

PFOMS

PFAS in Firefighters of Michigan Surveillance

# Findings from an Investigation of Blood Per- and Polyfluoroalkyl Substances (PFAS) Concentrations Among Michigan Firefighters

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October 8, 2026

MDHHS

Michigan Department of Health & Human Services

# Presentation Overview

- Project overview.
- Initial findings of the PFOMS project.
- Limitations and conclusions of these findings.
- PFOMS' Community Partners group.
- Next steps.

# The PFOMS Project

## Project Overview

# What is The PFOMS Project?

- PFOMS was a statewide biomonitoring project focused on Michigan firefighters.

- Its objectives were:
  - Determine average blood concentrations of PFAS in Michigan firefighters.
  - Help inform decisions about how to minimize firefighters' exposure to PFAS.

- The project was funded by the Centers for Disease Control and Prevention (CDC) State Biomonitoring Cooperative Agreement and State of Michigan (SOM).

# What are possible ways that firefighters are exposed to PFAS?

MDHHS Michigan Department of Health & Human Services

## When they are working



PFAS-containing firefighting foam.



Turnout gear or personal protective equipment (PPE).



PFAS-contaminated drinking water at workplace.



Fire station dust.

## When they are not working



Stain and water-resistant products.



Food packaging.



Carpet and other textiles.



PFAS-contaminated drinking water at home.

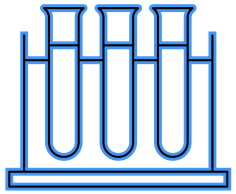
# Selection of Fire Departments and Firefighters

- Fire departments from across the state of Michigan were invited to participate in the PFOMS project.
  - All airport fire departments.
  - City of Detroit fire department.
  - Other randomly selected municipal fire departments.

- All firefighters from selected fire departments were invited to participate.



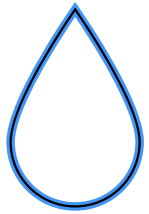
# What was the PFOMS Process?



Participants provided a **blood sample** which was analyzed for 39 PFAS.



Participants also completed a **survey** about their job history, things they did while they were working as a firefighter and things that could have exposed them to PFAS.



**Drinking water samples** were collected from each fire station and tested for the same 39 PFAS that were tested for in participant blood samples.

# The PFOMS Project

## Results

# PFOMS

PFAS in Firefighters of Michigan Surveillance



# Final Project Status

## Fire Departments

| 177 | 64 | 64 | 61 |
|---|---|---|---|
| Invited to participate. | Enrolled. | Visits completed. | Completed firefighting foam survey. |

## Fire Stations

| 122 | 122 |
|---|---|
| Enrolled in water sampling. | Water sampling appointments completed. |

## Firefighters

| 2,296 | 1,090 | 1,023 | 1,017 |
|---|---|---|---|
| Invited to participate from enrolled fire departments. | Enrolled. | Provided a blood sample. | Completed both the survey and blood sample. |

### PFOMS Firefighter Participation Progress

113%

900 Participant Goal

# Participant Characteristics




Average age was 44.7 years.



91.7% were males.



Most participants (86.5%) were white.



Most participants (55.6%) were full-time paid employees of the department.



Most participants (83.8%) were from non-airport fire departments.

# What Findings are Presented?

1. Describe the prevalence estimates and concentrations of PFAS in blood among Michigan firefighters, including:
    - Compare participants' blood PFAS concentrations to the National Health and Nutrition Examination Survey (NHANES) results and other firefighter studies, where available.

2. Compare the concentrations of PFAS in blood among various subgroups.

3. Describe the detection frequencies of PFAS in drinking water samples from fire stations.

# Statistical Considerations

- Values for PFAS reported as non-detect (ND) or below the reporting limit (RL) were recoded to $\frac{\text{limit of quantification}}{\sqrt{2}}$ and $\frac{\text{reporting limit}}{\sqrt{2}}$, respectively.
- All analyses were performed using natural log (ln) transformed PFAS values to meet normality assumptions.
- The analysis presented here focused on analytes detected in over 60% of Michigan firefighters to ensure estimates were meaningful and reflective of actual exposure levels.
- Statistical significance was determined by non-overlapping 95% confidence intervals for geometric means between groups.

# The PFOMS Project

**Objective 1:** Describe the prevalence estimates and concentrations of PFAS in blood among Michigan firefighters and compare participants' blood PFAS concentrations to the National Health and Nutrition Examination Survey (NHANES) results and other firefighter studies, where available.

