



# NIEHS PFAS Research Coordination

**Christopher Weis, Ph.D., D.A.B.T.,  
Senior Advisor to the Director,  
National Institute of Environmental Health Sciences (NIEHS)  
and National Toxicology Program (NTP)**

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# What are Per- and Polyfluoroalkyl Substances (PFAS)?

- **Total number of PFAS**

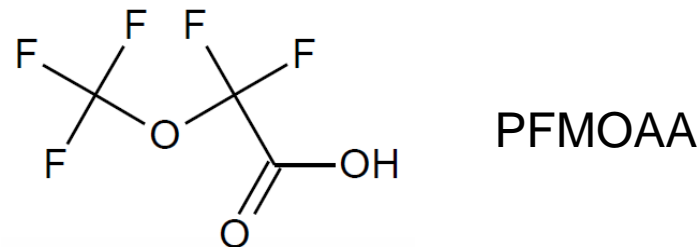
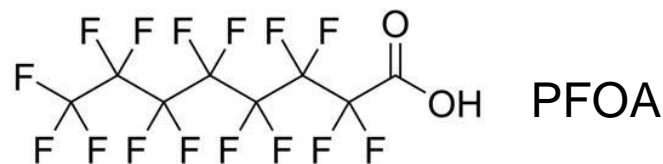
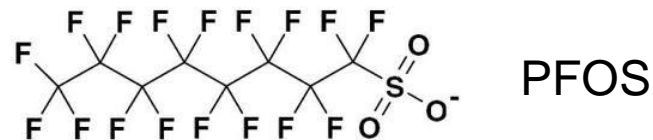
**>5,000 chemicals**

- Includes products, impurities and degradants

- Resistant to grease, water & oil

- Persistent and bioaccumulative

- Emergence of short-chain and substituted alternatives (PFMOAA & GenX)



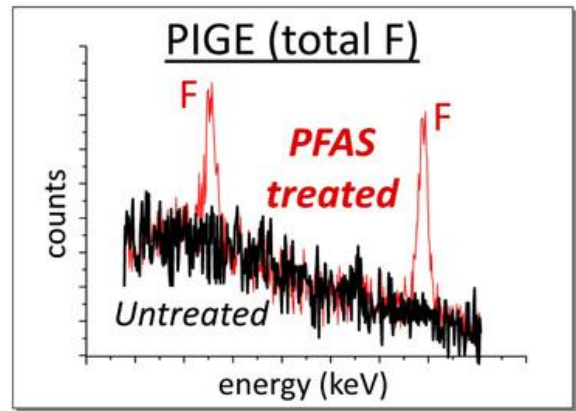
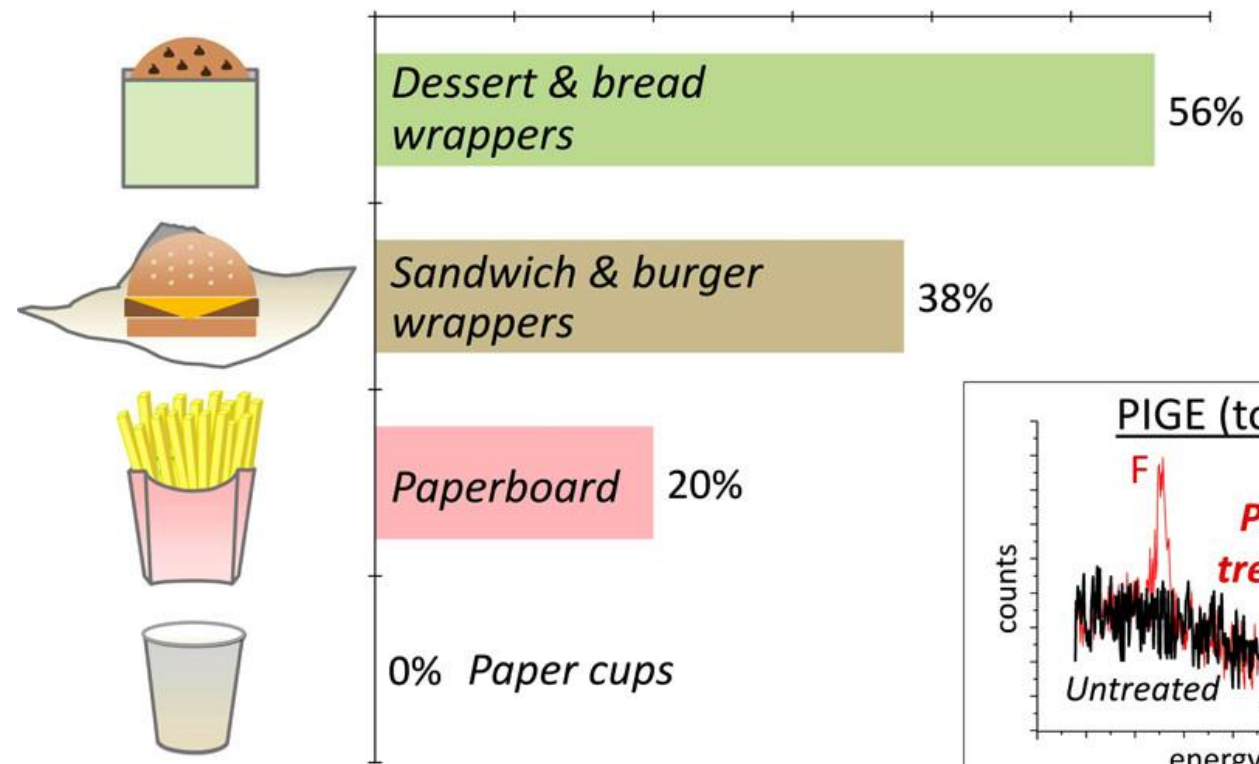
## How are we exposed?

