ATSDR Perspectives on Study Scope, Background, and Objectives

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NASEM Committee Guidance on PFAS Testing and Health Outcomes – 1st Meeting

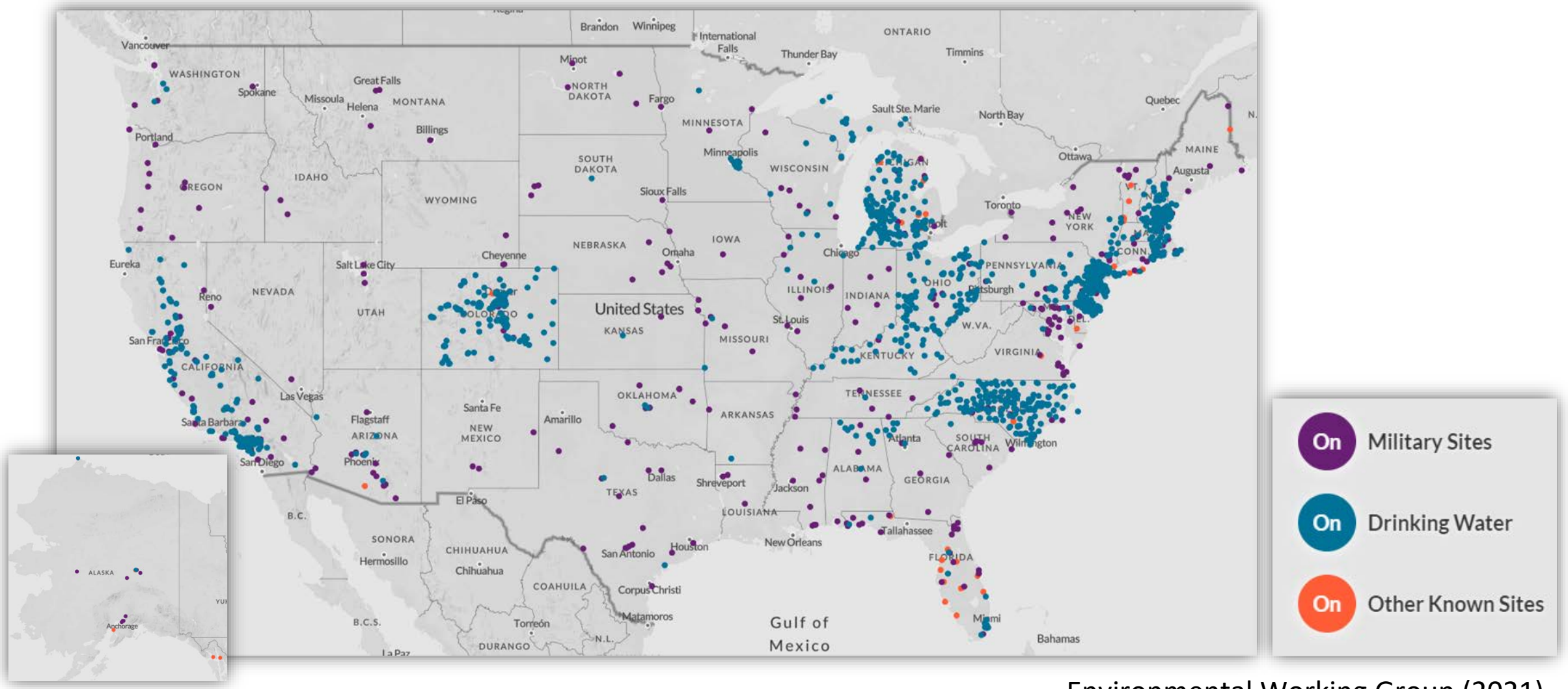
February 4, 2021

Agency for Toxic Substances and Disease Registry (ATSDR)

- Established by Superfund Act in 1980
  - Identifies human health effects of hazardous substances
  - Works directly with communities
  - Responds to environmental health emergencies
  - Conducts exposure assessments, public health assessments and studies
  - Provides guidance to health departments and practitioners

- Key strategies:
  - Build capacity in states, tribes and localities
  - Monitor and investigate hazardous exposures
  - Develop science-based tools and resources
  - Conduct risk communication activities

PFAS Contamination: 2,337 Locations in 49 States



Environmental Working Group (2021)

PFAS Background

- Class of approximately 5,000 **man-made chemicals** used in a variety of consumer products
- PFAS **do not break down** in the environment or in humans
- Approximately 6 million people have been exposed to PFAS in drinking water above EPA health advisory levels
- In 1999, CDC's NHANES was the first to document **widespread exposure PFAS** in the US (>98%)
- ATSDR has been involved in PFAS exposure investigations since 2010

Sources of PFAS Exposure

- People can be exposed to PFAS by
  - Drinking contaminated municipal water or private well water
  - Eating fish caught from water contaminated by PFAS (PFOS in particular)
  - Accidentally swallowing contaminated soil or dust
  - Eating food that was packaged in material that contains PFAS
  - Using some consumer products such as non-stick cookware, stain resistant carpeting, and water repellant clothing.

- Research has suggested that exposure to PFOA and PFOS from today's consumer products is usually low, especially when compared to exposures to contaminated drinking water.

Limitations in Classifying PFAS Exposures

- PFAS exposures from **non-drinking water sources** (e.g., food, air, soil) are often **poorly** characterized.
- Analytical methods are **insufficient** to identify and measure the **full range** of PFAS people may be exposed to.
- Toxicological and epidemiological data are only available to support the development of health-based screening values for **some of the PFAS** that have been detected in water and in people's bodies.
- **Historical** PFAS exposure data is frequently **unavailable**.