# PFAS Prevalence in Michigan Firefighters

MDHHS Michigan Department of Health & Human Services

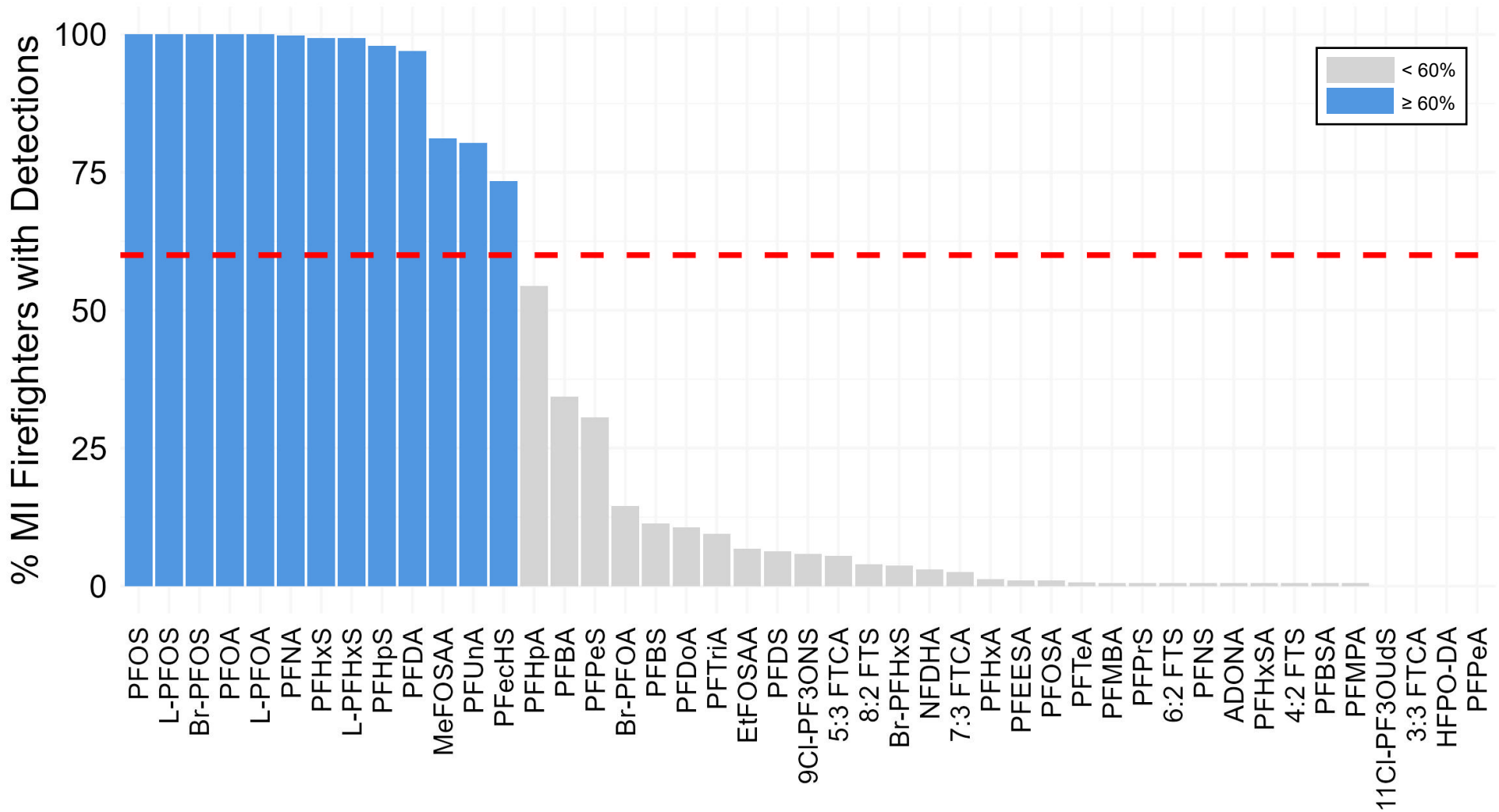


**Found in most participants**





**Found in few participants**



# Nine PFAS had **Higher** Prevalence in Michigan Firefighters Compared to U.S. Population

Compared to the U.S. population, PFAS Prevalence in Michigan firefighters was:

