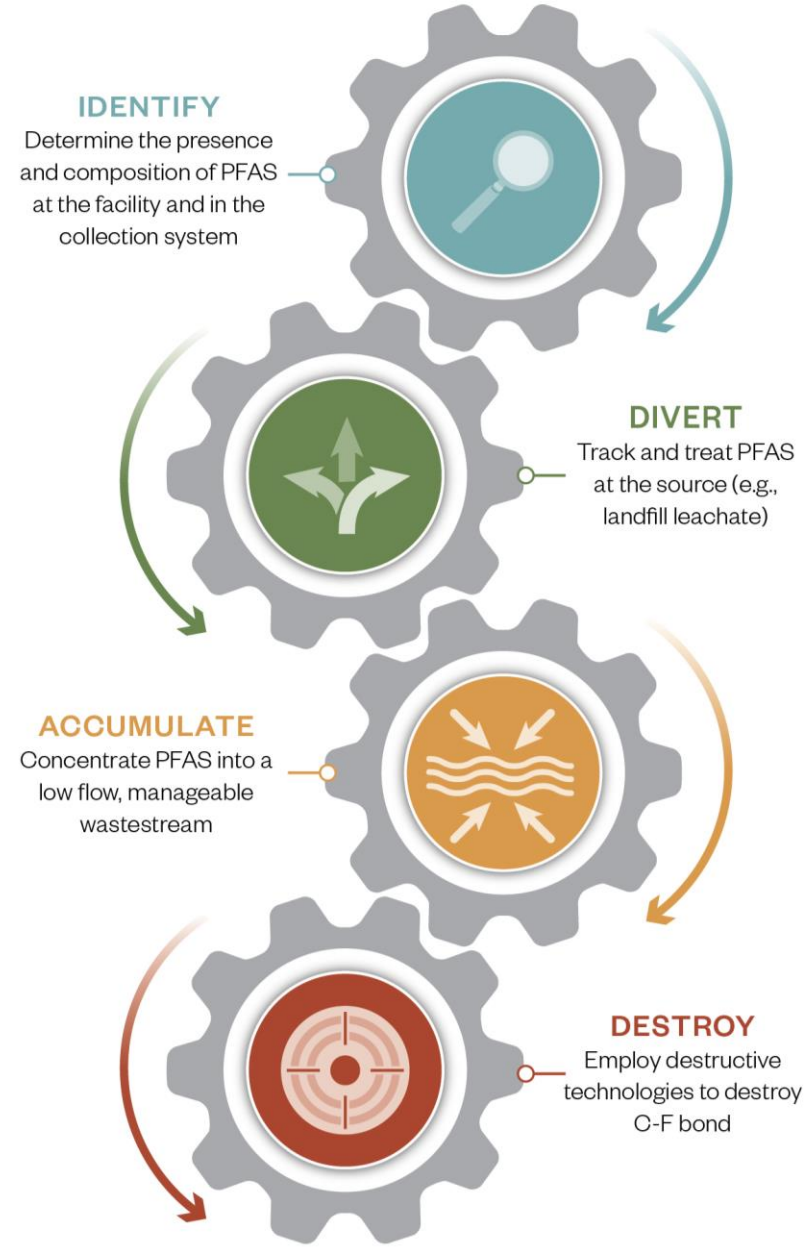
Hazen

City of Burlington's Success with Control of PFAS and 1-4 Dioxane

Kelly Landry, PhD, PE, ENVSP



North Carolina Regulatory Update

Proposed Adoption of PFOS, PFOA, and GenX Monitoring and Minimization Rules

Impacted Facilities

- Direct Industrial Dischargers
- POTWs with IPP
- SIUs in IPP

First Year Baseline Characterization

- Quarterly influent/effluent sampling and reporting of PFOA, PFOS, GenX
- EPA Method 1633

Ongoing Monitoring

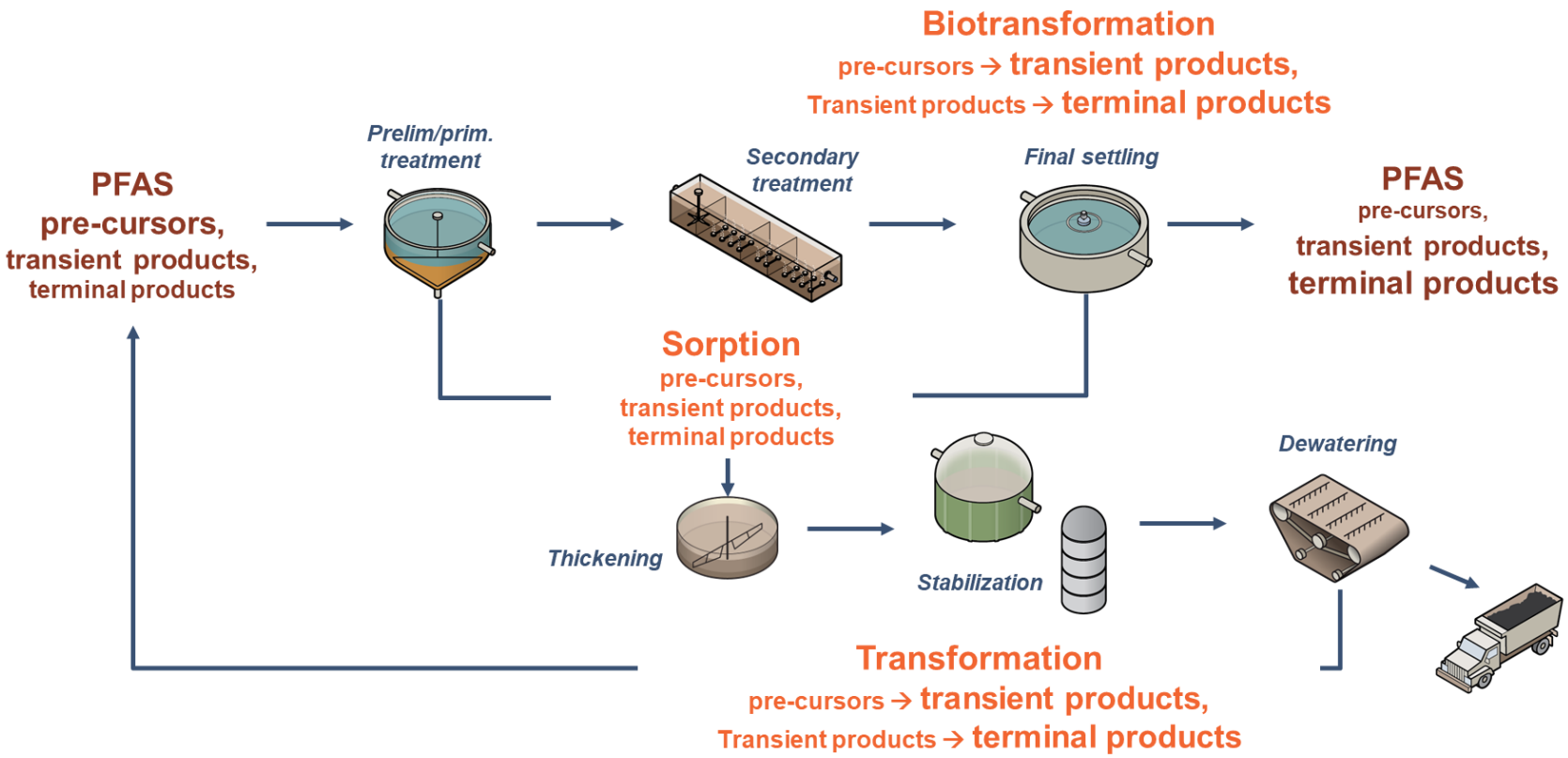
- Facilities with PFOA, PFOS, or GenX > ND
- Semi-annually until PFOA, PFOS, and Gen X < ND for four consecutive events

