

# Screening Stormwater for Contaminants of Emerging Concern

Rebecca Sutton, PhD  
San Francisco Estuary Institute

RMP Annual Meeting, October 2023



# Contaminants of emerging concern (CECs)



Martin Pot

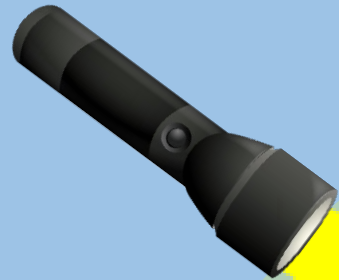
NOT well-regulated  
pollutants



Un- or under-regulated  
contaminants



# Casting a broad net



Known toxic  
contaminants

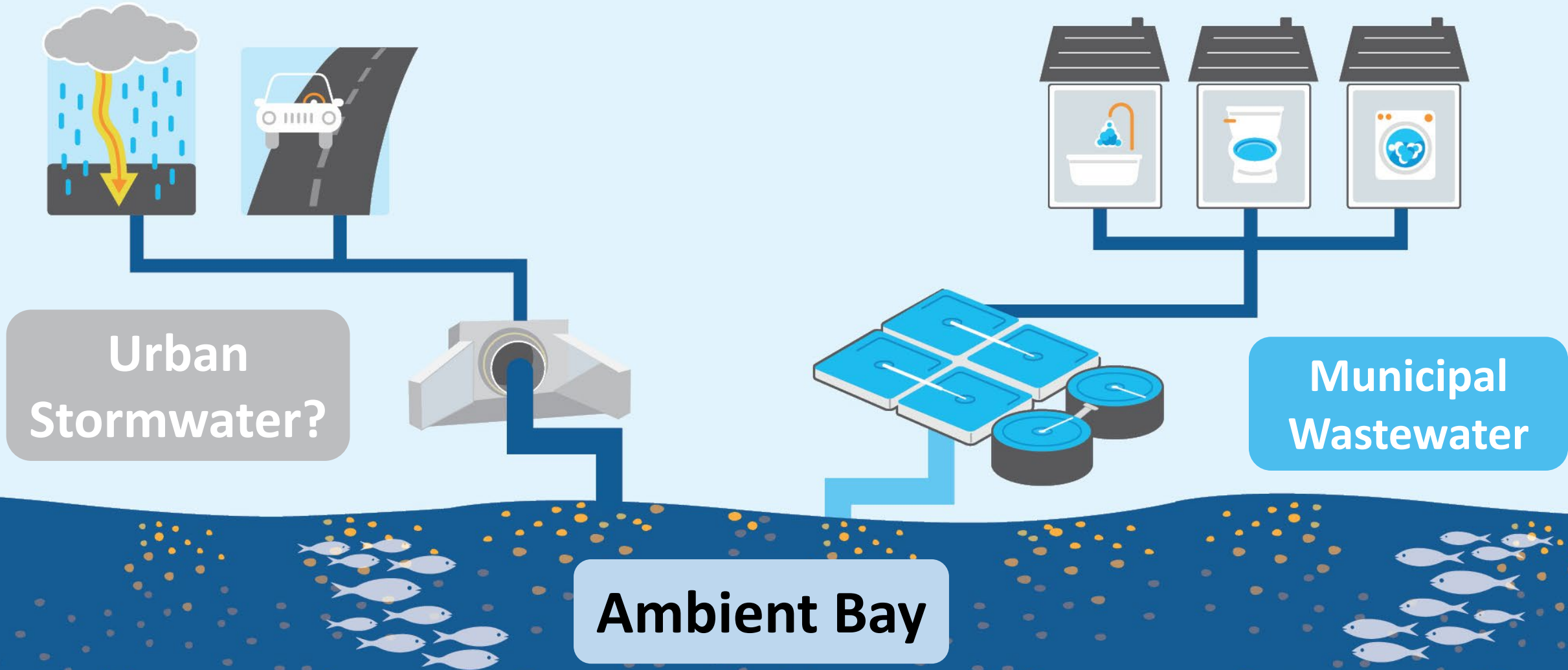
Related  
chemicals

Related  
chemicals

Regrettable  
substitutes



