



PFAS in Wastewater: Regional PFAS Studies Supporting Source Control

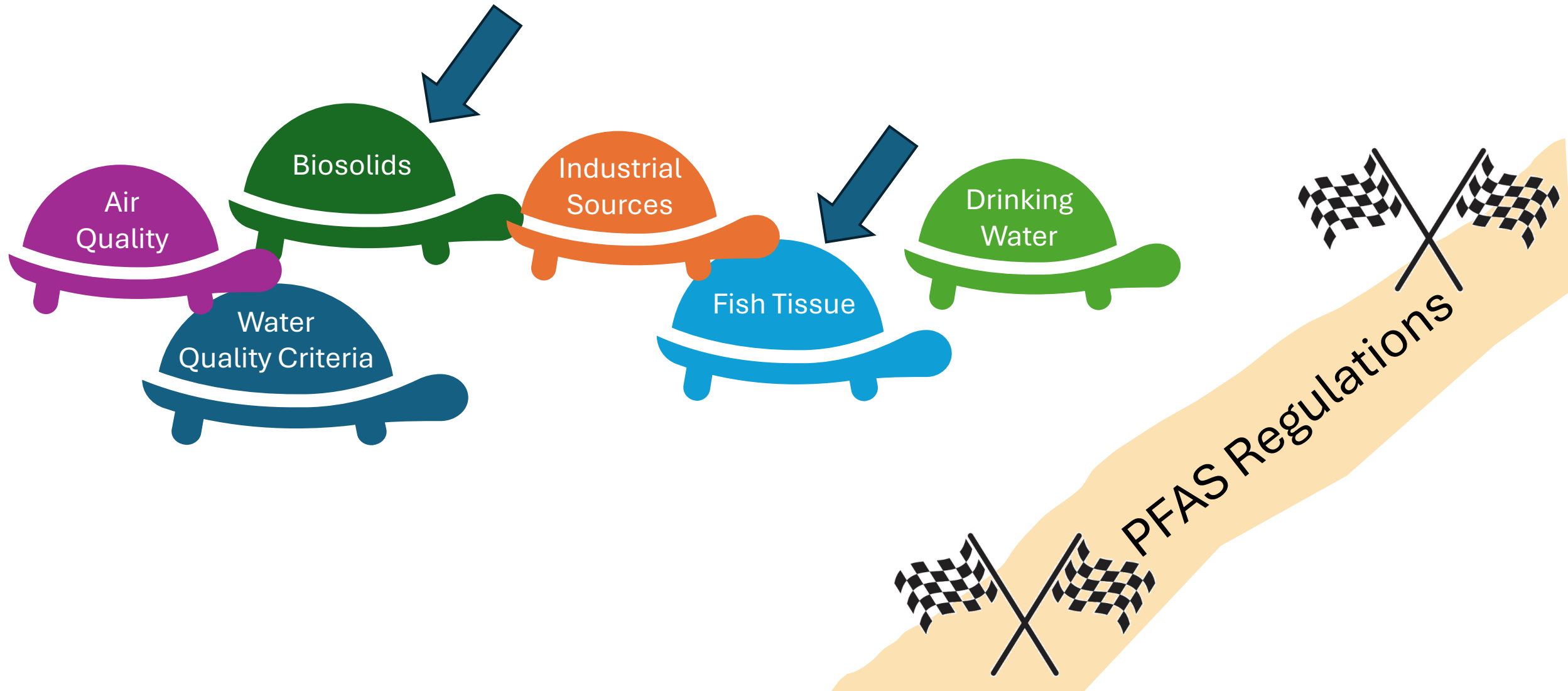
Lorien Fono

BACWA Executive Director

WateReuse NorCal, Oct 16 2026

PFAS Regulations for the Wastewater Sector:

A Slow Race to Limit “Forever” Chemicals



Fish Tissue



Women
(18 – 49 Years)

Children
(1 – 17 Years)

2 TOTAL
SERVINGS
A WEEK

OR

1 TOTAL
SERVING
A WEEK

0 DO NOT
EAT

California Office of
Environmental Health
Hazard Assessment

web: www.oehha.ca.gov/fish
email: fish@oehha.ca.gov
phone: (916) 324-7572

A GUIDE TO EATING FISH from SAN FRANCISCO BAY

(ALAMEDA, CONTRA COSTA, MARIN, NAPA, SAN FRANCISCO, SAN
MATEO, SANTA CLARA, SOLANO, SONOMA COUNTIES)

**WOMEN 18 – 49 YEARS AND
CHILDREN 1 – 17 YEARS**

Eat the Good Fish

Eating fish that are
low in chemicals
may provide health
benefits to children
and adults.



Avoid the Bad Fish

Eating fish with higher
levels of chemicals like
mercury or PCBs may
cause health problems
in children and adults.



Choose the Right Fish

Chemicals may
be more harmful
to unborn babies
and children.



American Shad
♥ high in omega-3s



Chinook (King) Salmon
♥ high in omega-3s



California Halibut



Jacksmelt



Barred Surfperch



Black Perch



Walleye Surfperch



Northern Anchovy
♥ high in omega-3s



Rubberlip Surfperch



White Surfperch



White Croaker

**Do Not Eat Any
Fish from
Lauritzen Channel**



Shark species



Striped Bass



Topsmelt



Mississippi Silverside



Pacific Sardine



Shiner Perch



White Sturgeon

Serving Size

A serving of fish is
about the size and
thickness of your
hand. Give children
smaller servings.

For Adults



For Children



Eat only the skinless fillet



Eat only the meat



Some chemicals are higher in the skin, fat, and guts.

Updated 04/2023

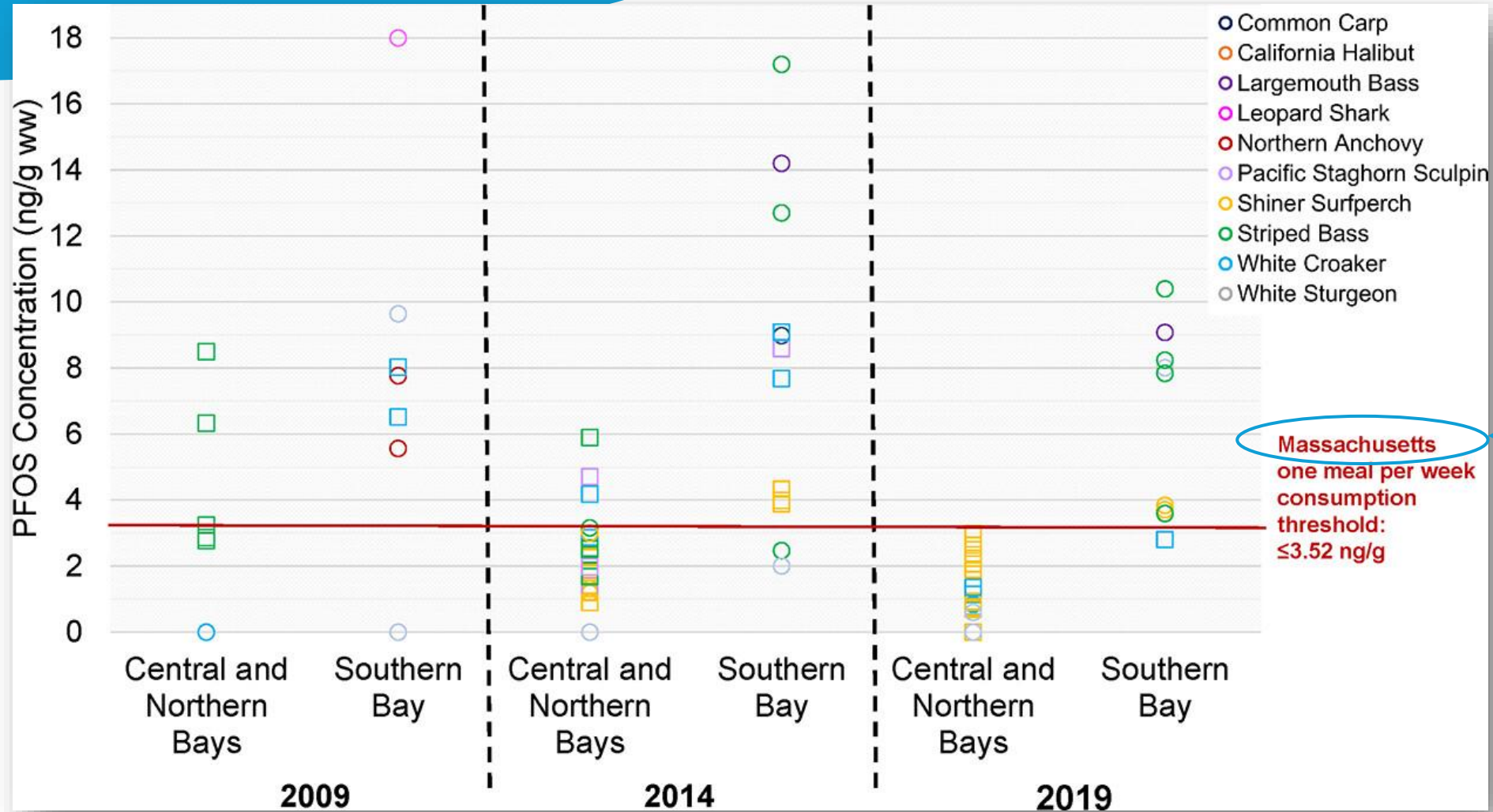
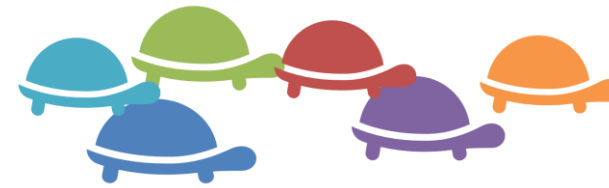
Fish Tissue



**PFOS
Only**

- OEHHHA is actively working on recommended thresholds for fish consumption at various concentrations
 - Advisory Tissue Levels (ATLs): Consider **health benefits** of eating fish and correspond to a 10^{-4} cancer risk for various consumption rates.
 - Fish Contaminant Goals (FCGs): Concentration at which there is lifetime 10^{-6} cancer risk from 1/week serving
 - Thresholds may be developed as soon as ~2026-2027
- 303(d) listings can trigger TMDLs and/or limits in NPDES permits. **Bay Area Example: Dioxin**

