Clean Water Summit Partners PFAS Workshop #4

PFAS Study Phase 1 Results

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SFEI AQUATIC SCIENCE CENTER
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BACWA BAY AREA CLEAN WATER AGENCIES

RMP

SWB requires PFAS sampling in California

State Water Board has issued 13267/13383 Orders to:

- Drinking water systems (& drinking water near military facilities
- Airports and Landfills
- Chrome platers
- Bulk fuel terminals/refineries
- POTWs: 4x influent, effluent, and biosolids ⇒ except in Region 2

How we leverage RMP's mature CECs program to best use resources

1. Inform region-wide understanding
   - (Nearly) all effluent goes to the Bay, not to drinking water sources

2. Develop study design that is efficient and informs management actions
   - Reduce unnecessary costs, resources by sampling representative POTWs
   - Region-wide QA/QC, data management and comparability
   - Investigate sources of PFAS

3. Leverage other RMP PFAS studies to gain insight on PFAS fate and transport

Why is the R2/RMP study important?

- POTWs are PFAS receivers, not PFAS sources
- POTWs have limited ability to control PFAS sources or destroy PFAS
- We can use this study to better understand the sources, transport, and fate of PFAS to best target management actions and source control efforts

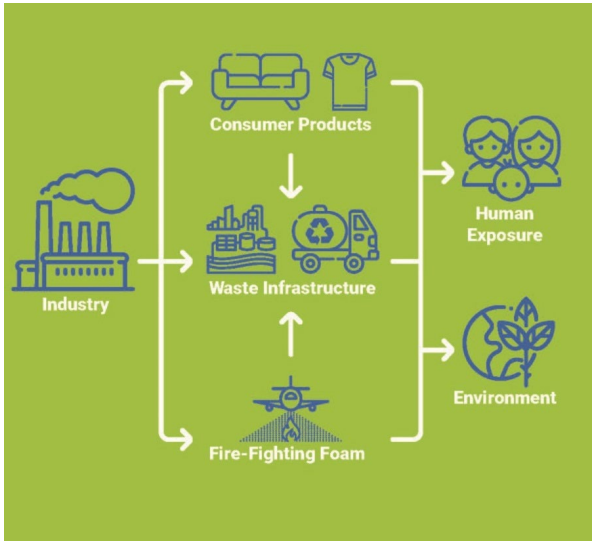

Image credit: CASA

Region 2 study comparability to Statewide effort

- Same list of compounds

  (plus more compounds! plus TOP!)
- Same sample matrices
- Sampling plan approved by SWB staff
- Data and monitoring report to be entered into Geotracker

Project Overview

Phase 1: Monitor representative subset of facilities in Q4 2020

Phase 2: Additional monitoring based on Phase 1 Results (Fall 2021)

- May include further investigation of PFAS precursors and analytes, trends, and/or source identification, groundwater monitoring

Phase 1 study design: select representative set of facilities for participation

- Discharge volume
  - 1 – 170 MGD
- Service population and industries
  - 0 - 100% residential/commercial
  - Fabricated metals, electronic manufacturing, industrial laundries, automatic vehicle washing, hospital, military, landfill
- Treatment
  - Secondary and advanced secondary filtration
  - Activated sludge, trickling filter, batch nitrification reactor, oxidation tower
- Participation in 2014 study to evaluate trends
- Geography
  - All Bay subembayments represented

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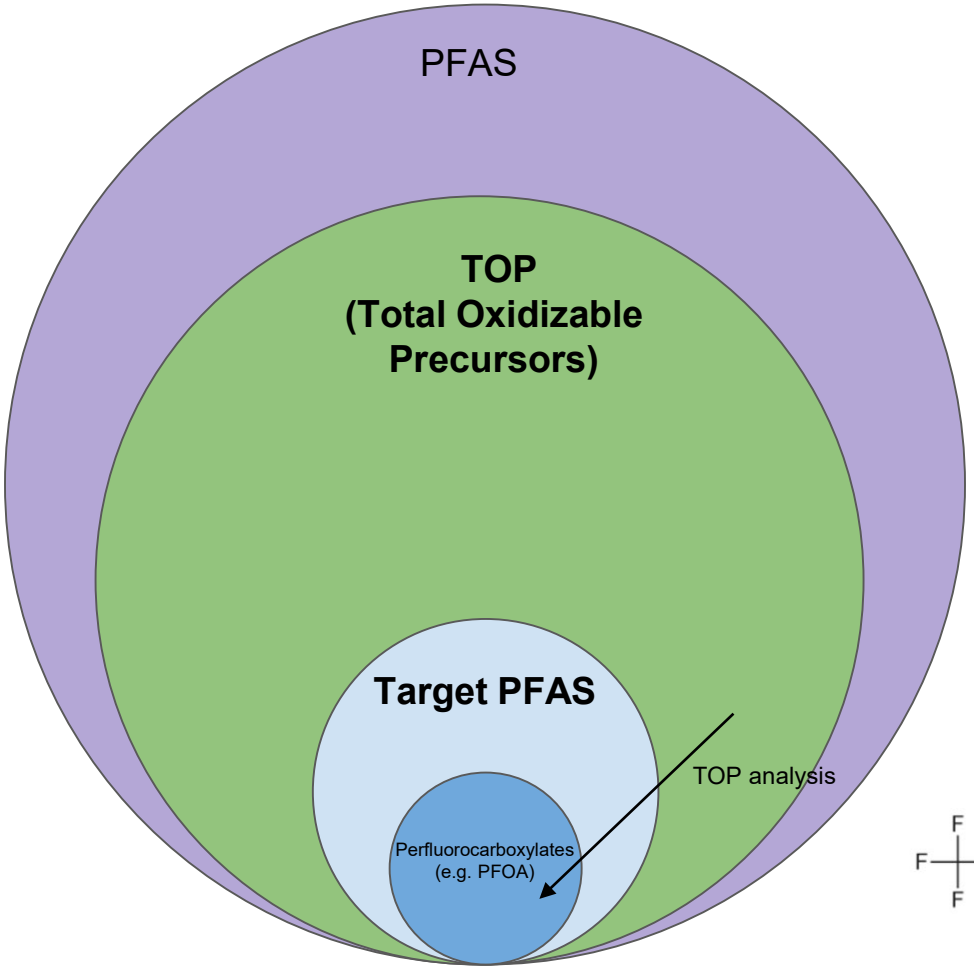
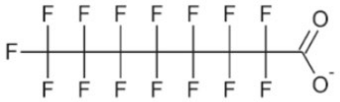
Phase 1 study design

- Sample influent, effluent, biosolids at 15 facilities
  - Evaluate whether samples sufficiently representative for R2, particularly for biosolids
- Partner with SGS Axys for target PFAS analysis that includes 40 target analytes
- QA/QC samples collected at subset of facilities
- Compare composites v. grab samples
- Collect field replicates to assess variation
- Utilize Total Oxidizable Precursors (TOP) assay
  - Indirectly quantify PFAS precursors through oxidation of precursors to terminal PFCAs
  - Analyze influent and biosolids samples and compare to target analytical method

