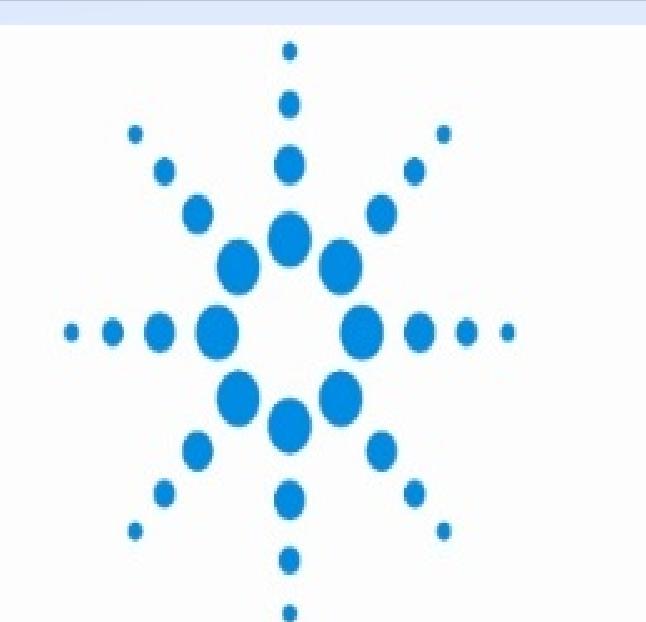




# Evaluation of firefighter breastmilk toxicity and flame retardant contaminants

Shawn Beitel<sup>1</sup>, Leanne Flahr<sup>1</sup>, Christiane Hoppe-Jones<sup>1</sup>, Fernanda Garavito<sup>2</sup>, Sally Littau<sup>2</sup>, Jefferey Burgess<sup>2</sup>, Sara Jahnke<sup>3</sup>, Shane Snyder<sup>1</sup>



Agilent Technologies

<sup>1</sup>Department of Chemical and Environmental Engineering, University of Arizona, Tucson, AZ.

<sup>2</sup>Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ

<sup>3</sup>Center for Fire, Rescue, and EMS Health Research, National Development & Research Institutes, Leawood, KS

## Background

- Lactating firefighters are exposed to a variety of chemicals at a fire scene which could impact their breastfeeding children.
- One class of chemicals of concern include flame retardants such as polybrominated diphenyl ethers (PBDEs), which are found in many household items.
- In addition to PBDEs, dioxin-like compounds are also of concern as they are known to be present during fire suppression.
- It is known that environmental exposures can result in chemicals being deposited into breastmilk as a form of excretion from the body.
- There is little known about the safety of breastmilk after fire-ground exposures, which has resulted in concern from mothers about using the breastmilk produced after responding to a fire.
- Analytical quantification of PBDEs are underway (no data shown).

## Objective

- Investigate the concentration of PBDEs along with the mixture of dioxin-like compounds by assessing the aryl hydrocarbon receptor (AhR) mediated response in breastmilk before and after responding to structural fires.

## Methods

- Breastmilk was collected from female firefighters before and at several time points after responding to structural fires.
- Extraction of the breastmilk began with the use of QuEChERS (Quick Easy Cheap Effective Rugged Safe) (Agilent Technologies) (Fig 1).
- The supernatant was concentrated and then passed through a clean-up column to remove additional lipids (Fig 2).
- The eluent collected was concentrated and either brought into DMSO for bioassay analysis or underwent gel permeation chromatography (GPC) to further clean-up the sample prior to being analyzed by Gas chromatography-tandem mass spectroscopy (Fig 3).
- In vitro* bioassay analysis used an aryl hydrocarbon receptor (AhR) bioassay to determine the AhR mediated response from the mixture of dioxin-like compounds (Fig 4).

