune suppression, and endocrine disruption

Courtesy, Cindy Hu, Harvard University

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

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

Hydrological units with detectable PFASs



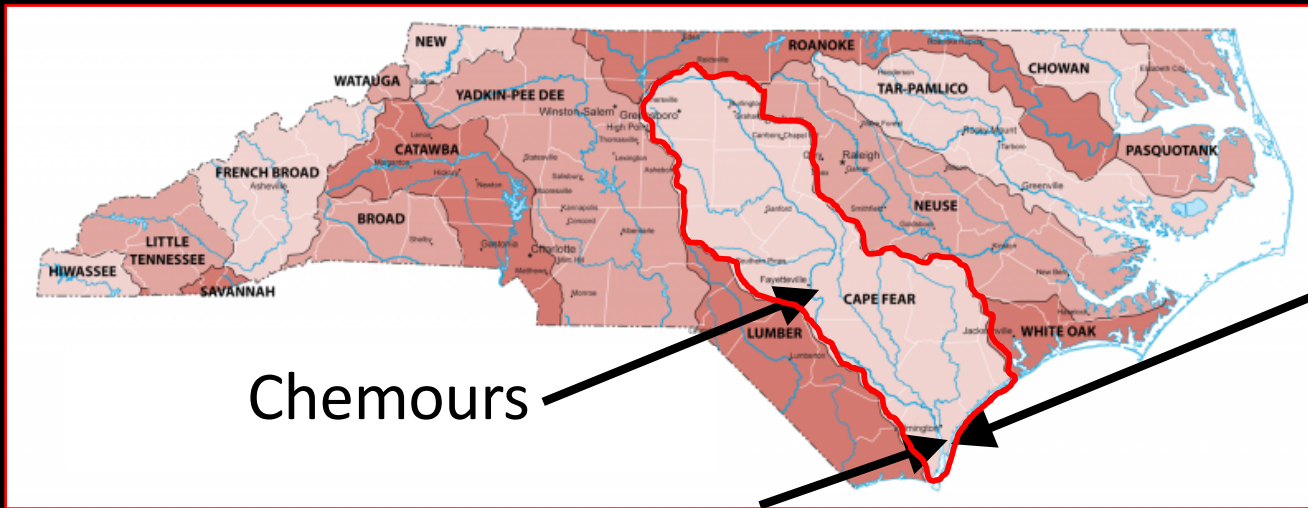
Hu et al., Environ. Sci. Technol. Lett. 2016

Highly Fluorinated Hush Puppies

- Wolverine used Scotchguard (PFOS) used for leather treatment 1950s – 2000
 - Leather scrap dumped
 - Sludge applied to fields
- PFOA + PFOS level up to 58,000 ppt
(842 times EPA health advisory level)



Water Treatment Costs: North Carolina



Chemours

Brunswick County:
reverse osmosis
filtration for 25,000
customers:

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

Cape Fear Public Utility Authority activated
carbon filtration plant:

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

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

PFAS are Problematic
& Difficult to Clean Up

Prevention is Preferable!

CA proposal to list carpets with any PFAS

February 15, 2018



The CA Department of Toxic Substances Control (DTSC) is proposing to list carpets & rugs containing any PFAS as priority products for regulation.

