Advancing the rigor, relevance, and reach of exposure science through community driven research.

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SFFD has one of the largest populations of women among its ranks in the US ($N = \sim 225$)
Mounting concern among SF firefighters about rates of premenopausal breast cancer among the women in their ranks.

Concern grows in firefighters, others after cancer-causing flame retardants found in test subjects
Women Firefighter Biomonitoring Collaborative Team

**Firefighter Organizations:**
- United Fire Service Women
- San Francisco Firefighters Cancer Prevention Foundation

**Science Team:**
- UC Berkeley
- UC San Francisco
- Silent Spring Institute

**Environmental Health Advocates:**
- Commonweal
- Breast Cancer Fund
Previous studies show firefighters have higher exposures to:

- Polycyclic Aromatic Hydrocarbons (PAHs)
  - Products of combustion
- Diesel exhaust – nitro-PAHs
  - Fire equipment
- Flame retardants
  - burning furniture, protective clothing, etc.
- Perfluorinated chemicals
  - Chemical in firefighter turnouts
- Dioxins and Furans
  - Combustion by-products during fire events

Studies almost exclusively on men.
Many of these chemicals have been shown to be mammary carcinogens in animal toxicology studies and warrant further study.

- Characterize exposures in humans.
- Inform regulatory, occupational and individual actions to reduce exposures.
What we want to learn:

- Are chemicals known or suspected to cause mammary tumors more elevated among women firefighters than non-firefighters?
- Are there other unknown or unmeasured chemicals that are higher among women firefighters?
- Is higher chemical exposure or exposure to night shift work associated with early health effect biomarkers of potential relevance for breast cancer?
  - thyroid hormone disruption
  - altered melatonin levels
  - telomere length
Study Aim 1

Measure and compare levels of environmental chemicals between women firefighters (N=80) and non-firefighter female controls (N=80)

**Targeted analysis:**
- Flame retardants
  - Polybrominated Biphenyl Ethers (PBDEs) and their metabolites (OH-PBDEs)
  - Firemaster 550 and other current use flame retardants
- Perfluorinated Compounds (PFCs)
- Polycyclic Aromatic Hydrocarbons (PAHs & nitro-PAHs)

**Non-targeted chemical analysis:**
- Time of Flight (TOF) LC/MS
- Reveals exposures we might not have thought about
Biospecimen Collection

Firefighter Karen Heald bleeding for a cause. WFBC team provided blood and urine samples to help with methods development to measure chemicals.

Chief Joanne Hayes-White and colleague having their blood drawn.
Sample processing at UCSF Lab

(R-L): Jessica Trowbridge, WFBC Study Coordinator (UCB), Emily O’Rourke (UFSW) & Nancy Carmona (UCB), processing blood and urine samples.
Exposure Assessment Interview

- Occupation and work activities
- Shift work and sleep
- Chronic stress
- Diet
- Personal product use
- Consumer and home products, hobbies, etc.
Why Non-Targeted Analysis?

1. Discovery-driven approach to screening biospecimens for novel environmental chemicals
2. Not limited *a priori* selection of chemical targets
3. General suspect screening optimizes selection of chemicals for confirmation and quantification
Study Aim 2

Evaluate the impact of chemical exposures and chronic exposure to night shift work on biomarkers of early effect of potential relevance to breast cancer

- Night shift work and melatonin
- PBDE and OH-PBDE exposures and thyroid hormone disruption (T4 and TSH)
- Chemical exposure and shortened telomere length (Exploratory)
Study Aim3

Report back individual–level and aggregate results to study participants who want them

- Focus groups and usability testing with study participants to develop report-back materials
- Aggregate dissemination to broader firefighter community, decision-makers, policy arena, and broader public
This web site provides your study results from the Women Firefighters Biomonitoring Collaborative Study. It shows:

+ The levels of chemicals found in your samples.
+ How your levels compare with other people.
+ Where these chemicals come from.
+ How they can affect health.
+ How you can reduce levels of these chemicals in your body, your home, and at work.

Start Here
More PFASs than most others.

Your samples had more PFASs than most others in the study. PFASs can come from non-stick sprays on pots and pans or in stain-resistant clothing.

- Each circle represents another person's level of PFOS in air. The brown ones are firefighters, and the blue office workers.

Click here to see all of your results for PFASs
Each circle represents another person's level of PFDA in air. The brown ones are firefighters, and the blue office workers.

**PFDA**

Your Level: 0.27

**PFOS**

**PFOA**
WFBC Emphasizes Prevention Evidence

Basis for action

- Education
- Policy
- Regulation
- Reformulation

Biological mechanism + Human exposure
Extinguishing Breast Cancer from the Fire Service
Implications for policy

• **LOCAL:** Changes to protective equipment policies, station design for any new stations, purchasing ordinances

• **OCCUPATION-SPECIFIC:** Policy work with state, national, and federal firefighting organizations to develop appropriate worker exposure protections

• **STATE & FEDERAL:** Chemicals Policy Reform. If the products that burn in fires are less toxic, then firefighters will have fewer exposures
Impact – Rigor, Relevance & Reach

Rigor: Advance biomonitoring science in new directions
• First study to examine the range of exposures to potential breast carcinogens and other EDCs among women firefighters compared to female controls
• Measuring biomarkers potentially relevant to breast cancer risk.
• Use of non-targeted biomonitoring techniques in a firefighter population

Relevance: Potential to extend to other female occupational groups
• Future recruitment of women from other occupations, such as nursing, nail salon workers, teachers, etc.

Reach: Disseminate results to diverse audiences
• Leverage research results to inform policy change
• Report-back to study participants
Thank you
Women Firefighters Biomonitoring Collaborative

Collaborative Partners:

- CBCRP: Community Research Collaboration Fund
- San Francisco Firefighters Cancer Prevention Foundation
- International Association of Firefighters (IAFF), Local 798