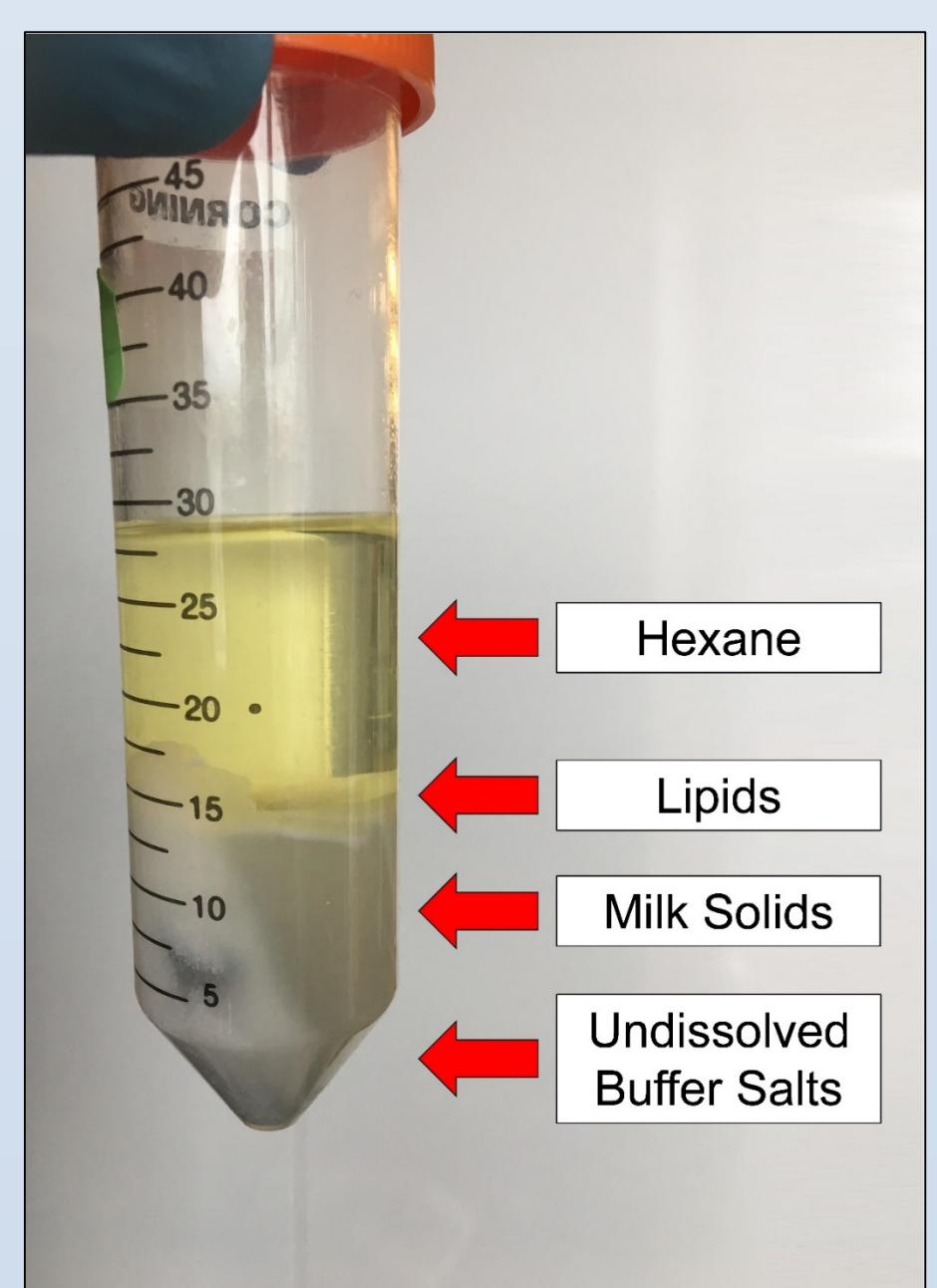


Fig 1: Picture of the layers separated through the use of QuEChERS.