Washington State's Healthy Food Packaging Act Signed into Law



Signed by Governor Inslee
March 21, 2018

Bans paper food packaging
containing any PFAS

<https://toxicfreefuture.org/key-issues/legislative-priorities-2018/>



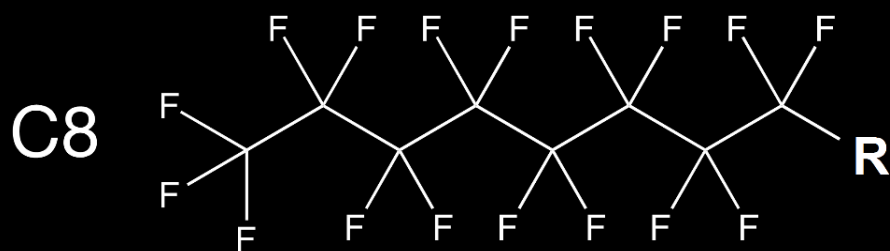
The
Intercept_

THE U.S. MILITARY IS SPENDING MILLIONS TO REPLACE TOXIC FIREFIGHTING FOAM WITH TOXIC FIREFIGHTING FOAM



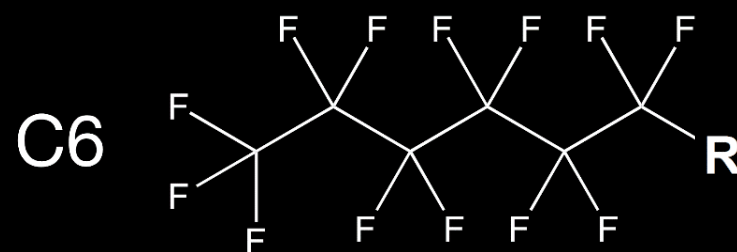
Sharon Lerner, The Intercept, February 10, 2018

US: Is C6 the “environmentally friendly” alternative to C8?



Concerns:

- Extreme persistence
- Bioaccumulation
- Toxicity



Concerns:

- Extreme persistence¹
- Bioaccumulation in plants⁴⁻⁵
- Suspected toxicity¹
- More mobile⁶
- Remediation more difficult⁷⁻⁹

Fluorine-Free Foams

| Manufacturer | Foam |
|-----------------------|---|
| Angus / National Foam | Jetfoam (Aviation), Respondol (Class B) |
| Auxquimia | UNIPOL |
| Vsfocum | Silvara |
| Bioex | Ecopol |
| Fomtec | Enviro 3x3 Plus |
| Solberg | Re-healing Foam RF6 / RF ₃ |
| Dr. Sthamer | Moussol F-F ₃ /6 |
| Biosafety Technology | Trident |
| 3F | FREEFOR SF, HYFEX SF, FREEDOL SF |

AFFF Phase-out in Norway

- 2011: Domestic airports in Norway phase out AFFF and adopt fluorine-free foam
- 2015: Norwegian Defense Force begins adoption of fluorine-free foams



Source: Norwegian Environment Agency

South Australia: AFFF Ban

Jan. 30, 2018

Applies to all fluorinated firefighting foams for all applications

Australia: about 90% of airports are now using fluorine free foams.
(They can reach the highest level of performance in ICAO (International Civil Aviation Organization) extinguishment tests.)



Washington State's Ban on PFAS in Firefighting Foam Passes both Houses

(HB 2793/SB 6413)



- Signed by Governor Inslee on March 27
- Bans sale of firefighting foam containing any PFAS beginning July 1, 2020
- Bans the use of PFAS-containing foam for training beginning July 1, 2018.
- Requires notification regarding firefighting gear that contains any PFAS

More info <https://toxicfreefuture.org/key-issues/legislative-priorities-2018/>



In 2012, after extensive testing, Heathrow in the UK switched away from the use of all PFAS. In 2015, a British Airways airbus caught fire and firefighters safely put out the flames with fluorine-free foam

“zero cleanup costs and zero environmental concerns”

Graeme Day, fire service compliance manager, Heathrow



<http://www.bio-ex.com/responsible-commitment/responsible-environmental-commitment>

PFAS are Problematic
& Difficult to Clean Up

Prevention is Preferable!



GREEN SCIENCE
POLICY INSTITUTE

Preventing Harm from PFAS

Tom Bruton PhD
Green Science Policy Institute

Summary of Recommendations

1. Change the MILSPEC (Specification for Firefighting Foams) and allow the use of fluorine-free foams with similar efficacy.
2. Change FAA rules to allow the use of fluorine-free foams at civilian airports.
3. Do not use PFAS fire-fighting foams for aviation and other practice drills.
4. When considering alternatives, avoid the entire class of PFAS.
5. Monitor for a diversity of PFAS in drinking water.
6. Develop enforceable health-based limits for PFOA, PFOS, and eventually all PFAS.
7. Support coordinated health studies in communities with PFAS-contaminated drinking water.

Recommendation 1

Change the MILSpec and allow the use of fluorine-free foams with similar efficacy.