PFAS Analytical Methods

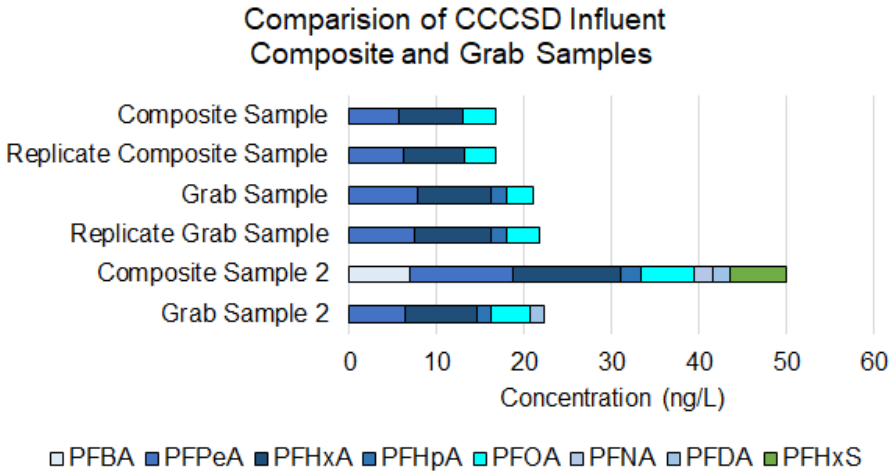


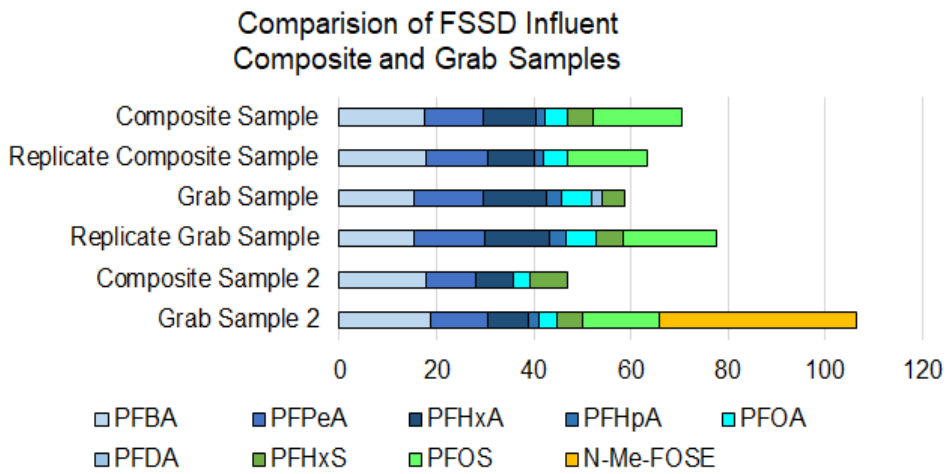


Data QA/QC review indicates no major quality concerns

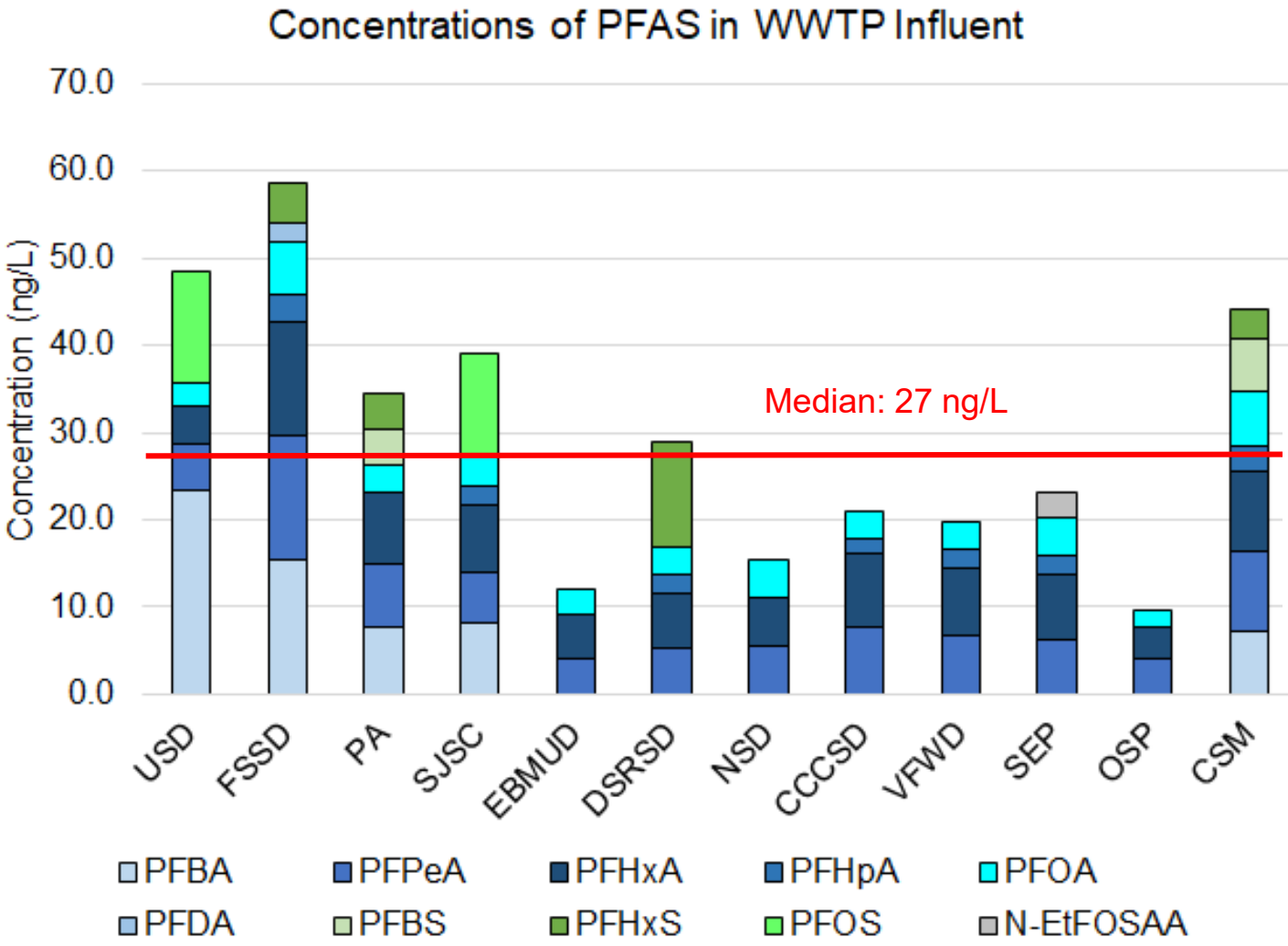
- No significant contamination issues observed
  - Elevated detection of 6:2 Fluorotelomer sulfonate (flagged with data qualifier)
- Field replicates showed good reproducibility
  - RPD for individual analytes = 9±11%
  - Grab and composite replicates collected at 3 facilities
- Precision: all MSD pairs met DoD QSM target for replicate RPDs of 30% in all quantified pairs
- Accuracy: Most LCS and MS/MSD samples met DoD QSM targets
  - Samples outside limits flagged with data qualifiers
- SFEI review did not add additional censoring qualifiers