# CECs monitoring in the Bay



# Stormwater transports CECs to the Bay



Motivation: Fill stormwater CECs data gap

Evaluate occurrence, concentration ranges over 4 wet seasons



# Sites

## Urban stormwater

- 21 sites
- mean 65% impervious area

## Reference sites

- 4 sites
- mean 4% impervious area

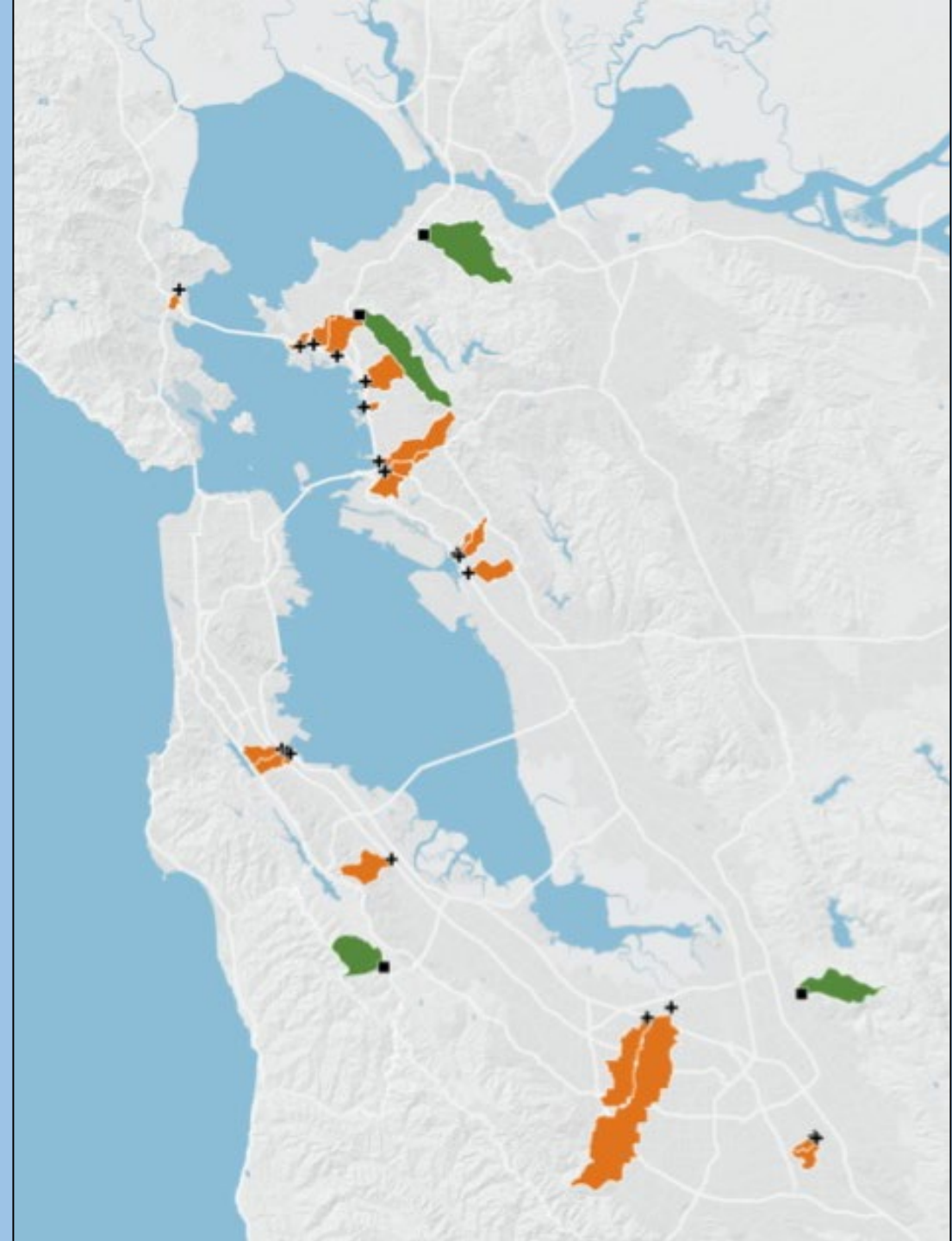
## Drainage area

- 0.7 to 50 km<sup>2</sup>

# Storms

## Storm forecast ≥ 1.3 cm in 6 hours

- 12 storms
- mean 2.6 cm rainfall



# Five contaminant classes

## **PFAS**

- Chris Higgins, Colorado School of Mines
- Andrew Patterson, Eurofins Environment