- Diverse group of chemical compounds used in industry and consumer products worldwide since 1950s
- Found in various products:
  - Carpet and fabric
  - Food paper
  - Pots and Pans
  - Clothing
  - Cardboard packaging
  - Firefighting foams
  - Drinking water



# PFAS in Food Packaging Materials

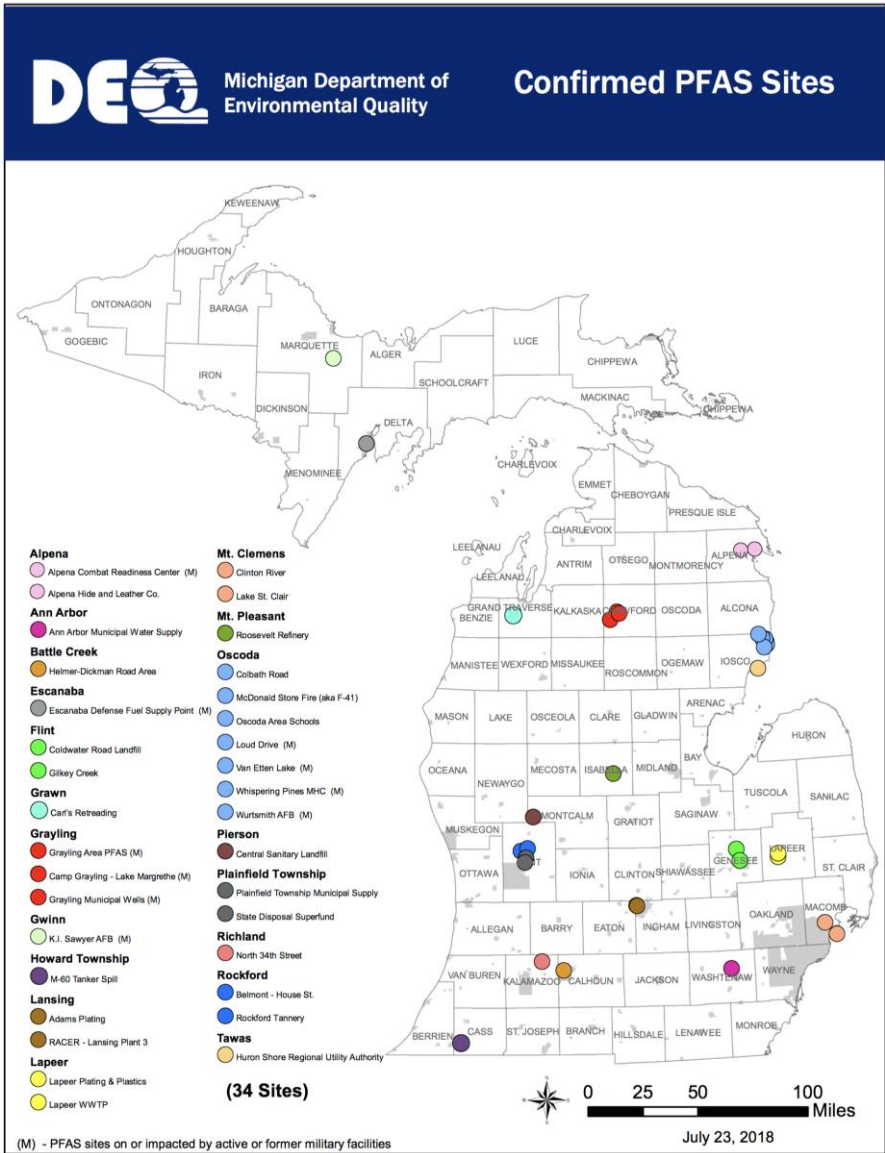
*Percent with fluorine*



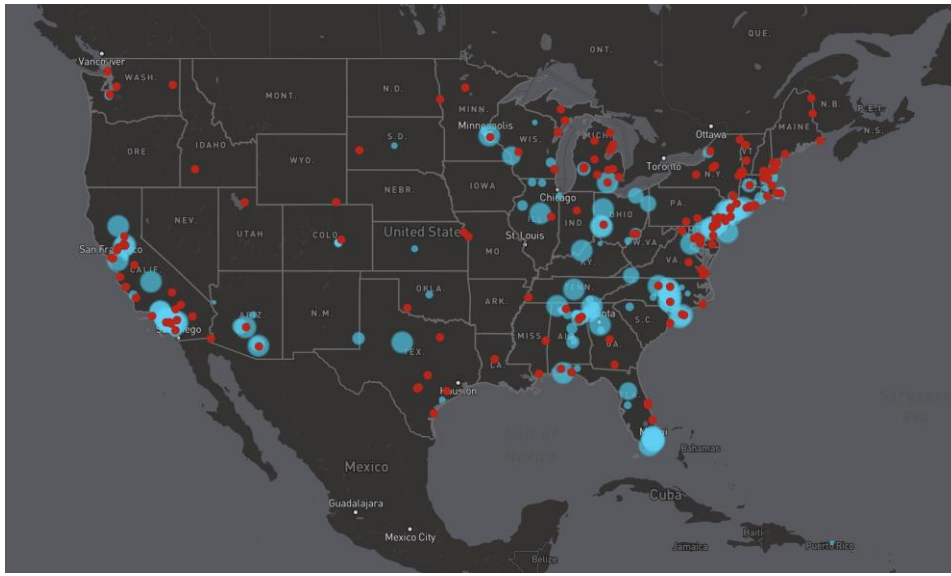
# Aqueous Film Forming Foams (AFFF)



- Fire fighting foams historically contained **PFOA** and **PFOS**.
- There are **now dozens of foams** with unknown PFAS content