Composites and grabs are generally comparable

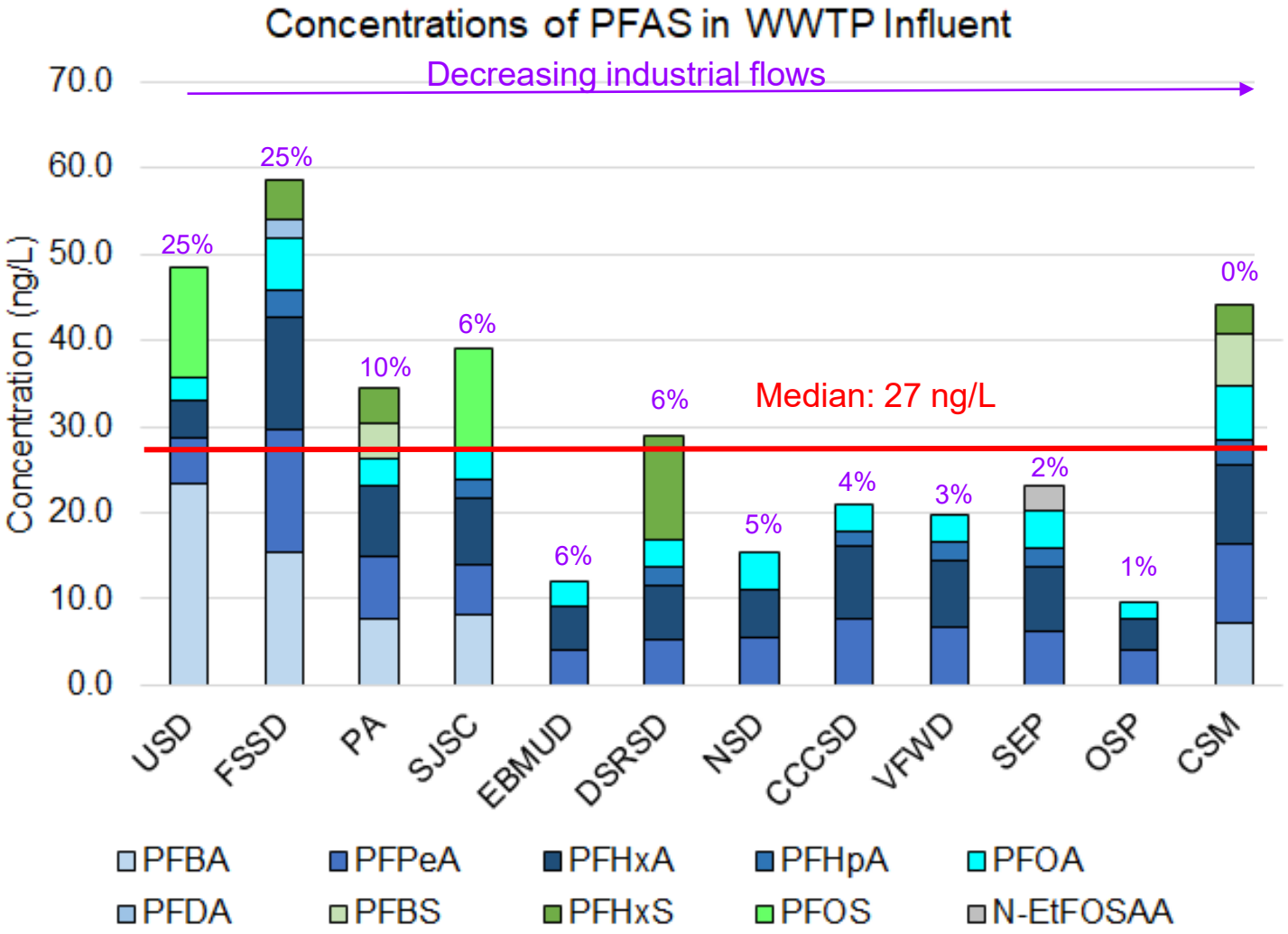




- Average RPD for individual analytes 19±15%
  - Compare to RPD of 9% for sample replicates using the same method
- No clear trend whether composites or grabs are higher