Fish Tissue



Source: Méndez et al., ACS ES&T Water, May 20, 2025

Biosolids



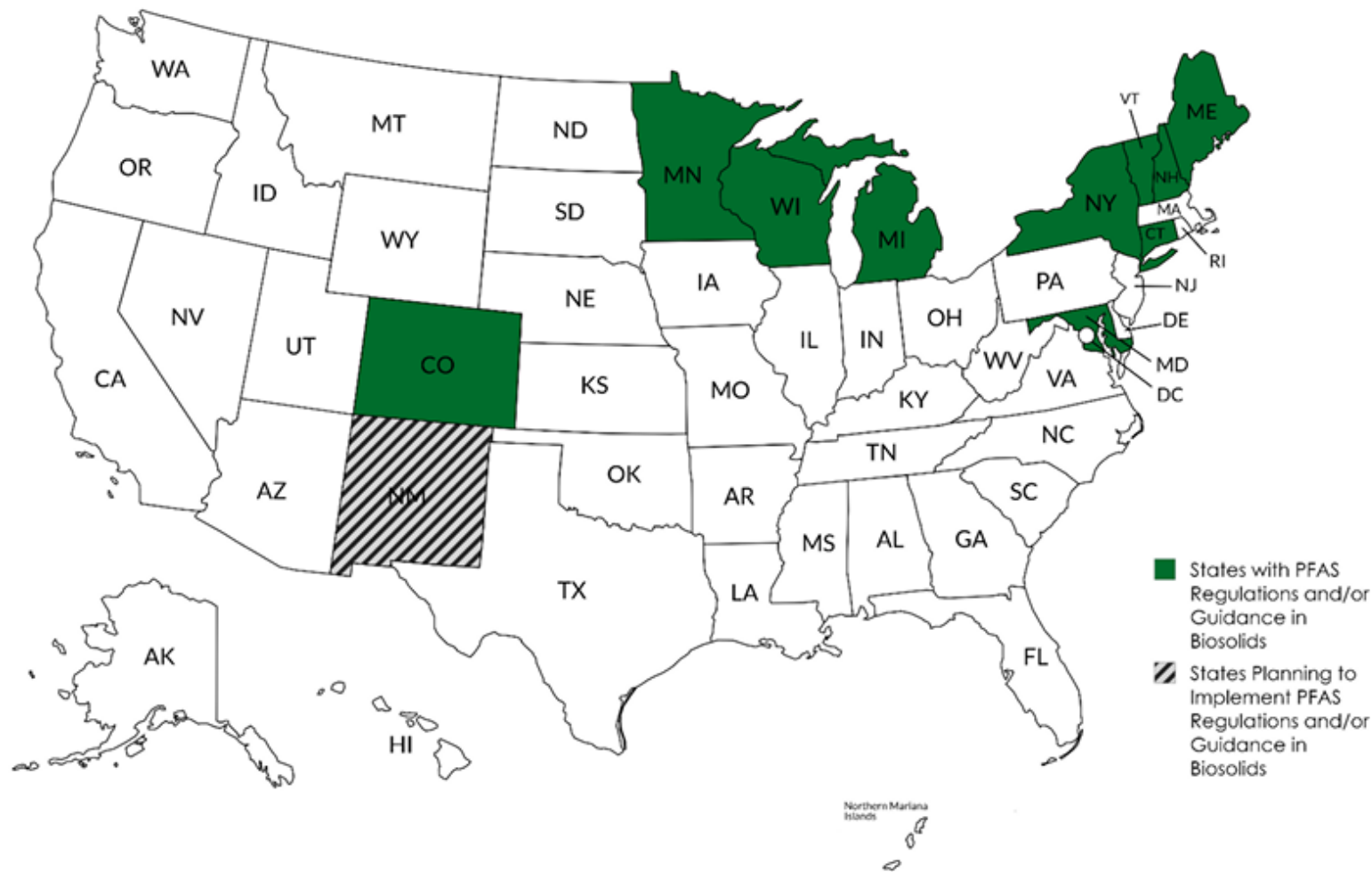
Federal:

- USEPA conducted a **Draft Sewage Sludge Risk Assessment** for PFOA and PFOS, which is being revisited.
 - Risk Assessment ≠ regulation, but **could** be followed by regulations
- PFOS and PFOA are Hazardous Substances under CERCLA (2024)
 - USEPA has heard public utilities' concern about **CERCLA liability**
 - In September 2025, USEPA requested that Congress provide statutory language to exempt “passive receivers” (e.g., biosolids) - HR 1267



States with PFAS Guidelines in Biosolids

Other states
(with industrial
sources) have
enacted rules for
PFAS in biosolids



This map shows the distribution of states with enacted or planned regulations and/or guidance for PFAS in biosolids.

Source: ECOS Compendium of State PFAS Actions, April 2025

SF Bay Regional Study



BACWA
BAY AREA
CLEAN WATER
AGENCIES

SFEI

SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER

**AQUATIC
SCIENCE
CENTER**



CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS



Diana Lin



Miguel
Mendez



Kayli
Paterson



SFEI/BACWA PFAS Special Study

Overview

Phase 1

Consistent approach to Statewide Investigation Order

- Monitor representative subset (n=15) of facilities
- Influent/effluent/biosolids
- **2020**

Phase 2

Investigate PFAS sources in sewershed

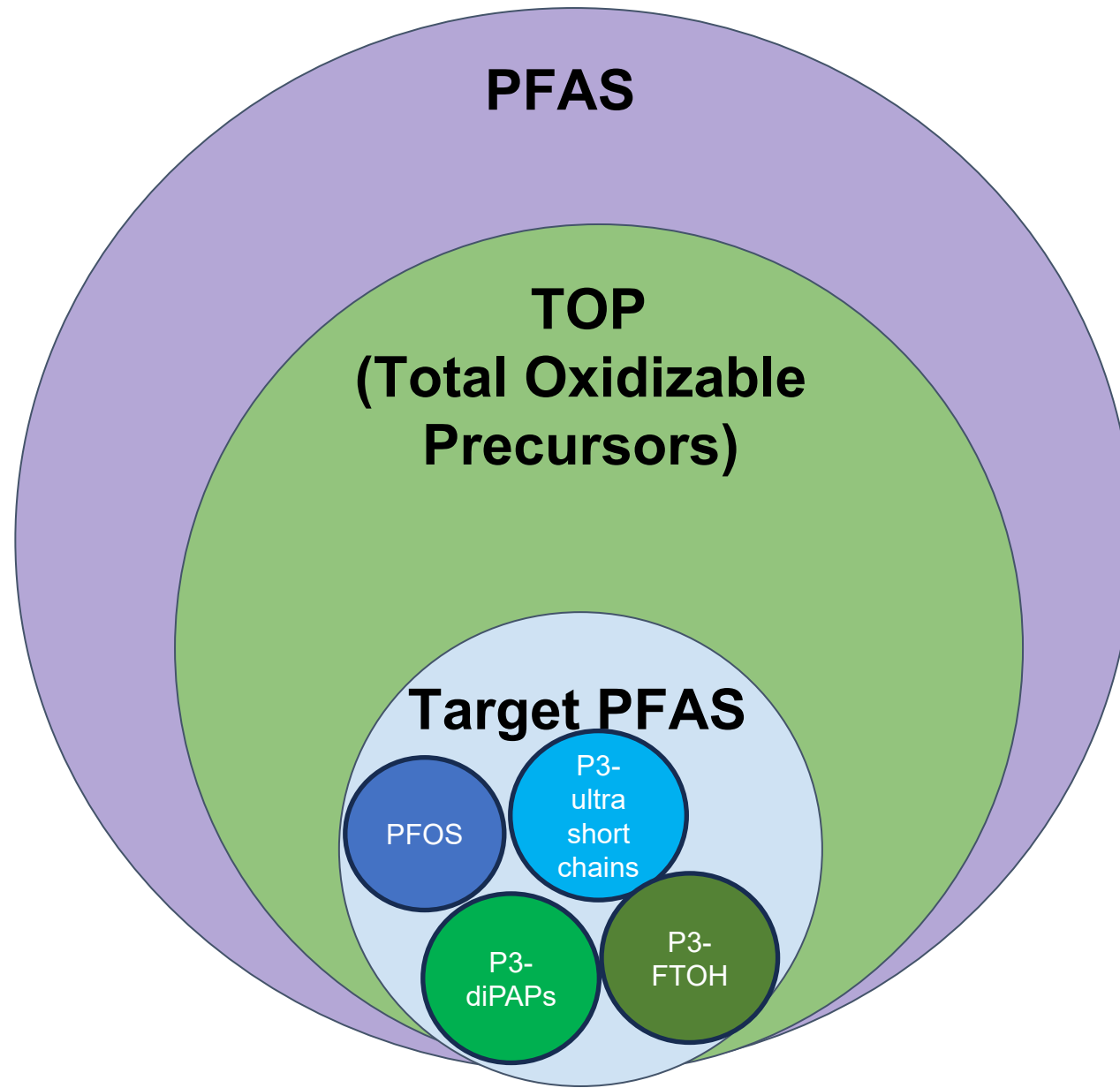
- Investigate upstream sources
- **2022**

Phase 3

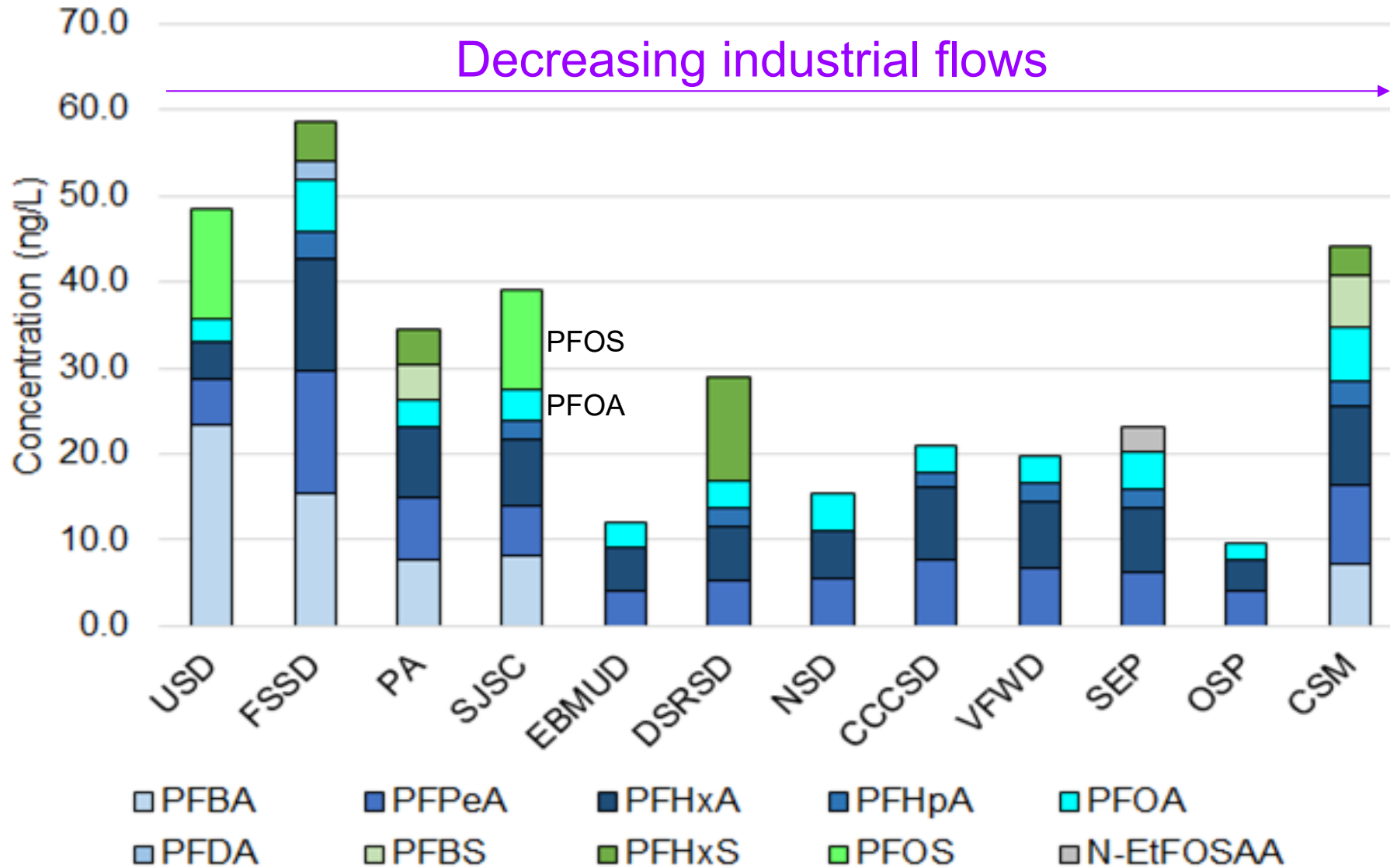
Expand Understanding of sources

- Track long-term trends
- Investigate upstream sources
- Expand analytical methods
- **2026/2027**