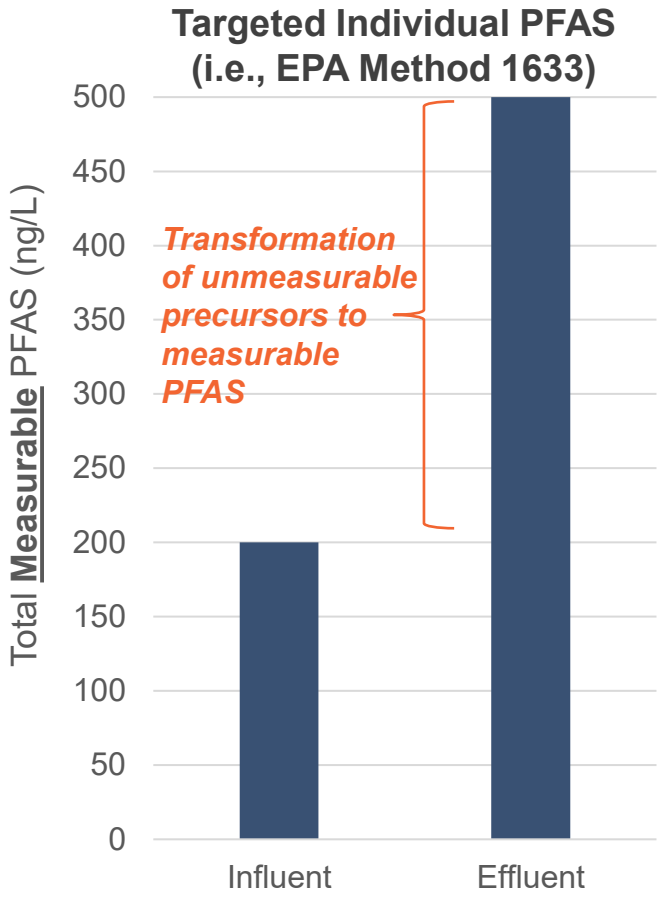
Minimization Plans

- Direct Industrial Dischargers and SIUs with PFOA, PFOS, or GenX > ND
- BMPs, process changes, treatment evaluation, timeline, goals
- Annual reporting and plan updates until goals are met

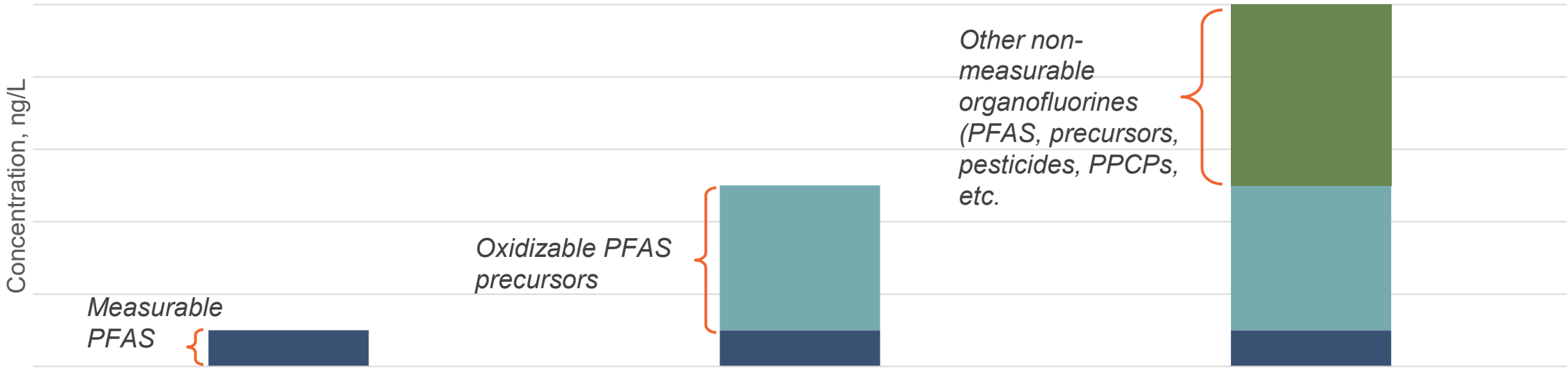
PFAS in Water Resource Reclamation Facilities

- Ubiquitous presence in the water cycle
- WRRFs are generally not producers of PFAS
- Transformation of pre-cursors can make it appears that PFAS are “generated” at WRRFs





Understanding What Different Methods Tell You Is Critical



Targeted Individual PFAS

- EPA Method 1633A, ASTM D8421
- Only measures 40 compounds; does not quantify non-measurable PFAS
- Informs sources and transformation through treatment process and downstream impacts in effluent

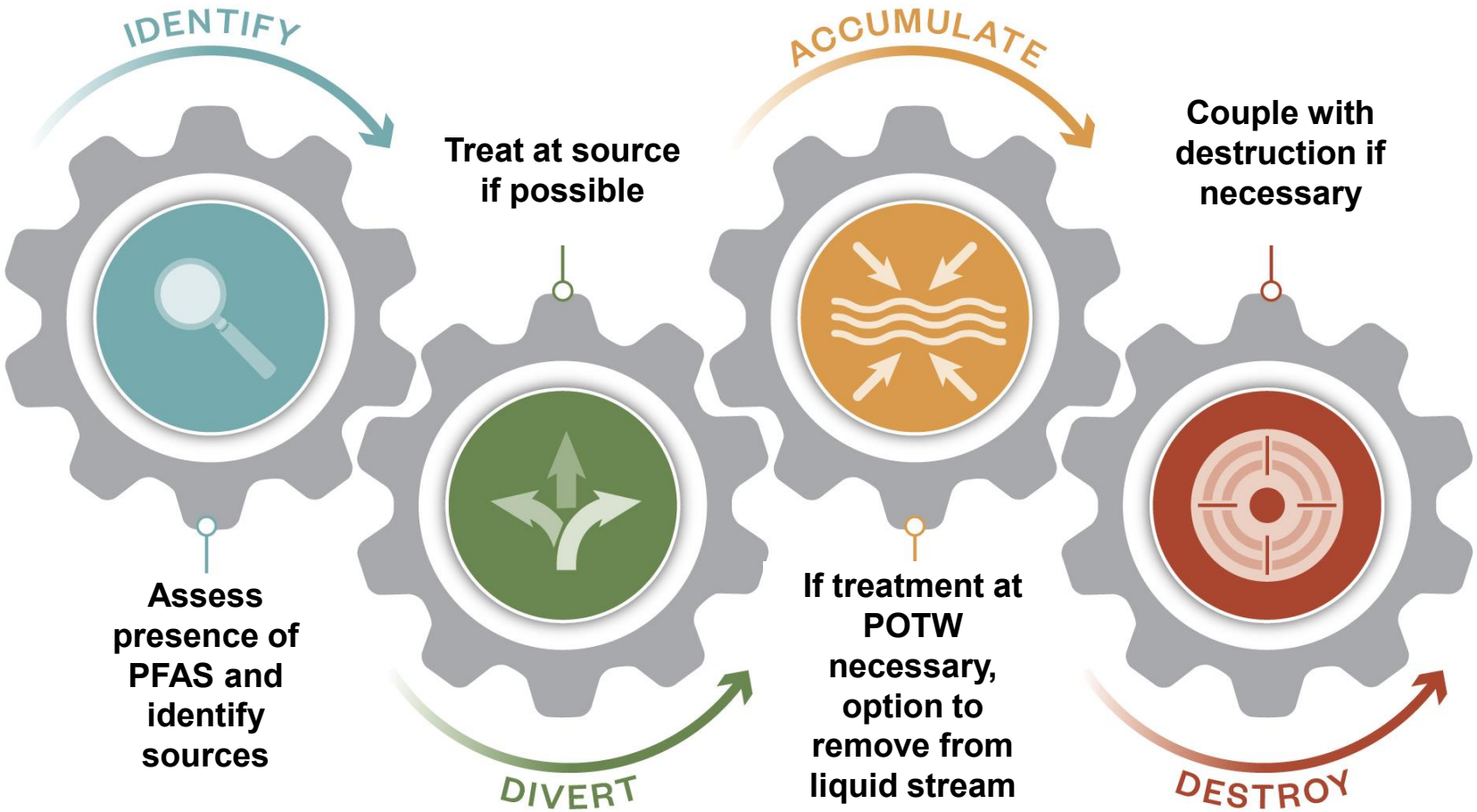
Total Oxidizable Precursors

- No standard method currently; lab variability
- Measures oxidizable PFAS precursors
- Informs precursor transformation potential to measurable PFAS (e.g., PFOA, PFOS)
- Model of how precursors may behave in environment by adding strong oxidant “worst case” scenario