MIL-PRF-24385F(SH)
w/AMENDMENT 2

3. REQUIREMENTS

3.1 Qualification. Liquid concentrate fire extinguishing agents furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.4).

3.2 Materials. Concentrates shall consist of fluorocarbon surfactants plus other compounds as required to conform to the requirements specified hereinafter. The material shall have no adverse effect on the health of personnel when used for its intended purpose.

3.3 Concentrate characteristics. Concentrates shall conform to the chemical and physical requirements shown in [table I](#).

3.3.1 Film formation and sealability. The foam produced film shall spread over the fuel surface and seal off vapor production to prevent sustained ignition (see 4.7.6).

Concentrates shall consist of fluorocarbon surfactants

- a. Spreading coefficient: (See [table I](#))
- b. Foamability: (See [table I](#))
- c. Film formation and sealability: As specified in 3.3.1
- d. Fire performance, 28 square feet (ft²) fire, 1.5 and 3 percent of Type 3 and 3 and 6 percent of Type 6 fresh and sea water solutions: As specified in 3.4
- e. Stratification: No visible evidence following test (see 4.7.15)
- f. Precipitation: 0.05 percent by volume (see 4.7.16).

Recommendation 2

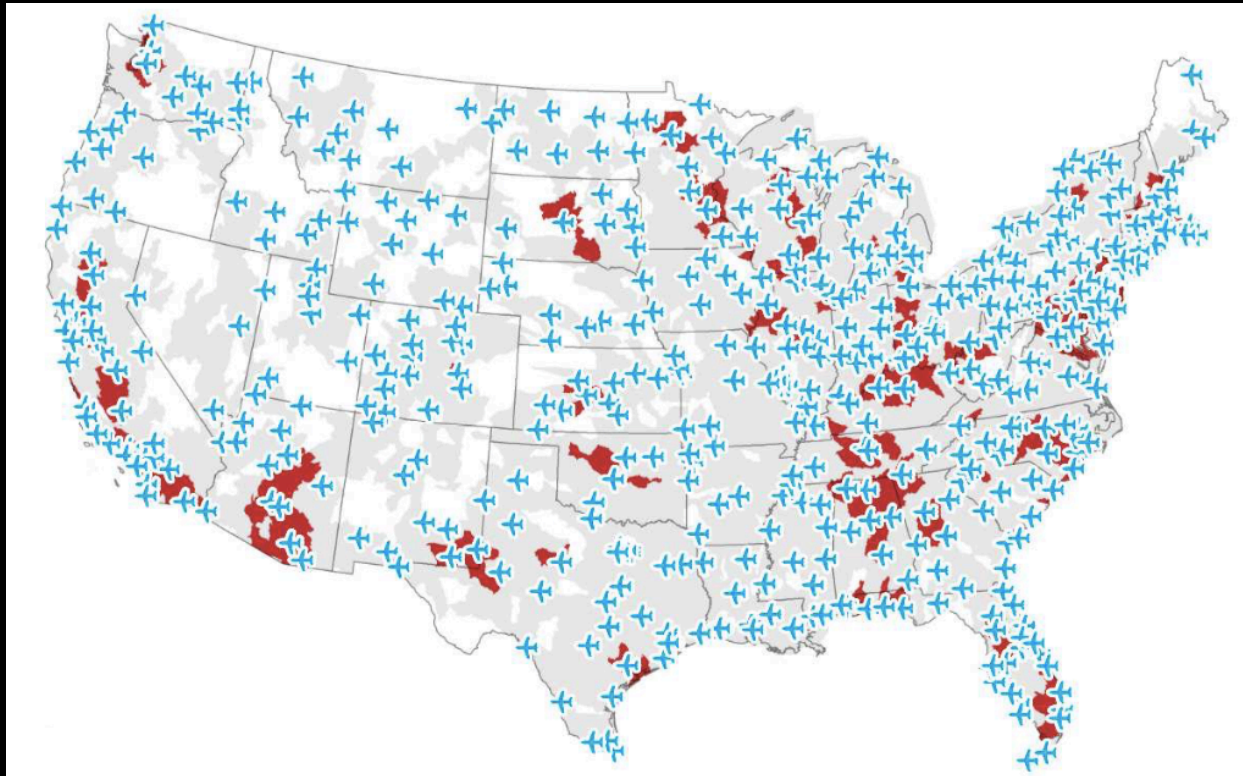
Change FAA rules to allow the use of fluorine-free foams at civilian airports.