PFAS Analytical Methods

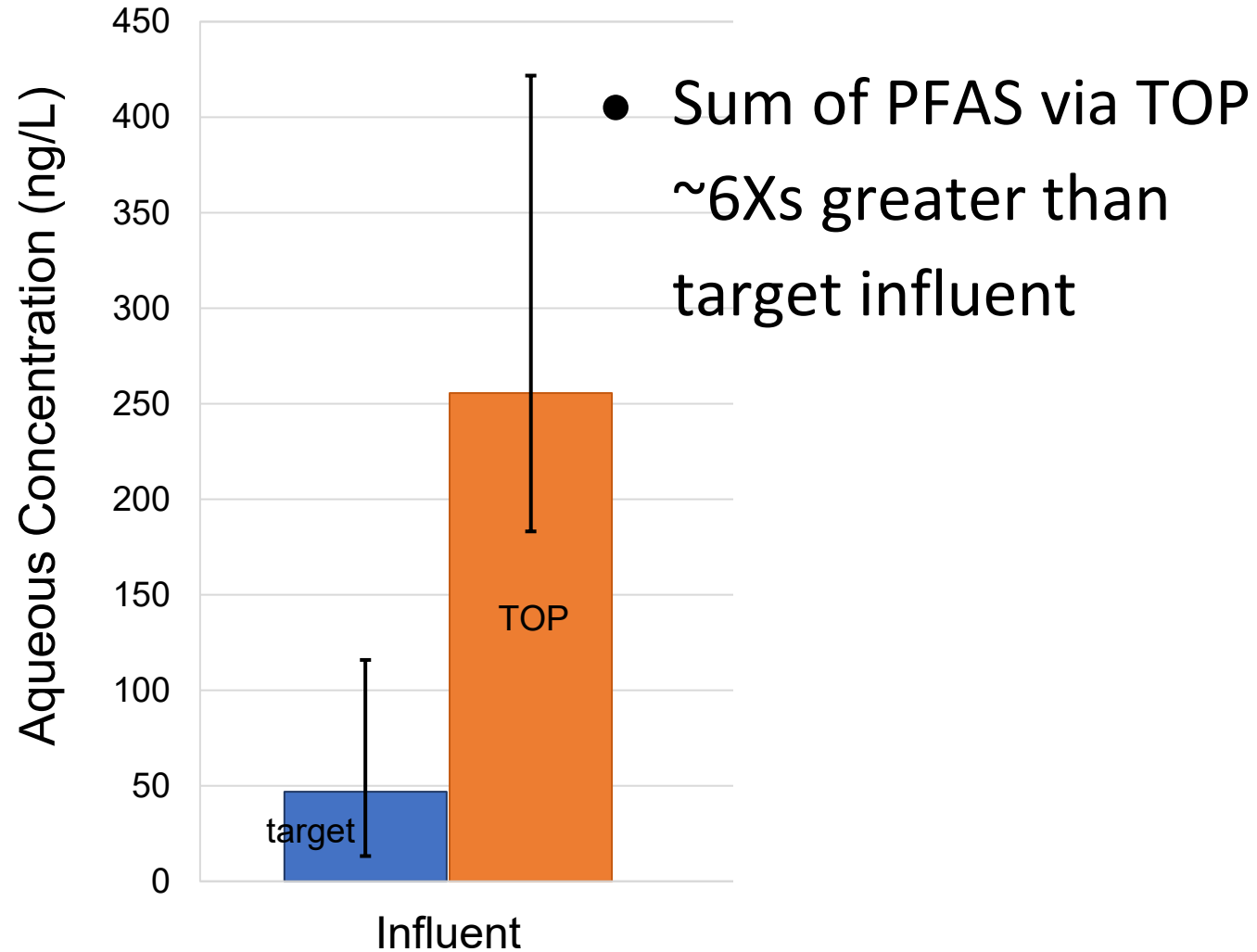


Influent Concentration (Target)

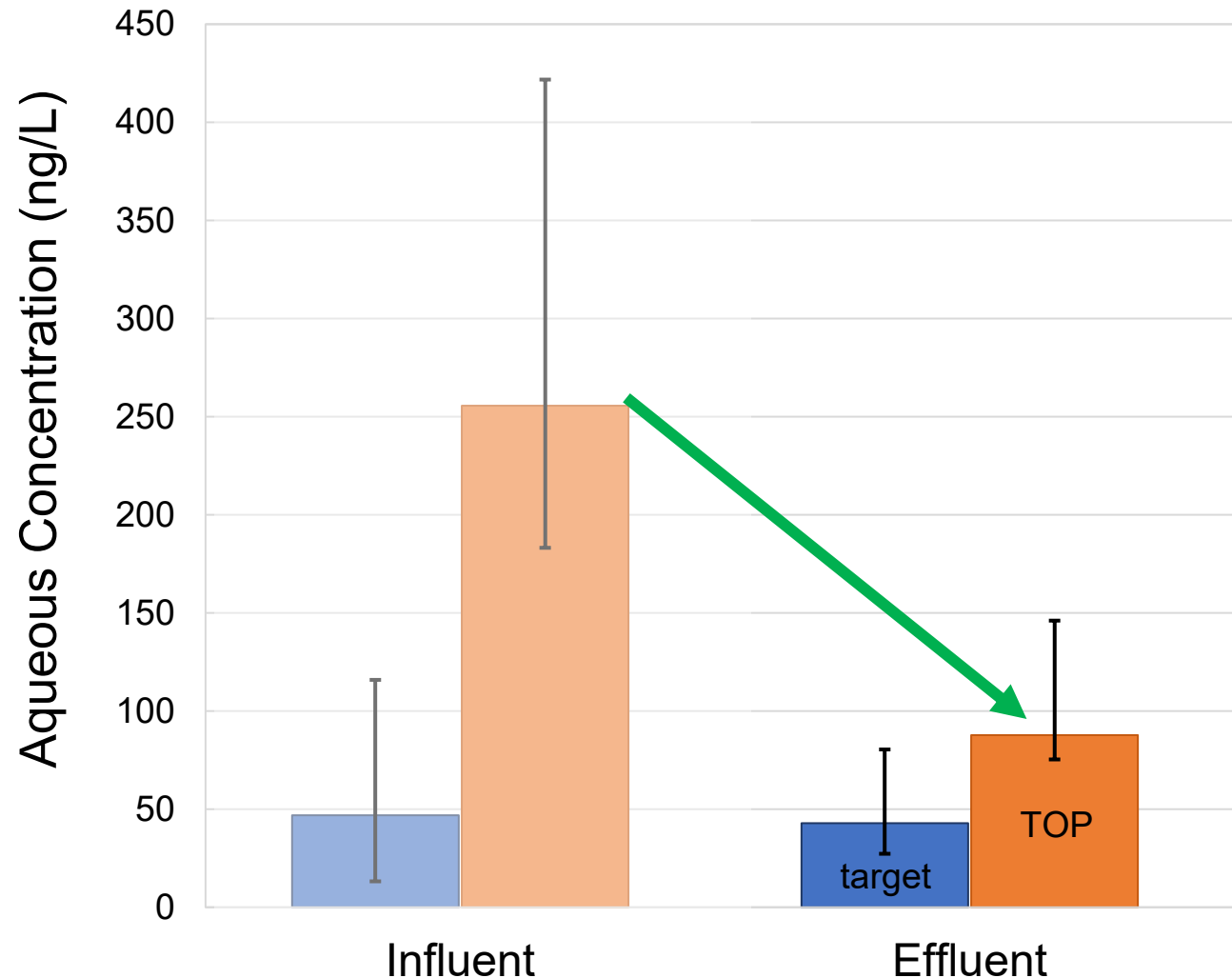


- Concentrations and composition comparable among sites
- Continued presence of long-chain PFOS and PFOA
- No clear trend from industrial discharges
- Comparable to other municipal wastewater in CA and international studies

PFAS Concentrations in Wastewater Matrices

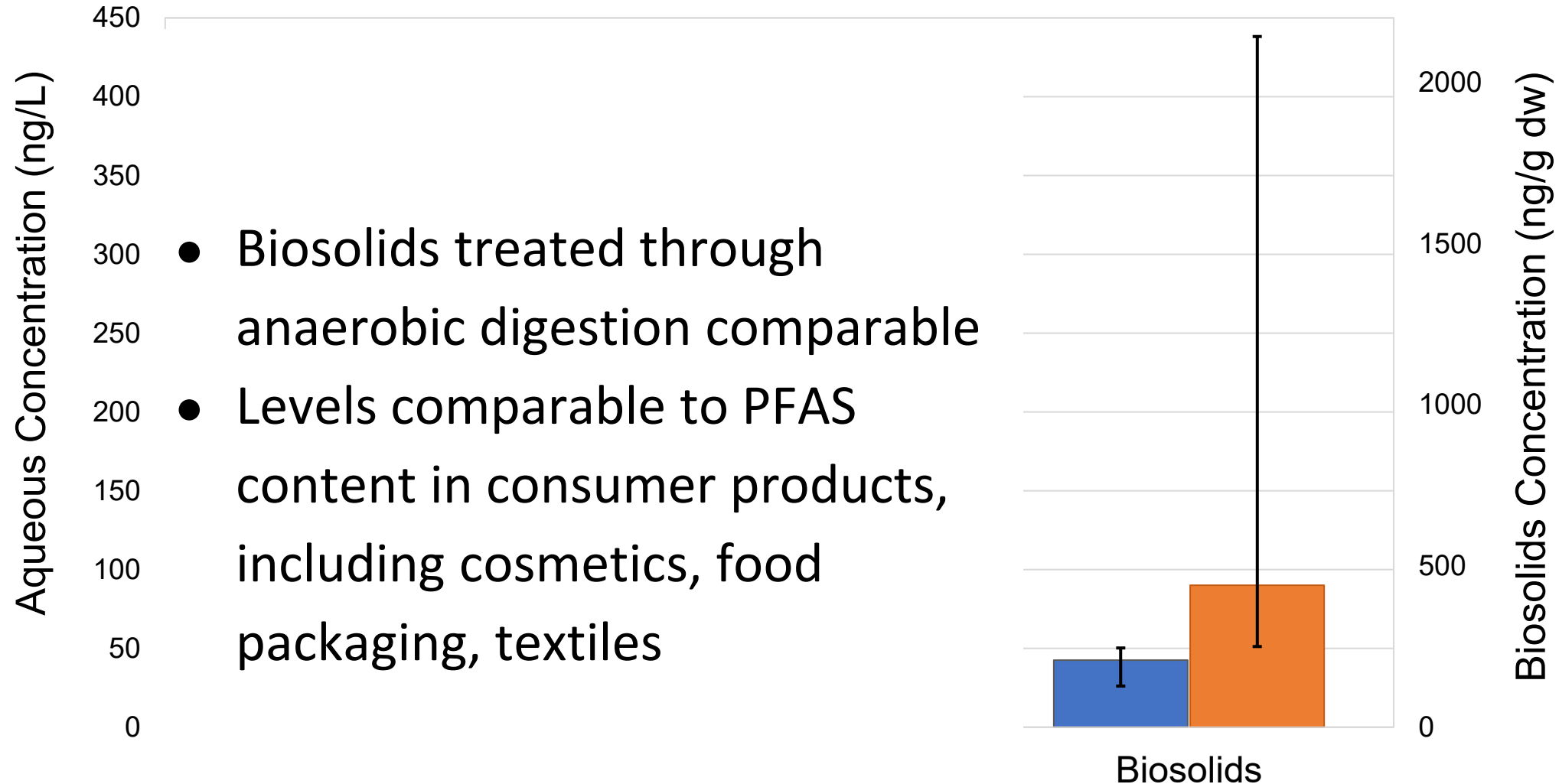


PFAS Concentrations in Wastewater Matrices



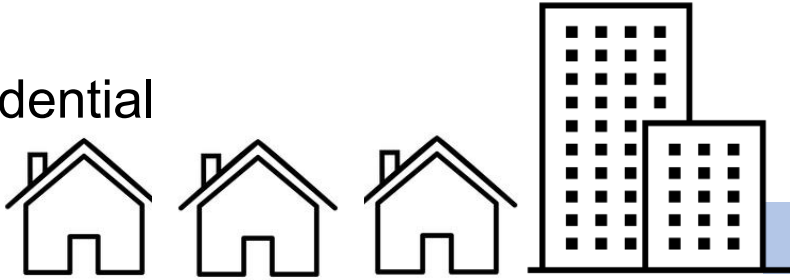
- Effluent results consistent and comparable with other studies
- ~80% reduction in PFOA and PFOS between 2009 and 2022
- 50% reduction in sum of PFAS quantified via TOP between 2014 and 2022
- Trends also observed in other studies