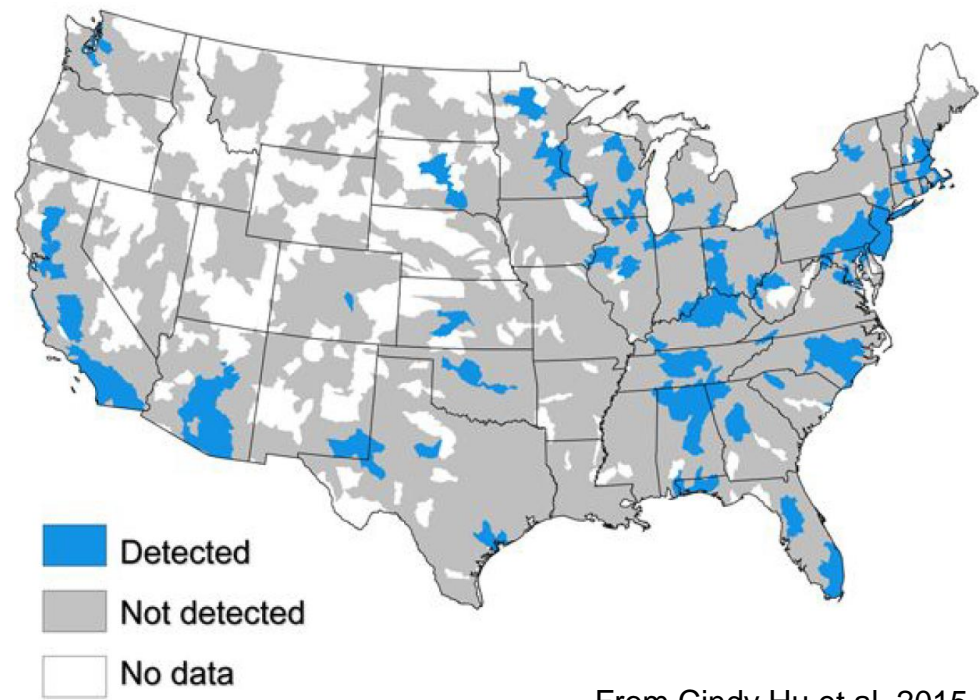


- Active or former military sites in Michigan;
- Michigan has identified 11,000 possible sources;
- Nationwide occurrence of PFAS.