Firefighting foam for aircraft is currently required to meet the MilSpec
- [FAA Advisory Circular 150/5210-6D](#)



Recommendation 2

Change FAA rules to allow the use of fluorine-free foams at civilian airports.



Recommendation 2

Change FAA rules to allow the use of fluorine-free foams at civilian airports.

H.R. 4 – FAA Reauthorization Act of 2018, Sec. 203

“shall not require the use of fluorinated chemicals to meet the performance standards...” for Class B firefighting foams.

Recommendation 3

Do not use PFAS fire-fighting foams for aviation and other practice drills.

2017 Survey:

- 72% of airports performed firefighter training using AFFF
- Of those, 79% discharged AFFF onto the ground

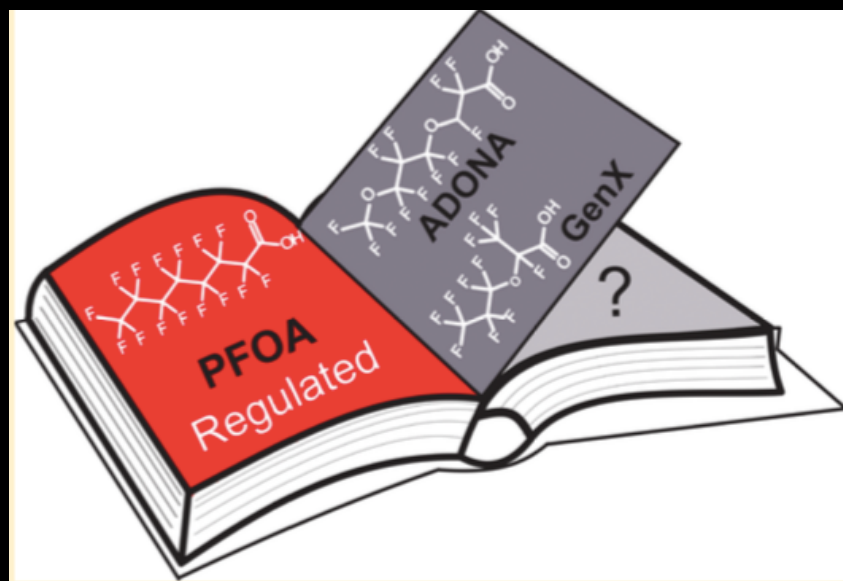


ACRP Research Report 173: Use and Potential Impacts of AFFF Containing PFASs at Airports

Recommendation 4

When considering alternatives, avoid the entire class of PFAS.

“An intractable, potentially never-ending chemicals management issue.”



Wang et al. *Environ. Sci. Technol.* 2017.

DOI: 10.1021/acs.est.6bo4806

Recommendation 5

Monitor for a diversity of PFAS in drinking water.

- UCMR₃ monitored large public water systems for six PFASs from 2013 to 2015
- PFAS not included in UCMR₄ (2018 - 2020)

