NCEH/ATSDR Involvement in *Per- and Polyfluoroalkyl Substances (PFAS)*

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APHL 2019 Plenary Session
June 3, 2019
Per- and Polyfluoroalkyl Substances (PFAS) Properties

- Carbon chain surrounded by fluorine atoms
  - Strength of the C-F bonds
- Environmentally persistent
- Thousands of different PFAS
- Repel water and oil
- Surfactants and dispersants
- Bind with serum protein, renal reabsorption yields long serum half-lives of some PFAS in humans
PFAS Basics

- **Uses**
  - Non-stick cookware products
  - Stain- and water-repellent carpet and clothing treatments
  - Food packaging
  - Dental floss and applications
  - Paper and cardboard packaging
  - Aqueous film-forming foam (AFFF)

- **Sources**
  - Waste from manufacturing facilities
  - Fire-fighting foam run-off
  - PFAS-containing sludge used as soil amendments

- **Exposure Pathways**
  - Drinking water
    - Private residential wells, municipal systems
  - Air and dust
  - Fish, meat, dairy (including game)
  - Consumer products
    - Food containers and wrapping
    - Clothing
    - Cookware
  - Produce
  - Gestational and lactational exposure
Potential Health Effects

- Pregnancy-induced **hypertension/pre-eclampsia** (PFOA, PFOS)
- **Liver damage** (PFOA, PFOS, PFHxS)
- Increased **serum lipids**, including cholesterol and LDL (PFOA, PFOS, PFNA, PFDeA)
- Increased risk of **thyroid disease** (PFOA, PFOS)
- Decreased **antibody response to vaccines** (PFOA, PFOS, PFHxS, PFDeA)
- Increased risk of **asthma diagnosis** (PFOA)
- Increased risk of **some cancers** (PFOA)
- Increased risk of **decreased fertility** (PFOA, PFOS)
- Small decreases in **birth weight** (PFOA, PFOS)
What do we know about PFOA and PFOS in community drinking water systems?

- **Not detected**: 4,600 systems (67–71%)
- **Detected below 70 ppt**: 129 systems (3%)
- **Detected at or above 70 ppt**: 65 systems (2%)

**Total PFOA+PFOS concentration (sum of two species)**

<table>
<thead>
<tr>
<th>Number of systems</th>
<th>Number of people served (percent of total population)</th>
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<tbody>
<tr>
<td>4,600</td>
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<tr>
<td>129</td>
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<td>65</td>
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<td>47,000</td>
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- **Most people currently do not have PFOA or PFOS in their drinking water**: The majority of the U.S. population gets water from CWS that have been tested and found to have no reportable\(^2\) levels of PFOA or PFOS. Most of the CWS already tested are large systems that each serve more than 10,000 people.

- **Some CWS reported levels of PFOA+PFOS that are below the lifetime health advisory (LTHA) level of 70 ppt issued by EPA**: 10 million systems (3%)

- **The 65 CWS that reported elevated levels of PFOA+PFOS serve about 6 million people in 26 different states and U.S. territories**: Most of these systems have already taken or are undertaking actions to reduce levels.

- **This estimate is based on data from the U.S. Census Bureau American Housing Survey (2007, 2013) and U.S. Environmental Protection Agency Safe Drinking Water Information System (2015)**: 13–15 million households (5–10%)

- **Almost 60 million people are getting water from CWS that have not been tested for PFOA and PFOS yet**: Almost all of these are small systems that each serve 10,000 or fewer people. These CWS are located throughout the 50 states and several U.S. territories. Additionally, about 20 million people get some drinking water from non-CWS (non-residential sources) that have not been tested.

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1. Large numbers are rounded. U.S. total population is the average (~318 million) during 2013–2015 (https://www.census.gov(population)/).
2. The minimum reporting level defined for UCMR 3 is 20 parts per trillion (ppt) for PFOA and 40 ppt for PFOS.