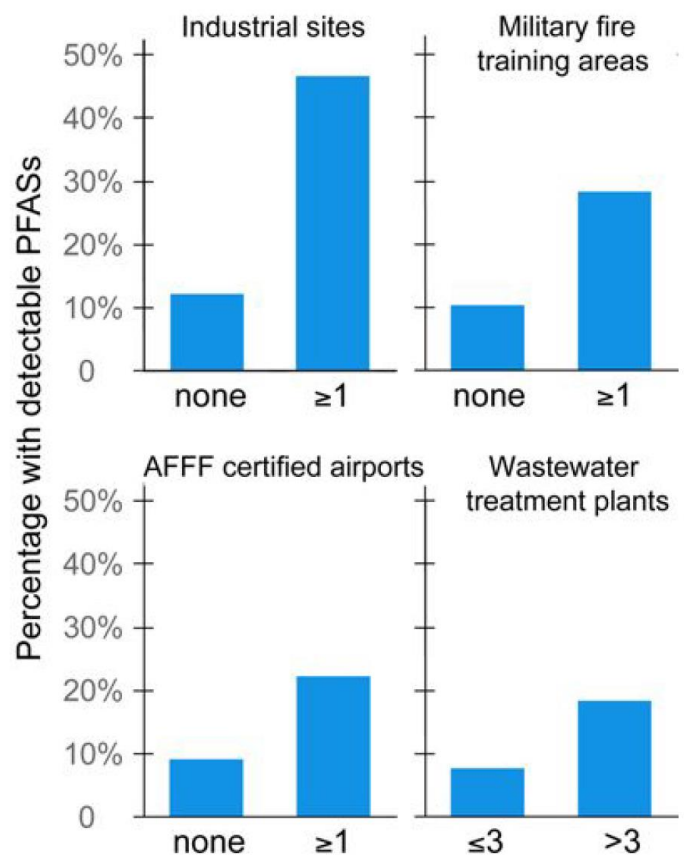


# Watersheds with point sources have higher detection frequencies for PFAS

Hydrological units with detectable PFASs

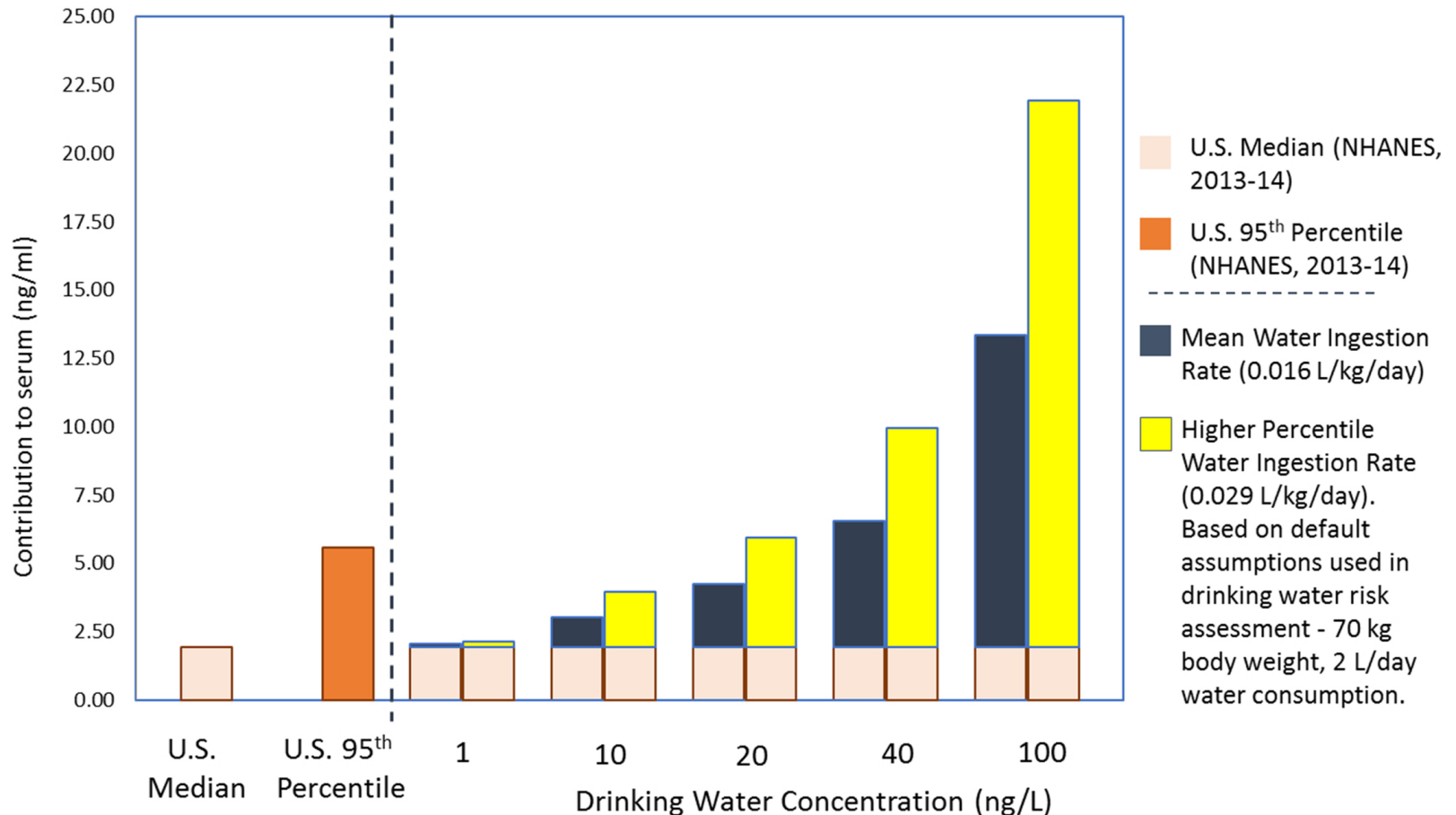


From Cindy Hu et al, 2015



-- Hu et al, *Environ. Sci. Technol. Lett.*, 2016, 3 (10), pp 344–350.  
T. Bruton supported by NIEHS Grant: P42 ES004705.

# Predicted PFOA blood levels rise with increased contamination of drinking water





## NIEHS PFAS Grants Portfolio

- **43 awards via various NIH funding mechanisms, including:**
- Investigator-initiated basic research
  - **Time-sensitive awards**
  - SBIR grants
  - NIEHS/EPA Children's Environmental Health and Disease Prevention Research Centers
  - Breast Cancer and The Environment Research Program
  - Superfund Research Centers
  - Conference Support
  - Environmental influences on Child Health Outcomes (ECHO) Program Awards

## Time Sensitive Awards on PFAS (R21)

- North Carolina State University, Raleigh:

- *Dr. Jane Hoppin (PI):*



- *ASSESSING IMPACT OF DRINKING WATER EXPOSURE TO GENX (HEXAFLUOROPROPYLENE OXIDE DIMER ACID) IN THE CAPE FEAR RIVER BASIN, NORTH CAROLINA*

- University of Colorado, Denver

- *Dr. John Adgate (PI)*



- *EXPOSURE AND HEALTH EFFECTS FROM POLY- AND PERFLUOROALKYL SUBSTANCES IN COLORADO WATER*

## Human Cohort PFAS Studies in Progress

### Health Outcomes and Measures of the Environment (HOME) Study

- Birth cohort study in Cincinnati, Ohio with 400+ mother/infant pairs (NIEHS)
- Developmental and behavioral outcomes.