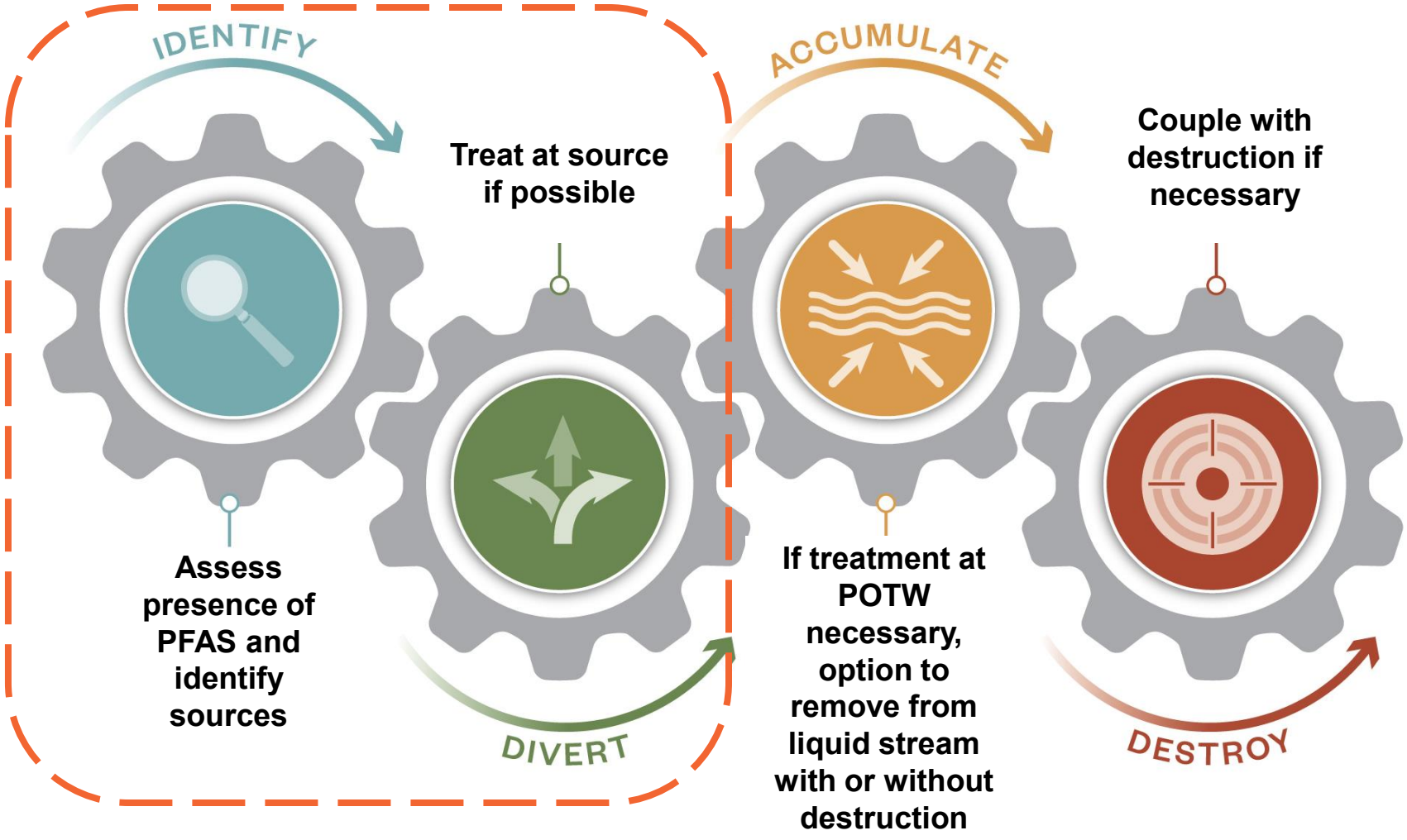
Total Organofluorine

- EPA Method 1621 for liquids; no standard method for biosolids
- Measures all organofluorines including PFAS and precursors
- Does not differentiate specific species
- Useful for screening industries