PFAS Concentrations in Wastewater Matrices



Sewershed Monitoring

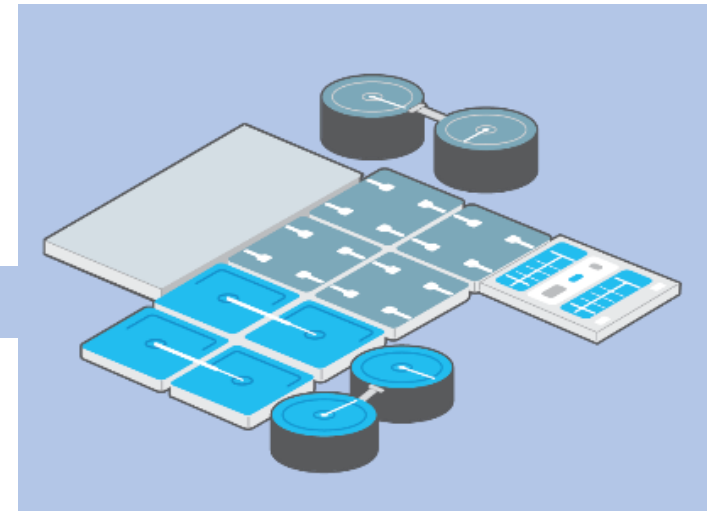
Residential



Industrial

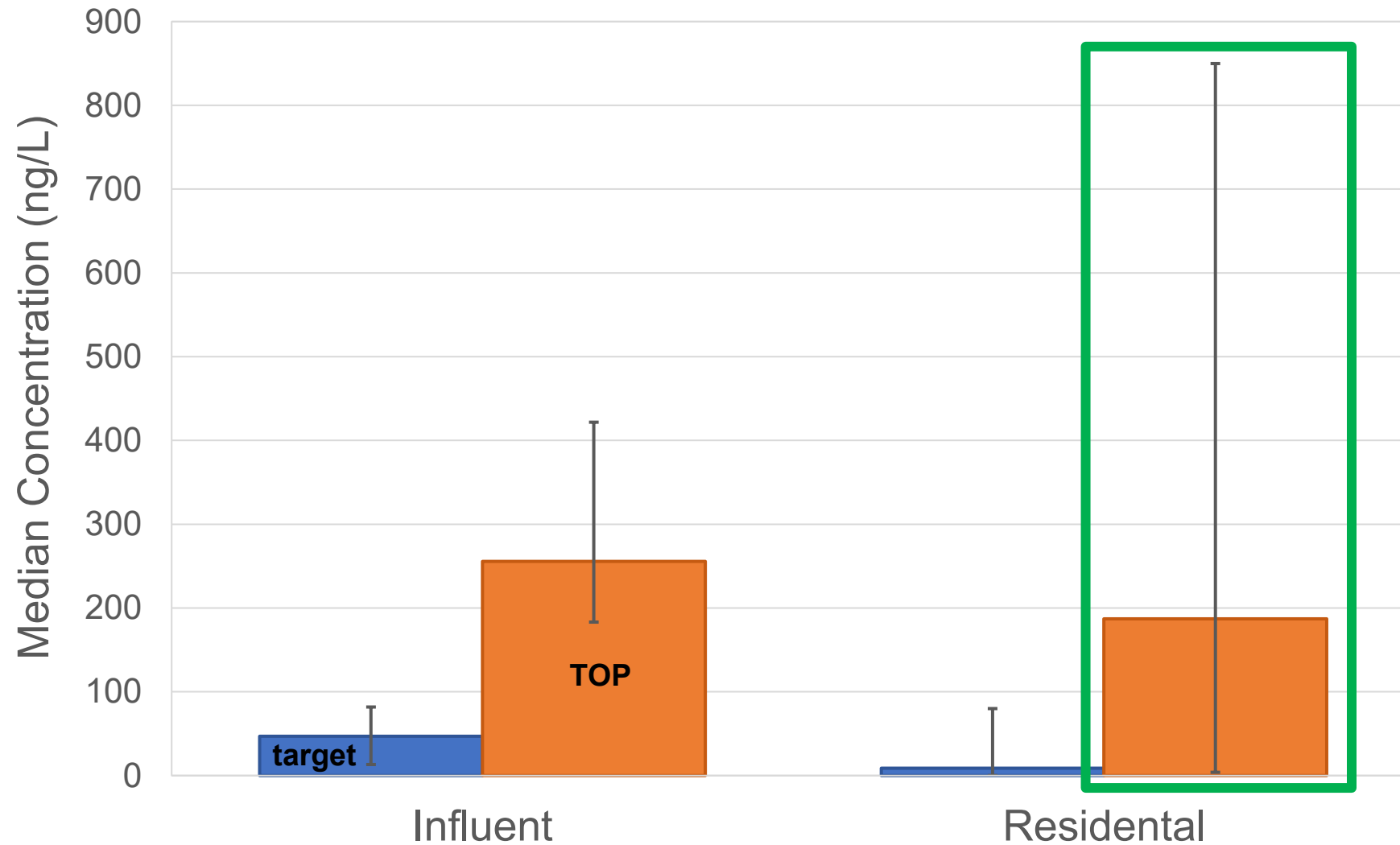


Commercial



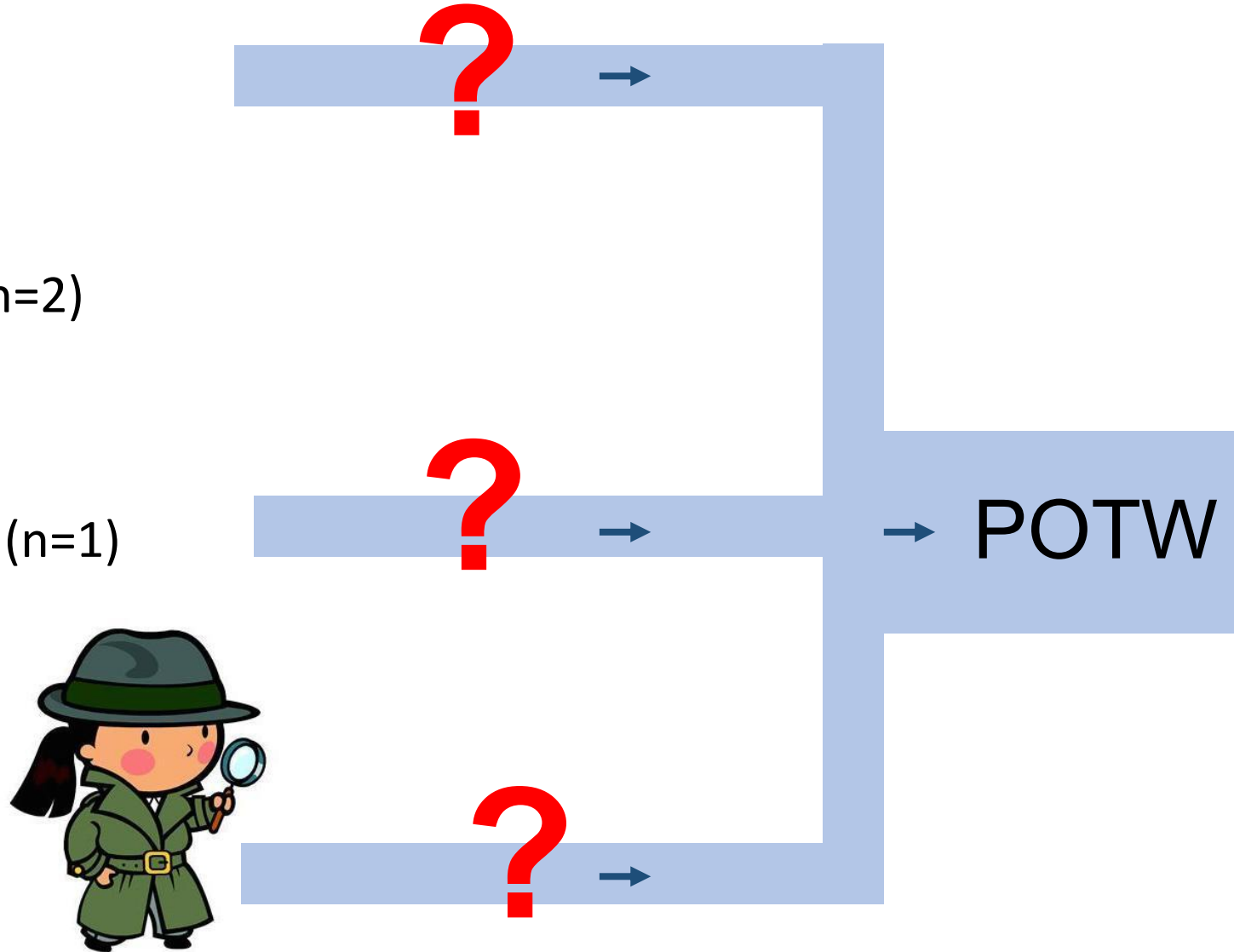
POTW

Residential Sewershed Discharge

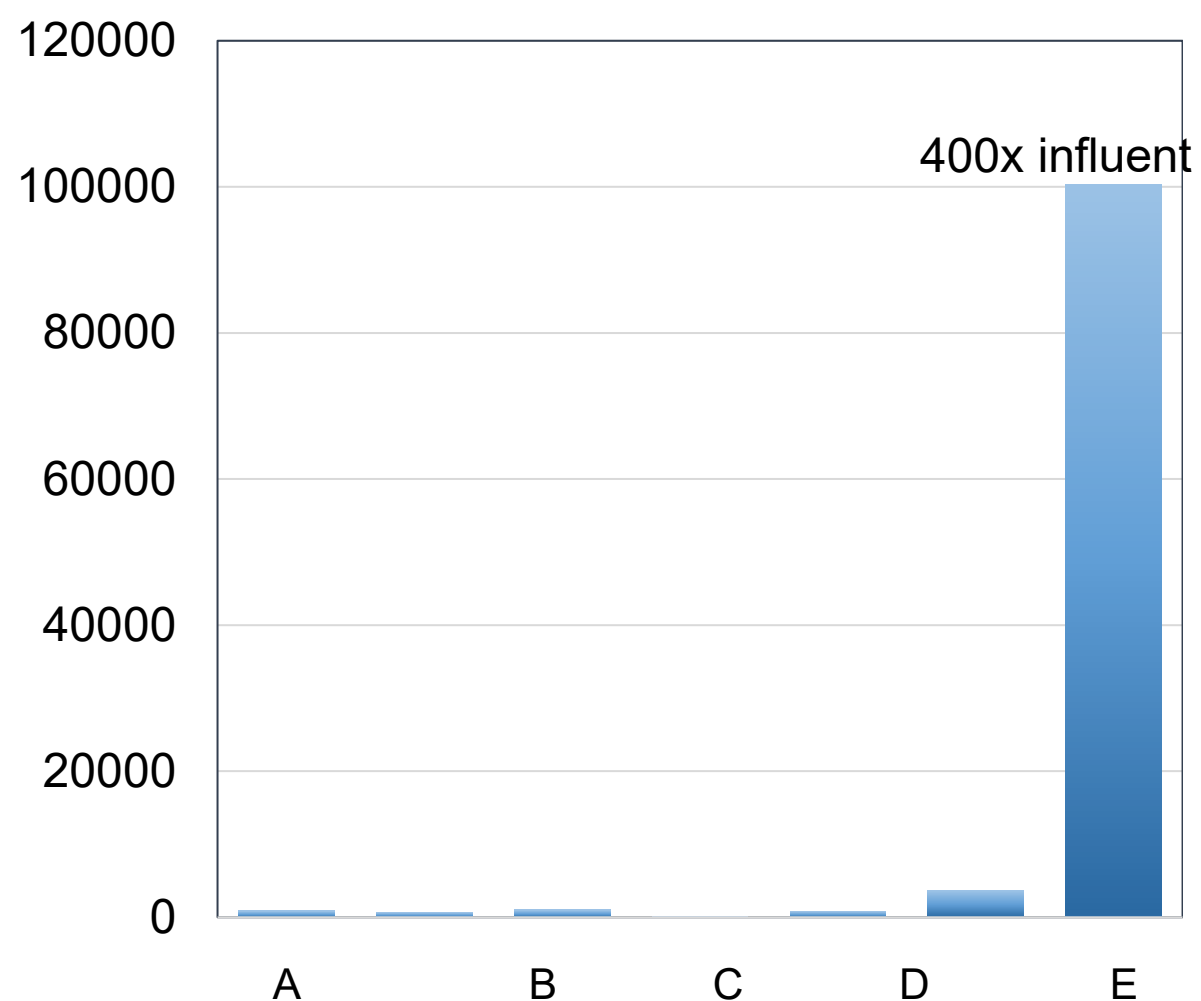
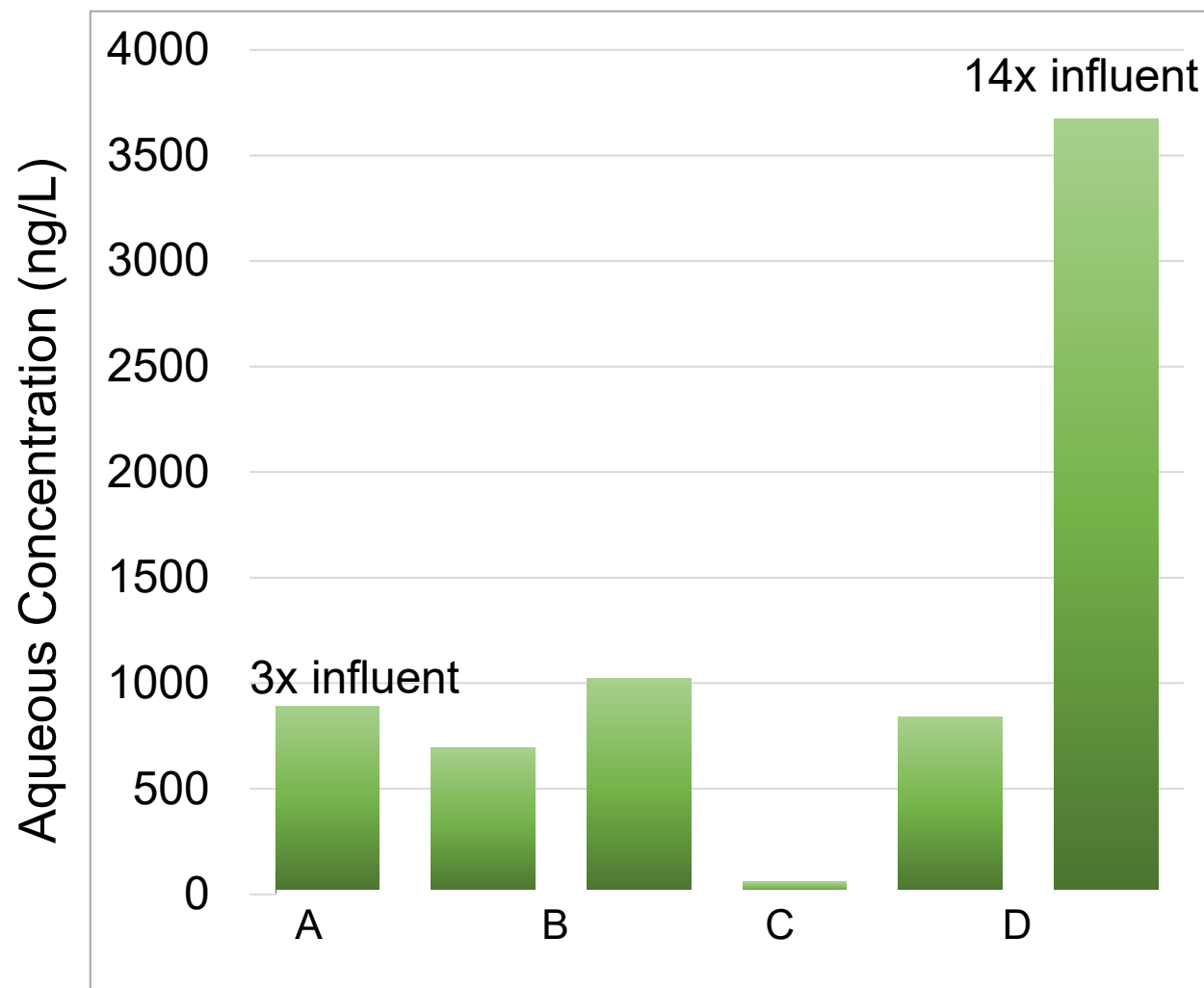


Industrial Discharge Screening Study