### Healthy Start Study

- Ethnically diverse cohort of 800+ mother/infant pairs (NIDDK)
- Metabolic and behavioral factors during pregnancy



### Markers of Autism Risk in Babies-Learning Early Signs (MARBLES)

- Longitudinal cohort of women with a child with autism (NIEHS)
- Environmental exposures and risk factors that may contribute to development of autism



## Human Cohort Studies (cont'd)

### Study of Women's Health Across the Nation (SWAN)

- Longitudinal study of 3,000+ ethnically diverse women (NIA)
- Health of women during their middle years

### Faroe Islands Birth Cohorts

- Birth cohort studies in the Faroe Islands (NIEHS)
- Postnatal development, neurobehavioral functions, metabolic outcomes, and immune system responses



### Project Viva

- Longitudinal Birth Cohort in Eastern, MA (NIDDK)
- Prenatal and child health, diet, neurodevelopment metabolic outcomes, and immune system responses



# PFAS Analyses within CHEAR



## **Superfund Research Program PFAS-Related Research**

### **Superfund Research Centers**

- ***Michigan State University***

**Developing energy efficient nanoreactors capable of breaking C-F bond. (Haoting et al. Sci Rep 2016)**

**NIEHS Grant No. P42 ES004911.**

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- ***University of California – Berkeley***

**Combining biological and chemical treatment options to degrade and destroy AFFF. (Yi et al. Env. Sci. & Tech. 2018)**

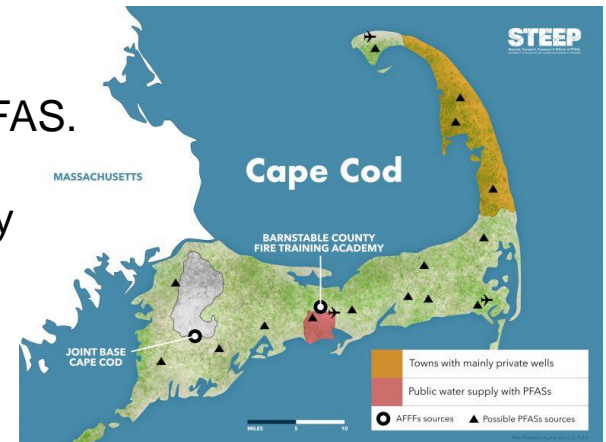
**NIEHS Grant No. P42 ES004705.**

# Superfund Research Program PFAS-Related Research



## University of Rhode Island: Sources, Transport, Exposure & Effects of PFASs (STEEP)

1. Support the source, exposure, and site assessment of PFAS.
2. Assess critical human health effects of PFAS exposure by integrating epidemiology and a rodent model.
3. Educate communities and advise stakeholders to reduce human exposure to PFAS.



Source: URI STEEP. <https://web.uri.edu/steep/communities/>



## Brown University: Toxicant Exposures in Rhode Island: Past, Present, and Future



## Northeast Waste Management Officials' Association

Sponsor numerous workshops and webinars for federal and state officials

- “State of Practice & Regulatory Perspectives Workshop”
  - held in Lebanon, NH, May 2017



# NTP Immunotoxicity studies

NTP is assessing the ability of PFAS to alter the effectiveness of childhood vaccinations.