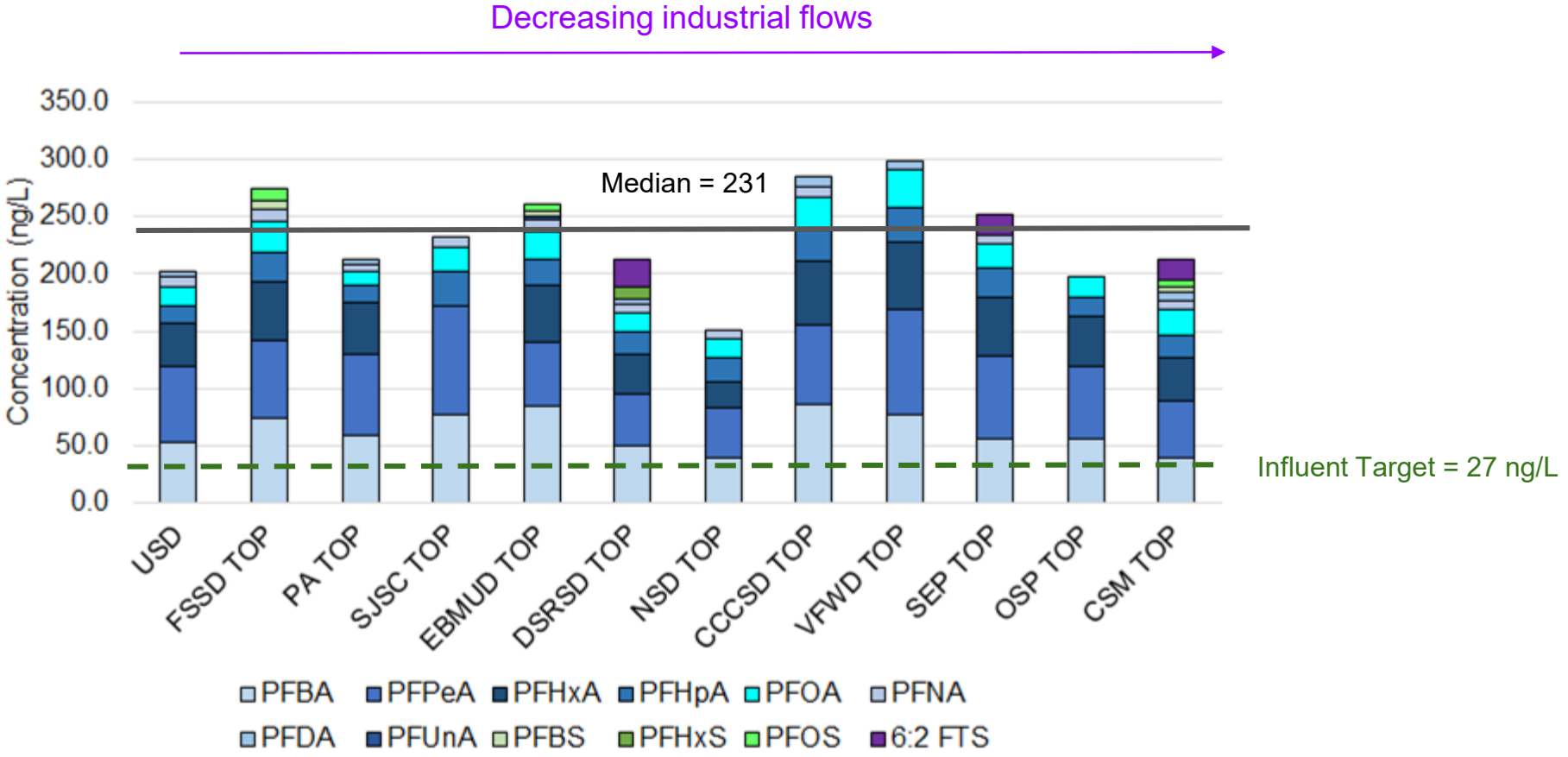


- PFAS in municipal facilities generally comparable

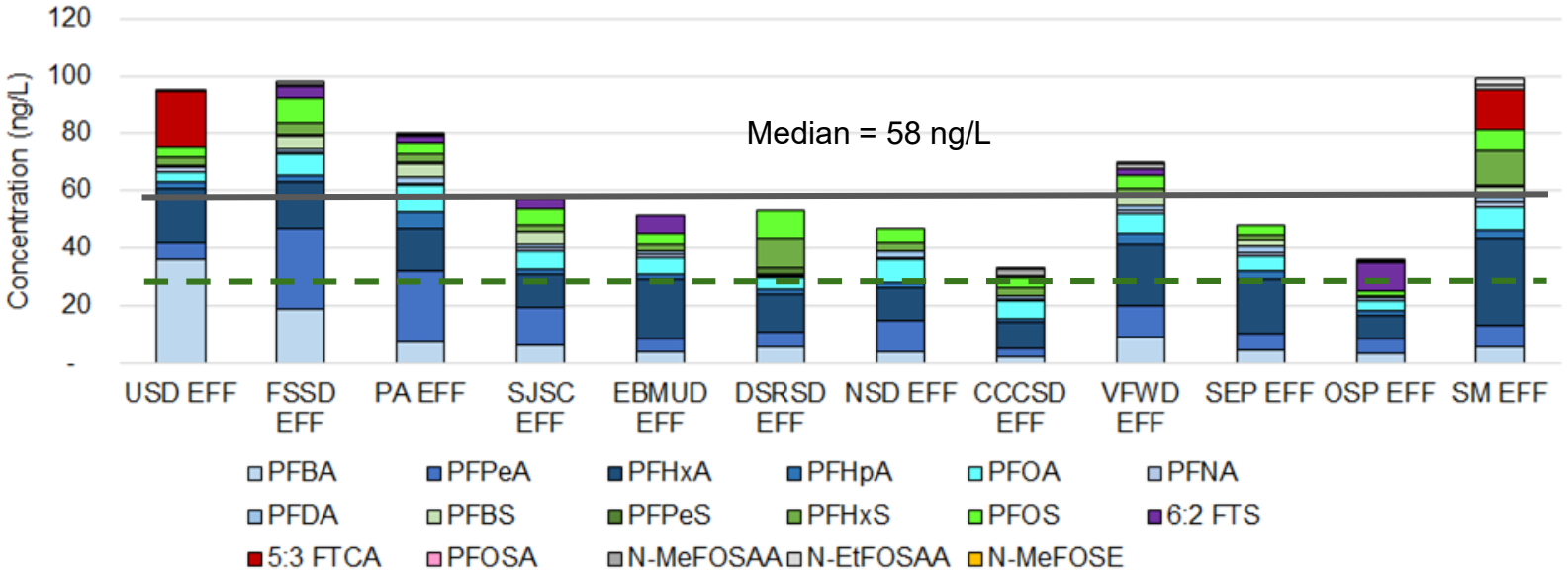


- No clear trend observed from industrial flows
- PFAS in municipal facilities generally comparable

TOP results indicate significant presence of precursors



Concentrations of PFAS in WWTP Effluent



Influent Target = 27 ng/L

Comparison of Effluent Concentrations 2009, 2014, and 2020 Studies

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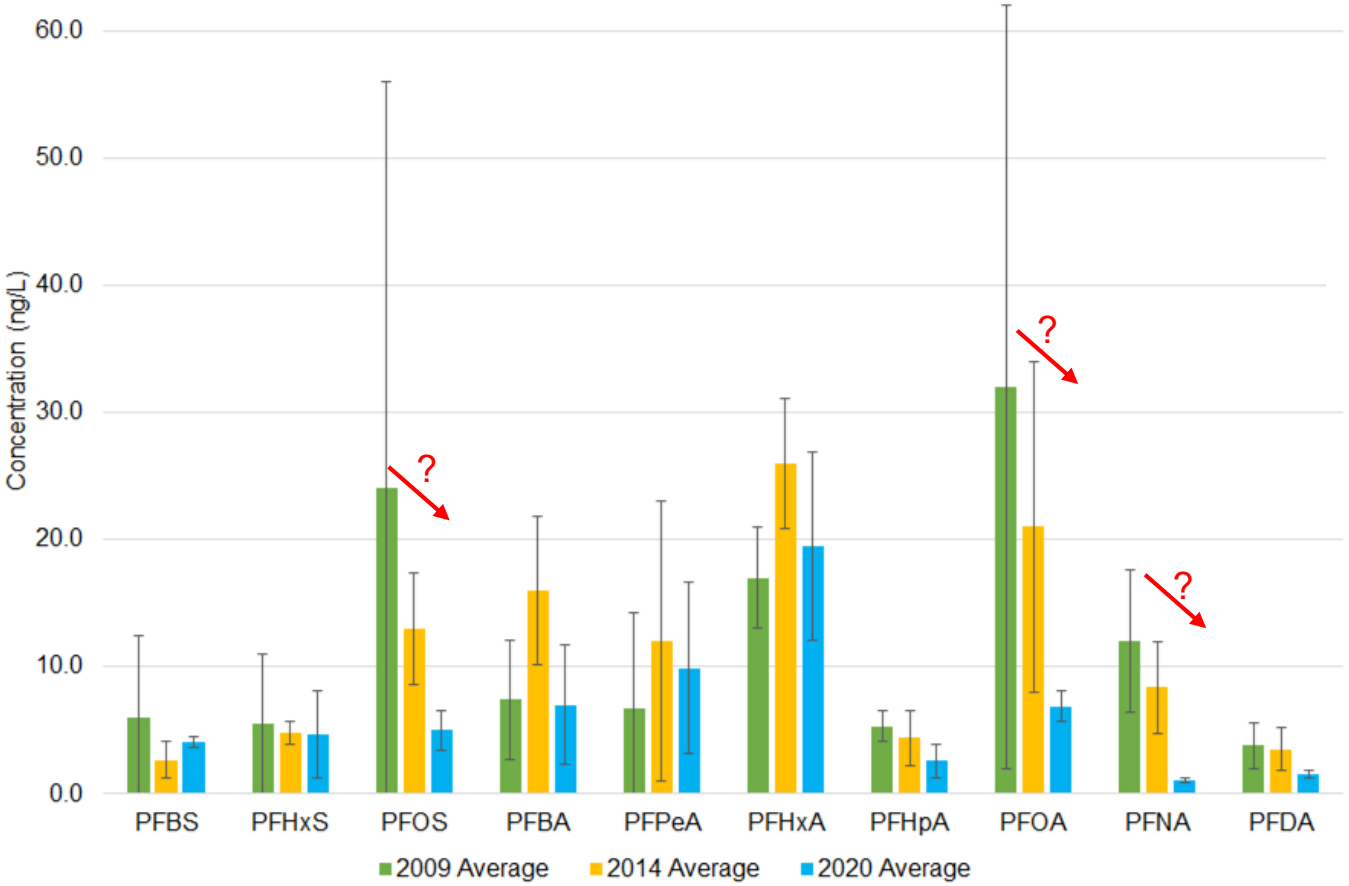
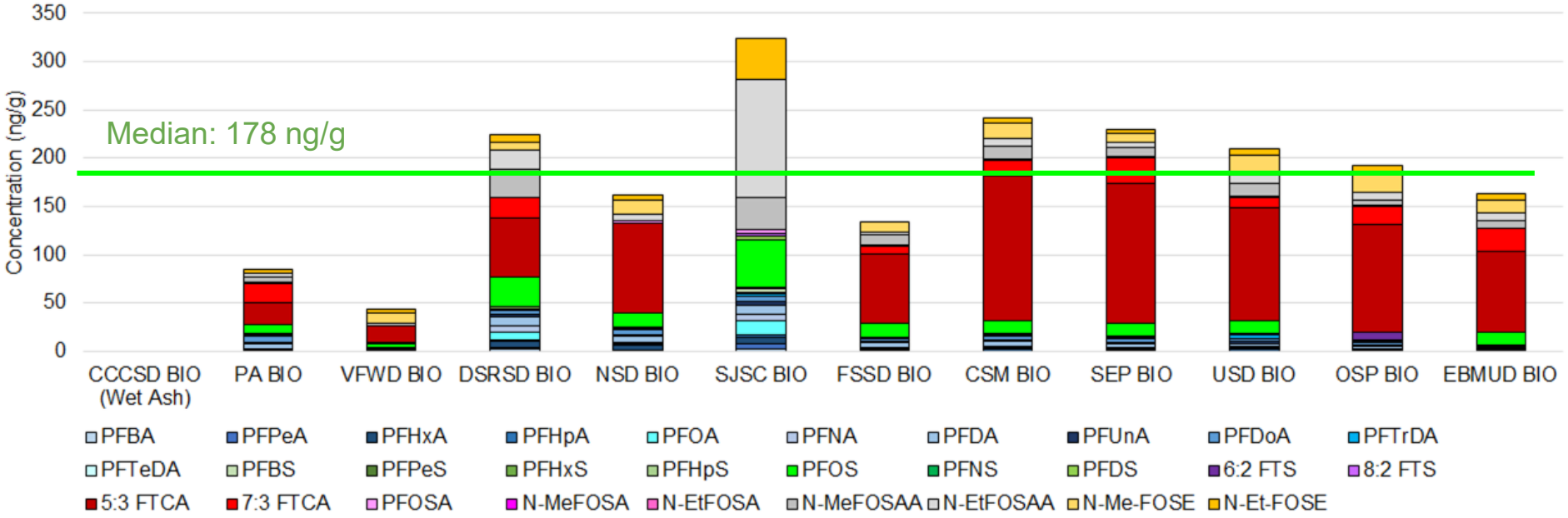