Recommendation 5

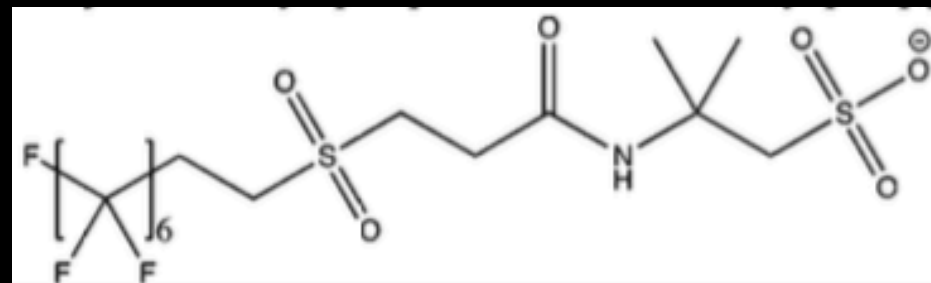
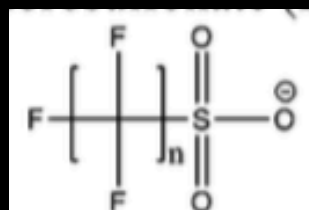
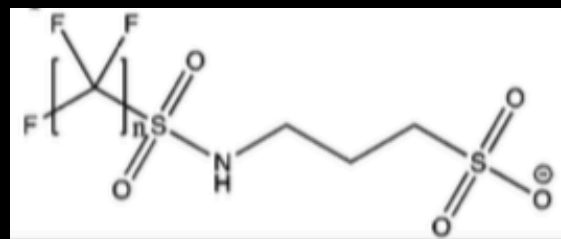
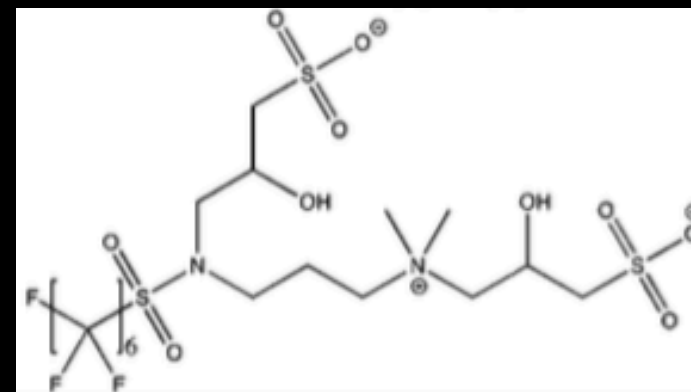
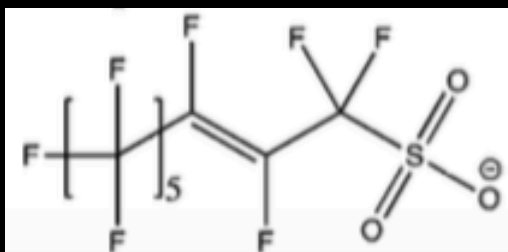
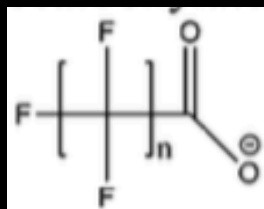
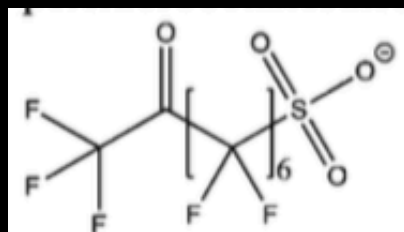
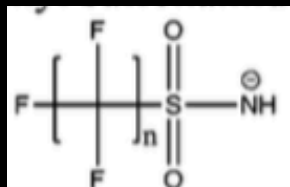
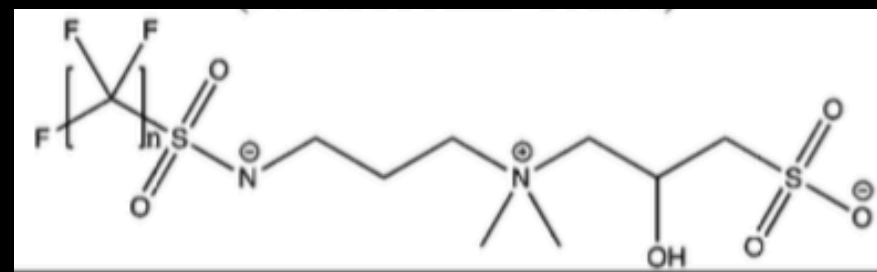
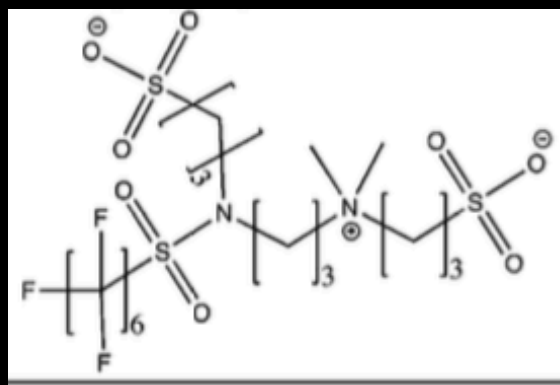
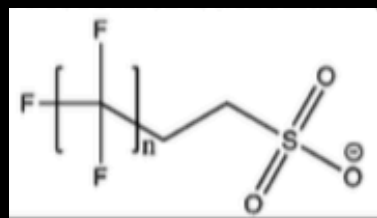
Monitor for a diversity of PFAS in drinking water.