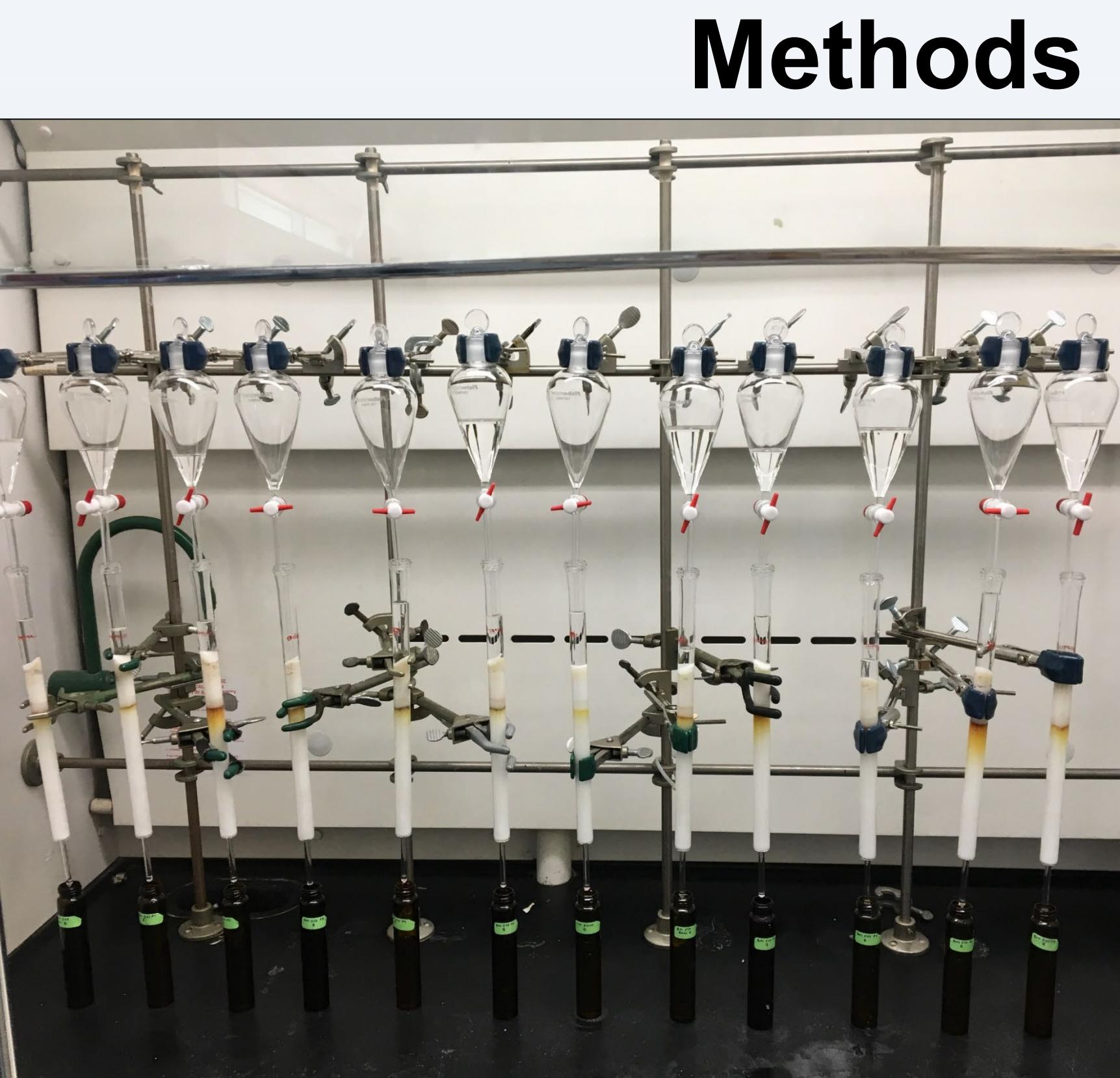


Fig 2: Picture of the acidified silica clean-up columns used to remove additional lipids.