- Only 2014 municipal participants included in comparison
- Possible reductions in long-chain PFAS, but trends require further investigation

Municipal biosolid samples generally comparable



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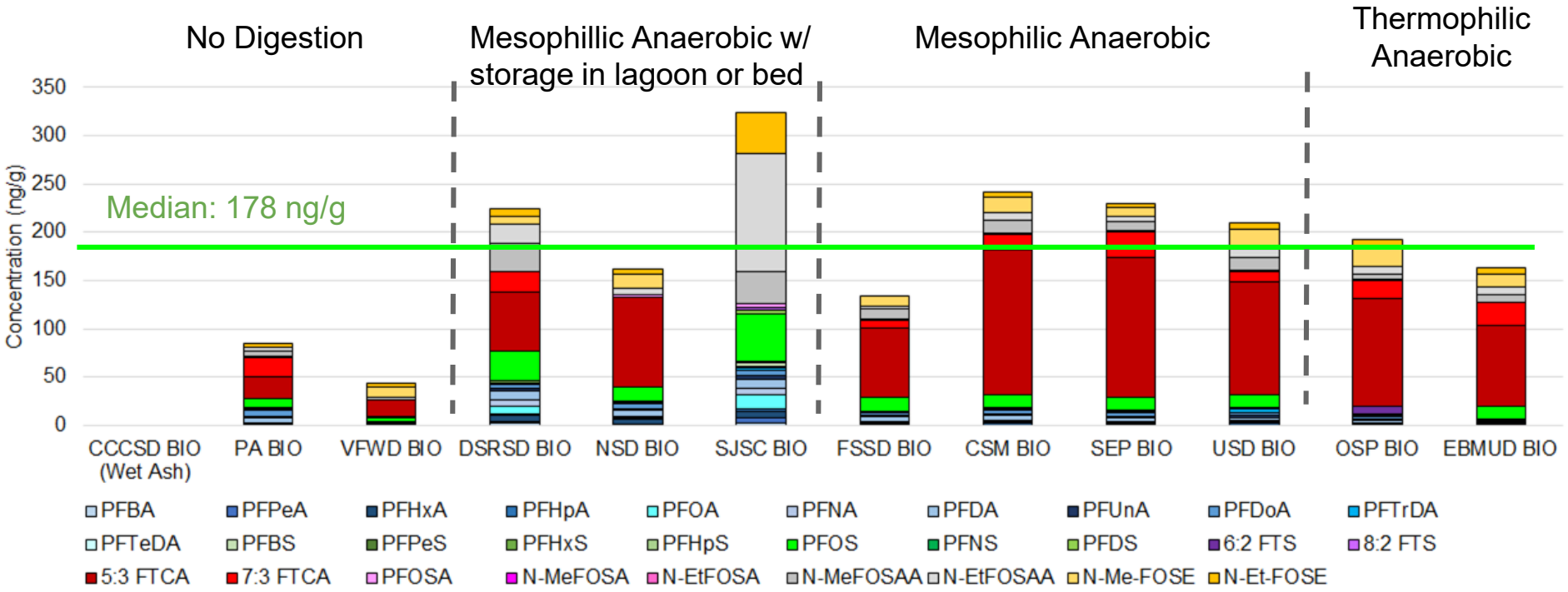

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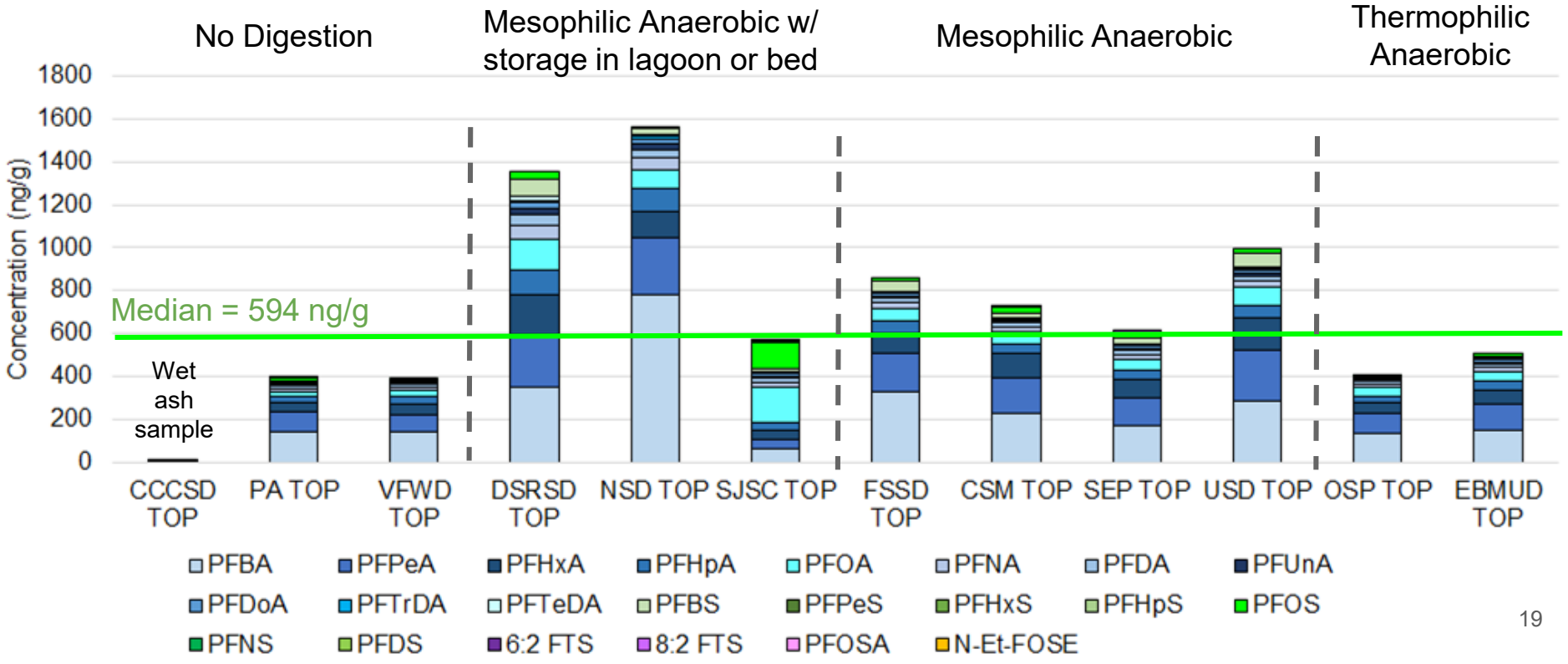
TOP results in Biosolids