**Significantly higher**

- Br-PFOA
- PFNA
- PFHpS
- PFDA
- PFUnA
- MeFOSAA
- PFHpA
- PFBS
- PFDoA

**Similar**

- L-PFOS
- Br-PFOS
- L-PFOA
- PFHxS
- EtFOSAA
- PFHxA
- PFOSA

**Significantly lower**

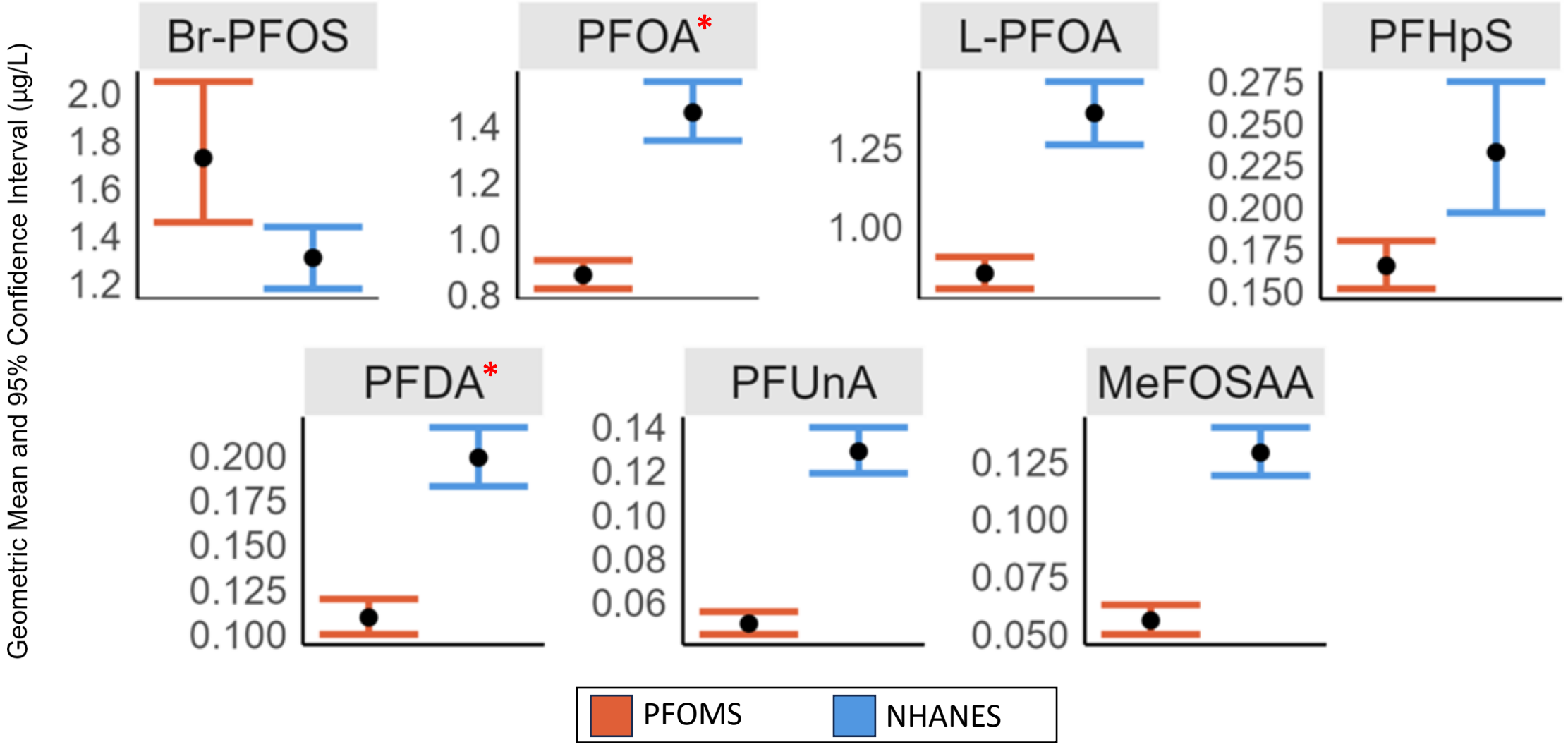
- 9Cl-PF3ONS

MI firefighters' prevalence is **significantly higher** than the U.S. population.

MI firefighters' prevalence is **similar** to the U.S. population.

MI firefighters' prevalence is **significantly lower** than the U.S. population.

# Michigan Firefighters had **Lower** Concentrations for six (46%) PFAS Compared to the U.S. Population




*Frequently found in PFAS-containing foam.

**Note:** Only significant findings are presented.

# Michigan Firefighters had Lower Average Concentrations Compared to Other Firefighter Studies

- Michigan firefighters generally had:
  - **lower average** blood PFAS concentrations.
  - **higher maximum** blood PFAS concentrations than reported in other firefighter studies^.

- Differences between Michigan firefighters and other studies may be due to:
  - The types of firefighters that participated in the studies.
  - Where they worked.
  - When the study was conducted.

