PFAS Exposure Assessment Community Summary

Collective Findings Across Ten Exposure Assessment Sites

INFORMATION TO PROTECT OUR COMMUNITIES

The Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) conducted ten exposure assessments (EAs) in communities near current or former military bases known to have had elevated levels of PFAS in their drinking water. The levels exceeded the Environmental Protection Agency's (EPA) 2016 health advisory (HA) of 70 parts per trillion (ppt) and applicable state guidelines. The EAs provide information to communities about levels of PFAS in their bodies. Results allow ATSDR to provide recommendations to reduce exposure. ATSDR will also use the data collected from these EAs to help inform future studies on PFAS exposures.

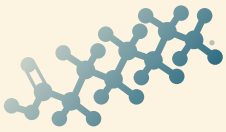
This document summarizes the findings from across all EA sites. Individual reports were published detailing the findings from each EA community. Additional information, including individual site reports, can be found at https://www.atsdr.cdc.gov/pfas/activities/assessments.html.

The EAs were conducted in:

- Westhampton Beach and Quogue Area, New York (NY pilot EA)*
- Montgomery and Bucks Counties, Pennsylvania (PA pilot EA)*
- Hampden County, Massachusetts (Westfield EA)
- Berkeley County, West Virginia (Berkeley County EA)
- New Castle County, Delaware (New Castle County EA)
- Spokane County, Washington (Airway Heights EA)
- Lubbock County, Texas (Lubbock County EA)
- Fairbanks North Star Borough, Alaska (Moose Creek EA)
- El Paso County, Colorado (Security-Widefield EA)
- Orange County, New York (Orange County EA)

* We refer to the two pilot PFAS data collection efforts as "pilot EAs" and the remaining eight EAs as the "ATSDR-led EAs." Although similar data were collected for all sites, the methods were slightly different. Only the blood data from the pilot EAs were combined with ATSDR-lead EAs in the analyses below.

What are PFAS?



PFAS (or "per- and polyfluoroalkyl substances") are a family of man-made chemicals that have been used in industry and consumer products since the 1950s.

PFAS do not occur naturally but are widespread in the environment. Most PFAS (including PFOA, PFOS, PFHxS, and PFNA) are either very resistant to breaking down or degrade into other PFAS that do not degrade further. Certain PFAS will therefore remain in the environment indefinitely. Some studies have shown that PFAS exposure may harm human health.

Why did we select these sites?

When selecting EA sites, ATSDR considered the extent of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) contamination in drinking water supplies, the duration over which exposure may have occurred, and the number of potentially affected residents. These ten sites were identified with PFAS drinking water contamination from use of products such as aqueous film forming foam (AFFF). The two pilot EAs were implemented by state agencies under cooperative agreements with ATSDR, and the remaining eight were led by ATSDR.

Possibly as early as the 1970s, Air Force and Air National Guard bases used AFFF containing PFAS for firefighter training and to respond to fires. Over time, the PFAS from the AFFF entered the ground, moved to offsite locations, and affected drinking water supplies (municipal wells, private wells, or surface drinking water). At all EA sites, exposures were mitigated (reduced) through corrective actions. This included removing contaminated water sources, installing filtration and treatment systems, or providing alternative drinking water supplies. Final mitigation was achieved in each community between 2014 and 2019. Based on information available to ATSDR, all households in affected areas across the EAs now have a drinking

water supply with PFAS concentrations that meet or are below current federal and state guidelines for PFAS in drinking water. ATSDR does not recommend that community members who get drinking water from any of the affected public water systems use alternative sources of water. For affected private wells, ATSDR recommends community members continue to use the alternative sources of water or filtration systems provided to them.

How were participants selected?

Each ATSDR-led EA site focused on a specific geographic area where known or expected PFAS exposure occurred. At some sites, households within these areas were randomly selected to participate. At other sites, all households were invited to participate so there were enough participants to provide meaningful results. The selection process allowed ATSDR to estimate exposure to PFAS for the entire community within the geographic area, even those who were not tested.

Across the 10 EA sites, we analyzed the blood samples of

2,384 residents from **1,212 households**

Not all participants completed the data collection activities.

Key Takeaways

- Average age-adjusted perfluorohexane sulfonic acid (PFHxS) blood levels are higher than national levels in all EA communities.
- Average age-adjusted PFOS and PFOA blood levels are higher than national levels in most EA communities.
- Elevated blood levels may result from past drinking water contamination in those communities.
- Some demographic and lifestyle characteristics are linked with higher PFAS blood levels.
- All tap water samples collected during the ATSDR-led EAs were below EPA's 2016 health advisory and state public health guidelines for PFAS in drinking water. Two tap water samples had concentrations of PFOS above ATSDR's environmental media evaluation guide (EMEG) for PFOS in drinking water.