Reducing PFAS Exposure

- **Drinking water filtration**
  - Granular activated carbon
  - Reverse osmosis and other high-pressure membrane processes
- **Baby formula**
  - Mix with non-PFAS water
  - Those who choose to breastfeed should continue
- **Local fish advisories**
- **Consumer products**

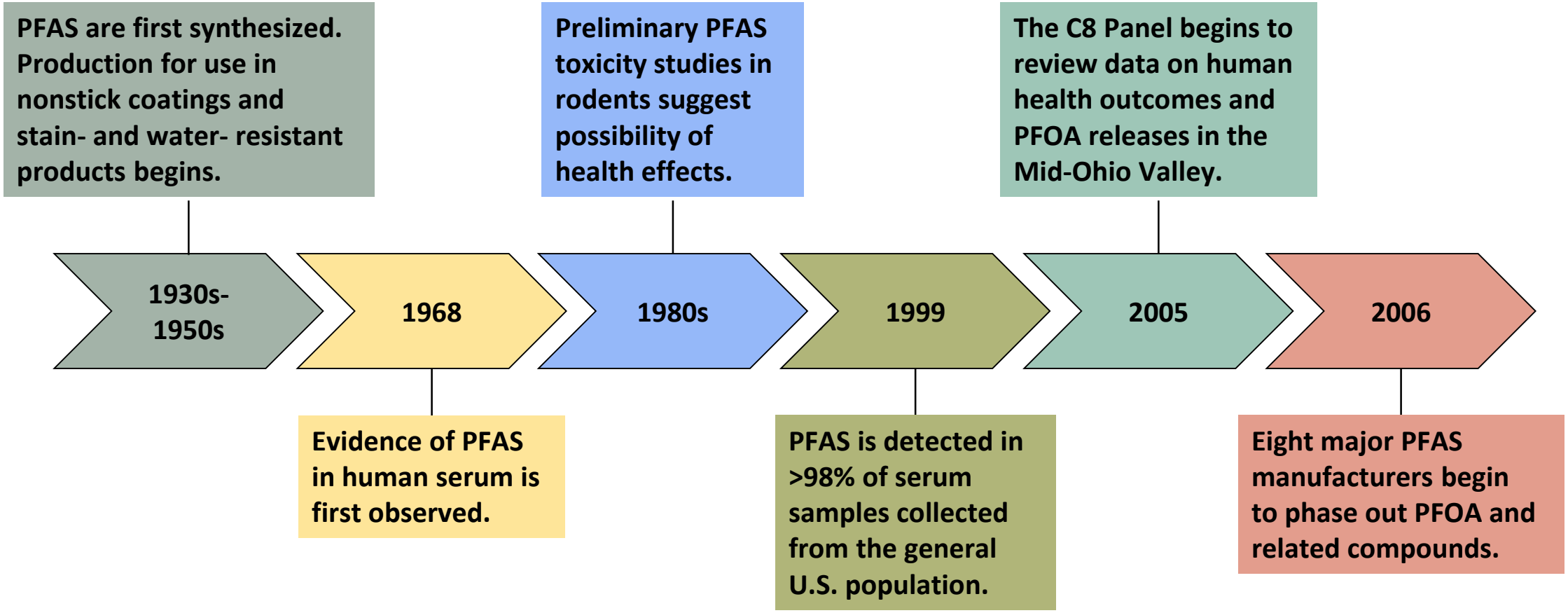
PFAS Public Health Challenges

- Growing community concern as more communities found to have been exposed
- Need more health information
- Need to expand environmental and biological sampling methods
- Understanding health effects of exposure to mixtures of PFAS
- New compounds being created and used
- Need to develop and evaluate water treatment methods
- Clinical interpretation of PFAS test results

Best Strategy = Exposure Prevention

History of PFAS and Initiatives Addressing PFAS Exposure

History of PFAS Exposure and Health Studies



NCEH/ATSDR PFAS Research Initiatives and EPA Actions

(1999-2014)

1999

NCEH/ATSDR detected PFAS in **>98% of serum samples** collected from general U.S. population though NHANES

2004

NCEH developed method to measure perfluorinated organic acids and amides in human serum and milk

2007

NCEH/ATSDR expanded NHANES to include **11 species PFAS**; found that PFOA and PFOS concentrations were declining

2009

ATSDR released the first draft **Toxicological Profile for Perfluoroalkyls**

EPA's Office of Water establishes **provisional drinking water Health Advisory levels**

2010

ATSDR Biomonitoring investigation in Decatur, AL, found elevated PFAS blood concentrations

2012

EPA requires all community water systems serving >10,000 customers **to monitor for PFAS** twice in 12-month period during 2013-2015.

2013

C8 Panel concludes, having **evaluated 17 health endpoints** and identified **six with probable links to PFOA exposure.**

NCEH/ATSDR PFAS Research Initiatives and EPA Actions

(2015-2019)

2015
ATSDR updated draft Toxicological Profile with **MRLs for PFOA and PFOS**

2016
EPA issues final **lifetime drinking water Health Advisory** level of 70 ppt

2017
ATSDR added PFOA, PFOS, PFNA, and PFHxS to the **Substance Priority List**

2018
ATSDR updated draft Toxicological Profile with **MRLs for PFOA, PFOS, PFHxS and PFNA**

NCEH added PFAS community water system indicators to the **National Environmental Public Health Tracking Network**

ATSDR designed **PFAS Exposure Assessment Technical Tools (PEATT)** for health depts.