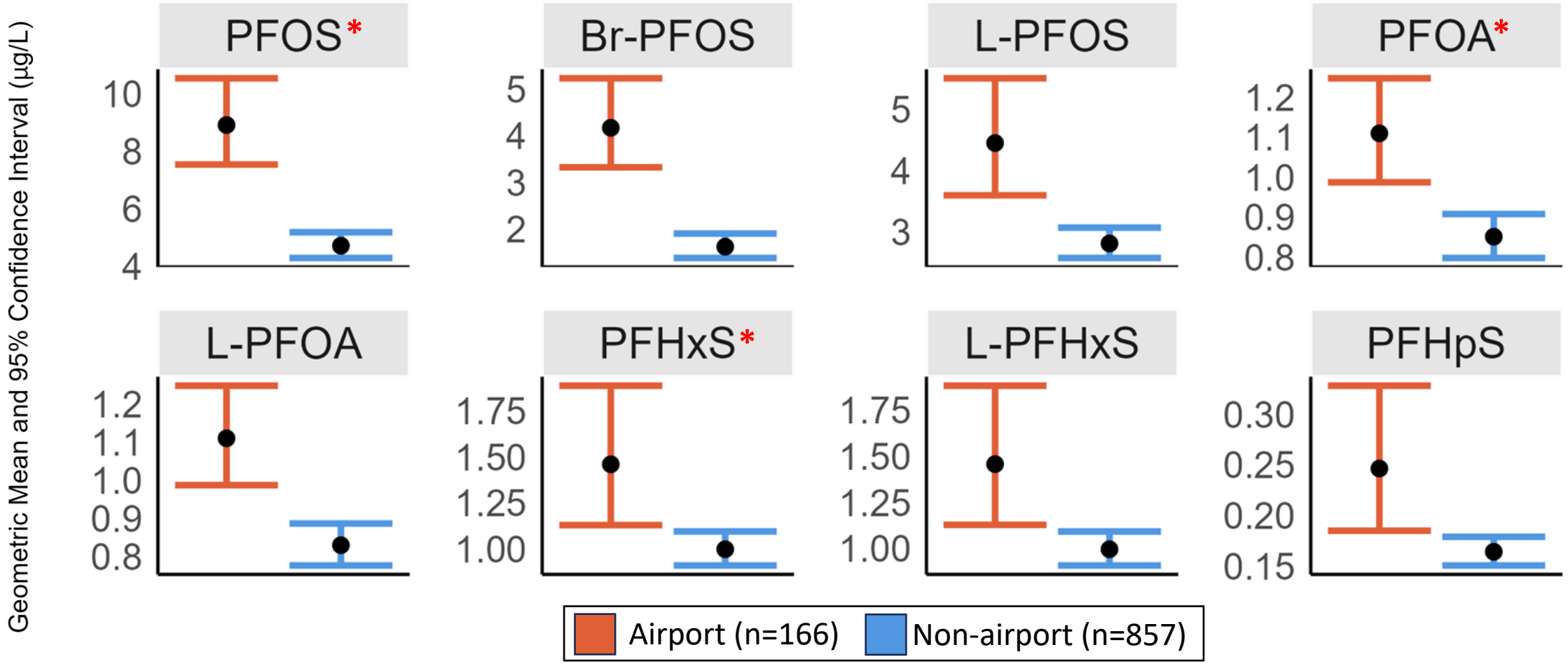
^ Comparison studies are listed in a supplemental slide.

**Note:** Based on comparisons for **PFOS, PFOA, PFHxS, PFNA and PFDA.**

# The PFOMS Project

**Objective 2:** Compare the average concentrations of PFAS in blood among various subgroups.

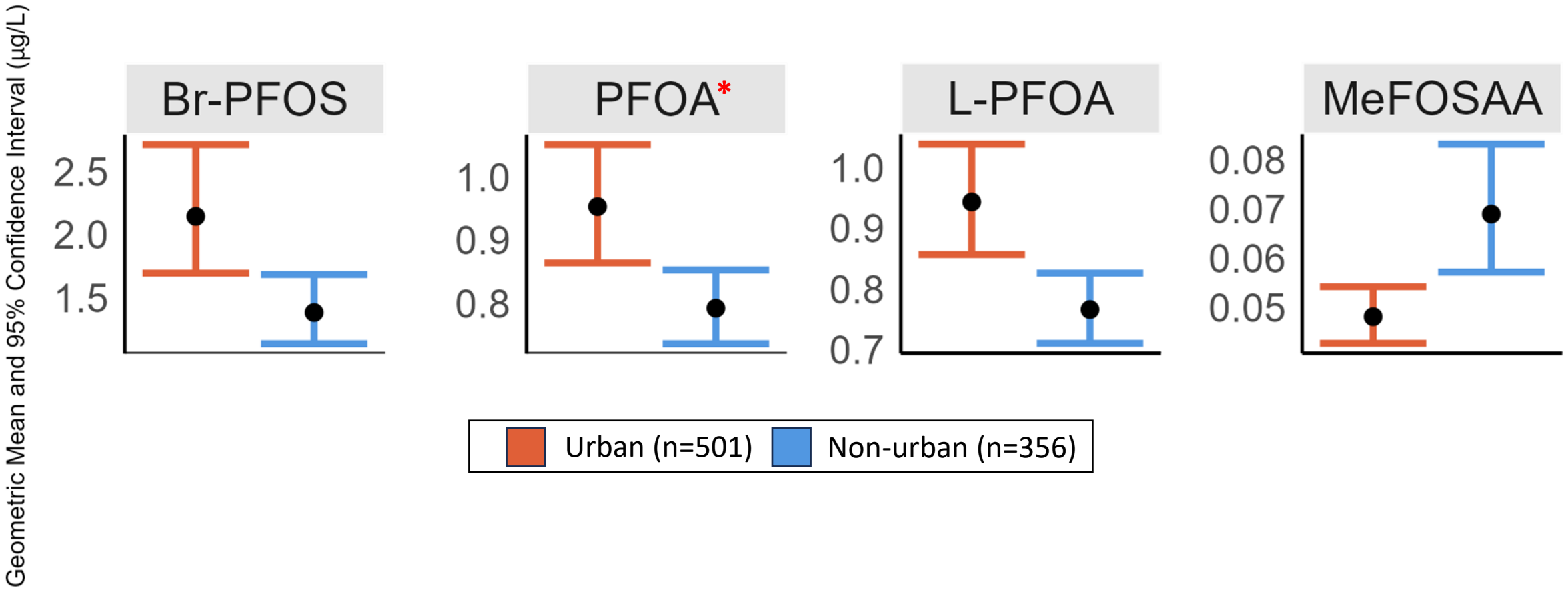
# Airport Firefighters had **Higher** Average PFAS Concentrations for Eight (61.5%) PFAS Compared to Non-airport Firefighters