- Industrial laundry (n=5)
- Hospitals (n=4)
- Chrome-plating on-site (n=3)
- Semiconductor manufacturing (n=2)
- Military site (n=1)
- Car wash (n=3)
- Pulp paperboard manufacturing (n=1)

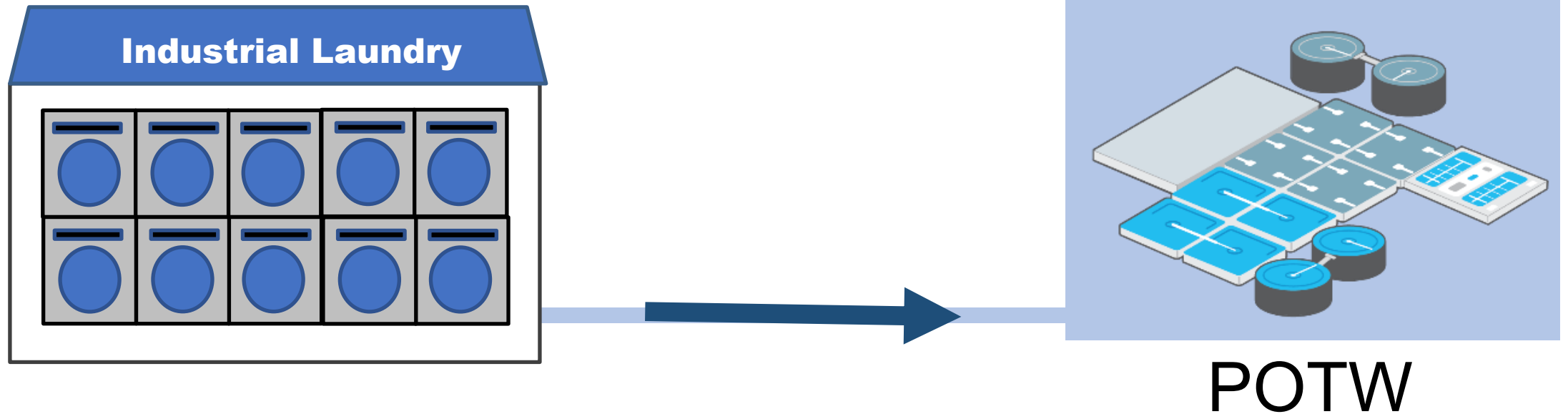


Industrial Laundry Sewershed TOP Analysis



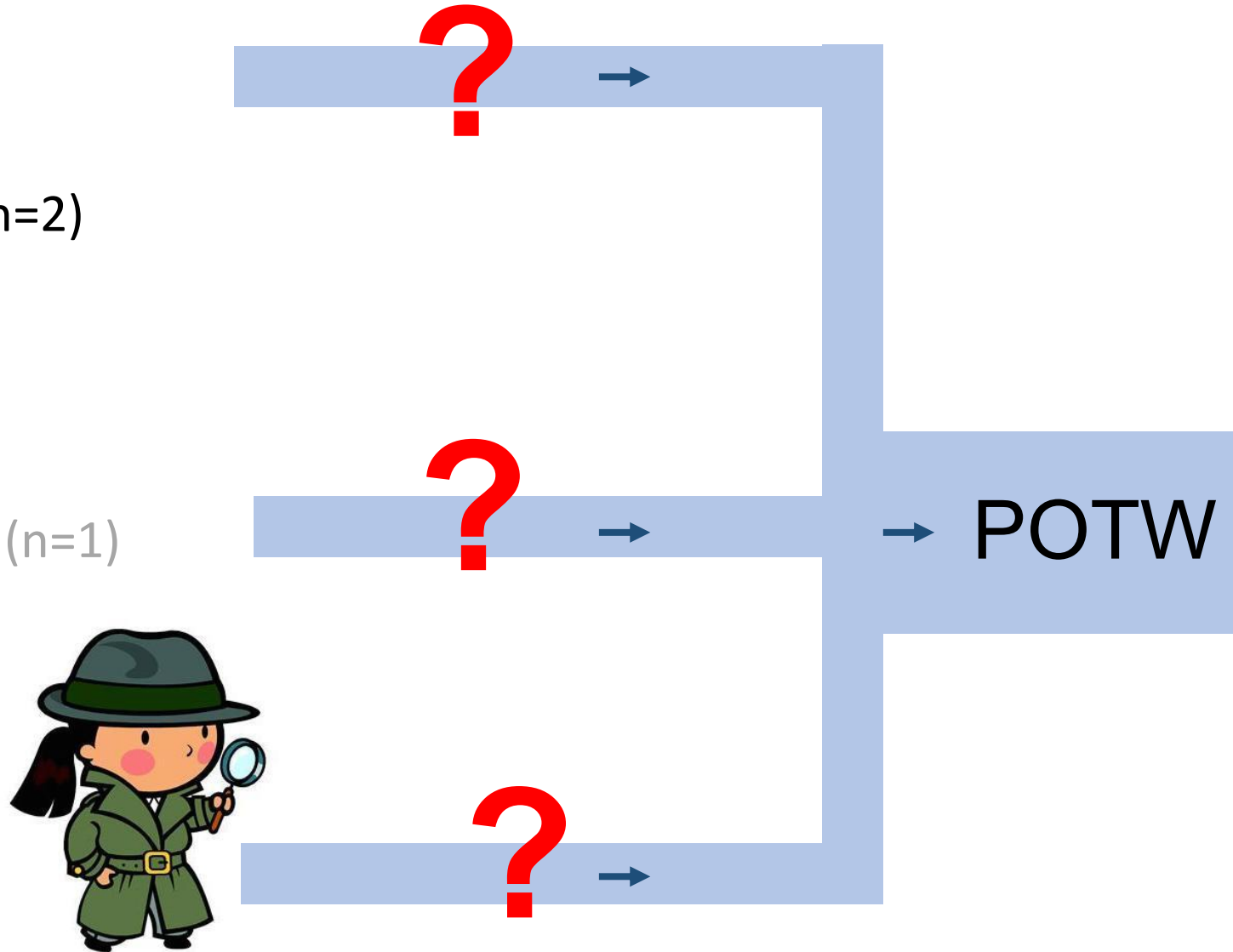
Industrial Laundry Contribution to PFAS Loading at POTW