- TOP results indicate significant presence of PFAS precursors
- Sum of target PFAS median was 178 ng/g



Main Takeaways from Phase 1

- Sum of PFAS concentrations in municipal influent, effluent, and biosolids generally comparable for each matrix
- Quantified concentrations of PFAS increased in effluent compared to influent due to conversion of PFAS precursors to terminal PFAS products through treatment process
- Significant presence of unknown PFAS precursors in influent and biosolids
- Gained experience of how to collect PFAS wastewater samples

Questions?

Project Timeline

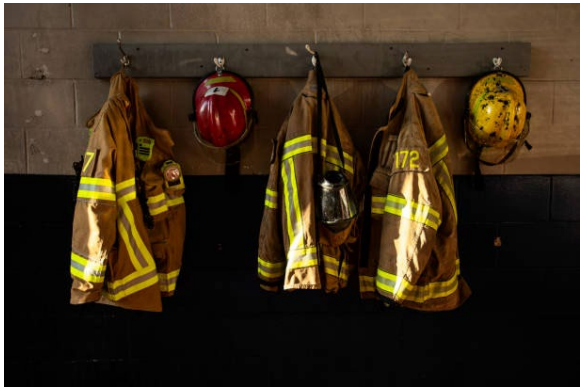
- August
  - Phase 1 data interpretation
  - Discuss and prioritize Phase 2 study objectives
- September
  - Further develop and agree on Phase 2 study objectives
  - Contract for Phase 2
  - Finalize sampling plan
- October
  - Begin sampling

Top Priority for Phase 2 Study Objective – inform management of PFAS entering sewershed

- Focus on where PFAS is coming from, in addition to where it's going
- Sample upstream in sewershed to understand PFAS concentrations from different service populations in sewershed.
- What is the relative importance of residential flows compared to commercial and industrial flows?
  - Work with R2 to compile industrial data that has already been collected
  - Which other businesses/entities are important sources?

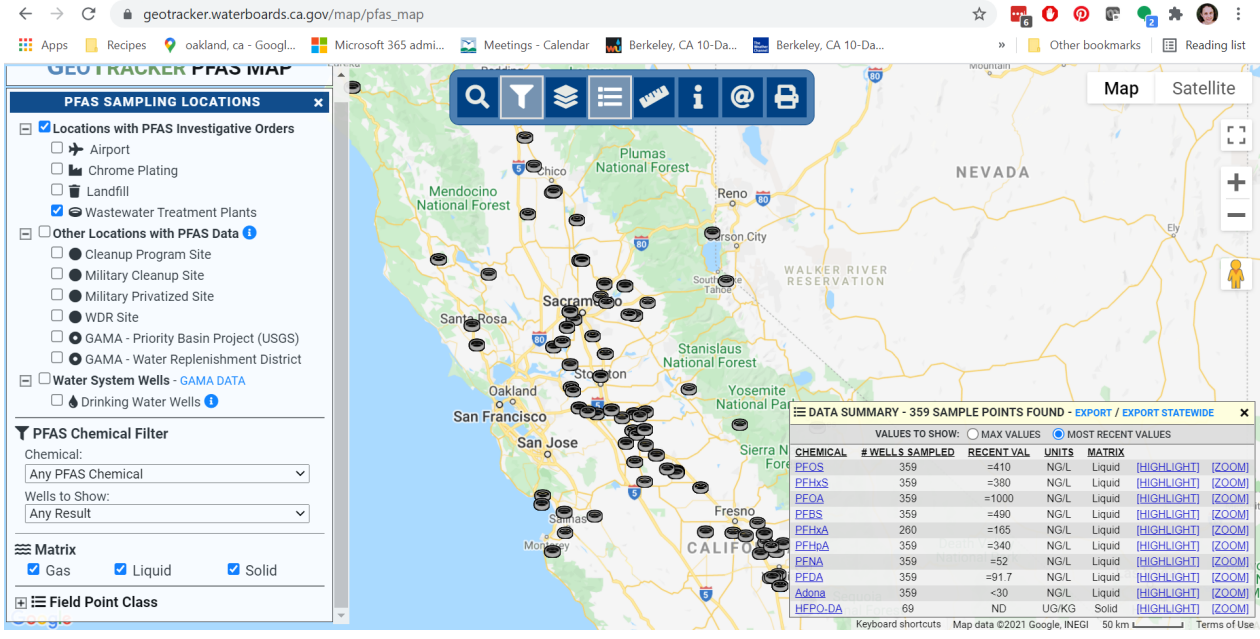
What industries or types of businesses are unique or are disproportionately high sources of PFAS (if any)?

- Car washes
- Laundries/carpet cleaners
- Dry cleaners
- Manufacturing
- Hospitals
- Prisons
- Fire stations
- Food waste/organics



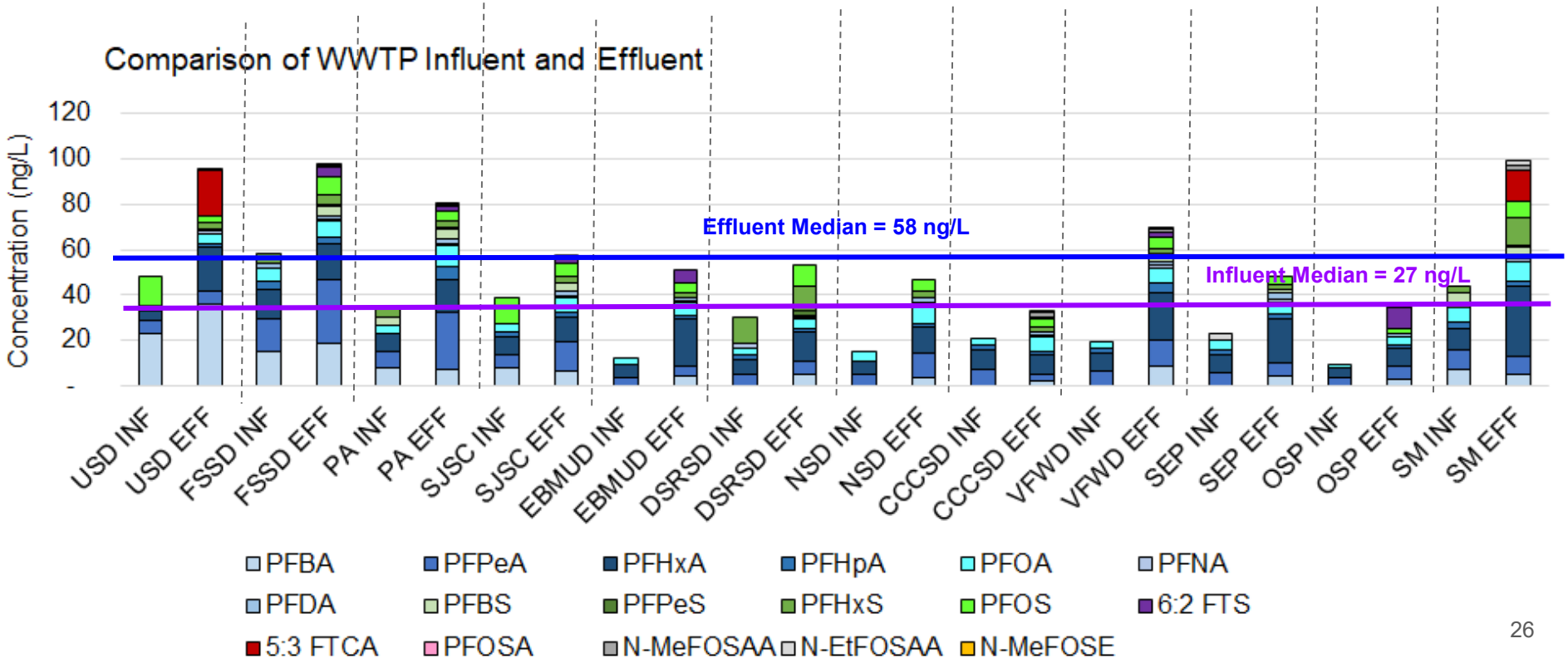
Additional possible follow-up investigations