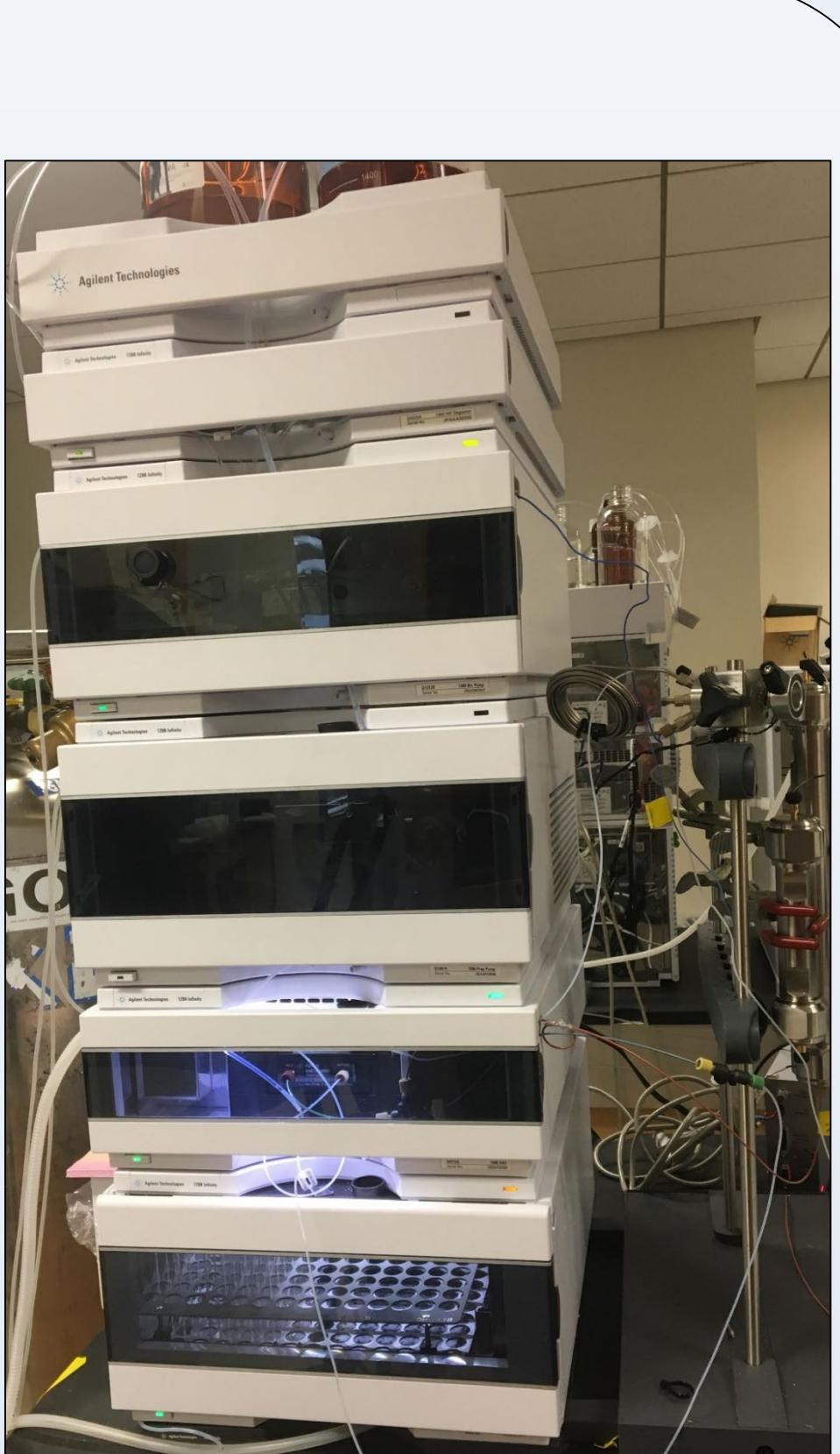


Fig 3: Picture of the GPC set-up.