## **Organophosphate esters & Bisphenols**

- Da Chen, Jinan University
- Jia Liu, Southern Illinois University

## **Ethoxylated surfactants**

- Lee Ferguson, Duke University

## **Tire and roadway contaminants**

- Ed Kolodziej, University of Washington





240+ CECs



REGIONAL MONITORING PROGRAM • UPDATE 2023





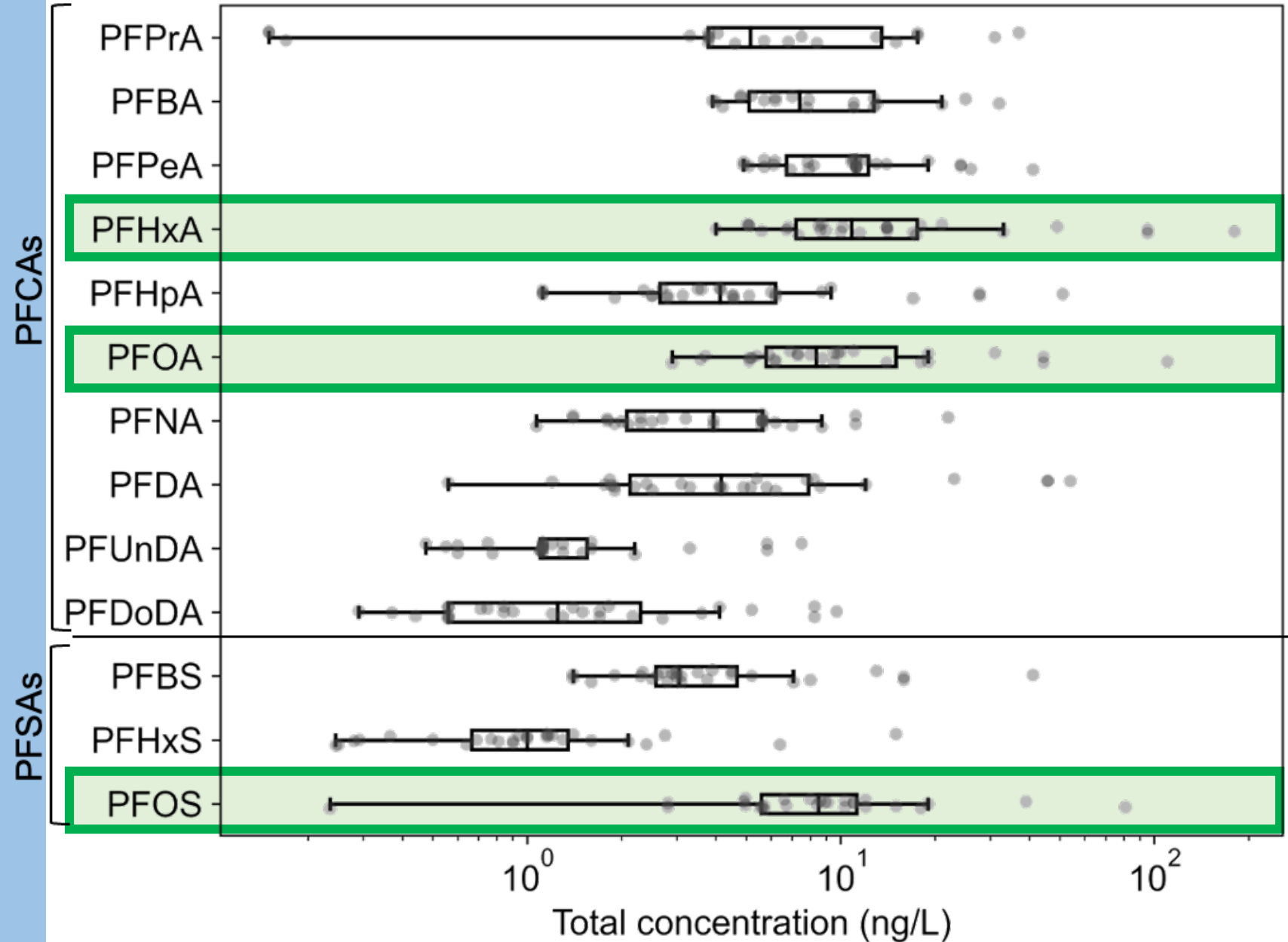
Image: Brocken Inaglory

# PFAS

- High priority at state and federal levels
- Persistent, bioaccumulative, highly toxic