*Frequently found in PFAS-containing foam.

**Note:** Only significant findings are presented.

# Urban Firefighters had **Higher** Average Concentrations for Only Three (23%) PFAS Compared to Non-urban Firefighters




*Frequently found in PFAS-containing foam.

**Note:** Only significant findings are presented.
This analysis includes only non-airport firefighters (n=857).

# Other Significant Findings



Males had higher average concentrations of PFAS such as PFOS, PFOA, PFHxS, PFNA and PFHpS.*




Older adults (60+ years) had higher concentrations of PFHpS and MeFOSAA.



Firefighters with graduate school or higher education had higher concentrations for PFOA.*



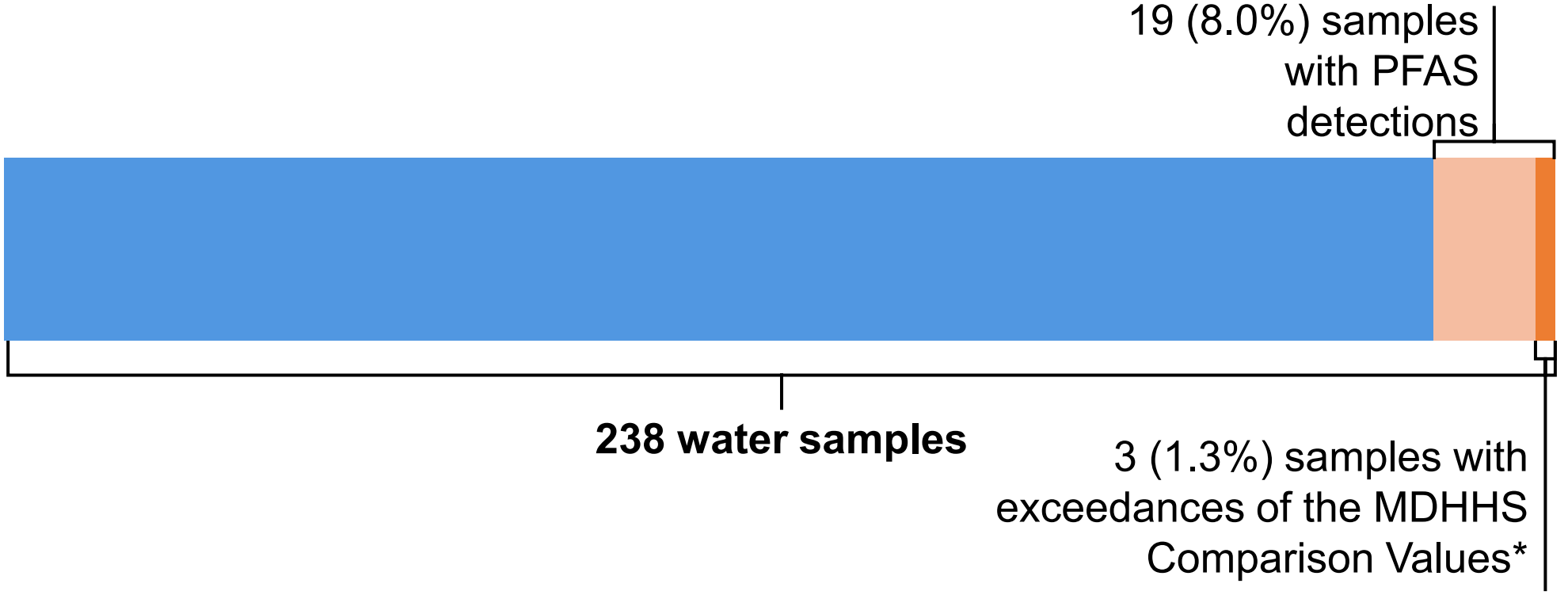
Firefighters with increasingly higher income levels ($100,000 or more annually) had higher average blood concentrations for PFHxS and PFeCHS and lower for MeFOSAA.