## Methods

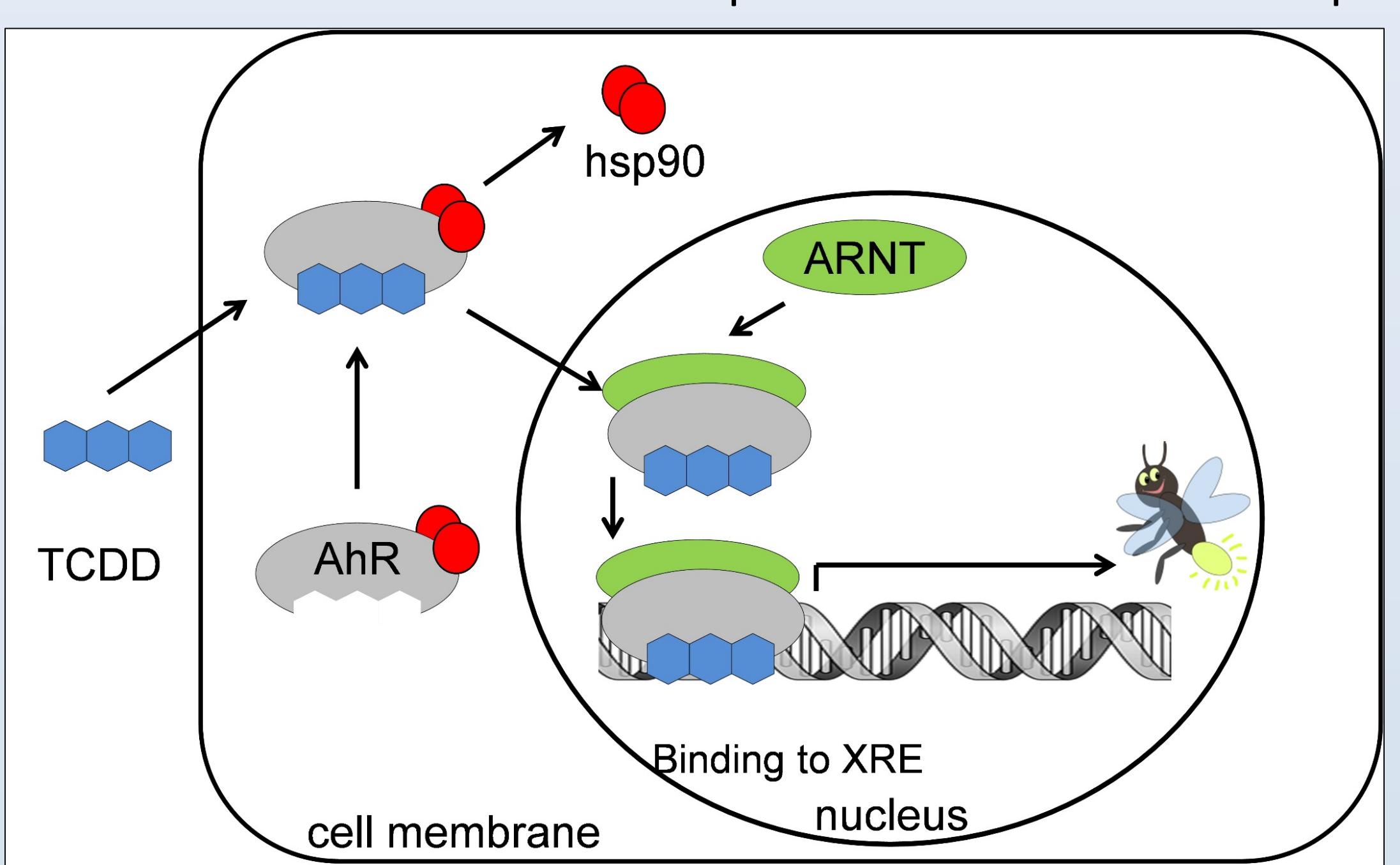


Fig 4: Mechanism of action for the AhR *in vitro* bioassay using a luciferase reporter gene.