# Many PFAS present in stormwater



# Urban stormwater vs. Municipal wastewater effluent

PFAS	Stormwater Median (Range) ng/L	Wastewater Median (Range) ng/L
PFHxA Perfluorohexanoic acid	<b>10</b> (4 – 180)	<b>13</b> (<MDL – 30)
PFOA Perfluorooctanoic acid	<b>7.7</b> (3 – 110)	<b>5</b> (3 – 12)
PFOS Perfluorooctanesulfonate	<b>8.5</b> (<MDL – 81)	<b>5</b> (<MDL – 13)





# Flame retardants & plastic additives

- **Organophosphate esters (OPEs) and bisphenols**
- **Mobile and toxic, widely observed in the environment**

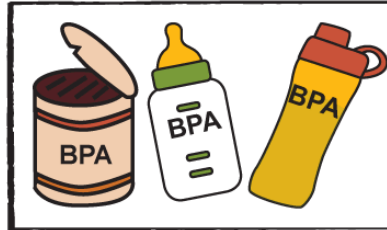


# Bisphenols and regrettable substitution

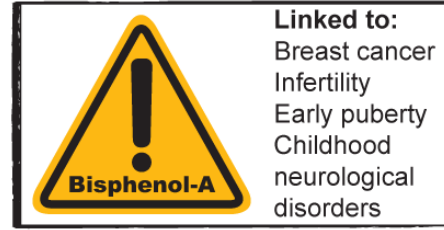


## THE STORY BEHIND BISPHENOLS

Once upon a time...



Then it was discovered...



People started to...



So...