- Contaminated water systems identified by UCMR₃: **2**
- Contaminated sites identified by MDEQ: **31**

Recommendation 5

Monitor for a diversity of PFAS in drinking water.



Recommendation 6

Develop enforceable health-based limits for PFOA, PFOS, and eventually all PFAS.

Enforceable levels (federal or state MCLs) would:

- Require utilities to perform monitoring
- Require utilities to treat water if necessary
- Expedite cleanups by responsible parties

Recommendation 6

Develop enforceable health-based limits for PFOA, PFOS, and eventually all PFAS.

H.R.3106 [115th]

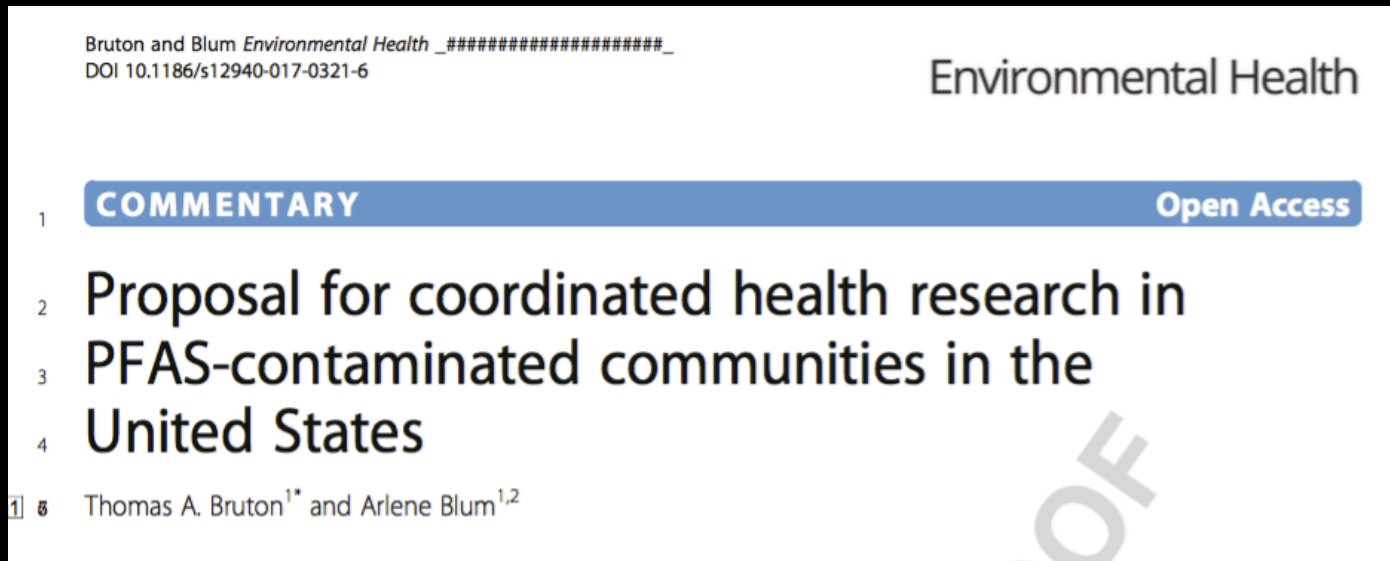
- Sponsor: [Rep Boyle](#) [D-PA-13]

S.B. 519 [115th]

- Sponsor: [Sen Gillibrand](#) [D-NY]

Recommendation 7

Support coordinated health studies in communities with PFAS-contaminated drinking water



- Study multiple PFASs (not just PFOA and PFOS).
- Continued & increased funding is needed.



With Reduced Use of Highly Fluorinated Chemicals

We can have a healthier world

www.GreenSciencePolicy.org