Mitigation of PFAS Requires a Multi-Pronged Approach



Mitigation of PFAS Requires a Multi-Pronged Approach



Case Study: City of Burlington PFAS Source Identification and Reduction

City of Burlington PFAS Timeline

2020-2022 PFAS Source Tracking and Control

Developed and implemented comprehensive PFAS monitoring and source tracking

2023 COB and Haw River Agreement

Reduce non-domestic PFAS discharges to EBWWTP

Reduce EBWWTP PFAS discharges

2023-Present

Ongoing PFAS monitoring support

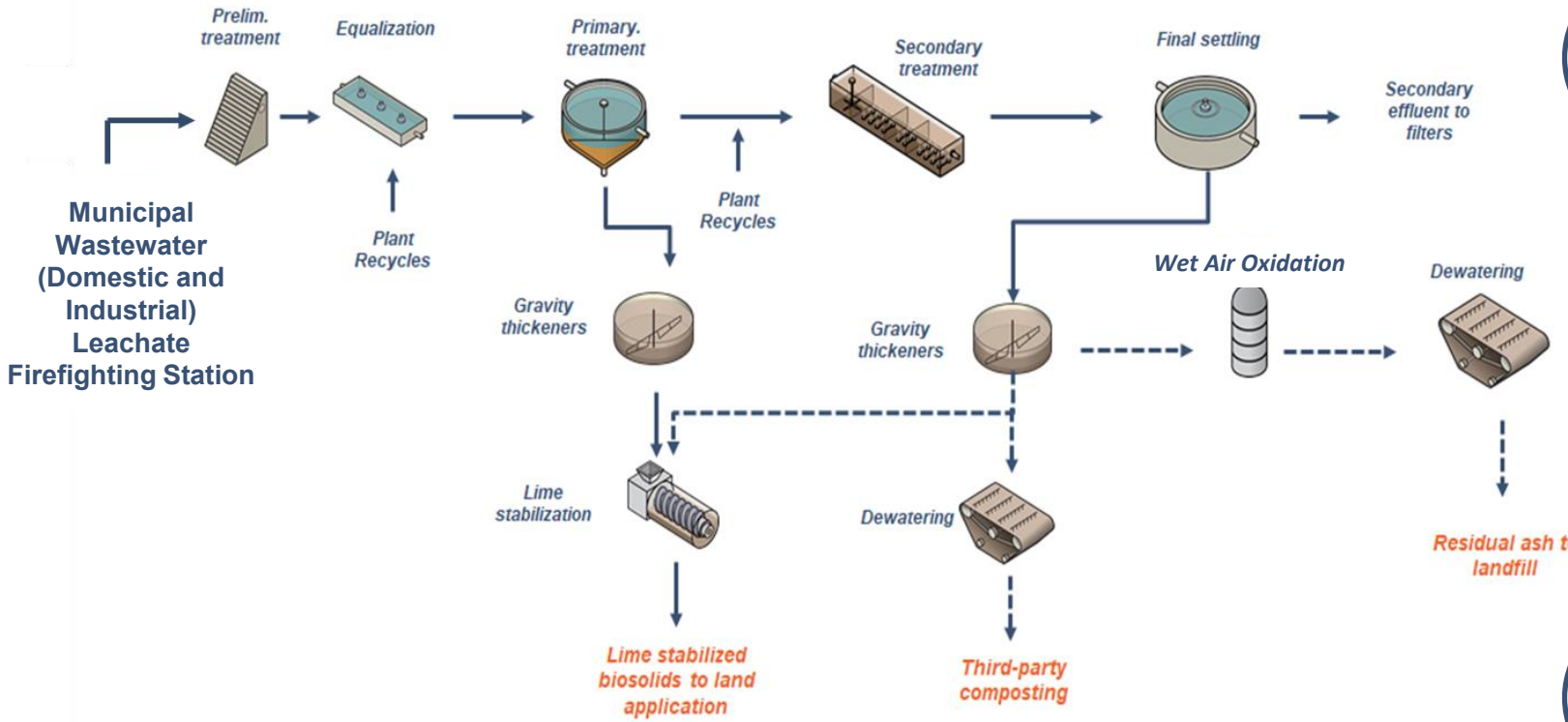
2025-Present

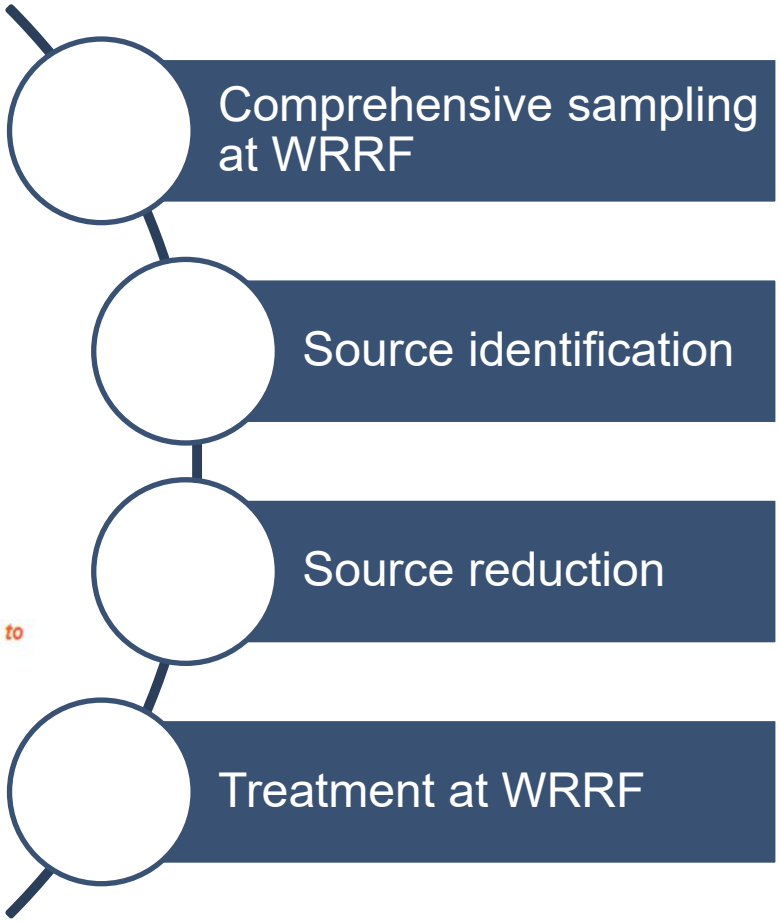
NC Pure EBWWTP GAC/IX piloting

EBWWTP Invicta piloting support

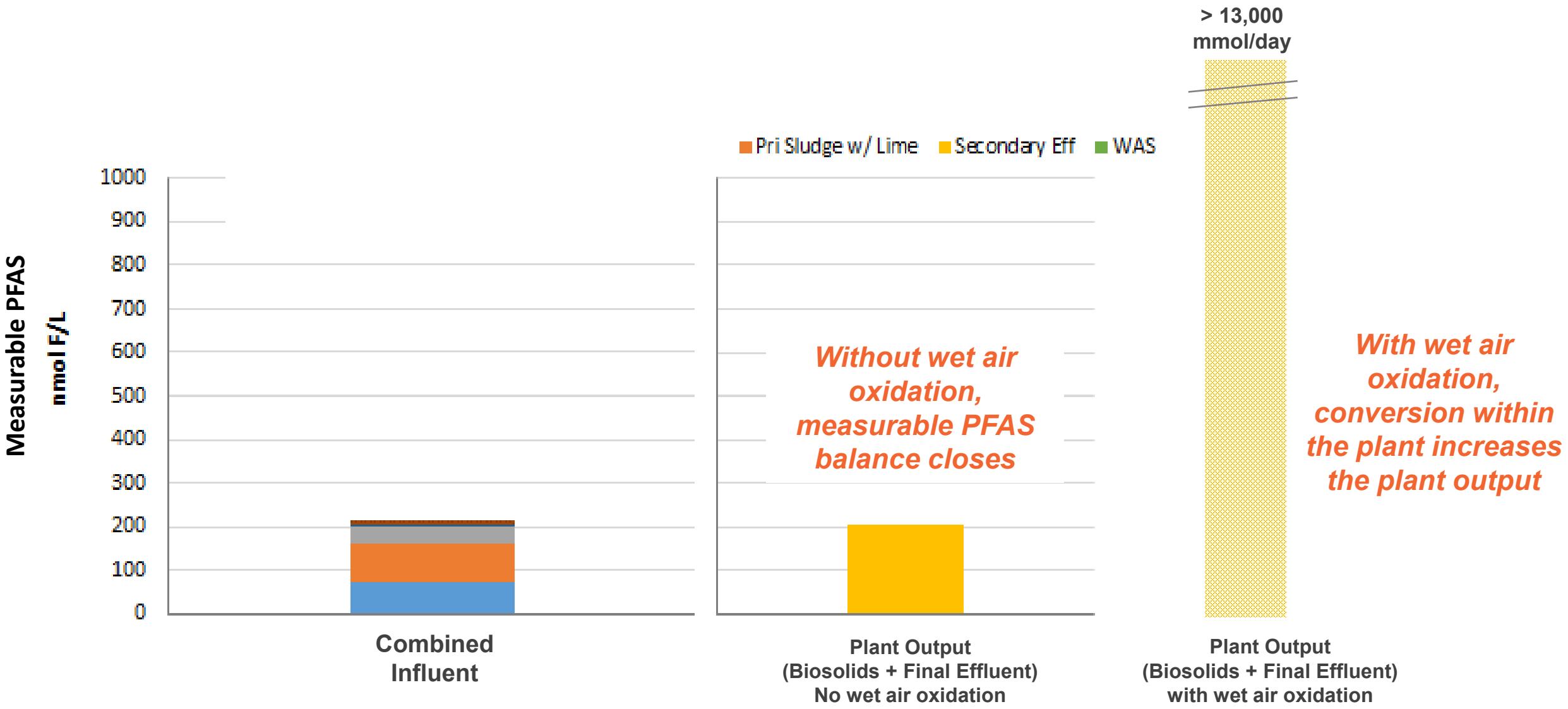
Potential future testing

Comprehensive Source Tracking and PFAS Minimization Approach

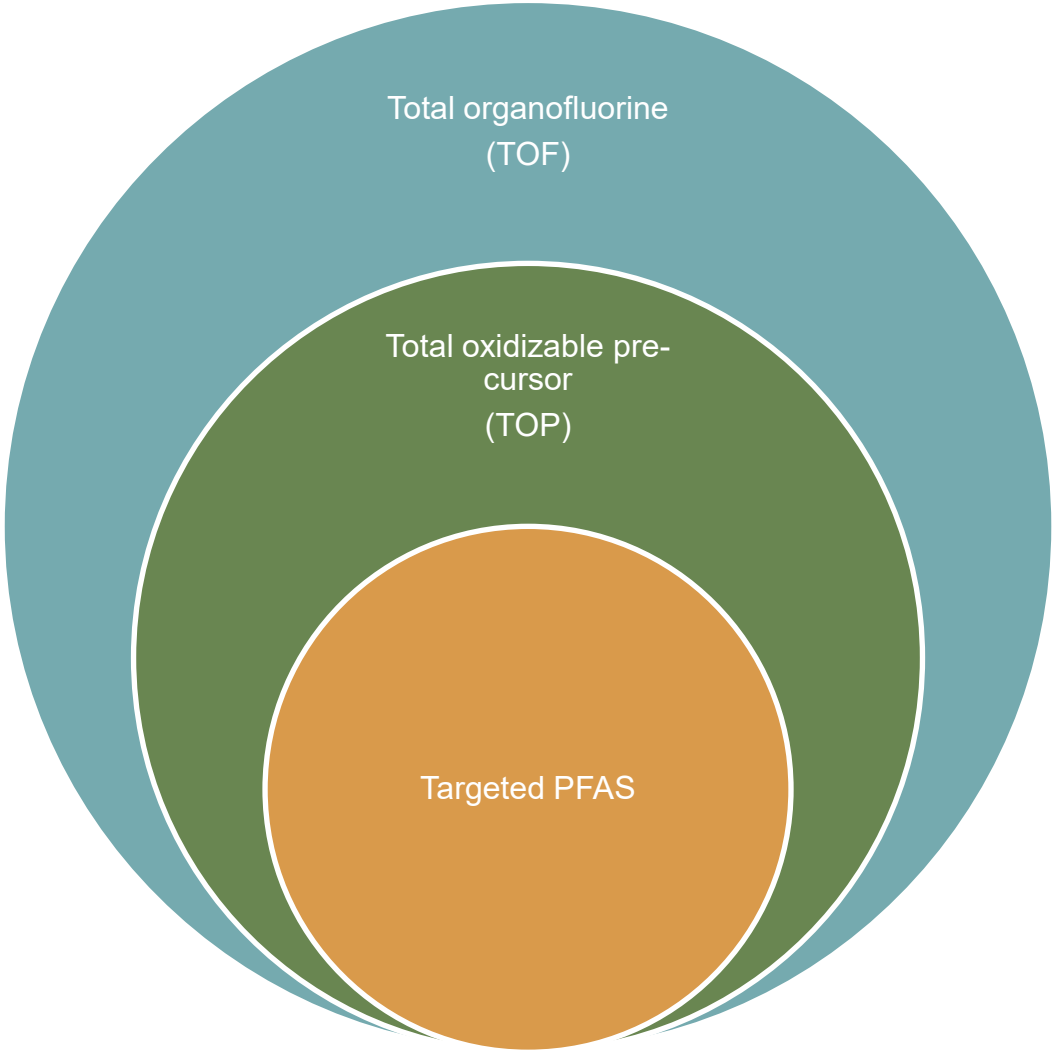