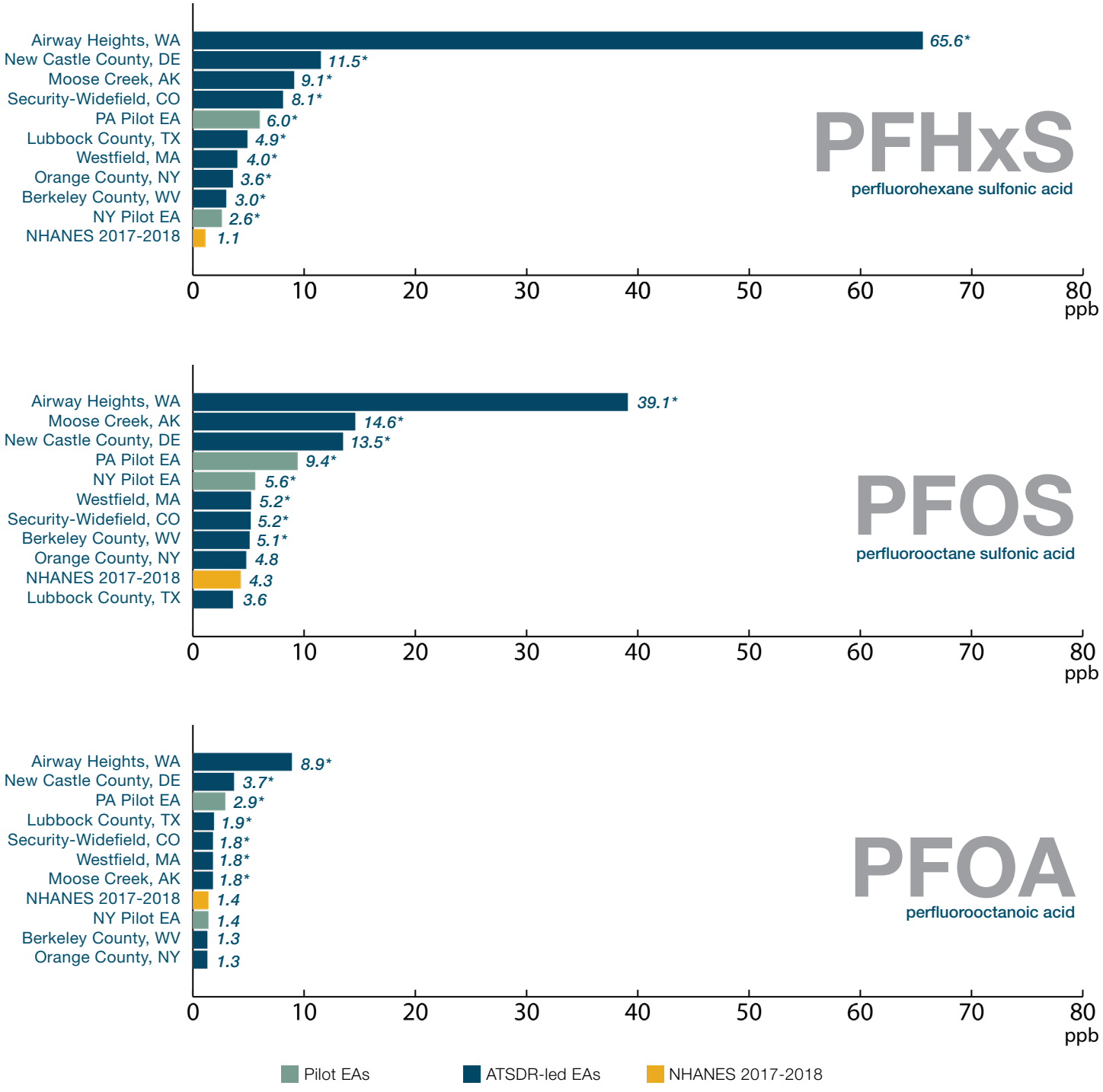
What did we learn about PFAS levels in blood?

Since 1999, the National Health and Nutrition Examination Survey (NHANES) has measured PFAS levels in blood in the U.S. population. PFAS levels are shown to be age dependent and tend to increase with age in part due to longer periods of exposure. ATSDR adjusted blood levels of EA participants to the age distribution of the U.S. population during NHANES 2015-2016. Age-adjustment enabled more meaningful comparison to the national average.