NCEH/ATSDR’s approach on PFAS

- Assessing and reducing/eliminating community PFAS exposures
- Addressing community health concerns related to existing or previous PFAS exposures, to support action on the basis of scientific information
- Conducting health studies on exposure and health endpoints to provide actionable information to communities and health care providers
# Environmental Health Lab - Biomonitoring

*No serum available in 2001-2

*aMeasured as isomers

<table>
<thead>
<tr>
<th>PFAS in serum</th>
<th>99–00</th>
<th>03–04</th>
<th>11–12</th>
<th>13–14</th>
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<tr>
<td>Short-alkyl chain</td>
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<tr>
<td>PFBS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>PFHpA</td>
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<td>PFHxS</td>
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<tr>
<td>PFOS</td>
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<td>X</td>
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</tr>
<tr>
<td>PFOA</td>
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<td>X</td>
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</tr>
<tr>
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<td>EtFOSAA</td>
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<tr>
<td>MeFOSAA</td>
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Long-alkyl chain
PFAS Trends in the U.S. NHANES 1999-2008

(Kato et al., 2011)
PFAS Exposures in Young Americans

- **ΣPFOS**
  - NHANES (3-11 years; 2013-2014)
  - Texas children (0 to <13 years; Aug-Nov 2009)*
  - Northern California SUPERB project (2 to <8 years; 2007-2009)
  - Greater Cincinnati BCERP (girls 6-8 years; 2005-2007)
  - C8 Health project (infants; 2005-2006)*
- **ΣPFOA**
  - NHANES (3-11 years; 2013-2014)
  - Texas children (0 to <13 years; Aug-Nov 2009)*
  - Northern California SUPERB project (2 to <8 years; 2007-2009)
  - Greater Cincinnati BCERP (girls 6-8 years; 2005-2007)
  - C8 Health project (5-18 years; 2005-2006)*
- **PFHXS**
  - NHANES (3-11 years; 2013-2014)
  - Texas children (0 to <13 years; Aug-Nov 2009)*
  - Northern California SUPERB project (2 to <8 years; 2007-2009)
  - Greater Cincinnati BCERP (girls 6-8 years; 2005-2007)
  - C8 Health project (infants; 2005-2006)*
- **PFNA**
  - NHANES (3-11 years; 2013-2014)
  - Texas children (0 to <13 years; Aug-Nov 2009)*
  - Northern California SUPERB project (2 to <8 years; 2007-2009)
  - Greater Cincinnati BCERP (girls 6-8 years; 2005-2007)
  - C8 Health project (infants; 2005-2006)*

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*(Ye et al., 2018)*
Health Consultations and Site Work in 30+ Communities
PFAS Exposure Assessment Technical Tools (PEATT)

- **Exposure and health effects question bank**
- **Risk communications materials**
- **Water sampling protocol**
- **Biomonitoring statistically-based sampling protocol**
- **Biomonitoring letters of interpretation, consent, assent**
- **Laboratory biomonitoring sample collection and analysis protocols**
PFAS Exposure Assessments

- Piloted PFAS exposure assessments in PA and NY in partnership with ASTHO and the PA DOH and NYS DOH

- Expanding exposure assessments to eight additional sites with resources from the National Defense Authorization Act

- Exposure assessments will produce information that can be used by public health professionals to help communities affected by PFAS
Pease Study

- Association between **health outcomes and PFAS exposure** to expand the PFAS science base

- Will allow CDC/ATSDR to **evaluate the study procedures and methods** to improve the design of the multi-site health study

- Pease Study data will be integrated with data from **other sites** in the multi-site health study to maximize the impact
Multi-Site Health Study

- Will expand the science about the relationships between PFAS exposure and certain health outcomes

- Seeks to enroll 6,000 adults and 2,000 children exposed to PFAS through drinking water

- Will help people better understand their risk for health effects
Timeline of Key PFAS-Related Activities

- **Community Engagement & Communications**
- **Exposure Assessments**
- **Pease Study**
- **Multi-Site Health Study**

- **Oct 2018**
- **Oct 2019**
- **Oct 2020**
- **Oct 2021**
- **Oct 2022**
- **Oct 2023**
Additional PFAS Projects Underway

- Conduct an analysis using previously collected data to look for associations between PFAS exposure and cancer
- Examine how psychosocial stress related to PFAS exposures can pose an independent health risk
- Develop pharmacokinetic models to estimate PFAS serum levels in blood/serum resulting from water exposures
Tools and Resources for States and Communities

- PFAS Exposure Assessment Technical Tools (PEATT)
- Draft Toxicological Profile for Perfluoroalkyls
- PFAS Factsheets
- PFAS Guidance for Clinicians

Visit online: https://www.atsdr.cdc.gov/pfas/
Questions?

https://www.atsdr.cdc.gov/pfas

For more information, contact NCEH/ATSDR
1-800-CDC-INFO (232-4636)
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