## Results

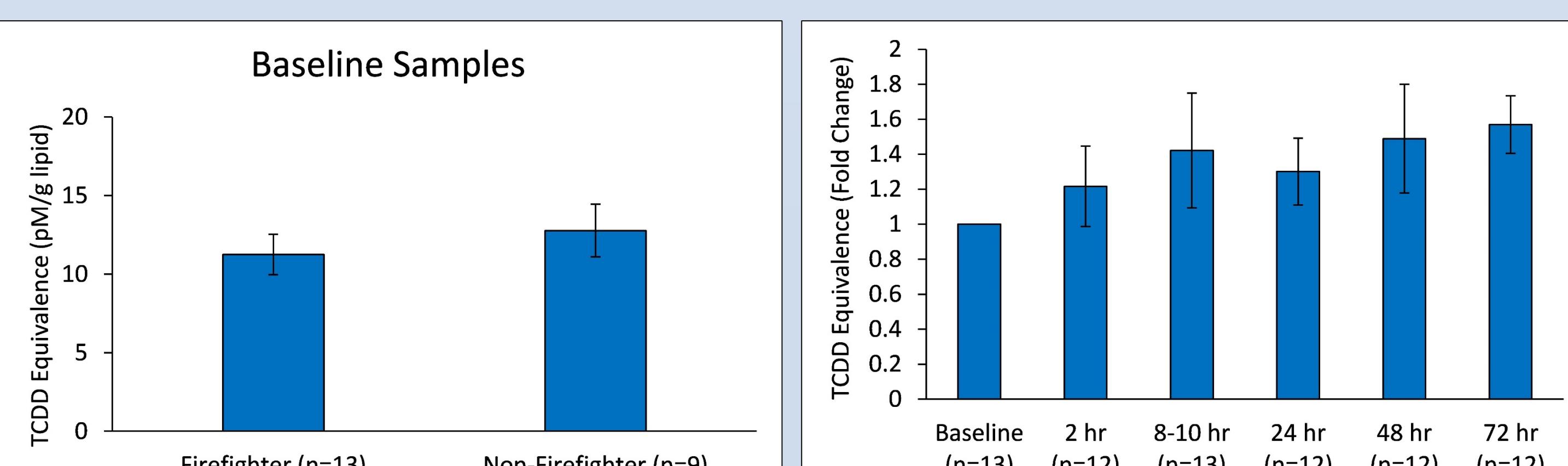


Fig 5: TCDD equivalence of baseline breastmilk samples from firefighter and non-firefighters. Data are represented as mean  $\pm$  SEM.