Unit Process Operation Was Observed to Impact PFAS Fate at the WRRF



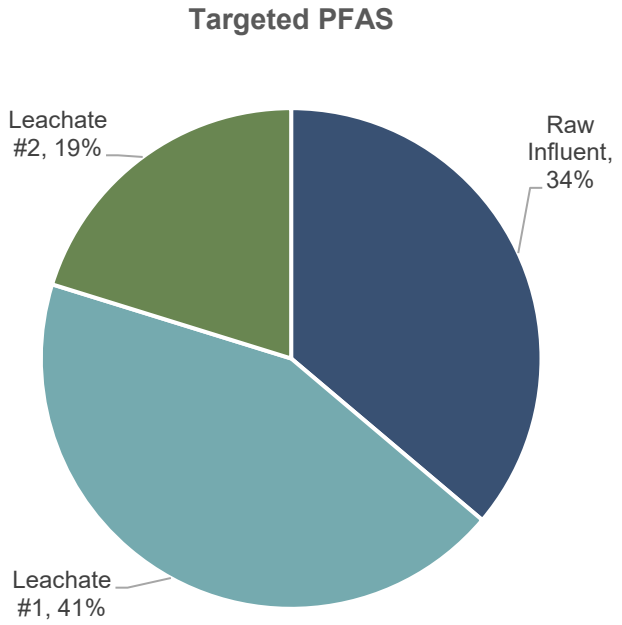
PFAS Is Complex

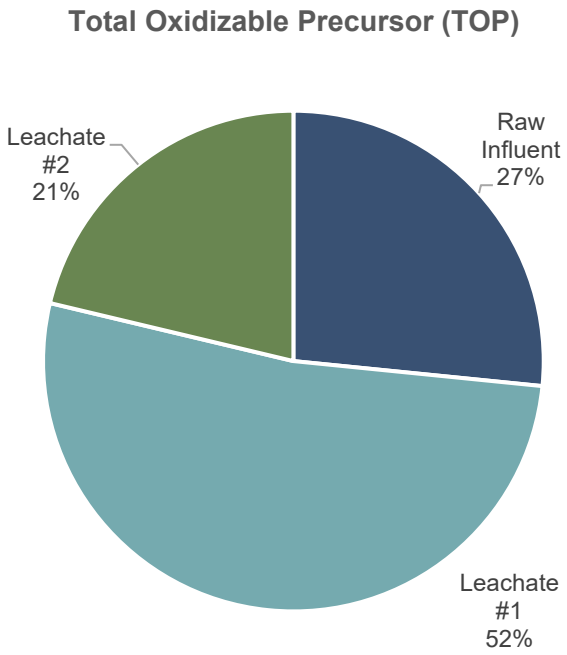


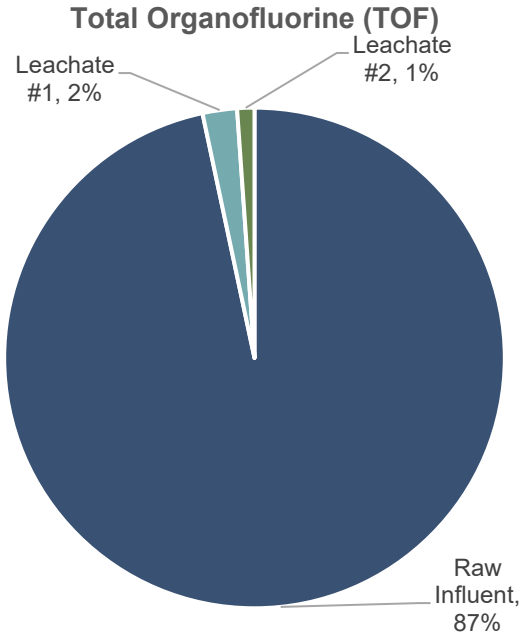
Data suggested a large bank of PFAS pre-cursors

Where Was the PFAS Coming From?

Multiple PFAS analyses were leveraged to identify sources of measurable PFAS and precursors







Leachates (~70%) and raw influent (~25%) are significant contributors to measurable PFAS (~70%)

Raw influent is also a major source of organofluorine (precursor)

"go look at industries"

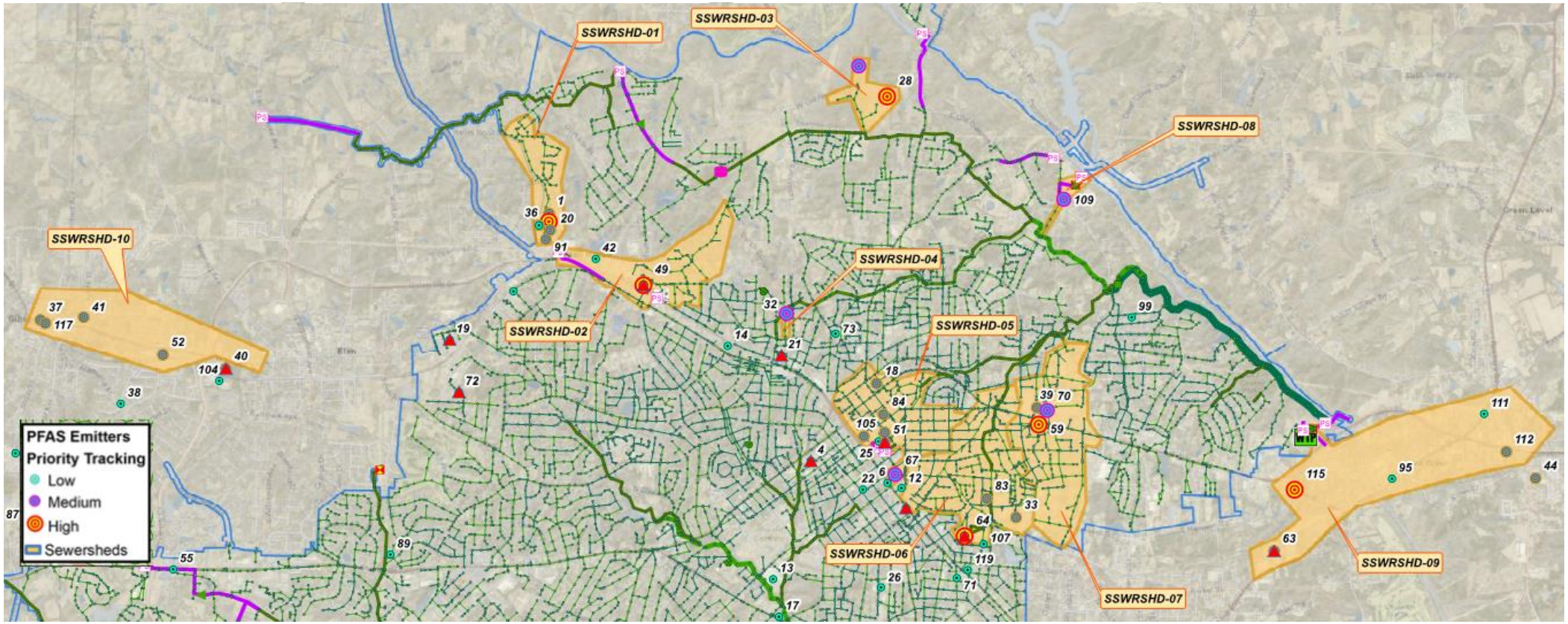
Comprehensive Risk Based Assessment and Source Tracking Was Performed to Identify Potential Dischargers

Industrial User Survey (industry type + flows)

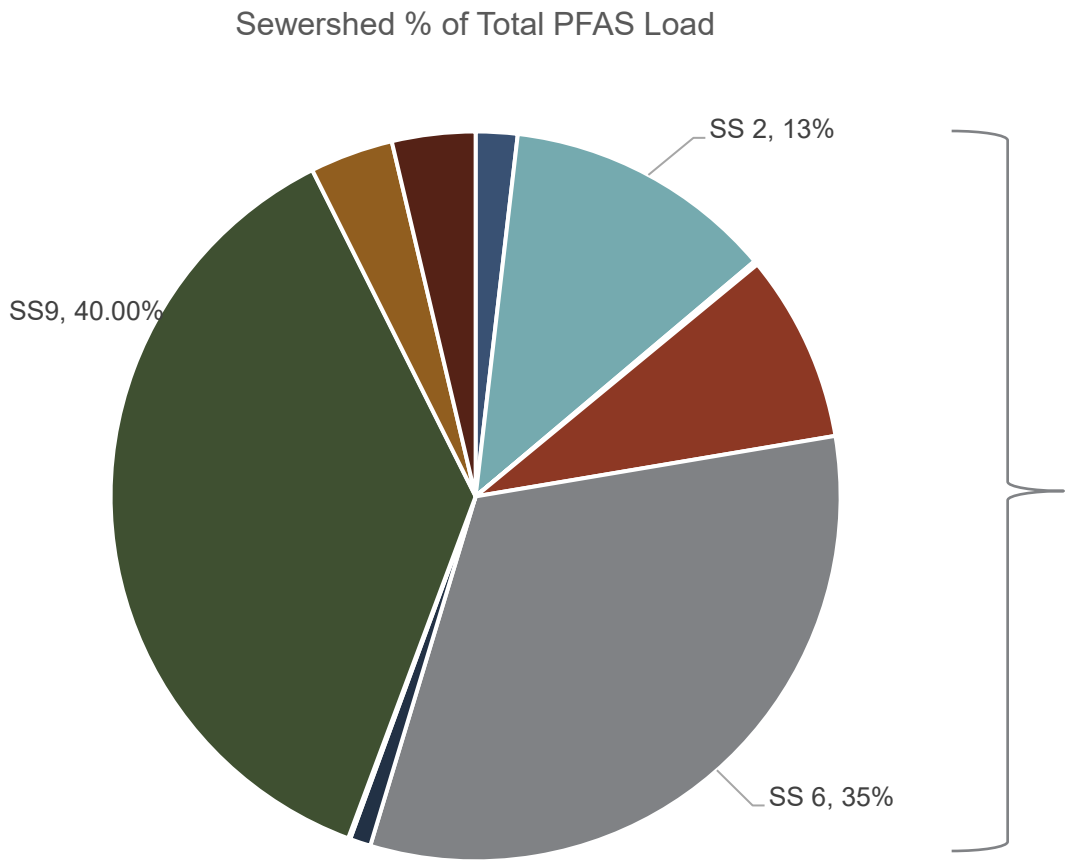
Estimate PFAS Loads (Flow x Conc)