- Discharge permit ~2.5 MGY
- Mean = 15,000 ng/L sum of PFAS (TOP)
- Facility discharging 0.01% of flows could contribute 1% of PFAS loadings

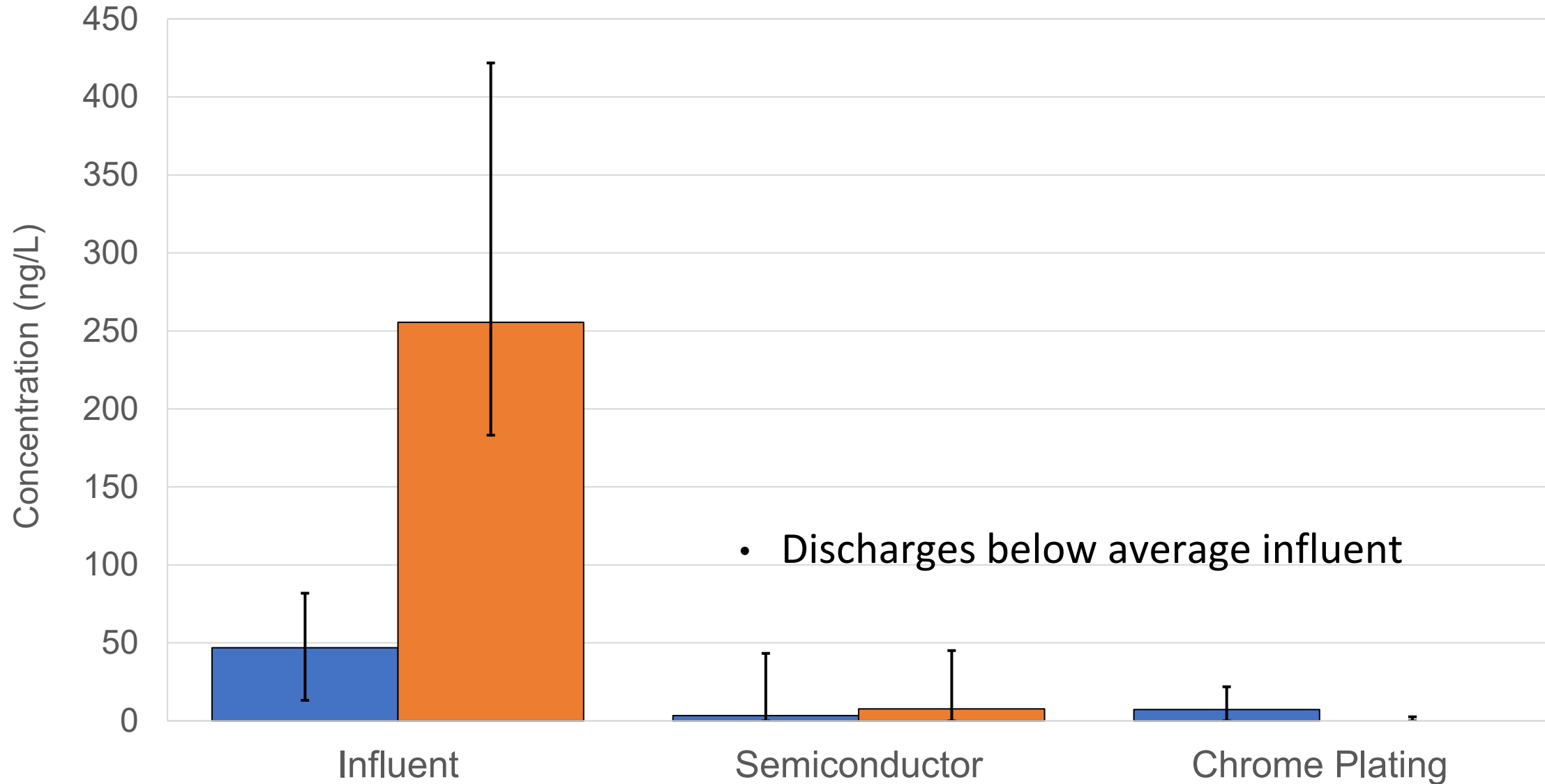


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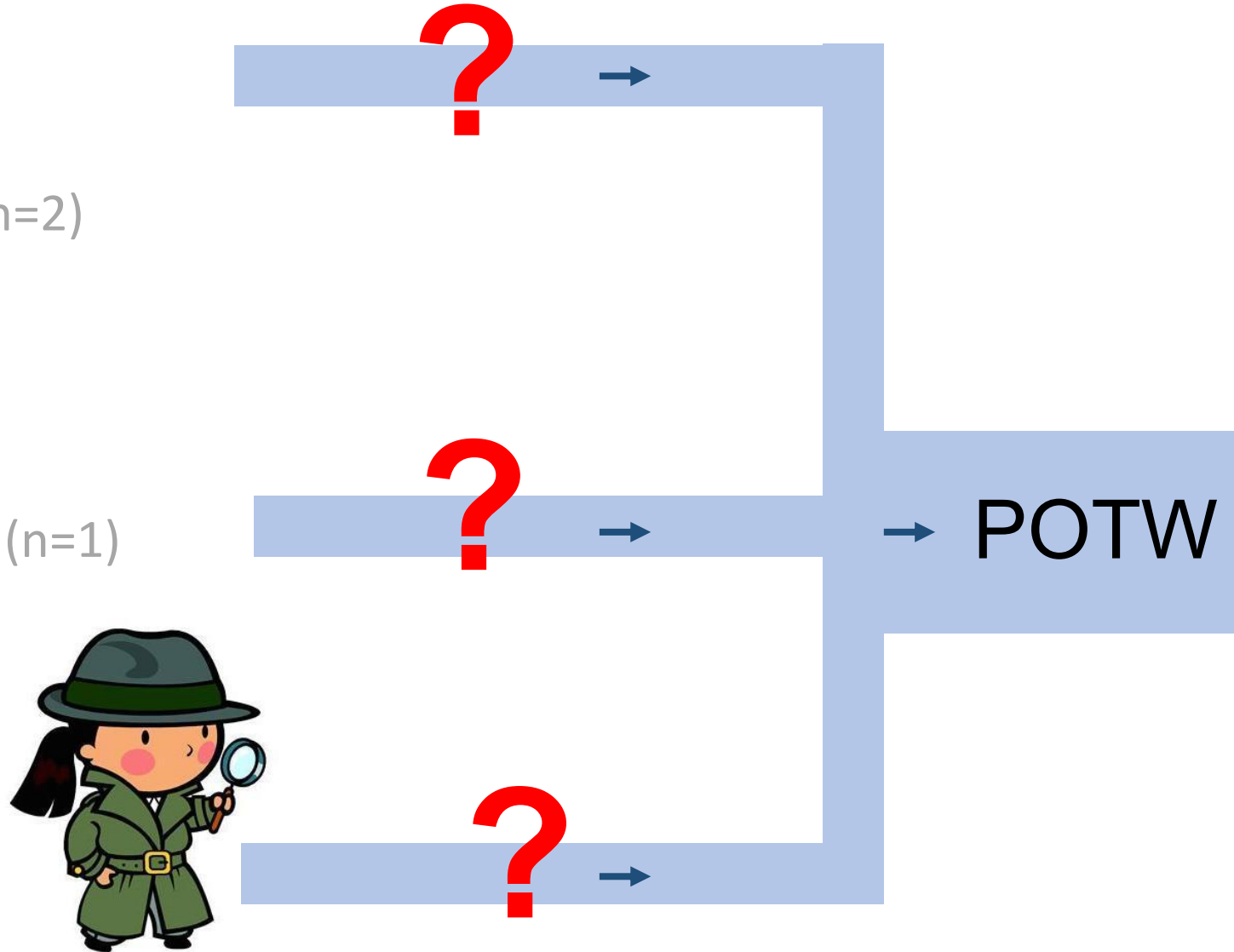