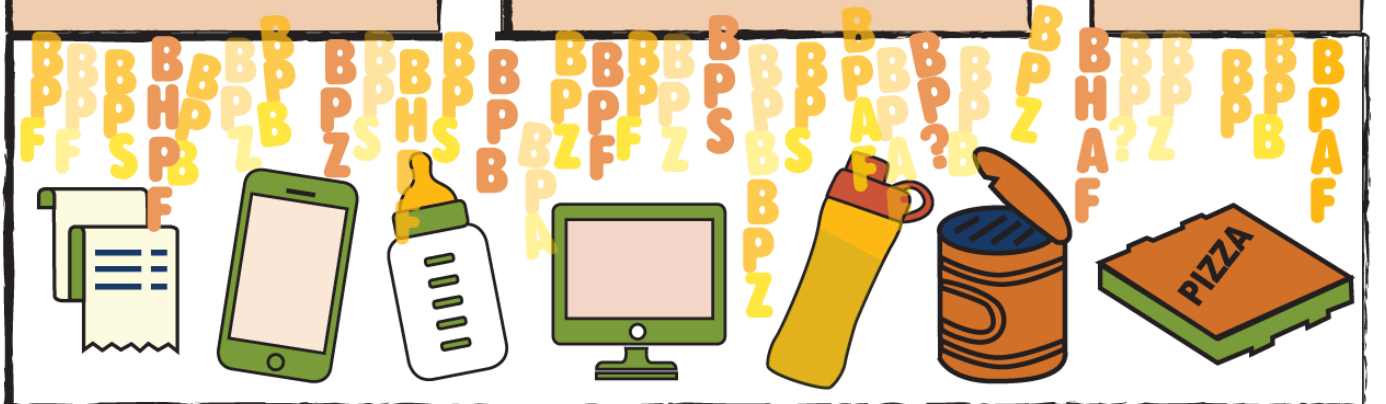
BPS, BPZ, BPF,

AND

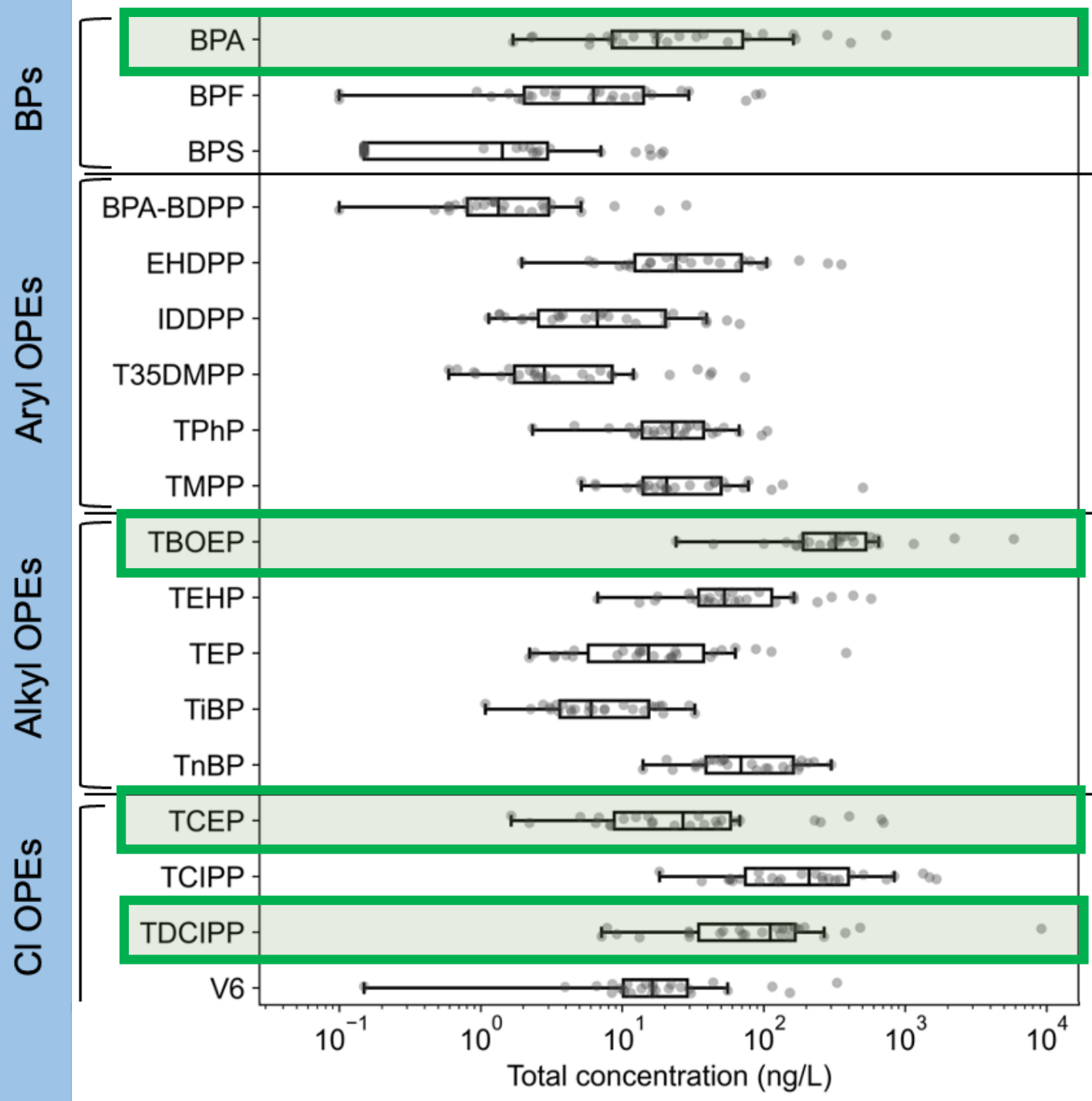
BPB, BPAF, BHPF,

AND EVEN

BP?



# Bisphenols and OPEs present in stormwater





# Takehome messages

**Many CECs are present in urban stormwater**

- Concentrations similar to wastewater effluent

**Presence of CECs is variable**

- Wide concentration ranges
- Variation within and between contaminant classes



# Future focus on stormwater CECs

## Remote sampler development

- Increase capacity and reduce cost of monitoring

## Monitoring & modeling approach

- Integrated approach to estimate loads and identify sources



# Thank you

- **Alicia Gilbreath, Diana Lin, Adam Wong, Don Yee, Pedro Avellaneda** - SFEI
- **Kathy Peter, Ed Kolodziej** - University of Washington, Center for Urban Waters
- **Da Chen** - Jinan University
- **Jia Liu** - Southern Illinois University
- **Chris Higgins** - Colorado School of Mines
- **Andrew Patterson** - Eurofins Environment