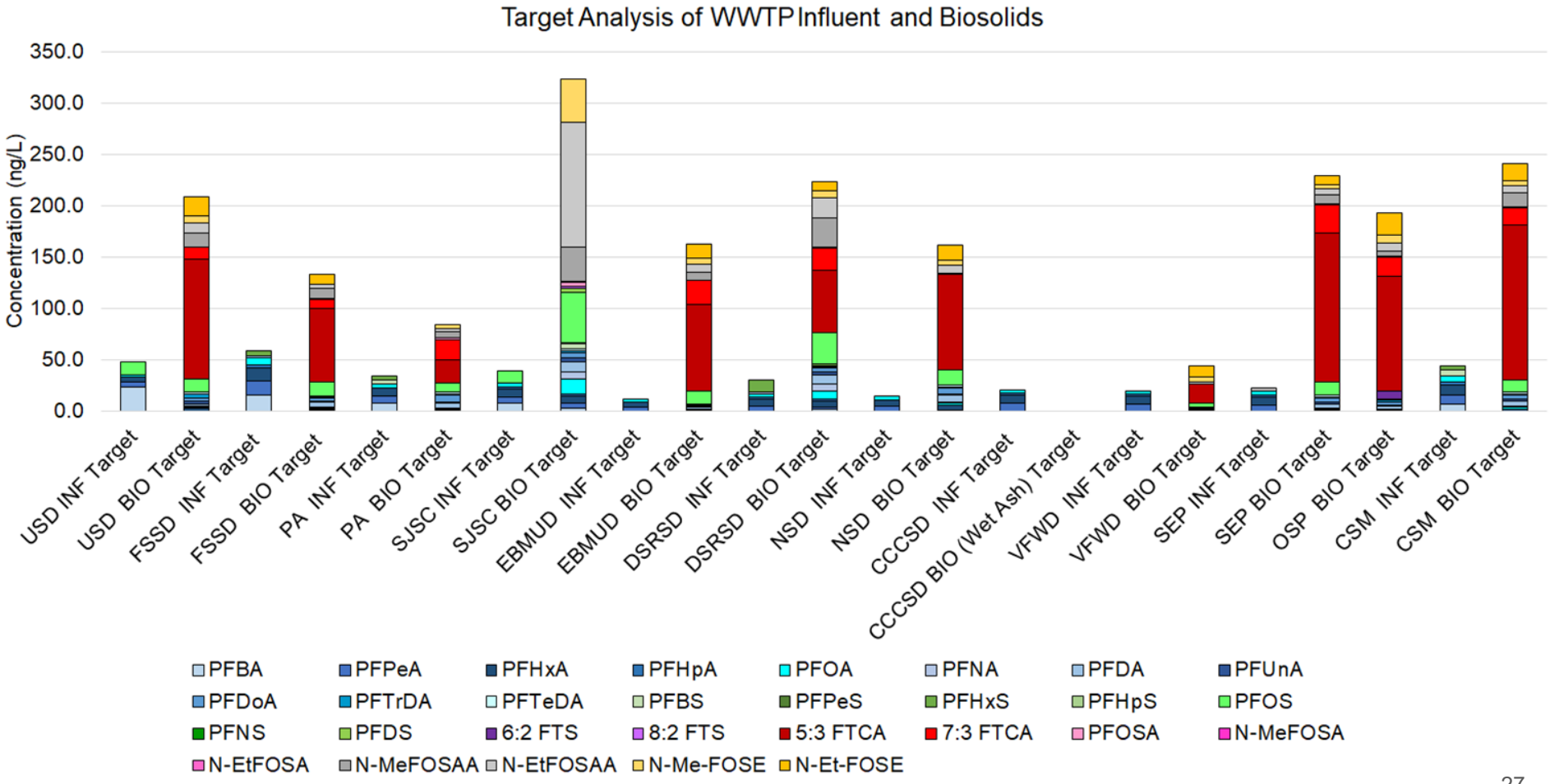
- Compare R2 data to statewide data
- Use TOP to do PFAS mass balance within a POTW
- Investigate the use of TOF to compare total oxidizable precursors to total