Semiconductor Manufacturing and Chrome-Plating Sites

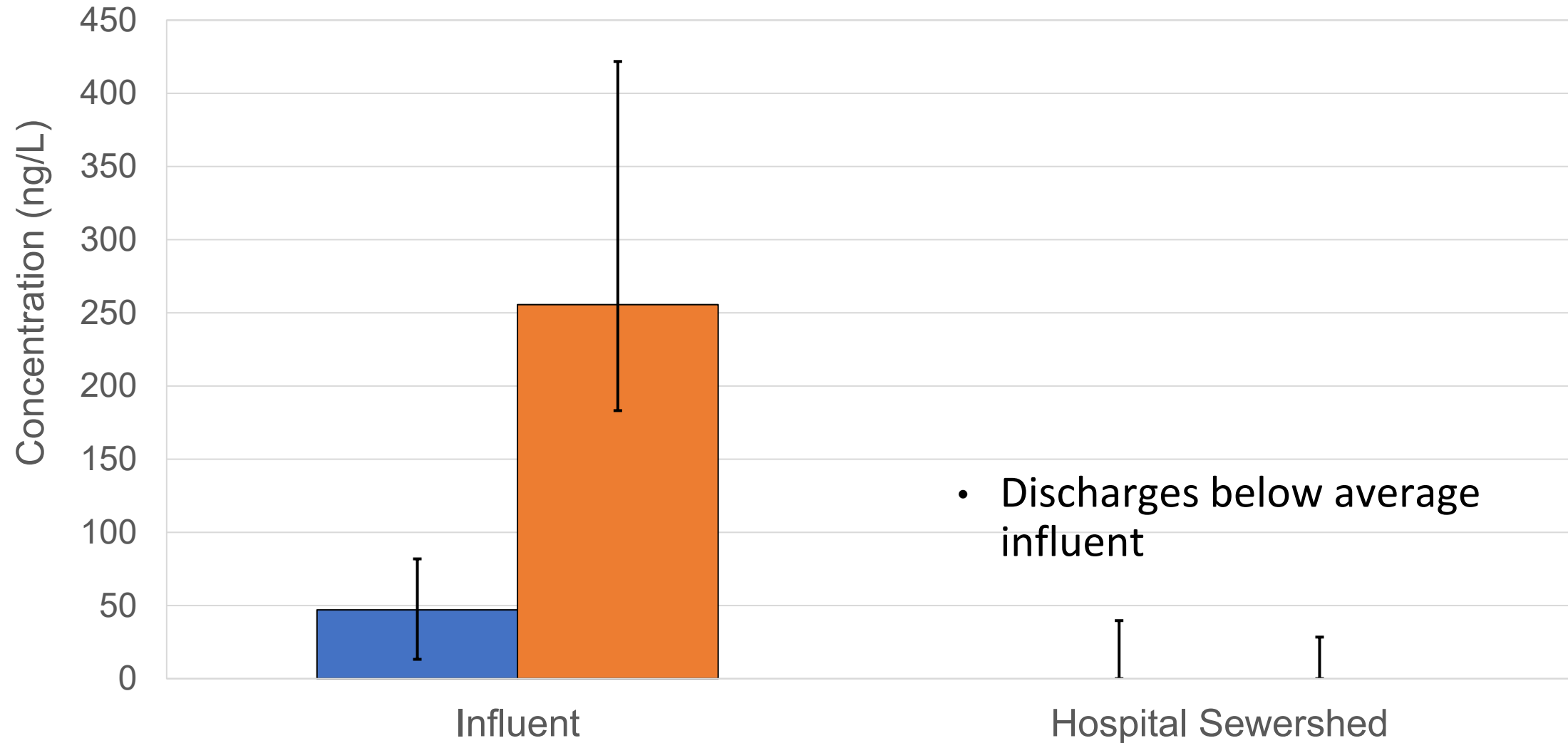


Industrial Discharge Screening Study

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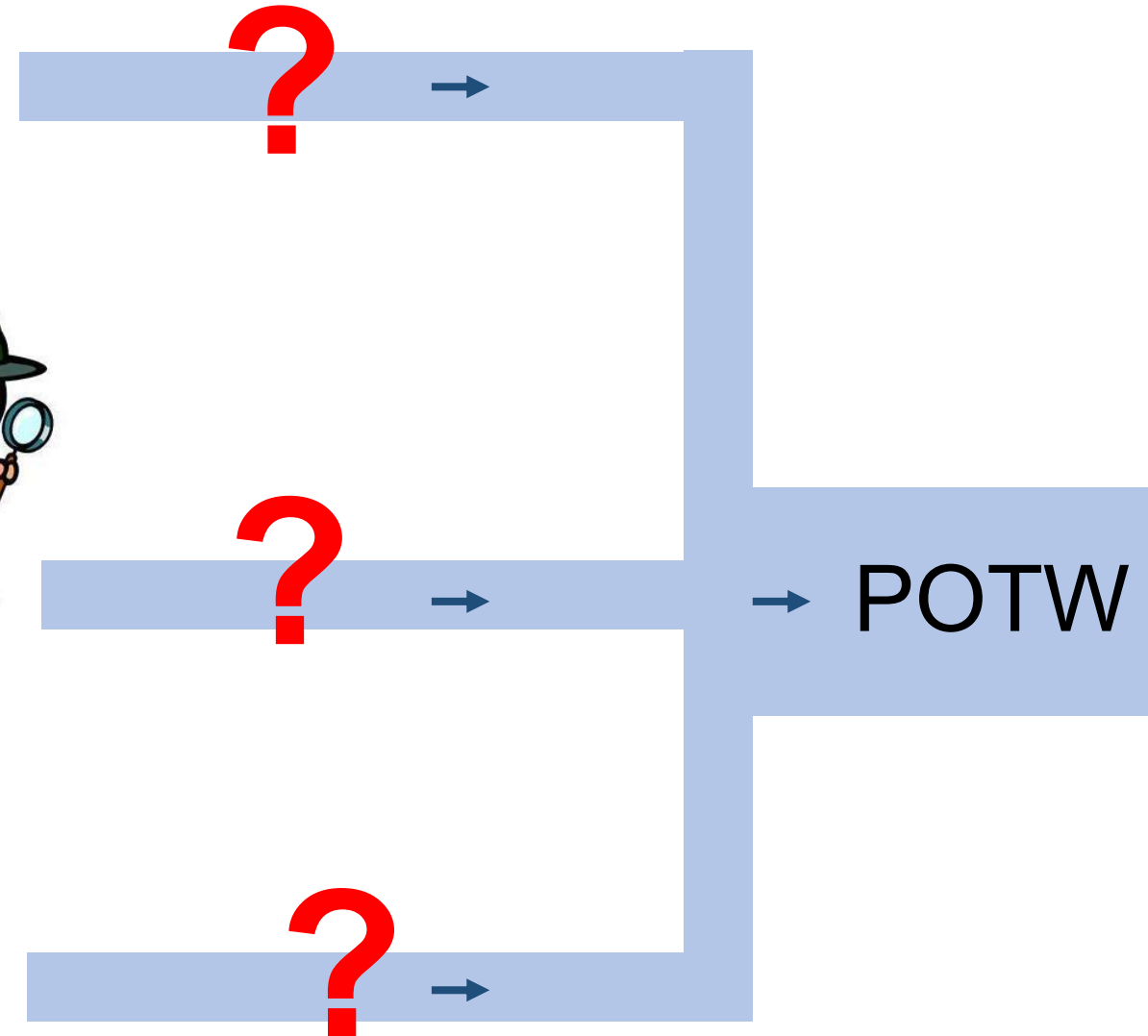


Hospital Sewershed Discharge

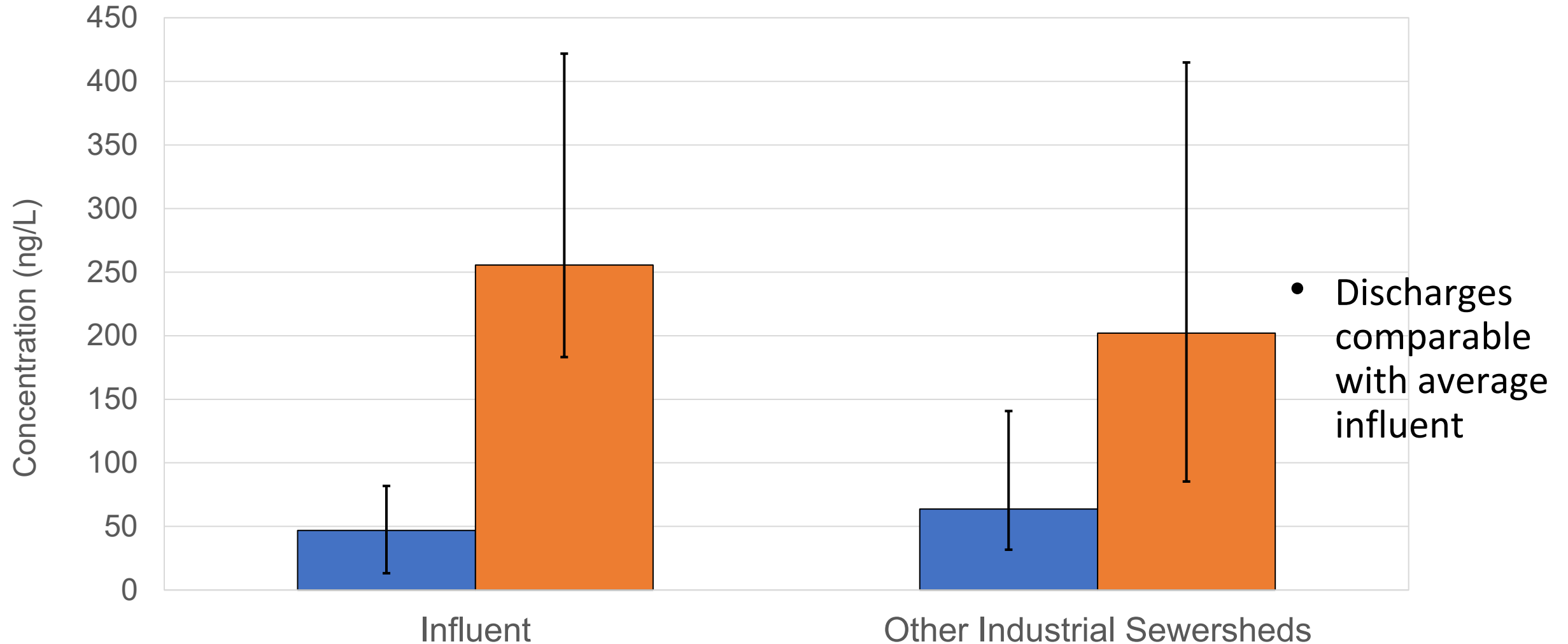


Industrial Discharge Screening Study

- Industrial laundry (n=5)
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- Semiconductor manufacturing (n=2)
- Hospitals (n=4)
- Military site (n=1)
- Car wash (n=3)
- Jail (n=1)
- Pulp paperboard manufacturing (n=1)



Other Industrial Sewershed Discharges



PFAS Sources to Solutions:

Identifying and Preventing PFAS Pollution
in San Francisco Bay

PROPOSAL TO THE EPA WATER QUALITY IMPROVEMENT FUND 2023
SUBMITTED BY THE **SAN FRANCISCO ESTUARY INSTITUTE** with

Regional Monitoring Program for Water Quality in San Francisco Bay (RMP)
Department of Toxic Substances Control (DTSC)
Bay Area Clean Water Agencies (BACWA)
Bay Area Municipal Stormwater Collaborative (BAMSC) Member Programs
Indiana University Bloomington
University of Toronto

PFAS Sources to Solutions

- Funded by US EPA
San Francisco Bay Water Quality Improvement Fund
- Led by SFEI, in coordination with RMP, DTSC, and BACWA



PFAS Sources to Solutions

- Identify major sources of PFAS
- Identifying priority PFAS product categories suspected to contain PFAS
- Measure PFAS in priority products
- Product selection
 - Data gap in California market
 - Not already subject to PFAS management action
 - Potentially large contribution to mass of PFAS entering SF Bay via urban runoff or POTW effluent
 - Coordination with data gaps most useful for DTSC



BACWA Phase 3 PFAS Study Questions

1. What are the concentrations of various PFAS subgroups (legacy and newer PFAS) within municipal POTW influent and effluent?
2. Are there observed temporal trends in wastewater?

The study will also be evaluated in the context of the larger PFAS Sources to Solutions project to inform the questions:

3. What are relative PFAS loadings from POTWs to the San Francisco Bay compared to urban stormwater runoff?
4. What are major sources of PFAS to municipal wastewater?



'Forever Chemicals' Reach Tap Water via Treated Sewage, Study Finds

Wastewater, even after treatment to make it drinkable, contains high levels of PFAS, according to researchers.



A wastewater treatment plant in Maine. PFAS chemicals have been linked to cancer. Cj Gunther/EPA, via Shutterstock



NEWSLETTER
Climate Forward

What to Know About 'Forever Chemicals' in Sludge Fertilizer

How to understand the E.P.A.'s new warning about PFAS levels in sewage sludge.



A wastewater treatment facility in Maine, which had once been the source of PFAS-contaminated sludge for fertilizer. Cj Gunther/EPA, via Shutterstock

Something's Poisoning America's Land. Farmers Fear 'Forever' Chemicals.

Fertilizer made from city sewage has been spread on millions of acres of farmland for decades. Scientists say it can contain high levels of the toxic substance.



Photo: Connie Park

These Stain-Resistant Shirts Repelled
(Almost) Everything We Threw at
Them



What happens if you pour a glass of red wine down one of these shirts? We found out. Photo: Connie Park

PFAS and stain-repellent fabrics

Most water- and stain-resistant textiles owe their liquid-repellent properties to chemical compounds called PFAS. The good news is that experts believe that occasionally wearing a shirt that's been treated with PFAS (like wearing period underwear, yoga pants, or any number of other garments that contain PFAS) is unlikely to pose much personal risk. But high levels of exposure to certain PFAS—through contact with contaminated water, air, soil, and food or proximity to PFAS manufacturing—has been linked to increased cholesterol, changes in liver enzymes, and other harmful health effects. For more info, we discuss the health and environmental impacts of PFAS here.

