Regents' Grant Interventions to Reduce Firefighter Cancer

Presenting preliminary findings to the Arizona Board of Regents

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- Fire Chief **Tom Shannon**, Scottsdale Fire Department and Past President, Arizona Fire Chiefs Association (AFCA)
- Firefighter **Gilbert Aguirre**, Goodyear Fire Department
- Captain **Orion Godfrey**, Goodyear Fire Department and Professional Fire Fighters of Arizona's State Cancer Coordinator
- Joining Virtually: Fire Chief **Jake Rhoades**, Buckeye Fire-Rescue Medical Department and President, AFCA
- Also involved: **Floris Wardenaar**, PhD, Arizona State University



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Firefighters and cancer – an increased risk

- PFAS, or "forever chemicals," are a large group of man-made substances used in many everyday products because of their resistance to heat, water and oil.
- PFAS do not break down easily in the environment or the human body, which means they build up over time.
- Exposure to PFAS is linked to increased cancer risk, immune system suppression, heart problems and more.
- While PFAS are found in most people, firefighters have significantly higher levels due to frequent occupational exposure.
- These chemicals are found in smoke, firefighting foam and turnout gear worn by firefighters.

***Consensus Study Report Highlights: Guidance on PFAS Exposure, Testing, and Clinical Follow-Up. National Academies of Sciences, Engineering and Medicine. July 2022**

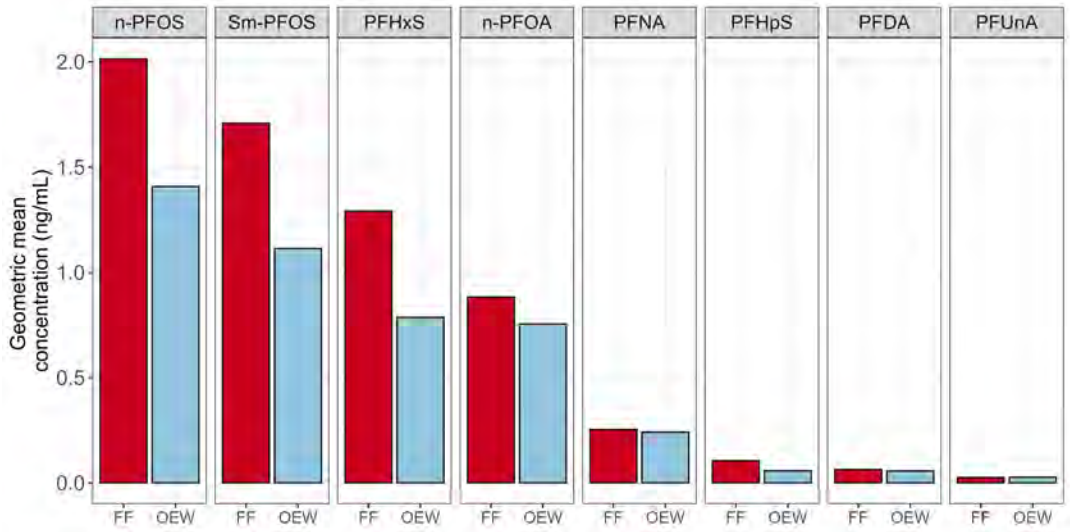


Figure: PFAS concentrations in Arizona firefighters (red) compared to other essential workers (blue)

(Mitchell et al. J Expo Sci Environ Epidemiol. 2025 May;35(3):437-444.)

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Opportunities to mitigate cancer risks

- Encouraging results from a previous Australian study indicated PFAS levels decrease through blood and plasma donations.
- Determine if there would be similar results for Arizona firefighters; other ways to PFAS
- Measure serum PFAS levels and epigenetic “cellular” age in “control” plasma, blood donation groups
- Firefighter participants in and outside of AZ – 1,932

Accelerated epigenetic age



https://www.frontiersin.org/journals/oncology/articles/10.3389/fonc.2023.1150731/full

Correlates with:*

All-cause mortality

Cancer

Reproductive harm

Cardiovascular disease

Neurodegenerative disease

* Salameh Y, et al. DNA Methylation Biomarkers in Aging and Age-Related Diseases. Front Genet. 2020;11:171;

Reducing PFAS exposure: what firefighters can do

**Results from PFAS concentrations and survey responses upon entry into the study*

- **Plasma and blood donation**
  - History of plasma donation: 18% to 33% lower levels of forever chemicals
  - History of blood donation: 6% lower levels of forever chemicals
- **On-scene decontamination**
  - Soap/rinse/brush on-scene decontamination associated with 24% lower forever chemical concentrations compared to no on-scene decontamination
- **Drinking bottled water**
  - Drinking bottled water at the department associated with 10% to 20% lower forever chemical levels compared to tap water
  - Drinking bottled water at home associated with 8% lower forever chemical levels.
  - Drinking well water at home associated with 14% higher forever chemical levels.
- **Reduce use of Aqueous Film-Forming Foam (AFFF)**
  - Aqueous film-forming foam (AFFF) is a type of foam that fire departments use to fight liquid-based fires (those started by oil, gasoline, or other flammable liquids)
  - AFFF use among Arizona firefighters associated with 15% to 29% higher levels of forever chemicals



Photo: On-scene decontamination

Reducing PFAS exposure: what departments can do

- **Remove carpet in living quarters**
  - Stations with carpet flooring in living quarters have an estimated 26% higher forever chemical concentration compared to those with no carpet
- **Wash turnout gear before storing**
  - Department policy requiring gear to be washed prior to storing is associated with a 17% lower forever chemical concentration
- **Department issued gear bags**
  - Supplying all employees with a gear bag associated with a 26% lower forever chemical concentration
- **Reverse osmosis water filtration**
  - Stations that use a reverse osmosis water filtration system associated with 11% lower forever chemical concentrations



What we've achieved and what's next

Achieved

- ✓ Completed zone 2 exercise and intermittent fasting study interventions
- ✓ Published the study protocol in April 2025
- ✓ Preparing "Predictors of PFAS" manuscript for submission

What's next

- Analyze & publish zone 2 exercise and intermittent fasting intervention studies
- Conclude blood/plasma interventions including follow-up PFAS and epigenetic age measurements by December 2025
- Analyze & publish the effectiveness of blood/plasma donation in reducing serum PFAS levels
- Analyze & publish epigenetic age results associated with all study interventions (zone 2 exercise, intermittent fasting, and blood/plasma donation)