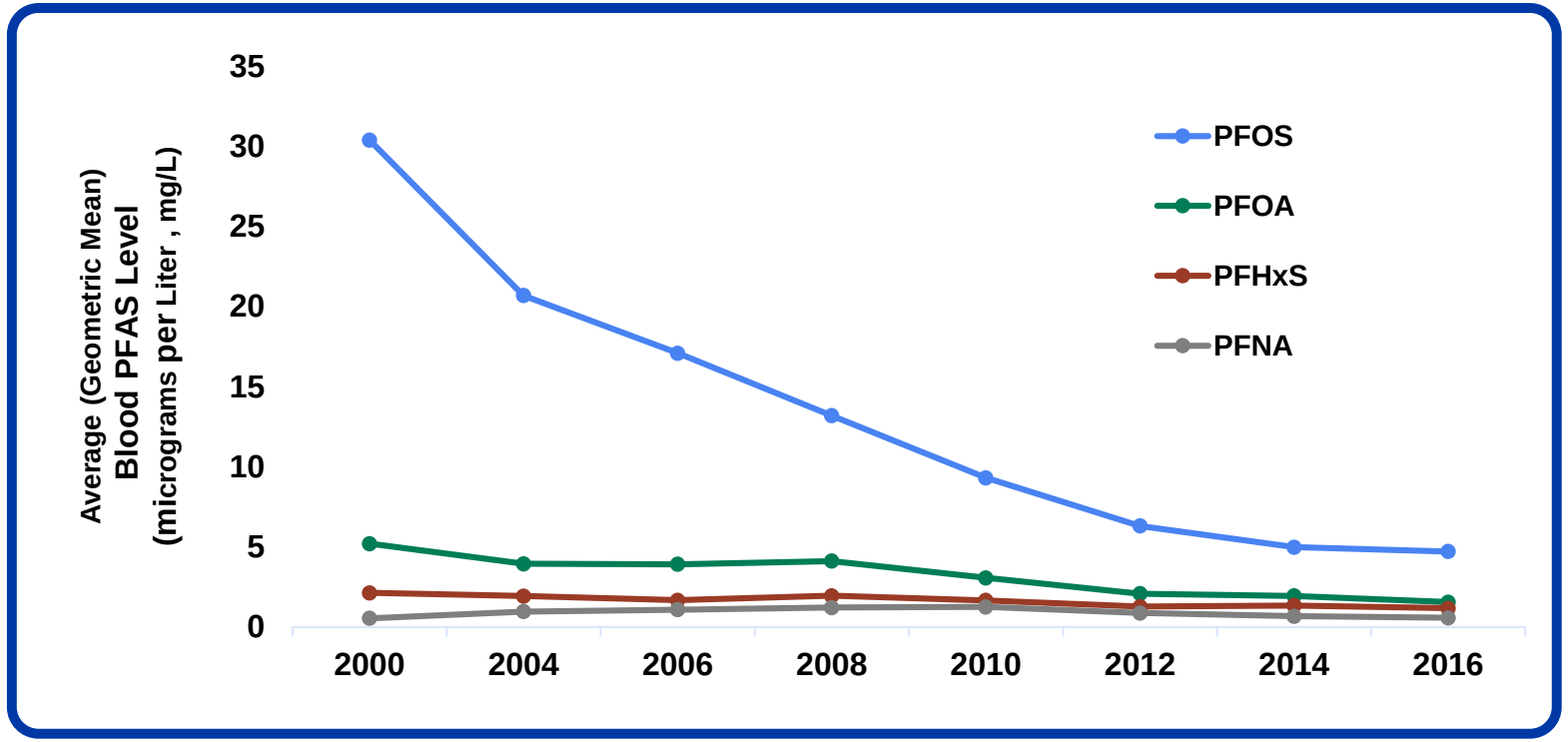
2019
ATSDR began **Exposure Assessments** in communities near current or former military bases

ATSDR began **Pease Health Study** to examine health effects from drinking contaminated water