BACWA's Public Outreach and Education



Average PFAS levels in common household products (parts per million)

208 ppm

Household chemicals
i.e. dishwashing liquids, carpet and fabric care products

12 ppm

Pesticides

6 ppm

Paints

0.2 ppm

Plastics

0.2 ppm

Bay Area Biosolids

We need to turn off the tap

- 😊 **Cosmetics:** Ban on intentionally-added PFAS in effect in 2025
- 😊 **Textiles:** Ban on intentionally-added PFAS in effect in 2025
- 😊 Department of Toxic Substances Control continues to consider PFAS in the Safer Consumer Products Program – evaluation of floor polishes and waxes underway in 2025-2026
- 😞 **SB 682:** Would have banned PFAS in cleaning products, ski wax, food packaging, dental floss, and cookware, but Governor vetoed



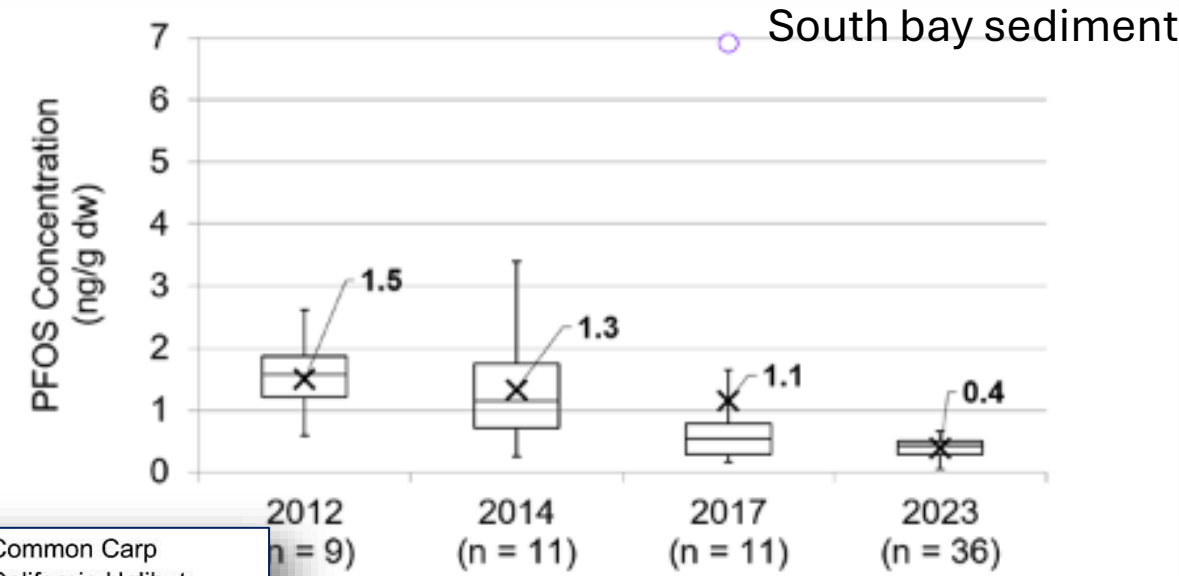
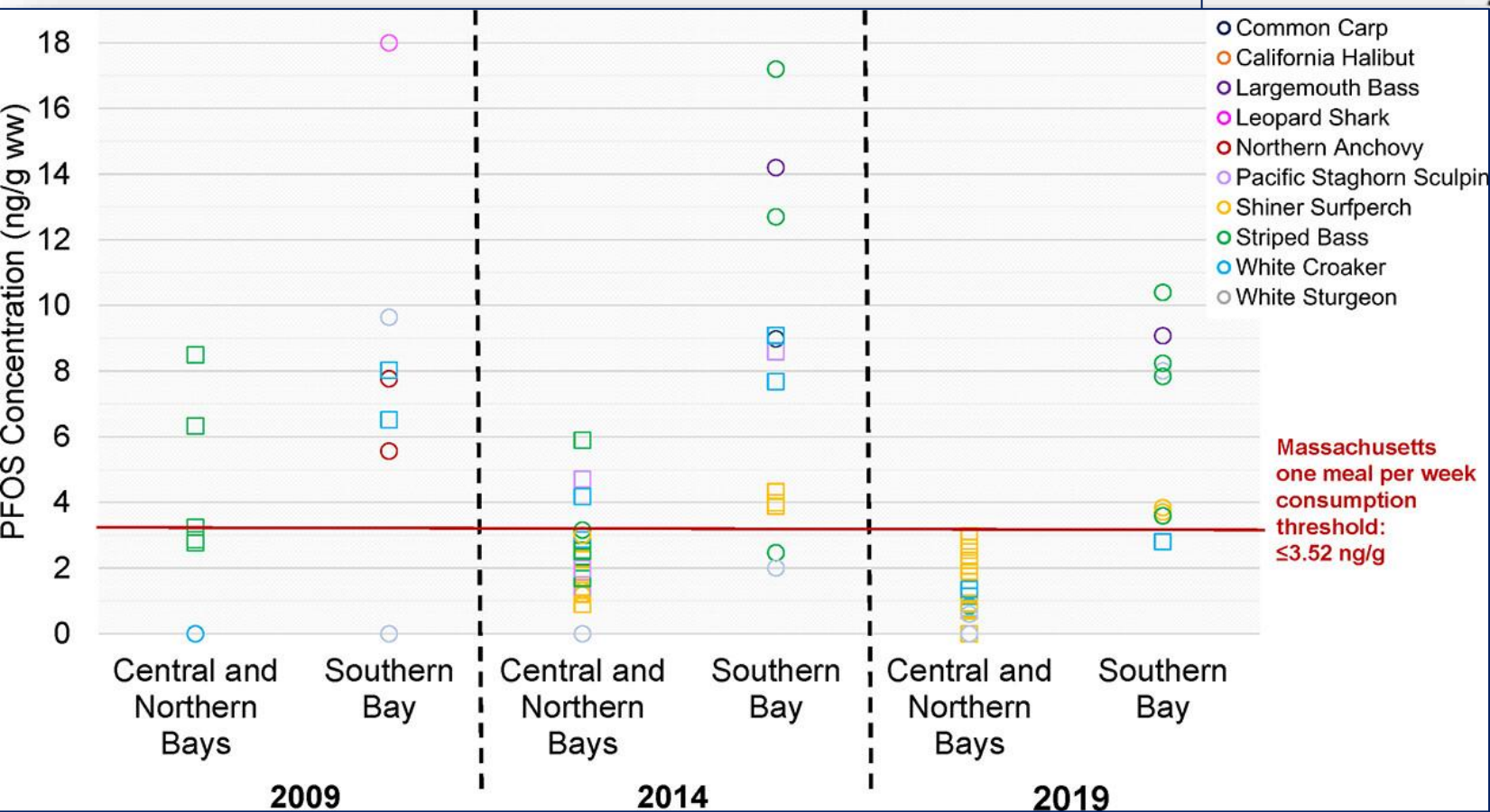
Cause for optimism?

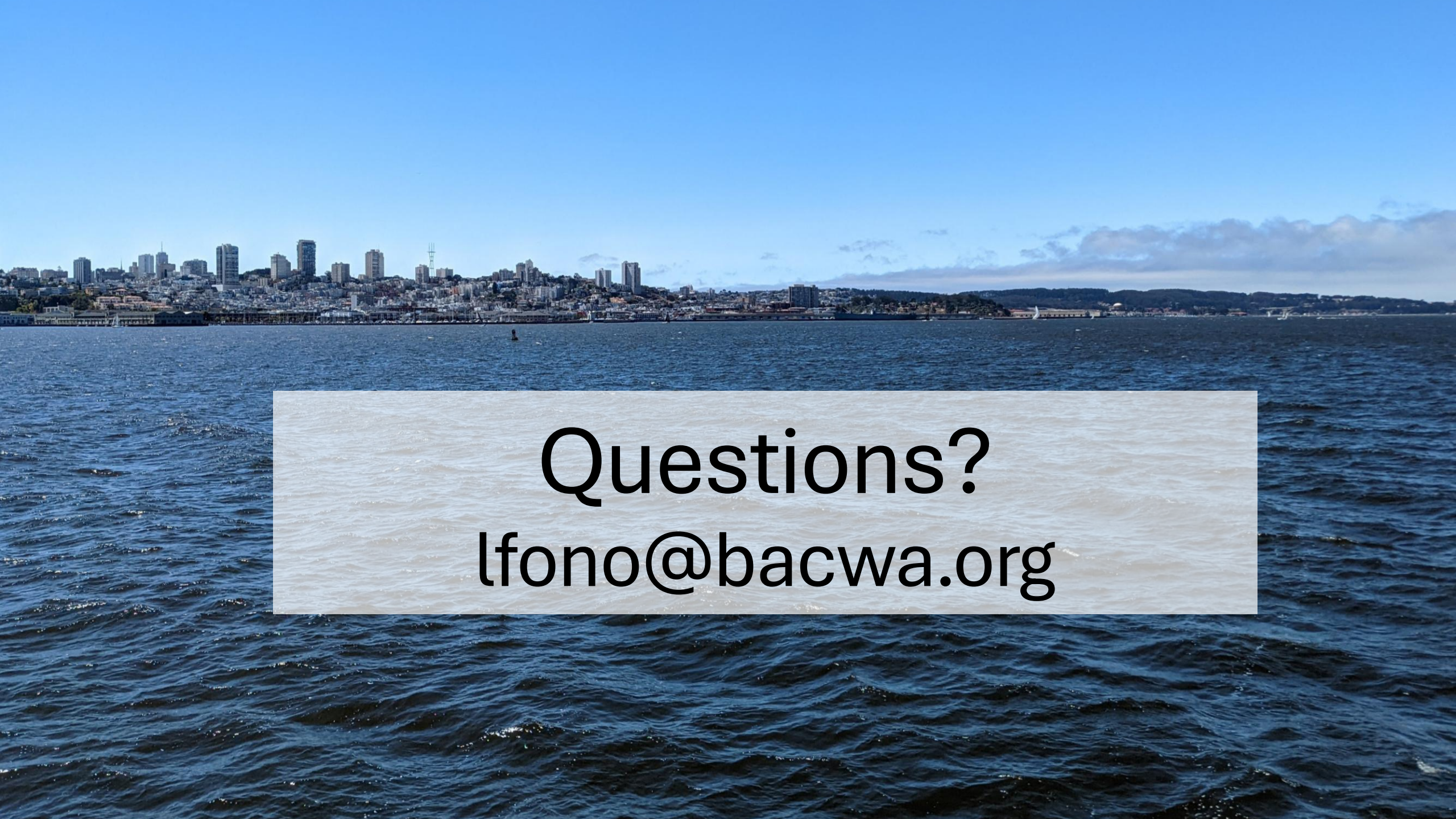


Source: 2026 RMP PFAS Synthesis

Figure 3.3: Average concentration of detected PFAS in San Francisco Bay POTW final effluent. The TOP assay was not applied for samples from 2009 and 2020.

Cause for optimism?



A wide-angle photograph of the San Francisco skyline across the water. The city is visible on a hillside, with various buildings and the Transamerica Pyramid. The water is dark blue with small waves. The sky is clear blue with some light clouds on the right side.

Questions?
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