* These analyses were limited by small sample sizes, resulting in less precise estimates.

# The PFOMS Project

**Objective 3:** Describe the detection frequencies of PFAS in drinking water samples from fire stations.

# PFAS Was Rarely Detected in Fire Station Drinking Water




*Exceedances were determined to be due to PFAS contamination associated with the faucet or spigot sampled, and not the water entering the station.

# Limitations of These Findings

1. Certain analyses were limited by small sample sizes, resulting in less precise estimates (e.g., lowest income category or those identifying as Hispanic).

2. There is a potential for volunteer bias, as firefighters from fire departments with known PFAS exposure may have participated at higher rates.

3. There are several considerations when it comes to comparing Michigan firefighter averages to the U.S. population, such as: Characteristics of participants, differences in data collection years and differences in PFAS test methods.

# Conclusions

- The PFOMS project determined average blood concentrations for 13 PFAS that were detected in more than 60% of Michigan firefighters.
- Many PFAS, including those found in PFAS-containing foam, such as PFOS and PFHxS, were detected in more than 95% of PFOMS participants. However, the concentrations found in PFOMS participants were lower than or similar to concentrations found to the U.S. population.



# Conclusions, Continued

- PFAS that are known to be found in protective gear showed little (less than 10%) to no detection in PFOMS participants.
- Airport firefighters had higher average concentrations of certain PFAS compared to non-airport firefighters.
- PFAS was rarely detected in fire station drinking water. Fire station drinking water is not a significant source of PFAS exposure for PFOMS participants.



# The PFOMS Project

## Community Partners

# Why Convene Community Partners?

**Goal:** To improve the design and tailor the PFOMS project specifically for Michigan firefighters, increasing trust and contributing to better project engagement.



# Building the Partners Group

- Identified potential members based on leadership in their field, interest and fire service experience.
- Conducted informational meetings by phone with potential members to gauge interest and invited them to join the partners group.
- Convened first meeting in Spring 2021 prior to launch of the project and held meetings annually or as needed.

# PFOMS Community Partners



Kevin Sehlmeyer
Former State Fire Marshal of Michigan



Steven Heim
Michigan Professional Fire Fighters Union



Mike Evans
Wayne County Airport Authority



Tony Gutierrez
Gerald R. Ford International Airport Authority



Tom Hughes
State Fire Marshal of Michigan



Stanley Barnes
Michigan Fire Inspectors Society



Tony Garcia
Michigan State Police
Hazmat Training Programs



Alfie Green
City of Detroit Fire Department

# Partner Involvement: Connecting MDHHS to Firefighters

- Letter of support and public endorsement from the State Fire Marshal.
- Convened audiences with national and local firefighting unions and organizations to gain buy-in.
- Networking with fire service groups at over 15 firefighting conferences to garner community feedback.



# Partner Impact: Project Implementation




## Consultation on Messaging and Materials

- Recruitment letters.
- Branding.
- Exposure survey design.
- Visit scheduling.

## Outreach Support and Operations Input

- Kick-off meetings.
- Fire department/organization contacts.
- Clinic layout, flow and flexibility.

## Participant Feedback and Department Support

- Capturing participant experiences.
- Storytelling through featured news publications (e.g., CDC feature).
- Improved operations as project progressed.

# Partners Engagement Successes

Engaging early-on allowed more time to build trust.

Regular attendance at conferences allowed our team to receive frequent feedback and adapt the project as needed.

High meeting attendance and 100% retention of community partners members throughout project.






# Read the PFOMS Report and Brief

**Available at: [Michigan.gov/DEHBio](Michigan.gov/DEHBio).**

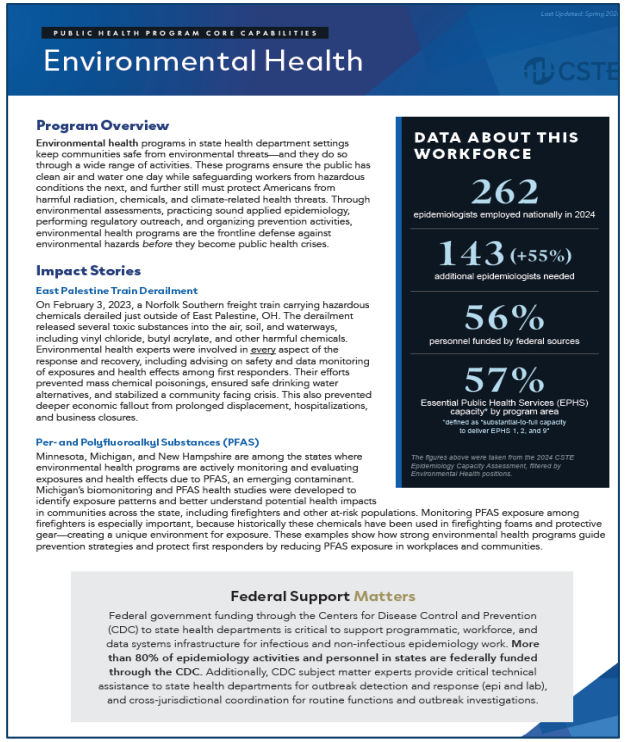
# Next Steps

- MDHHS will continue to analyze the data collected as part of the PFOMS project.
  - Compare PFOMS findings to the Michigan Chemical Exposure Monitoring (MiChEM) program.
  - Explore specific occupational and non-occupational activities and behaviors between different firefighter subgroups, such as airport and non-airport personnel.