ATSDR launched the **Multi-site Health Study**

Initial Investigations: Biomonitoring

Blood Levels of the Most Common PFAS in US Population, 2000-2016

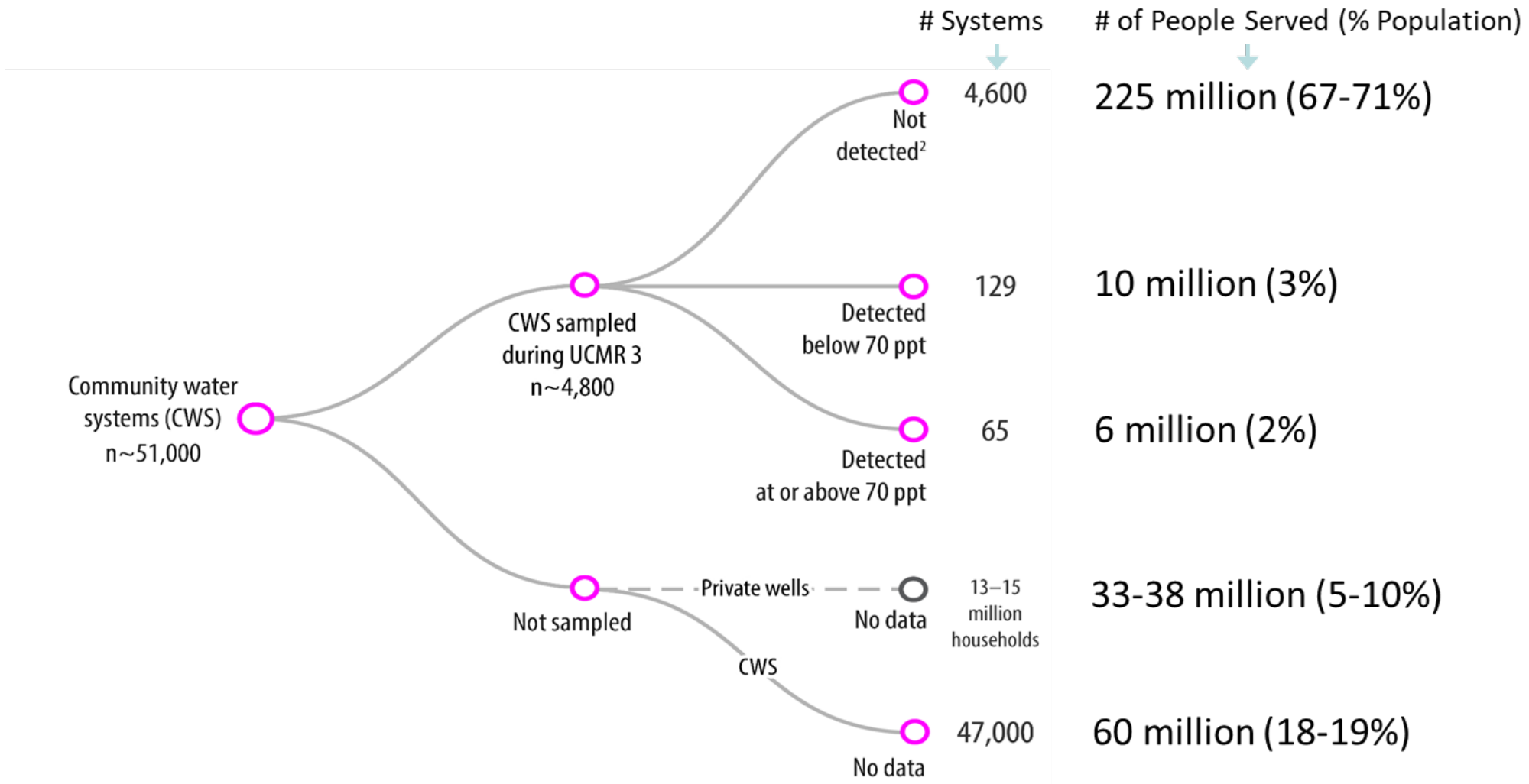


Data Source: CDC. Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019, Volume One.

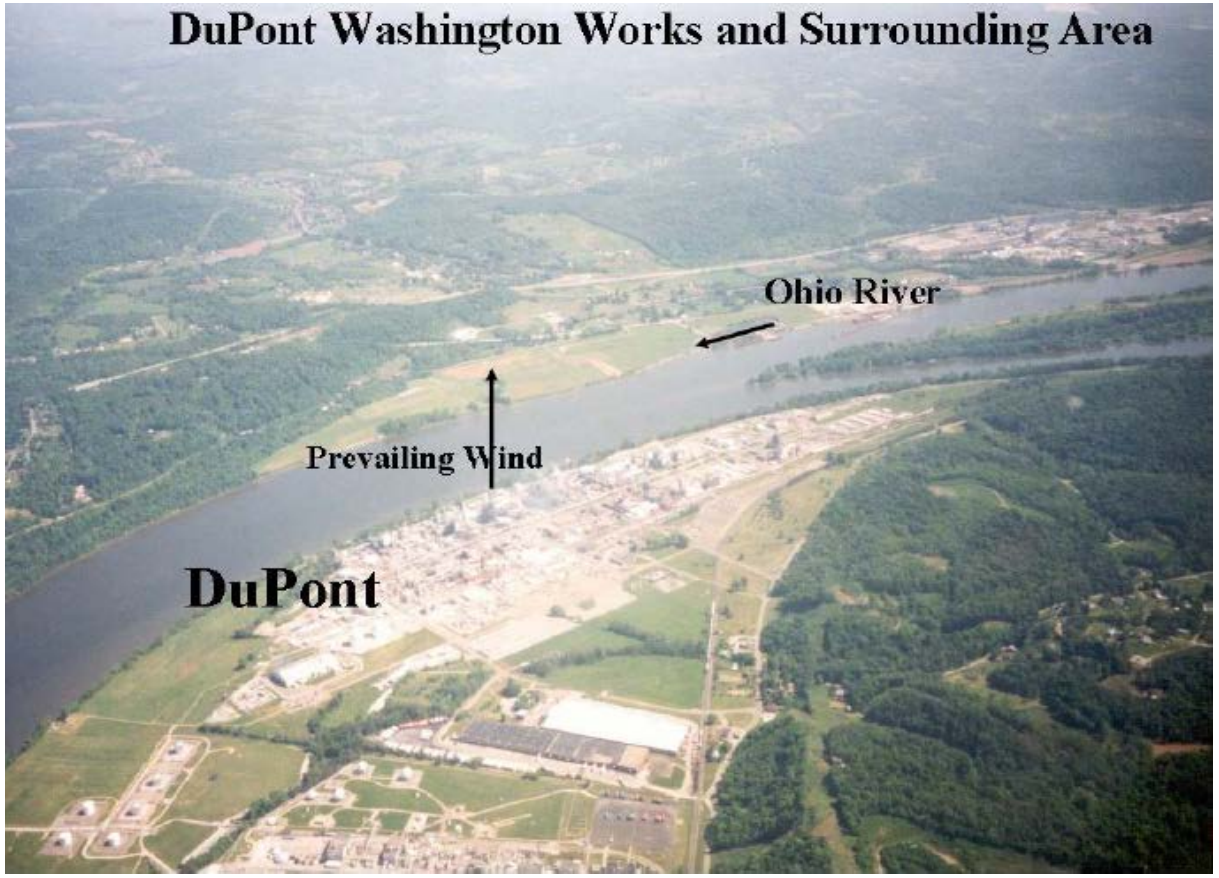
NHANES PFAS Analytes	
PFHxS	PFUnDA
n-PFOS	MeFOSAA
Sm-PFOS	PFBS*
n-PFOA	PFpA*
Sb-PFOA	PFDoDA*
PFNA	FOSA*
PFDA	EtFOSSA*