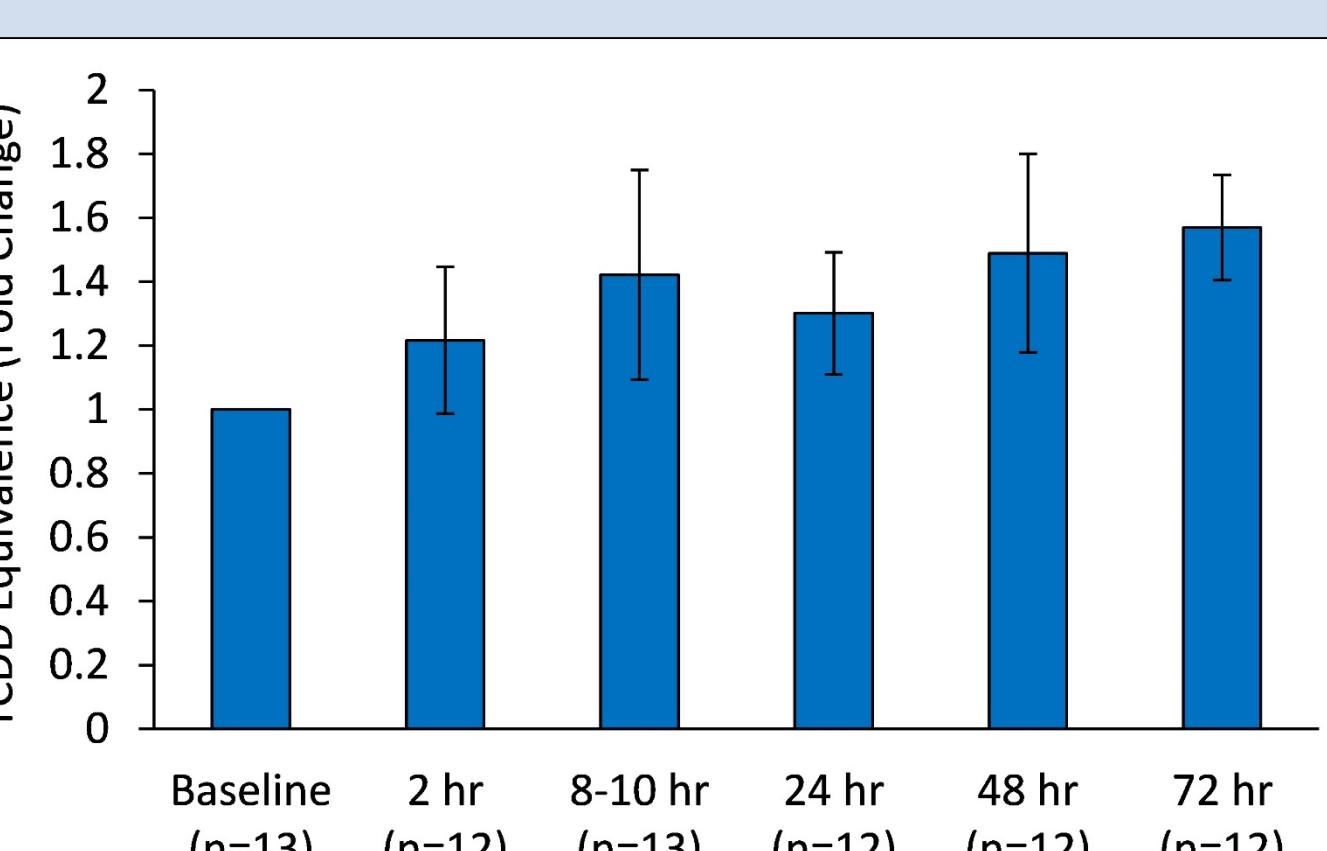


Fig 6: TCDD equivalence of breastmilk samples collected before and at post-fire time points. Data are represented as mean  $\pm$  SEM.

## Acknowledgements

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- There was no statistical difference of bioassay response between firefighter and non-firefighter baseline samples (Fig 5).
- There was an observed increase (not significant) in bioactivity from breastmilk collected after responding to a fire up to 72hr post-fire (Fig 6), indicating there are greater concentrations of TCDD-like compounds present in the breastmilk post-fire.