- State regulatory agencies are encouraged to consider the PFOMS findings when developing policy.

# Impact of PFOMS

- PFOMS was shared in a 2026 Council of State and Territorial Epidemiologists (CSTE) article.



PUBLIC HEALTH PROGRAM CORE CAPABILITIES

Environmental Health

**Program Overview**

**Environmental health** programs in state health department settings keep communities safe from environmental threats—and they do so through a wide range of activities. These programs ensure the public has clean air and water one day while safeguarding workers from hazardous conditions the next, and further still must protect Americans from harmful radiation, chemicals, and climate-related health threats. Through environmental assessments, practicing sound applied epidemiology, performing regulatory outreach, and organizing prevention activities, environmental health programs are the frontline defense against environmental hazards *before* they become public health crises.

**DATA ABOUT THIS WORKFORCE**

**262**
epidemiologists employed nationally in 2024

**143 (+55%)**
additional epidemiologists needed

**56%**
personnel funded by federal sources

**57%**
Essential Public Health Services (EPHS) capacity* by program area
*defined as "substantial-to-full capacity to deliver EPHS 1, 2, and 9"

*The figures above were taken from the 2024 CSTE Epidemiology Capacity Assessment, filtered by Environmental Health positions.*

**Impact Stories**

**East Palestine Train Derailment**

On February 3, 2023, a Norfolk Southern freight train carrying hazardous chemicals derailed just outside of East Palestine, OH. The derailment released several toxic substances into the air, soil, and waterways, including vinyl chloride, butyl acrylate, and other harmful chemicals. Environmental health experts were involved in every aspect of the response and recovery, including advising on safety and data monitoring of exposures and health effects among first responders. Their efforts prevented mass chemical poisonings, ensured safe drinking water alternatives, and stabilized a community facing crisis. This also prevented deeper economic fallout from prolonged displacement, hospitalizations, and business closures.

**Per- and Polyfluoroalkyl Substances (PFAS)**

Minnesota, Michigan, and New Hampshire are among the states where environmental health programs are actively monitoring and evaluating exposures and health effects due to PFAS, an emerging contaminant. Michigan's biomonitoring and PFAS health studies were developed to identify exposure patterns and better understand potential health impacts in communities across the state, including firefighters and other at-risk populations. Monitoring PFAS exposure among firefighters is especially important, because historically these chemicals have been used in firefighting foams and protective gear—creating a unique environment for exposure. These examples show how strong environmental health programs guide prevention strategies and protect first responders by reducing PFAS exposure in workplaces and communities.

**Federal Support Matters**

Federal government funding through the Centers for Disease Control and Prevention (CDC) to state health departments is critical to support programmatic, workforce, and data systems infrastructure for infectious and non-infectious epidemiology work. **More than 80% of epidemiology activities and personnel in states are federally funded through the CDC.** Additionally, CDC subject matter experts provide critical technical assistance to state health departments for outbreak detection and response (epi and lab), and cross-jurisdictional coordination for routine functions and outbreak investigations.

CSTE Public Health Program Core Capabilities. Environmental Health, Spring 2026.

- PFOMS informing best practices for firefighter biomonitoring in other states (e.g., Minnesota).



*Best-Practices for Per- and Polyfluoroalkyl Substances (PFAS) Biomonitoring in Firefighters*