Rank locations based on discharge potential

Perform targeted sampling at high risk locations



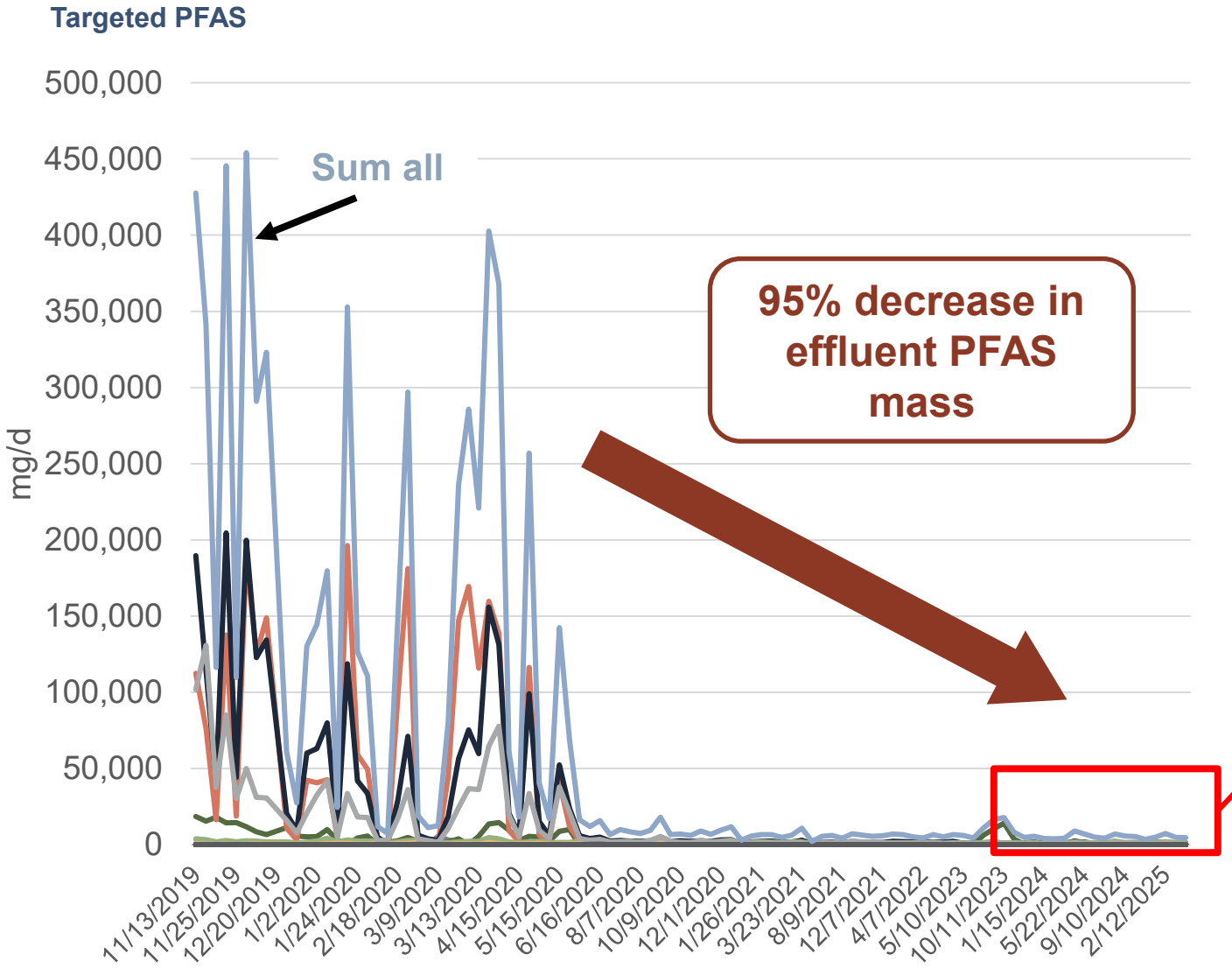
Three Sewersheds Identified as Greatest Total PFAS Contributors



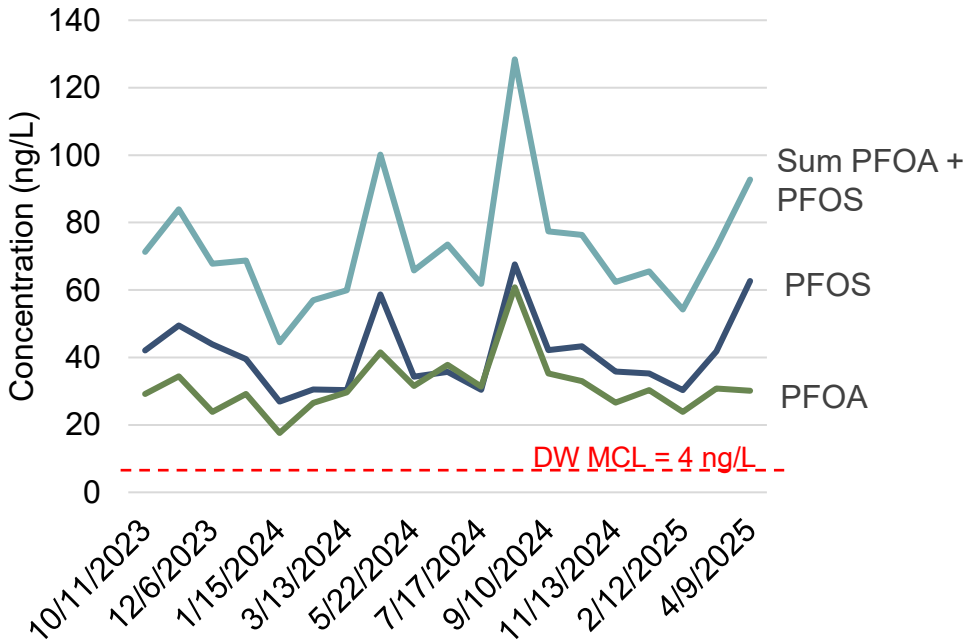
SS6 – Three textile industries
SS2 – Textile industry
SS9 – Plastic manufacturer, chemical industry, and textile industry

Coordinating with industries to phase out PFAS and/or implement closed-loop systems

Effluent PFAS Has Been Reduced Significantly



- Change in operations & source control has helped reduce PFAS mass
- Present conditions
  - **PFOA and PFOS is > 20 ng/L**

