Chemical Characterization of Airborne Per- and Polyfluoroalkyl Substances (PFAS) in North Carolina Firehouses

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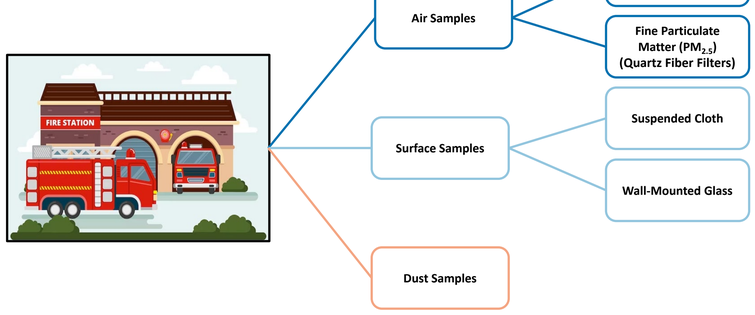
Background

- PFAS comprise a class of >12,000 unique manufactured chemicals[1]
- Water, oil & heat resistant properties of PFAS have led to their use in a multitude of consumer products[2]
- PFAS have been associated with a number of negative health effects, including cancer[3]
- Cancer is the #1 cause of death among firefighters[4]
- Firefighting equipment & aqueous film forming foams (AFFF) may increase firefighters' PFAS exposure[5]
- There are no measurements of airborne PFAS in firehouses, to our knowledge

Open Questions

- What is the molecular composition of airborne PFAS in firehouses?
- What are the partitioning dynamics of PFAS in firehouses?

Study Design

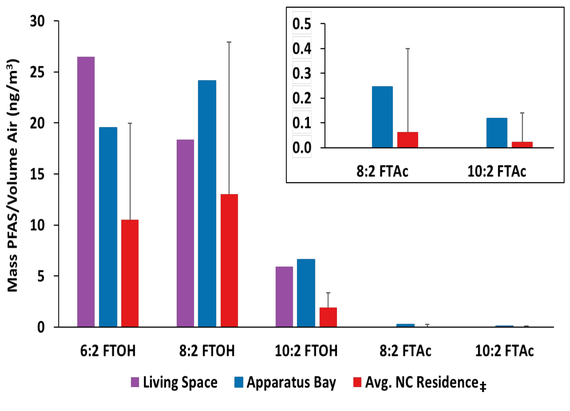


- Pilot study includes three firehouses in the Triangle region of North Carolina
  - Firehouses vary in age, design & type
- Samples collected from both living space & apparatus bay
- Sampling occurs over a 6-month period
  - Air & dust samples: 0 & 6 months
  - Surface samples: 0, 1, 3 & 6 months
- We anticipate insights into air concentrations & partitioning behavior of PFAS

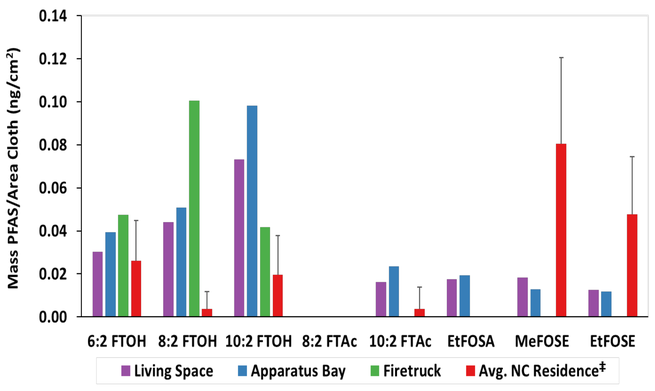
Preliminary Findings

- To date, one set of air samples (gas phase & $PM_{2.5}$), one dust sample, and duplicate 0- & 1-month cloth & glass samples have been collected from one firehouse
- Gas phase, suspended cloth & dust samples are analyzed for 8 neutral PFAS via gas chromatography-mass spectrometry (GC/MS)
- $PM_{2.5}$, wall-mounted glass & dust samples are analyzed for 26 ionic PFAS via ultra high-performance liquid chromatography coupled to negative mode electrospray ionization triple quadrupole mass spectrometry (UHPLC/(-)ESI-QQQ)

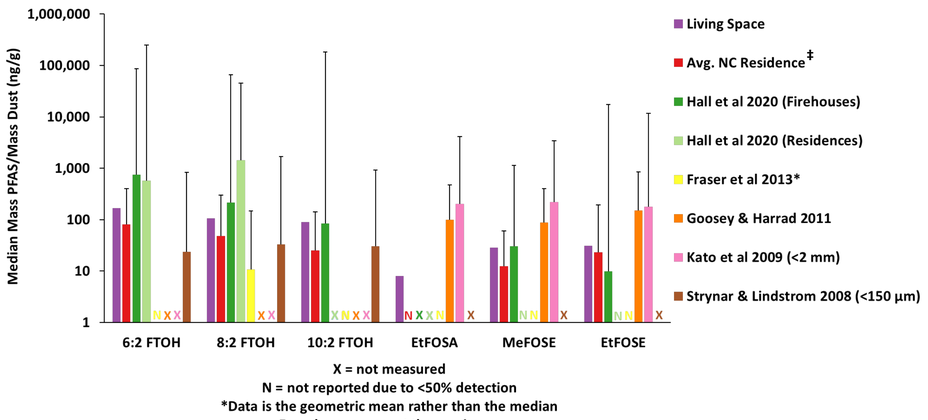
Neutral PFAS in the Gas Phase



Neutral PFAS Partitioned to Suspended Cloth

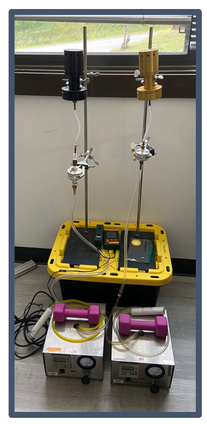


Neutral PFAS in Dust <500 µm Compared to Literature Values from U.S. Firehouses & Private Residences



X = not measured
N = not reported due to <50% detection
*Data is the geometric mean rather than the median
Error bars represent the maximum

$PM_{2.5}$ & Wall-Mounted Glass Samples



‡Eichler et al. (2023)

Conclusions

- Initial findings from the first firehouse suggest similar levels of airborne PFAS in firehouses compared to private residences in the same region of North Carolina
- Levels of volatile PFAS measured in firehouse dust compare well to literature values
- Repeat measurements at the first firehouse & measurements from the remaining two firehouses will provide additional insights into airborne PFAS concentrations & partitioning in firehouses

Acknowledgements

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