ERG

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**August 2025**

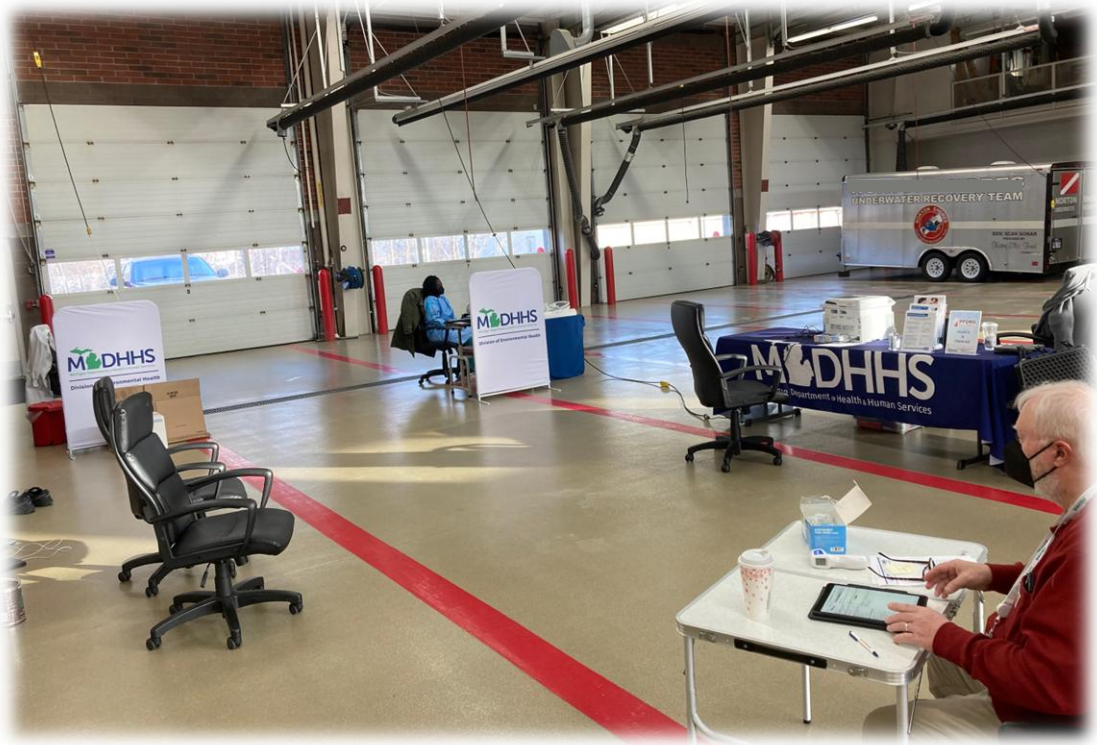
SWIFT No. 20000016871

Minnesota Department of Health, Aug 2025, Retrieved from: https://www.health.state.mn.us/communities/environment/hazardous/docs/ffbiomonitor.pdf.

# Questions?

# Presenters Contact Information


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# THANK YOU!

MDHHS thanks the PFOMS participants, the community partners and staff for their time and effort on this project!

You can contact us by calling 844-464-7327 or emailing MDHHS-PFOMS@Michigan.gov

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# Supplemental Information

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# PFAS Measured in Blood and Water

MDHHS Michigan Department of Health & Human Services

**45 PFAS (including linear and branched isomers) were measured**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PFOA** | L-PFOA* | Br-PFOA* | PFOS** | L-PFOS* | Br-PFOS* | PFeCHS | PFEESA | PFBSA |
| PFHxS** | L-PFHxS* | Br-PFHxS* | PFNA | PFBS | PFTeA | 9Cl-PF3ONS | PFMBA | PFMPA |
| PFTriA | PFDoA | PFUnA | PFDA | PFHpA | PFHxA | 5:3 FTCA | PFPrS | 11CL-PF3OUdS |
| PFPeA | PFBA | PFDS | PFNS | PFHpS | PFPeS | 7:3 FTCA | ADONA | 3:3FTCA |
| PFOSA | FTS 8:2 | FTS 6:2 | FTS 4:2 | EtFOSAA | MeFOSAA | NFDHA | PFHxSA | HFPO-DA (GenX) |

*Linear (L) and branched (Br) isomers

**Total sum of branched and linear

# Firefighter studies information

| Study | Sample Size (n) | Participants |
|---|---|---|
| PFOMS (2021-2023) | 1,023 | Firefighters from Michigan. |
| Řiháčková et al. (2023) | 52 | Male firefighters (excluding new trainees) from the Czech Republic. |
| Burgess et al. (2023) - Fire Dept. A | 77 | Male firefighters from departments in the Southwestern, Southeastern, or Northeastern U.S. |
| Burgess et al. (2023) - Fire Dept. B | 59 | |
| Burgess et al. (2023) - Fire Dept. C | 59 | |
| Burgess et al. (2023) - Fire Dept. D | 61 | |
| Goodrich et al. (2021) | 197 | Firefighters from Arizona, California, and Massachusetts. |
| Graber et al. (2021) | 116 | Non-Hispanic White, male, volunteer firefighters from New Jersey. |
| Trowbridge et al. (2020) | 86 | Female firefighters from California. |
| Dobraca et al. (2015) | 101 | Firefighters from one county in southern California. |
| Rotander et al. (2015) | 149 | Firefighters working at AFFF training facilities in Australia. |
| Shaw et al. (2013) | 12 | Firefighters from California who had worked in the fire service for at least 5 years and responded to fire scenes at least 20 times in the last 5 years. Their blood was sampled within 24 hours of responding to a fire. |
| Jin et al. (2011) | 36 | Firefighters from West Virginia and Ohio who were part of a larger population in a region with PFOA contamination of drinking water. |