Average age-adjusted blood levels of PFAS are higher than national levels in many, but not all, EA communities.

- PFHxS is higher in **ten** out of ten EA communities.
- PFOS is higher in **eight** of ten EA communities.
- PFOA is higher in **seven** of ten EA communities.
- PFNA is higher in **four** of ten EA communities.
- PFDA & PFUnA are higher in **one** of ten EA communities.
- MeFOSAA levels **were not statistically elevated** at any sites.

Average PFAS blood levels (age-adjusted) at PFAS exposure assessment sites compared to national averages†



NA Not applicable

† Averages represent geometric means.

ppb Parts per billion

* Values are statistically higher than NHANES 2017-2018.

§ Per the protocol, geometric means were not calculated for PFAS detected in less than 60% of samples.

Individual site reports compared results to the most recent NHANES data at the time, which was 2013-2014 for pilot EAs and 2015-2016 or all others. This summary document shows comparisons to NHANES 2017-2018.

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What did we learn about PFAS levels in blood?

Elevated blood levels of PFHxS, PFOS, and PFOA may result from past drinking water contamination.

Participants with higher levels of PFHxS, PFOS, and PFOA in their drinking water generally had higher PFHxS, PFOS, and PFOA blood levels.

PFHxS, PFOS, and PFOA were previously detected at elevated levels in drinking water at all EA sites.

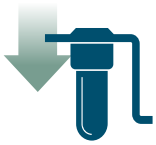
Because it takes a long time for PFAS to leave the body, past drinking water exposure may have contributed to the PFAS blood levels found in EA participants years later.

Participants who had elevated blood PFHxS levels typically had elevated PFOS and PFOA blood levels.

This suggests a common source of exposure, such as drinking water supply. It also suggests a common contamination source, such as AAAF. Other sources of exposure were not measured but could have contributed to PFAS in participants' blood.

Long-time residents had higher PFHxS, PFOS, and PFOA blood levels (these people likely drank the contaminated water the longest).

The amount of drinking water a participant consumed was associated with PFHxS blood levels.



Adults who used at least one filter or treatment device in their homes and adults who reported not drinking tap water at all had lower PFHxS, PFOS, and PFOA blood levels compared to those who did not.

Average PFOS and PFOA blood levels decreased in adult participants after the drinking water exposure stopped or was reduced.

PFAS blood levels varied with different demographic and exposure characteristics of the participant population.

ATSDR used statistical models to study relationships between various demographic and lifestyle characteristics of the tested residents (1,791 adults and 197 children) in the eight ATSDR-led EAs. The models showed that, in general:

The strength of these results varied, and they should be interpreted with caution. Some of these associations may be due to chance as we were testing many associations at once.

AGE

Blood levels of PFHxS, PFOS, PFOA, and PFNA were higher in older adults and the size of the effect was stronger in females.

In children (3 to 17 years old), PFHxS and PFOA levels decreased for every additional year in age.

SEX

Males had higher blood levels of PFHxS, PFOS, PFOA, and PFNA. The difference between males and females was larger in younger adults.

In children, blood levels in males were higher than females for PFOS, PFOA, PFNA, and PFDA.

RACE / ETHNICITY

Race and ethnicity were associated with PFNA blood levels in adults and children. Compared to those who identified as "White, non-Hispanic," some groups had higher PFNA blood levels, while others had lower PFNA levels.

CLEANING

Adults who reported cleaning their homes more frequently had higher PFNA blood levels than those who cleaned a few times per year or less.

SOIL CONTACT

Children who reported coming in contact with soil more frequently had higher levels of PFOS, PFNA, and PFDA.

LOCALLY GROWN PRODUCE & DAIRY

Adults and children who reported eating locally grown fruit and vegetables had higher PFDA blood levels.

Adults who reported drinking locally produced milk, even occasionally, had higher PFHxS and PFOA blood levels compared to those who did not.

STAIN-RESISTANT PRODUCTS

Participants who reported using stain-resistant products a few times per year or more had blood levels of PFNA that were higher than participants who never used them.

CHILDBIRTH

Women who had given birth had lower PFHxS blood levels than those who had not.

BREASTFEEDING/FORMULA

Every additional month of reported breastfeeding was associated with an increase in PFDA blood levels in child participants.

Every additional month of formula consumption was associated with an increase in PFNA blood levels in child participants.