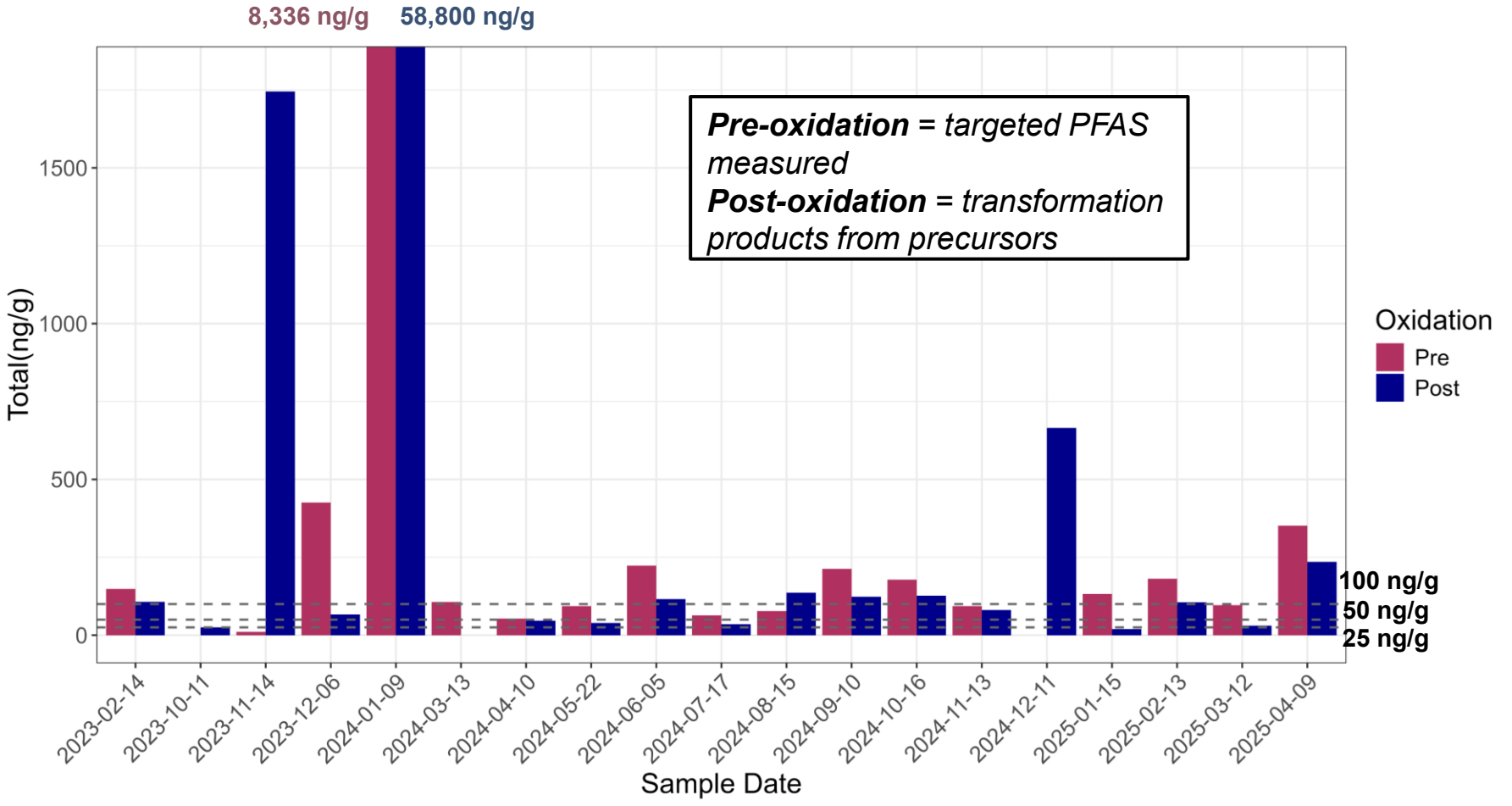


Biosolids PFAS Data Is Variable

Total PFAS

Median Total PFAS concentration similar to NC DEQ statewide biosolids study

- PFAS in biosolids in variable
- NC median = 190 ng/g
- EBWWTP median = 107 ng/g



Current PFOA and PFOS Concentrations Are Below Thresholds Identified by Other Regional States….

Pre-Oxidation PFAS

Draft EPA Risk Assessment

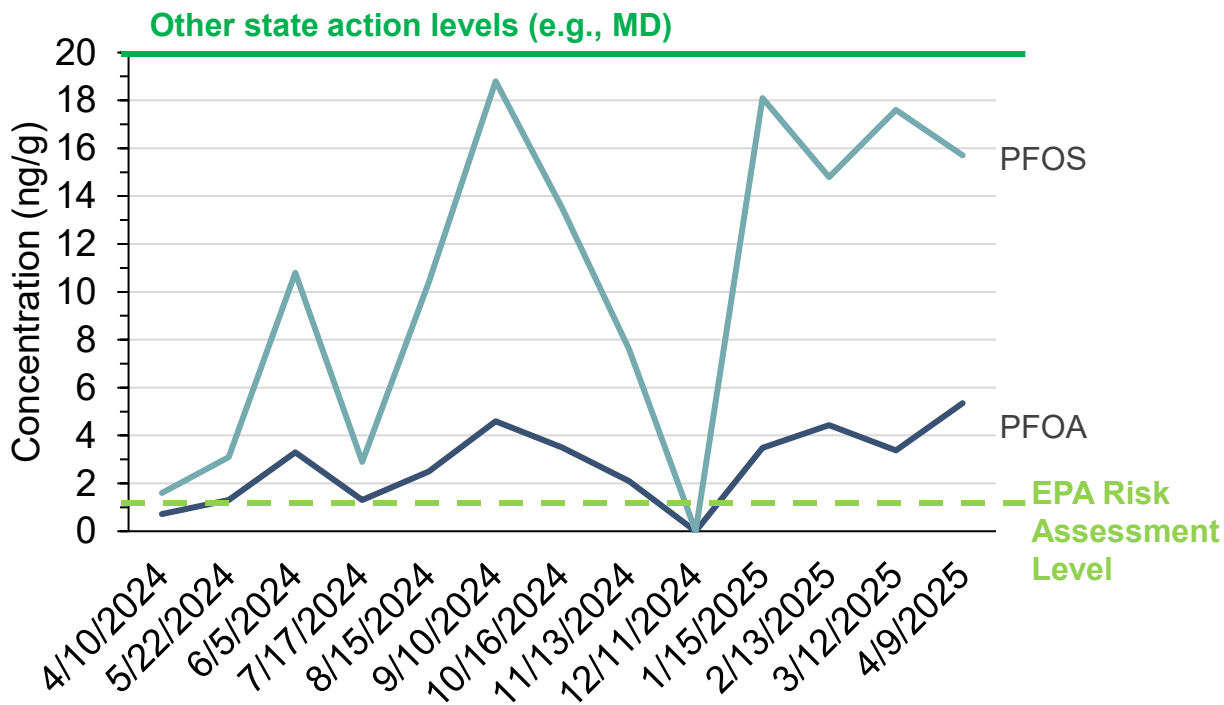
- **Land application: 1 ng/g PFOA or PFOS**
- Surface disposal, unlined: 1 ng/g PFOA or 4-5 ng/g PFOS

Maryland

- > 100 ng/g PFOS or PFOA: No land application
- 50 - 100 ng/g PFOS or PFOA: Land application ≤ 1.5 dt/acre
- 20 - 50 ng/g PFOS or PFOA: Land application ≤ 3 dt/acre
- **< 20 ng/g PFOS or PFOA: No restrictions**

Virginia

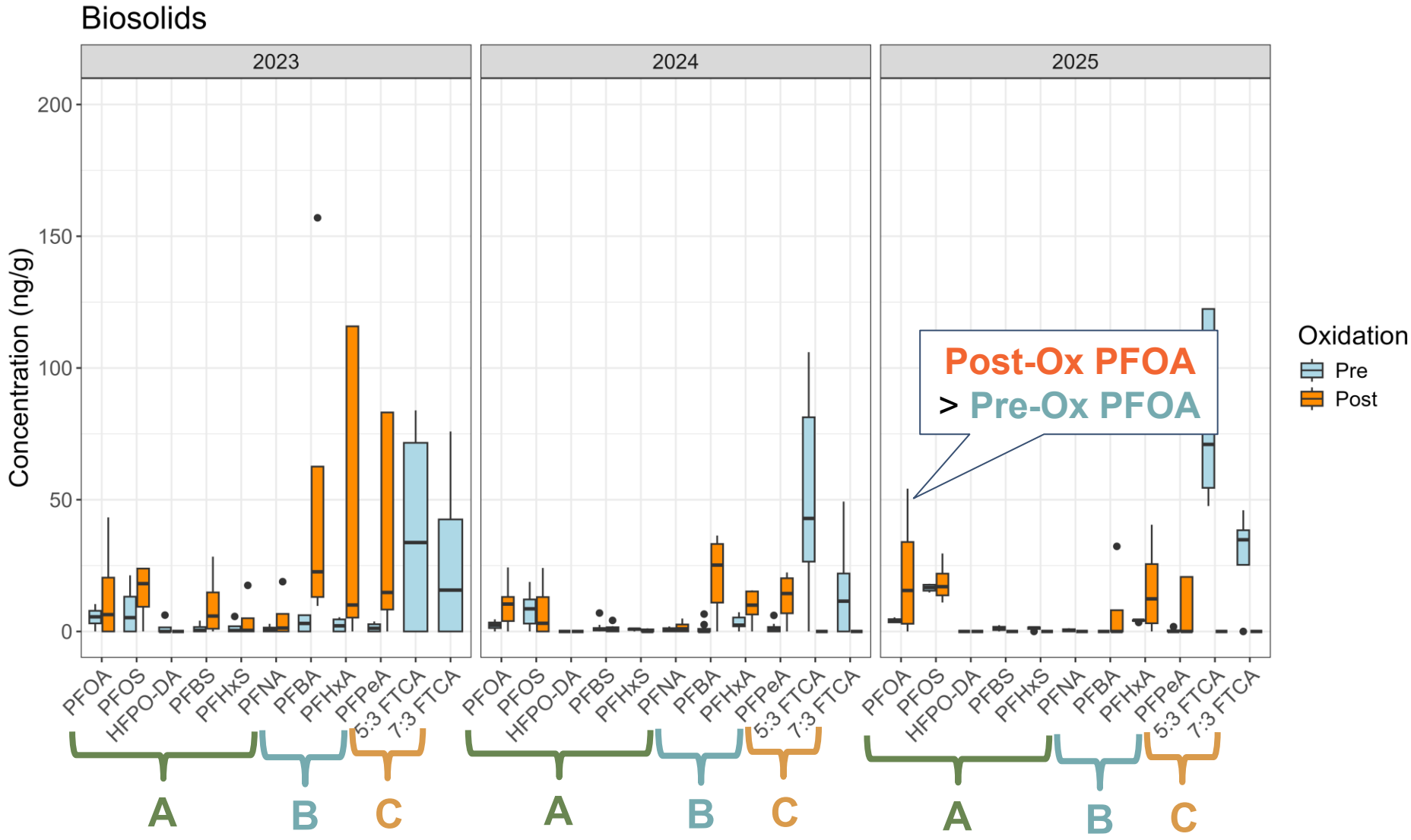
- > 50 ng/g PFOS or PFOA: No land application
- 25 – 50 ng/g PFOS or PFOA: Land application ≤ 3 dt/acre
- **< 25 ng/g PFOS or PFOA: No restrictions**