- **2016 Monograph<sup>1</sup>:**

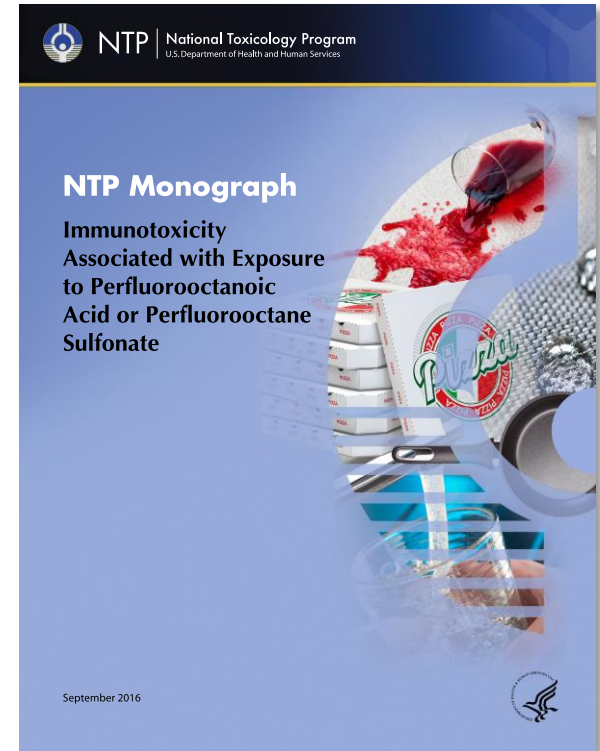
*PFOA and PFOS are immune hazards to humans based on:*

- *animal studies*
- *human studies*

- **Future Review:**

Evaluating evidence collectively across six PFAS to determine whether they weaken the antibody response to vaccinations:

— PFNA, PFHxS, PFHxA, PFDA, PFBA, and PFBS







- **28-Day toxicity studies: Comparing of 7 PFAS**
  - TOX Report 96: Sulfonates (2018)  
(PFBS, PFHxS, PFOS)
  - TOX Report 97: Carboxylates (2018)  
(PFHxA, PFOA, PFNA, PFDA)
    - Study included a PPAR $\alpha$  agonist (WY-14643) as a comparator
- **PFOA two-year study: Comparison of PFOA perinatal and non-perinatal effects**
  - Draft NTP Technical Report (TR-598) anticipated in early 2019 for peer review



- Responsive Evaluation and Assessment of Chemical Toxicity (**REACT**) PFAS Project

- REACT is a general approach that the NTP is developing to **address urgent environmental and public health challenges.**
- Collaboration with EPA (NCEA and NCCT)
- Involves literature mining, "read-across", *in silico*, computational, *in vitro* (cell) and *in vivo* (animal) toxicological methods
- Enables "**class**" of chemicals to be screened for wide range of biological effects
  - Too many PFAS in the class to use traditional approaches
- **Screening 110 representative PFAS**

NTP PFAS LIBRARY	
PFOA	PFOS
PFDoA	PFUnA
PFDA	PFNA
PFHpA	PFHxA
PFPeA	PFBA
PFDS	PFHpS
PFHxS	PFPeS
PFBS	PFOSA
FtS 8:2	FtS 6:2
NEtFOSAA	NMeFOSAA
FtOH 8:2	FtOH 6:2
GenX	ADONA
6:2 monoPAP	6:2 diPAP
8:2 monoPAP	8:2 diPAP
6:2/8:2 diPAP	5:3 acid
PFPE-1	PFPE-2
PFPE-3	PFPE-4
PFPE-5	PFPE-6
PFPE-7	PFTriA

## Authorization Legislation That Has Become Law

- H.R. 5515, National Defense Authorization Act for FY2019
- Funding of Study and Assessment of Health Implications of PFAS Contamination in Drinking Water
  - Authorizes DOD to transfer **\$30 million** for FY2018, FY2019 and FY2020, combined, in Defense-wide O&M funds to HHS for PFAS human health study and exposure assessment
    - Must focus on no less than 8 current or former military bases
  - Requires DOD Secretary to conduct an assessment of the **human health implications of PFAS exposure**
    - Meta-analysis linking exposed servicemembers
    - Estimate of number of servicemembers and Veterans exposed
    - DOD-VA process for transfer of health information
    - Funding required to administer potential registry



## Congressional Hearings Focused on PFAS

- **Aug. 23**: Senate HELP Committee NIH Hearing
  - Sen. Maggie Hassan (NH) Questioned Dr. Collins about PFAS
  
- **Sept. 6**: House Energy and Commerce Subcommittee on Environment
  - EPA, DOD, ASTSWMO, ASDWA, MI PART, Clean Cape Fear and NRDC
  
- **Sept. 26**: Senate HSGAC Subcommittee on Federal Spending Oversight and Emergency Management
  - Dr. Birnbaum will testify



***Thank you!***

**Questions**