** PFAS that has previously been measured as part of NHANES but is not currently measured in the survey*

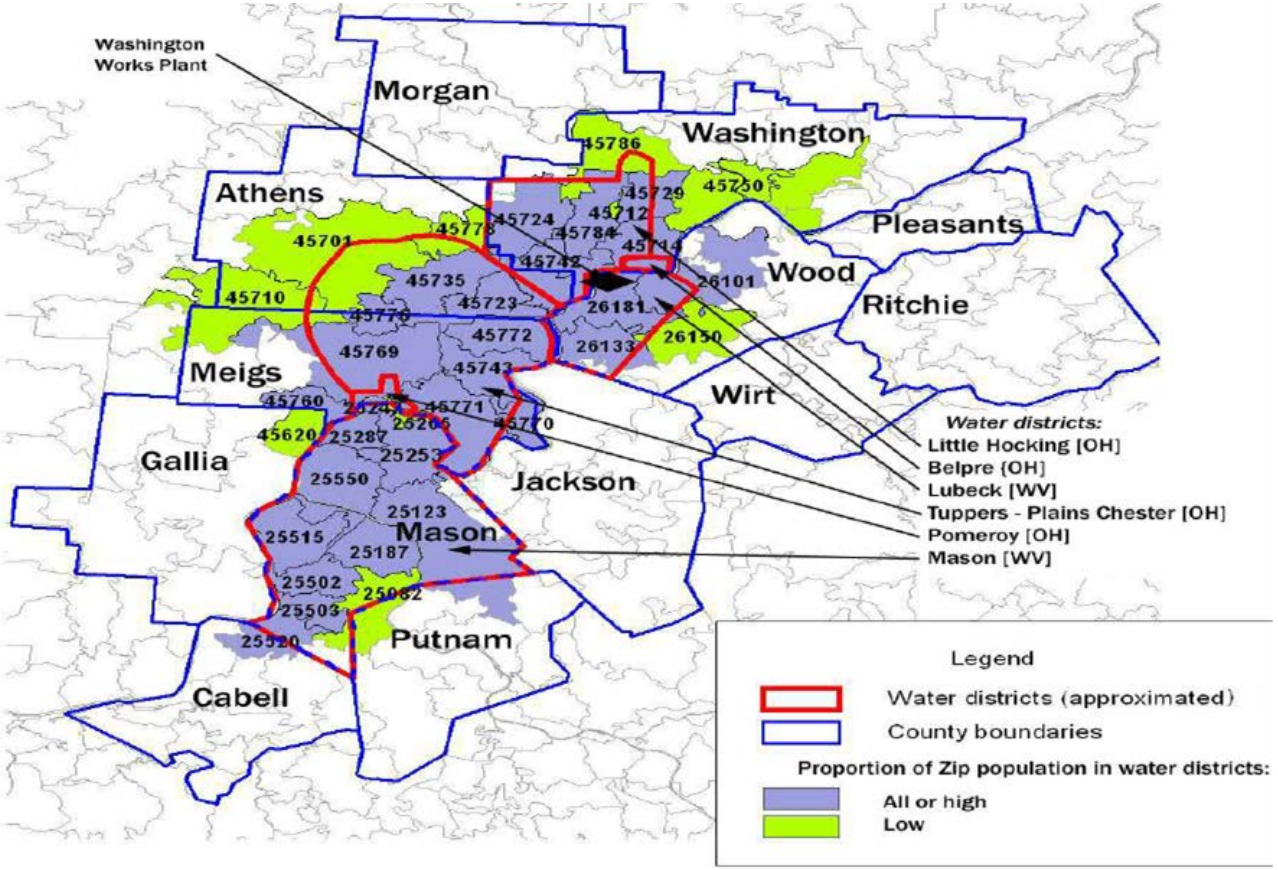
Initial Investigations: Public Drinking Water Testing



Initial Investigations of Possible Health Effects: C8 Science Panel



Point source of PFOA contamination



PFOA-Affected Water Districts

C8 Science Panel Conclusions

- **Probable* links between PFOA exposure and health effects**
  - High cholesterol
  - Ulcerative colitis
  - Thyroid disease
  - Testicular cancer
  - Kidney cancer
  - Pregnancy-induced hypertension

C8 Science Panel:
Kyle Steenland, Tony Fletcher, David Savitz

Paul Brooks, project lead
and community physician

**Probable link: Given the available scientific evidence, it is more likely than not that a connection exists between PFOA exposure and a particular human disease.*

www.c8sciencepanel.org/publications.html

Human Health Effects: Immune System Dysfunction

- **National Toxicology Program systematically reviewed human, animal, and *in vitro* data for PFOA and PFOS**
- **Both compounds presumed to be immune hazards in humans**
  - Decreased antibody response to vaccines
- **Additional systematic reviews for six additional PFAS currently underway**

Human Health Effects: Elevated Cholesterol

- **Epidemiological studies have identified significant positive correlations between serum PFOA and PFOS concentrations and total cholesterol in specific populations**
  - Residents of communities with high levels of PFOA in drinking water
  - Workers exposed to PFAS in occupational context