What did other testing find?

PFHxS, PFHxA, and PFBA were detected in urine and at low concentrations.

Almost all tap water samples collected during the ATSDR-led EAs were below all federal and state guidelines for PFAS in drinking water at the time the samples were collected. Two of the 176 samples collected had PFOS measured above ATSDR's screening value for PFOS in drinking water.

PFAS contamination in house dust was similar to that reported in other studies (with and without known PFAS contamination).

What do these results mean for EA community members?

The PFAS EAs provide evidence that past exposures to PFAS in drinking water have impacted the levels of PFAS in people's bodies. PFAS are eliminated from the body over a long period of time. This allowed ATSDR to measure PFAS even though exposures through drinking water were mitigated, or lowered, years ago.

Although the exposure contribution from PFAS in drinking water has been mitigated (reduced), there are actions community members and stakeholders can take to further reduce exposures to PFAS and protect public health.

What can EA community members do?

Become familiar with Consumer Confidence Reports for information on each system's water quality.

Private well owners living in areas affected by PFAS should consider having their wells tested for PFAS if testing has not been conducted before. To learn more about testing wells for PFAS in your community, visit the resources listed in EA-specific reports.

Based on test results, consider installing a home water treatment system to further lower levels of PFAS in drinking water. The global public health organization NSF International has developed a test method to verify a water filter's ability to reduce PFOA and PFOS to below the health advisory levels set by the EPA or individual states. NSF International-approved devices can be found at: https://info.nsf.org/Certified/DWTU/. Click on "reduction devices" at the bottom of the page for PFOA and PFOS. Any treatment systems installed should be operated and maintained according to manufacturer recommendations to ensure proper operation and removal of PFAS from water.

Nursing mothers should continue breastfeeding. Based on current science, the known benefits of breastfeeding outweigh the potential risks for infants exposed to PFAS in breast milk.

When possible, eliminate or decrease potential exposure to PFAS in consumer products such as stain-resistant products and food packaging materials. To learn more visit: https://www.fda.gov/food/chemical-contaminants-food/questions-and-answers-pfas-food.

Pay attention to advisories about food consumption, such as local fish advisories.

Discuss any health concerns or symptoms with your health care provider. Share results of PFAS blood testing with your health care provider and make them aware of ATSDR resources for clinicians (https://www.atsdr.cdc.gov/pfas/resources/info-for-health-professionals.html). Follow the advice of your health care provider and the recommendations for checkups, vaccinations, prenatal care, and health screening tests.

Follow the advice of your child's health care provider and the recommendations for well child checkups, vaccinations, and recommended health screening tests. Consult https://health.gov/myhealthfinder to help identify those vaccinations and tests.

For additional information about environmental exposures and children's health, contact the Pediatric Environmental Health Specialty Units, a nationwide network of experts in reproductive and children's environmental health (https://www.pehsu.net/).

What can water providers do?

Based on the PFAS drinking water test results from sites with public water supplies, ATSDR does not recommend an alternate source of drinking water at this time. However, operators of affected public water systems should continue to monitor concentrations of PFAS in drinking water delivered to EA communities and appropriately maintain treatment systems to ensure that concentrations of PFAS remain below the existing federal and state guidelines for specific PFAS in drinking water. Results of PFAS monitoring should be shared with community members through appropriate communication channels.

The Air Force is encouraged to continue providing bottled water and/or water filtration systems for households with private wells with PFAS concentrations above relevant state or federal guidelines unless a different alternative source of drinking water that meets all guidelines has been provided. Testing should continue to be made available for private wells for PFAS if new data indicate they may be impacted by PFAS-containing groundwater. Households with private wells that receive bottled water and/or have water filtration systems installed specifically to treat water to remove PFAS should continue to use these alternative sources of water.

What does ATSDR recommend for future PFAS work/action?

- **Federal and state regulatory agencies can consider the EA findings about PFAS blood levels and the amount of PFAS that was in drinking water for policy development.**
- **ATSDR recommends monitoring PFAS in drinking water in more communities (beyond those that were studied in the EAs) to improve the ability to identify and respond to communities affected by PFAS.**
- **ATSDR will continue to share information about ongoing research related to the potential health effects of PFAS exposure.**

About ATSDR

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency of the U.S. Department of Health and Human Services. https://www.atsdr.cdc.gov/

For More Information

visit: https://www.atsdr.cdc.gov/
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National Center for Environmental Health
Agency for Toxic Substances and Disease Registry