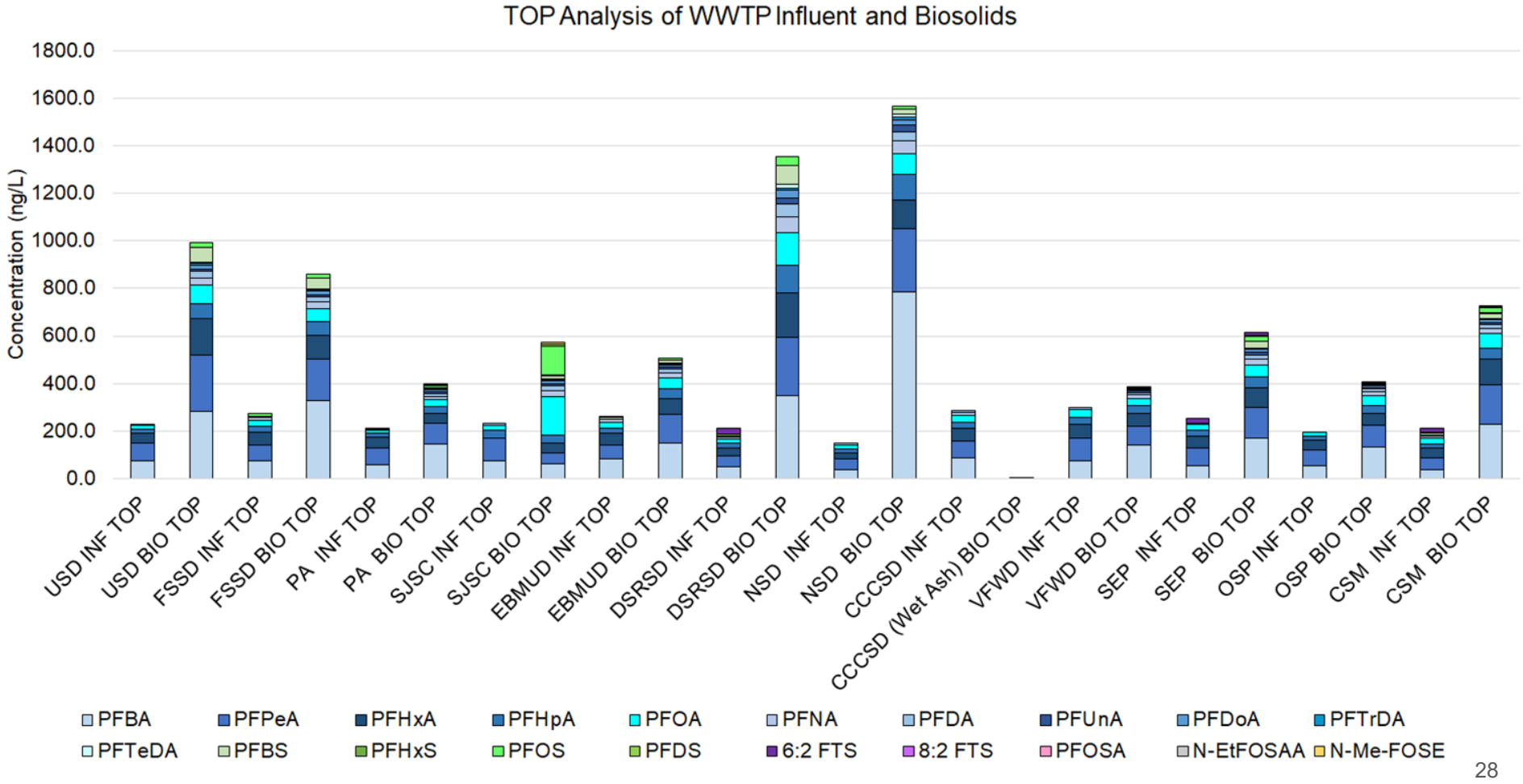


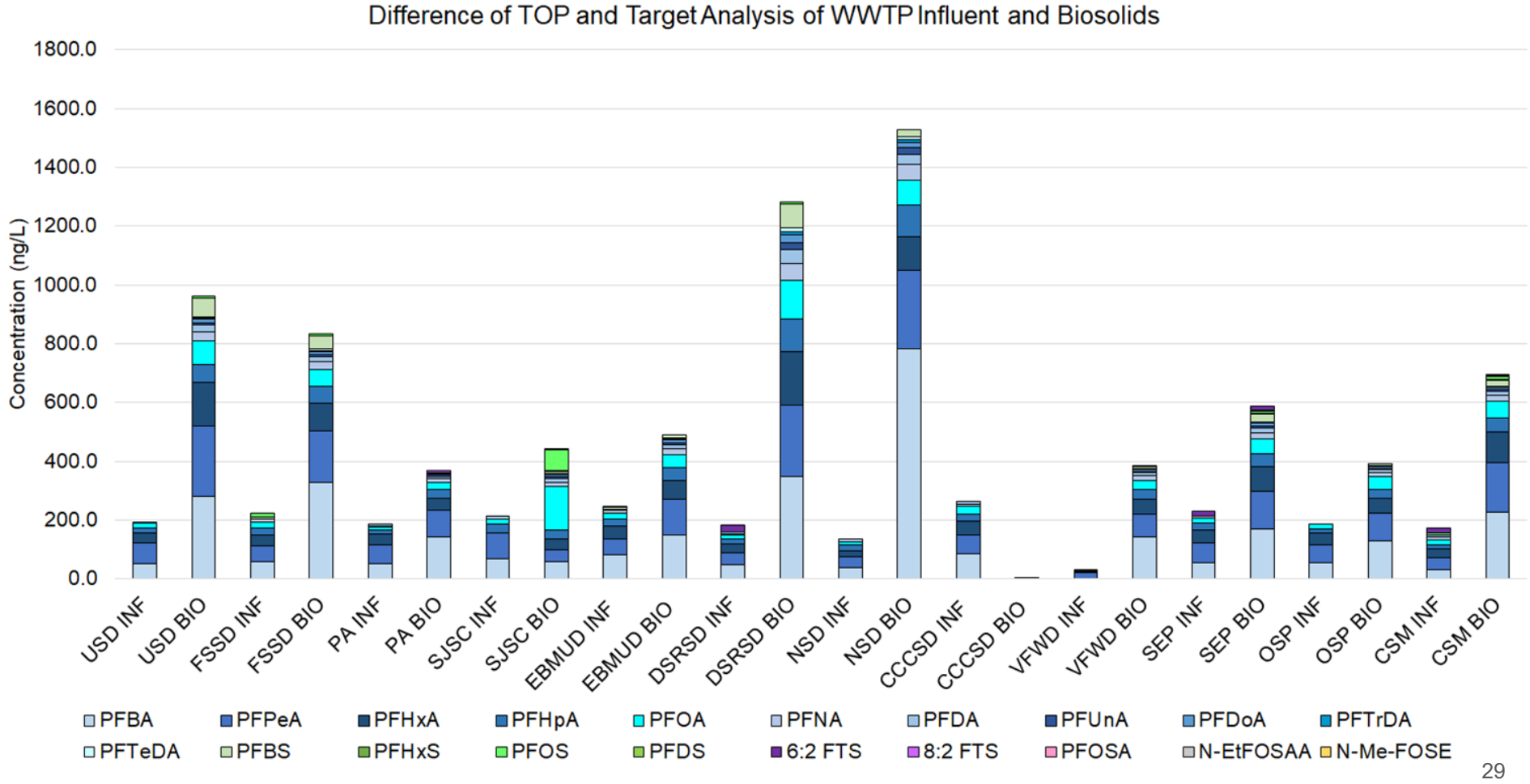
Questions?

Sum of PFAS measured in effluent increased compared to influent




Target Analysis of WWTP Influent and Biosolids
Concentration (ng/L)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
USD INF Target
USD BIO Target
FSSD INF Target
FSSD BIO Target
PA INF Target
PA BIO Target
SJSC INF Target
SJSC BIO Target
EBMUD INF Target
EBMUD BIO Target
DSRSD INF Target
DSRSD BIO Target
NSD INF Target
NSD BIO Target
CCCSD INF Target
CCCSD BIO (Wet Ash) Target
VFWD INF Target
VFWD BIO Target
SEP INF Target
SEP BIO Target
OSP BIO Target
CSM INF Target
CSM BIO Target
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTrDA
PFTeDA
PFBS
PFPeS
PFHxS
PFHpS
PFOS
PFNS
PFDS
6:2 FTS
8:2 FTS
5:3 FTCA
7:3 FTCA
PFOSA
N-MeFOSA
N-EtFOSA
N-MeFOSAA
N-EtFOSAA
N-Me-FOSE
N-Et-FOSE


TOP Analysis of WWTP Influent and Biosolids
Concentration (ng/L)
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
USD INF TOP
USD BIO TOP
FSSD INF TOP
FSSD BIO TOP
PA INF TOP
PA BIO TOP
SJSC INF TOP
SJSC BIO TOP
EBMUD INF TOP
EBMUD BIO TOP
DSRSD INF TOP
DSRSD BIO TOP
NSD INF TOP
NSD BIO TOP
CCCSD INF TOP
CCCSD (Wet Ash) BIO TOP
VFWD INF TOP
VFWD BIO TOP
SEP INF TOP
SEP BIO TOP
OSP INF TOP
OSP BIO TOP
CSM INF TOP
CSM BIO TOP
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTrDA
PFTeDA
PFBS
PFHxS
PFOS
PFDS
6:2 FTS
8:2 FTS
PFOSA
N-EtFOSAA
N-Me-FOSE


Difference of TOP and Target Analysis of WWTP Influent and Biosolids
Concentration (ng/L)
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
USD INF
USD BIO
FSSD INF
FSSD BIO
PA INF
PA BIO
SJSC INF
SJSC BIO
EBMUD INF
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DSRSD INF
DSRSD BIO
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NSD BIO
CCCSD INF
CCCSD BIO
VFWD INF
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