Human Health Effects: Testicular and Kidney Cancer

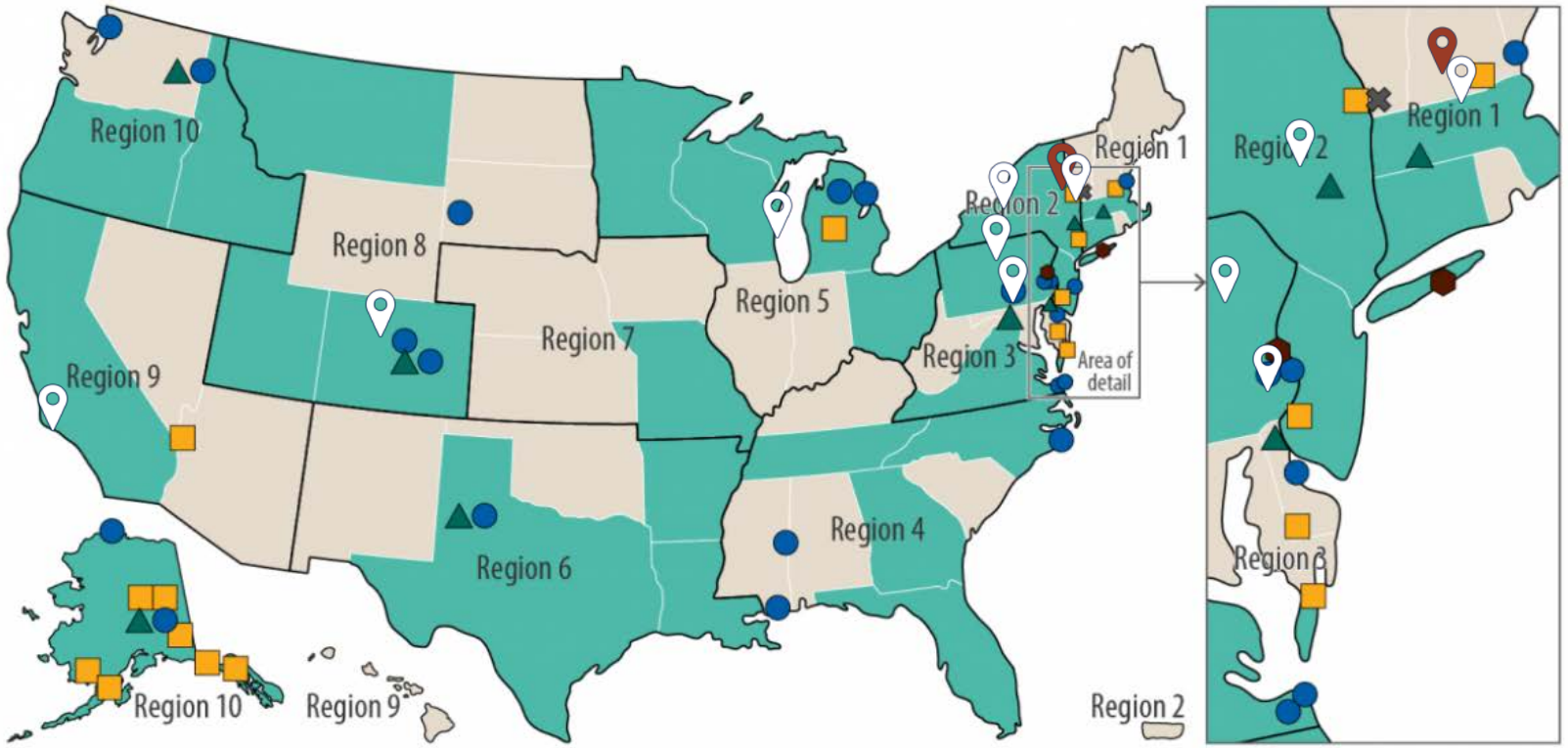
- **International Agency for Research on Cancer has classified PFOA under Group 2B, possibly carcinogenic to humans**
  - Evidence suggests carcinogenic potential for both PFOS and PFOA in humans
- **Workers exposed to PFAS and residents living near PFOA production facility have experienced increases in testicular and kidney cancer**

Human Health Effects: Other Effects

- **Elevated serum uric acid**
- **Liver effects**
  - Elevated AST, ALT, GGT, ALP
- **Kidney effects**
  - Reduced kidney function, dysregulated metabolic pathways
- **Endocrine effects**
  - Increased body fat, increased risk of cardio-metabolic disorders, obesity
- **Thyroid effects**
  - Increased TSH, T3, T4
- **Reproductive effects**
  - Lower fertility and fecundity
- **Preeclampsia**

NCEH/ATSDR Activities Addressing PFAS Exposure

ATSDR has 28 active PFAS projects, including 9 research studies in addition to its site-based activities nationwide



- ATSDR or state lead (funded under cooperative agreement)
- ATSDR or state lead (cooperative agreement) and Department of Defense Site
- ATSDR support of site work conducted by a state not funded by the cooperative agreement program
- Multi Site Health Study
- PFAS Exposure Assessment Site
- PFAS Exposure Assessment Technical Tools Pilot Site
- States funded through cooperative agreement
- Pease Health Study

LONG-TERM OBJECTIVES

1. Understand the where, how, and to what degree exposure is occurring in affected communities
2. Examine the relationship between PFAS exposure and health effects
3. Identify and implement strategies to prevent and/or reduce exposure

Exposure Assessments

Overview:

- 2018 NDAA tasked ATSDR with conducting exposure assessments in no fewer than eight former/current military sites with high levels of PFAS in the drinking water
- ATSDR has enrolled participants and collected biological (i.e., blood and urine) samples at all sites
- ATSDR also funded two exposure assessments in Pennsylvania and New York to pilot the PFAS Exposure Assessment Technical Tools (PEATT)

