



#### Update from ECL:

#### **New and Ongoing Work on PFASs**

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Biomonitoring California Scientific Guidance Panel August 22, 2018, Oakland, CA

# Outline

- Overview of current PFASs methods
- Limited biomonitoring study of three firefighters accidentally exposed to firefighting foam
- Current/upcoming work in ECL



#### **Targeted PFASs Methods**





#### **Classic and Expanded PFASs List**

Classic		Additional Classic	Replacement/Precursors	
	-		FPePA/5:3 FTCA	
РЕНрА		PFBA	FHpPA/7:3 FTCA	
PFOA		PFPeA	FHEA/6:2 FTCA	
PFNA		PFHxA	FOEA/8:2 FTCA	
PFDA		PFDS	FHUEA/6:2 FTUCA	
PFUdA	-	FOUEA/8:2 FTUCA		
PFDoA			4:2 FTS	
PFBS	-		6:2 FTS	
PFHxS		8:2 FTS		
PFOS		8:2 PAP		
PFOSA			6:2 diPAP	
MeFOSAA	-		8:2 diPAP	
FtFOSAA	-		6:6 PFPi	
			6:8 PFPi	
			PFHxPA	
			PFOPA	

#### Semi-Targeted Method



# Limited Study - Background

- What we know:
  - Physician requested analysis of PFASs in serum samples from three male firefighters
  - Individuals were accidentally exposed to firefighting foam



# Limited Study - Background

#### • What we know:

- Physician requested PFASs analysis on serum samples from three male firefighters
- Individuals were accidentally exposed to firefighting foam
- What we don't know:
  - Specifics of accidental exposure
    - Type of foam to which they were exposed
    - Time between exposure and collection
  - Information on other possible
    PFASs exposure



# **Results from Classic Method**

	MDL	Firefighter A	Firefighter B	Firefighter C
PFOSA	0.05	0.08	<mdl< td=""><td><mdl< td=""></mdl<></td></mdl<>	<mdl< td=""></mdl<>
MeFOSAA	0.01	0.13	0.07	0.13
PFHxS	0.02	7.5	4.6	10.1
PFOS	0.20	26.2	5.7	30.8
PFHpA	0.05	<mdl< td=""><td>0.09</td><td><mdl< td=""></mdl<></td></mdl<>	0.09	<mdl< td=""></mdl<>
PFOA	0.06	2.5	3.1	1.8
PFNA	0.05	1.1	0.78	0.23
PFDA	0.08	0.13	<mdl< td=""><td><mdl< td=""></mdl<></td></mdl<>	<mdl< td=""></mdl<>
PFUdA	0.02	0.15	0.05	0.02

Units: µg/L

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# Firefighting Foam Exposures

- AFFF (aqueous film-forming foam)
  - Proprietary mixtures that are used to extinguish fuel-based fires
  - Contain fluorinated surfactants to aid in fire suppression
- Manufacturing process leads to different degradation products
  - Could be used to "fingerprint" the type of AFFF exposure

# **Firefighter PFAS Levels**

- Factors affecting PFASs:
  - Male or female
  - Years on the job
  - Type of AFFF exposure
  - # of Blood donations

# **Results from Expanded Method**

	MDL	Firefighter A	Firefighter B	Firefighter C
PFDS	0.01	0.01	<mdl< td=""><td>MDL</td></mdl<>	MDL
6:2 FtS	0.02	0.05	0.13	0.03
8:2 FtS	0.01	0.08	<mdl< td=""><td>0.03</td></mdl<>	0.03
6:2 diPAP	0.05	0.08	0.07	0.09

Units: µg/L

### **Results from Expanded Method**

	MDL	Firefighter A	Firefighter B	Firefighter C
PFDS	0.01	0.01	<mdl< td=""><td>MDL</td></mdl<>	MDL
6:2 FtS	0.02	0.05	0.13	0.03
8:2 FtS	0.01	0.08	<mdl< td=""><td>0.03</td></mdl<>	0.03
6:2 diPAP	0.05	0.08	0.07	0.09

Units: µg/L

# Levels were similar to those found in ACE I and ACE 2

### Initial Results from Semi-Targeted Analysis

- In initial analysis over 3369 features (potential chemicals) were extracted
  - ~ 15% were F-containing features (506)



### Screening/Library Search Results

- PFASs in the targeted analysis list found
- No additional firefighting foam compounds or environmental breakdown products found in the serum samples via the library search

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Were the compounds the firefighters were exposed to non-persistent in humans or metabolized into different compounds?

# Possible proposed structure determined from:

- Accurate mass
- Isotope patterns
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Possible precursor:

- Perfluoroalkyl sulfonamide amino carboxylate (n = 3-8)
- Product of electrochemical fluorination process



References: Place and Fields (2012); D'Agostino and Mabury (2014)

### **Biomonitoring Research at ECL**

- Non-targeted and semi-targeted methods give the opportunity to determine exposures not currently measured in targeted methods
- Non-targeted studies:
  - Investigating mother-infant transfer of chemicals of health concern using non-targeted methods (UCB, UCSF, DTSC)
  - Applying novel exposomic approaches for characterizing chemical exposure among women firefighters and nurses (UCB, Silent Spring, DTSC)
- New instrumentation

### **Biomonitoring Research at ECL**

- Method development for targeted analysis
  - Online SPE automation of Expanded PFAS method
  - Addition of new PFAS compounds
    - Expanding current list of compounds
      - PFPeS, PFHpS, PFNS, 10:2 FTS, br-NMeFOSAA, br-NEtFOSAA
    - New replacement PFAS compounds
      - ADONA and F-53B
      - PFCHS

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- DTSC Biomonitoring Staff
- Biomonitoring California Staff

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