## Results

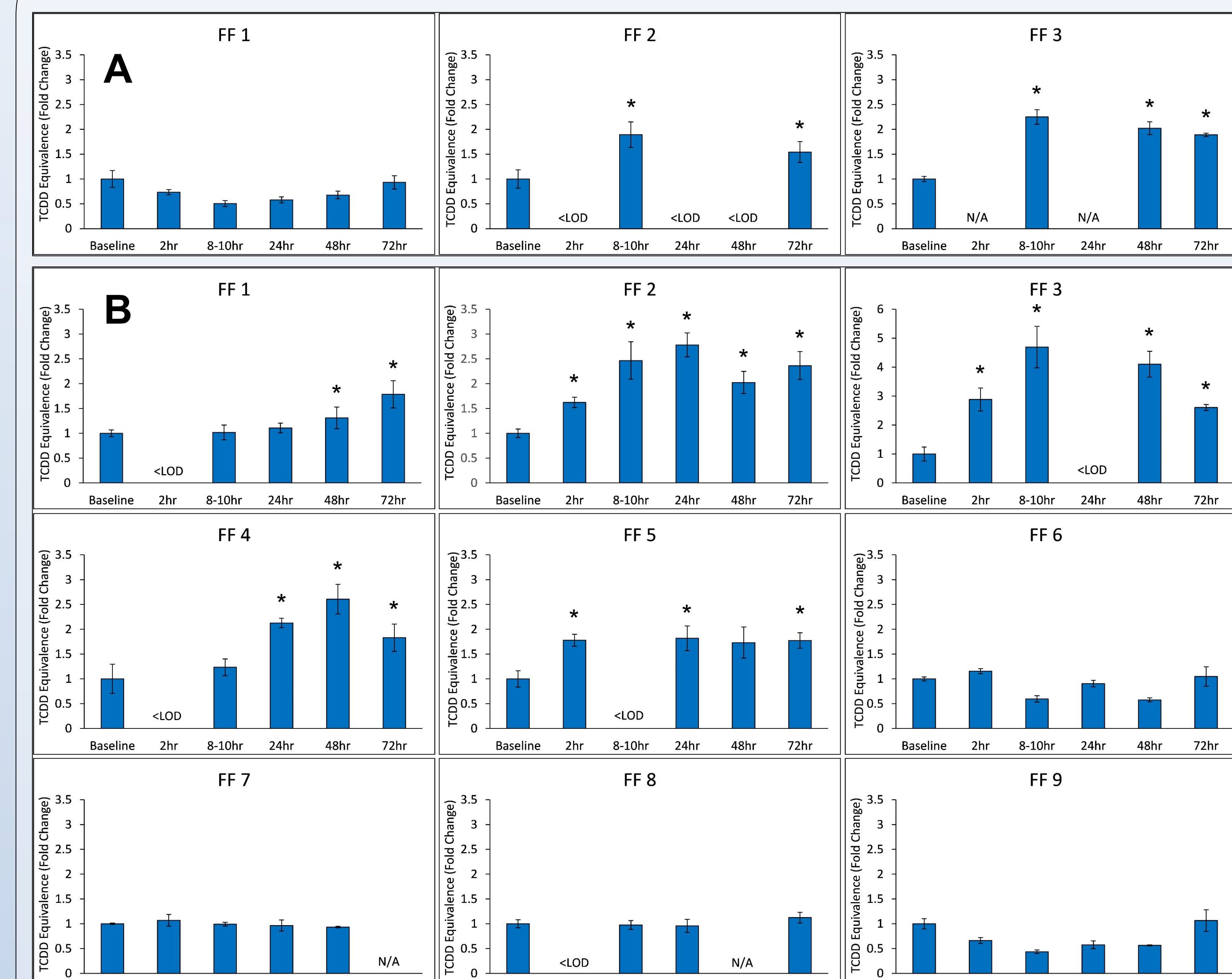


Fig 7: TCDD equivalence as fold-change compared to baseline of breastmilk collected before and at several time points post-fire from firefighters participating in an (A) exterior or (B) interior response. Data are represented as mean  $\pm$  SD. '\*' represents a post-fire sample being statistically greater than baseline (ANOVA  $p \leq 0.05$ )

- There was variability in the observed bioassay response among individuals responding to structural fires, with 3 different types of patterns of response (Fig 7):
  - The maximum concentration of dioxin-like compounds compared to baseline was at 72 hr post-fire.
  - The increase in concentration of dioxin-like compounds post-fire was decreasing by 72hr post-fire.
  - There was no increase in dioxin-like compounds post-fire.
- There was an observed increase in dioxin-like compounds in post-fire samples even when the firefighter was not part of the interior response.

## Conclusions

- There was an increase in dioxin-like compounds in breastmilk of female firefighters after responding to a structural fire.
- The increase was still observed in some individuals after 72hr post-fire.

## Ongoing Research

- Additional individuals (20 total) are being analyzed for bioassay activity to provide greater statistical power.
- PBDE quantification is underway and will provide data to identify if concentrations of these compounds increase in breastmilk post-fire.
- Additional analyses will be conducted to take into account the duration of response and the role of the firefighter during the response.