Objectives:

- Determine serum PFAS concentrations in the community and understand how they compare to the general population
- Generate information about risk factors for exposures to PFAS through drinking water, food pathways, and contact with contaminated soil
- Communicate and engage with community members to encourage participation and enhance transparency

1. Berkeley County, WV
2. Bucks & Montgomery Counties, PA
3. El Paso County, CO
4. Fairbanks North Star Borough, AK
5. Hampden County, MA
6. Lubbock County, TX
7. New Castle County, DE
8. Orange County, NY
9. Spokane County, WA
10. Westhampton, NY

POPULATION

Over 2,000 adults and children living in **10** selected sites

PFAS Exposures Assessment Progress

Fairbanks North Star Borough, AK
El Paso County, CO
Orange County, NY

Hampden County, MA
Berkeley County, WV
New Castle County, DE
Spokane County, WA
Lubbock County, TX

Exposure Assessment Next Steps

- Send individual test results and share summary results of remaining sites in AK, NY and CO.
- Continue to evaluate data collected from all sites to better understand exposure in the community.
  - Occupational differences
  - Age, Gender
  - Length of residency
  - Environmental exposure, and more
- Write report with findings for each site and one final report combining findings from all sites.
- Host information sessions to talk with community members

Multi-Site Study

Objectives:

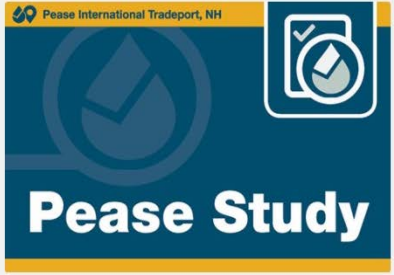
- Study association between health outcomes and PFAS exposure
- Improve understanding of risks associated with PFAS exposure

Outcomes:

- The Multi-site Health Study will look at many health endpoints:
  - lipid metabolism
  - kidney function
  - thyroid disease
  - liver disease
  - glycemic parameters and diabetes
  - immune response

Pease Study:

- Serves as first site in multi-site health study
- Lessons learned from Pease Study will improve multi-site health study protocol



1. Pease International Tradeport, Portsmouth, NH
2. Anaheim and Orange County, CA
3. Ayer, MA
4. Belmont/Rockford area, MI
5. El Paso County, CO
6. Greater Hoosick Falls, NY
7. Hyannis, MA
8. Montgomery and Bucks Counties, PA
9. Newburgh, NY
10. Parchment/Cooper Township, MI
11. Paulsboro ad West Deptford, NJ

POPULATION

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

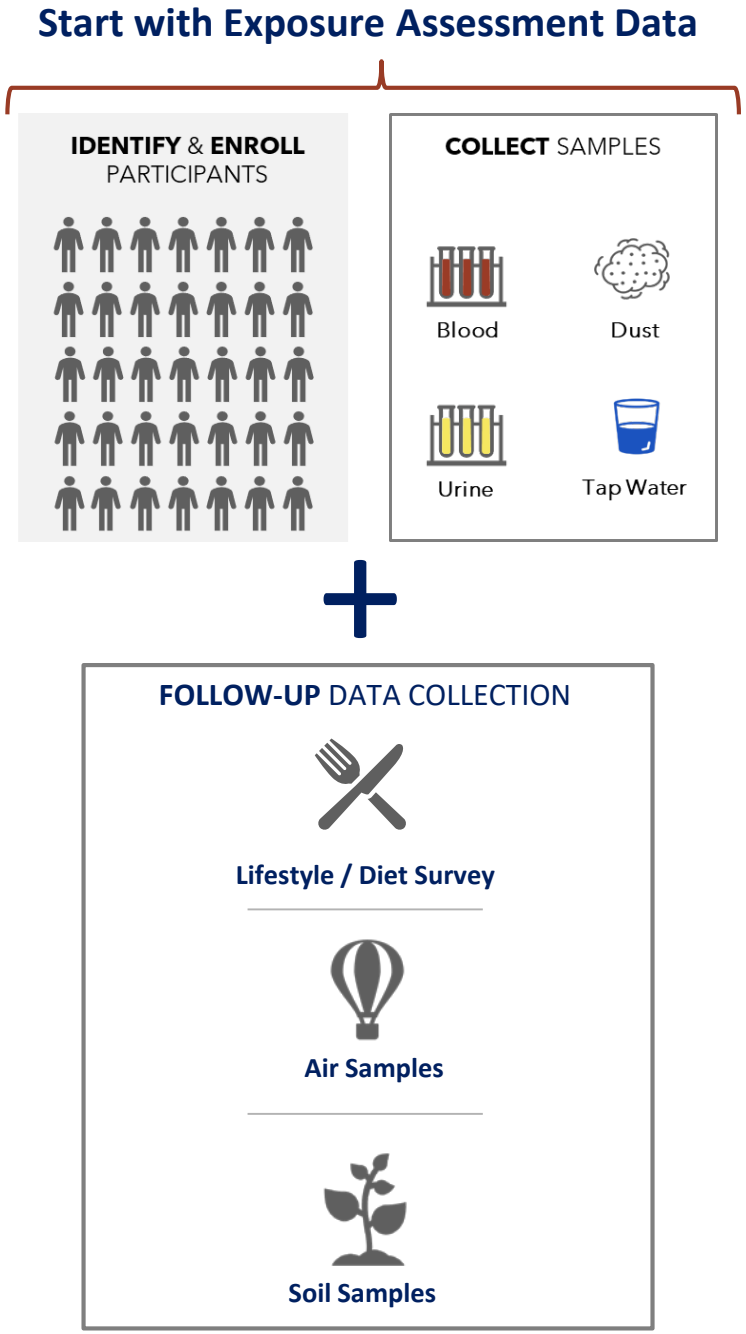
Non-Drinking Water Sources of Exposure

Overview:

- ATSDR was approached by EPA to expand on environmental measurements gathered as part of the original exposure assessments
- Together, ATSDR and EPA are working to determine the scope of additional measurements, which could include PFAS in air, soil, and diet

Objectives:

- Identify significant non-drinking water sources of PFAS exposure (e.g., dust, dirt, home-based gardening, etc.)
- Use multiple regression analysis to discern the contributions of individual exposure pathways to overall PFAS body burden



PFAS and COVID-19

- **Impact of PFAS exposure on COVID-19 susceptibility and illness**
  - NCEH/ATSDR is collaborating with the CDC Influenza/Epi Task Force Healthcare Provider/First Responder COVID-19 study to support this sub-study

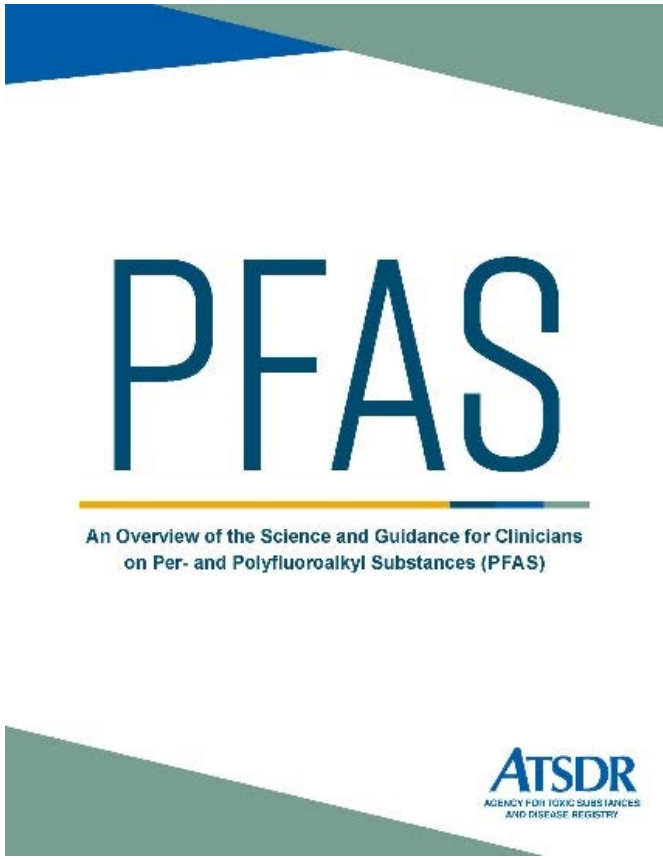
- **Impact of PFAS exposure on susceptibility to viral infection, including, but not limited to, COVID-19**
  - NCEH/ATSDR is planning this questionnaire-based study

ATSDR Toxicological Profile

- **Tox Profile**
  - ATSDR required by Congress to examine, summarize, and interpret available studies on the health effects of a hazardous substance
  - PFAS drafts published 2009, 2015, 2018
- **Minimal Risk Levels (MRL)**
  - Estimate of the daily exposure a person can undergo without detectable risk to health (typically oral and inhalation routes considered)
  - Screening tool for identifying potential human health risks
  - Data adequate and appropriate to calculate intermediate duration oral MRL for **PFOA (3×10^{-6} mg/kg BW/day), PFOS (2×10^{-6} mg/kg BW/day), PFHxS (2×10^{-5} mg/kg BW/day),** and **PFNA (3×10^{-6} mg/kg BW/day)**

ATSDR's PFAS Clinical Guidance

- Provides an overview of what is known about PFAS and identifies health effects associated with PFAS exposure
- Intended to help clinicians respond to patient concerns about PFAS exposure
- The document contains information on:
  - PFAS basics
  - PFAS health studies
  - Questions patients may ask clinicians about PFAS
  - Where to find additional PFAS resources and references
- Revised December 2019



NASEM Guidance on PFAS Testing and Health Outcomes

Goal: *Establish a basis for development of clinical guidance*

- **Understand the strength of associations between PFAS body burden and clinically relevant health outcomes**
- **Develop guidance on how clinicians can advise patients on PFAS exposure, assessment, and health outcomes**
- **Develop principles for clinical evaluation and biological testing**
- **Review current knowledge about PFAS exposure sources, to develop strategies for exposure reduction**

Project Scope: Literature Review

- NASEM will conduct a review of the literature on the sources of human exposure to PFAS and provide CDC/ATSDR with a white paper that summarizes the findings
  - Guided by input from the ad hoc committee
  - Limited to the PFAS currently monitored in humans by the CDC National Report on Human Exposure to Environmental Chemicals
  - Will include all routes of exposure: inhalation, ingestion, and dermal absorption
- Types of studies
  - Primary focus: studies that aim to associate modifiable behaviors (product use, dietary factors) or other interventions (air cleaners, water filters, dietary changes) with measurements of PFAS in blood and urine
  - Exposure modeling, environmental monitoring, and human dosing studies may be included if determined relevant.

Applying the NASEM Review

- It is vital to understand what actions are most effective to eliminate PFAS exposures and reduce PFAS levels in blood.
- This information is needed by health care providers to facilitate risk reduction counseling.
- CDC/ATSDR will use the NASEM review as a basis for the **development of clinical guidance and clinician education** to ensure people exposed to PFAS receive appropriate medical care.

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.