…But the EBWWTP Biosolids Does Contain Precursors that Can Transform to Measurable PFAS

Pre-oxidation *= targeted PFAS measured*
Post-oxidation *= transformation products from precursors*

- Precursors present
- Some transformation potential into PFOA/PFOS
- Transformation potential into PFAS not currently regulated

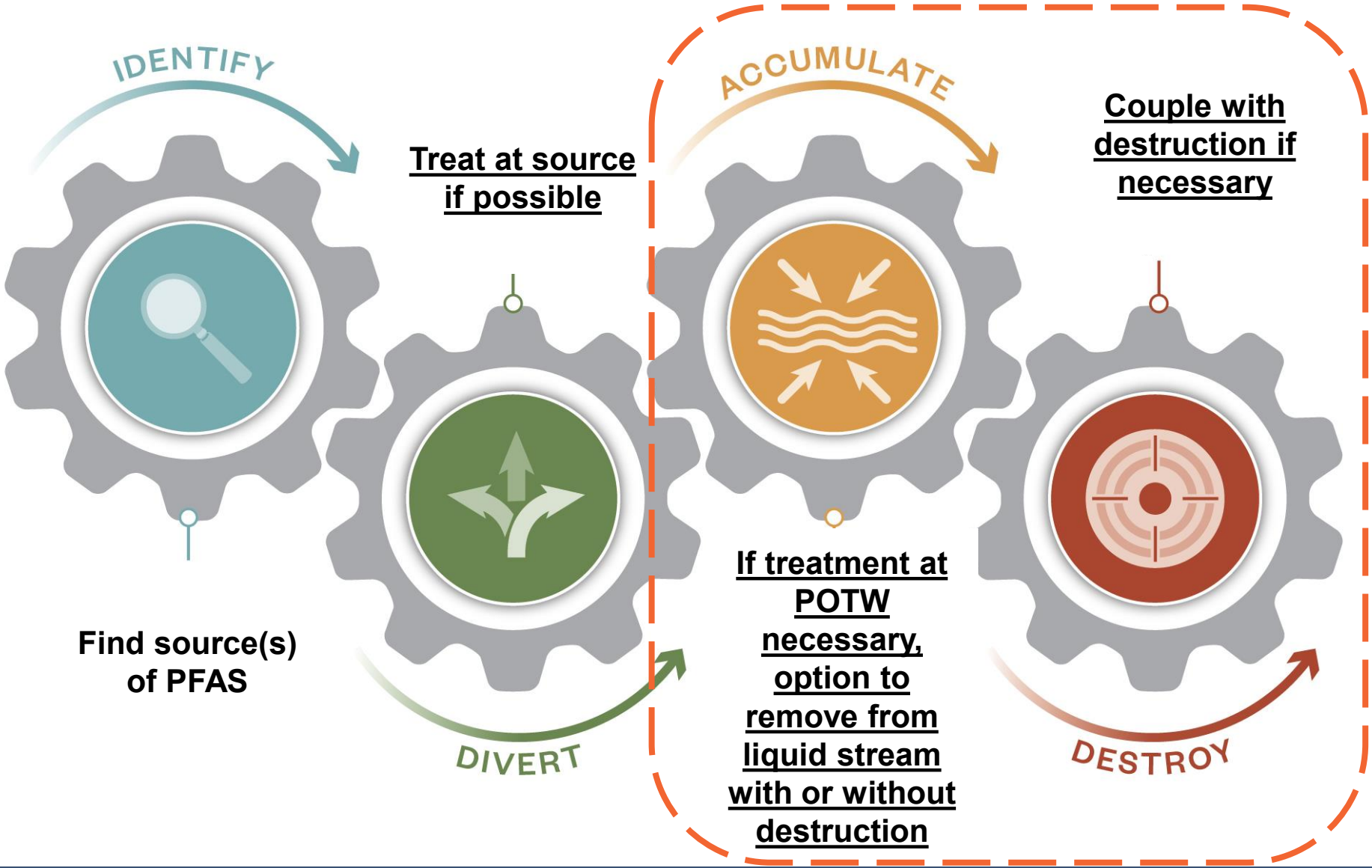


A - PFAS in DW Standards

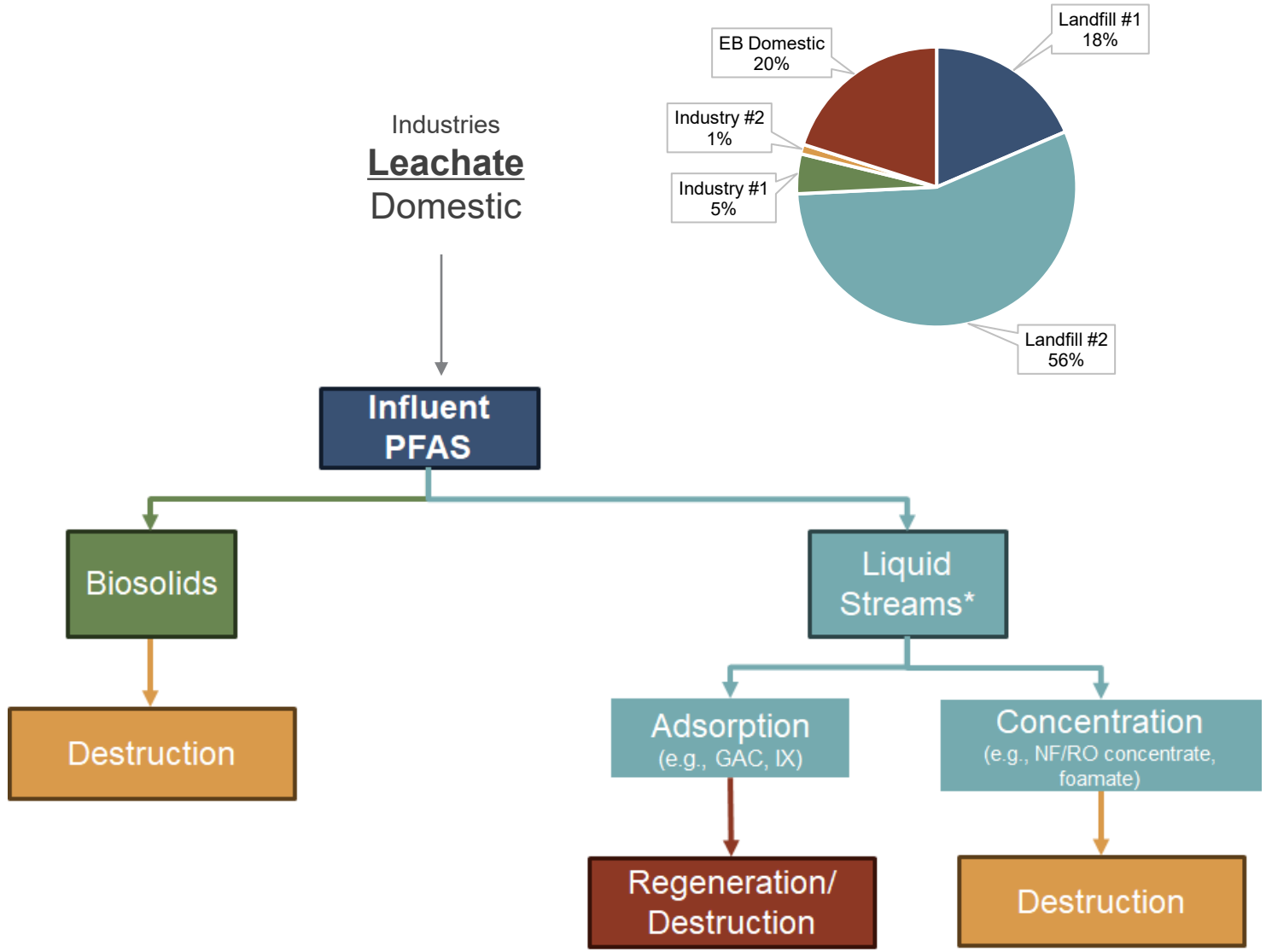
B - Higher concentration PFAS

C - Precursors

Looking into the Future: Opportunities to Reduce PFAS

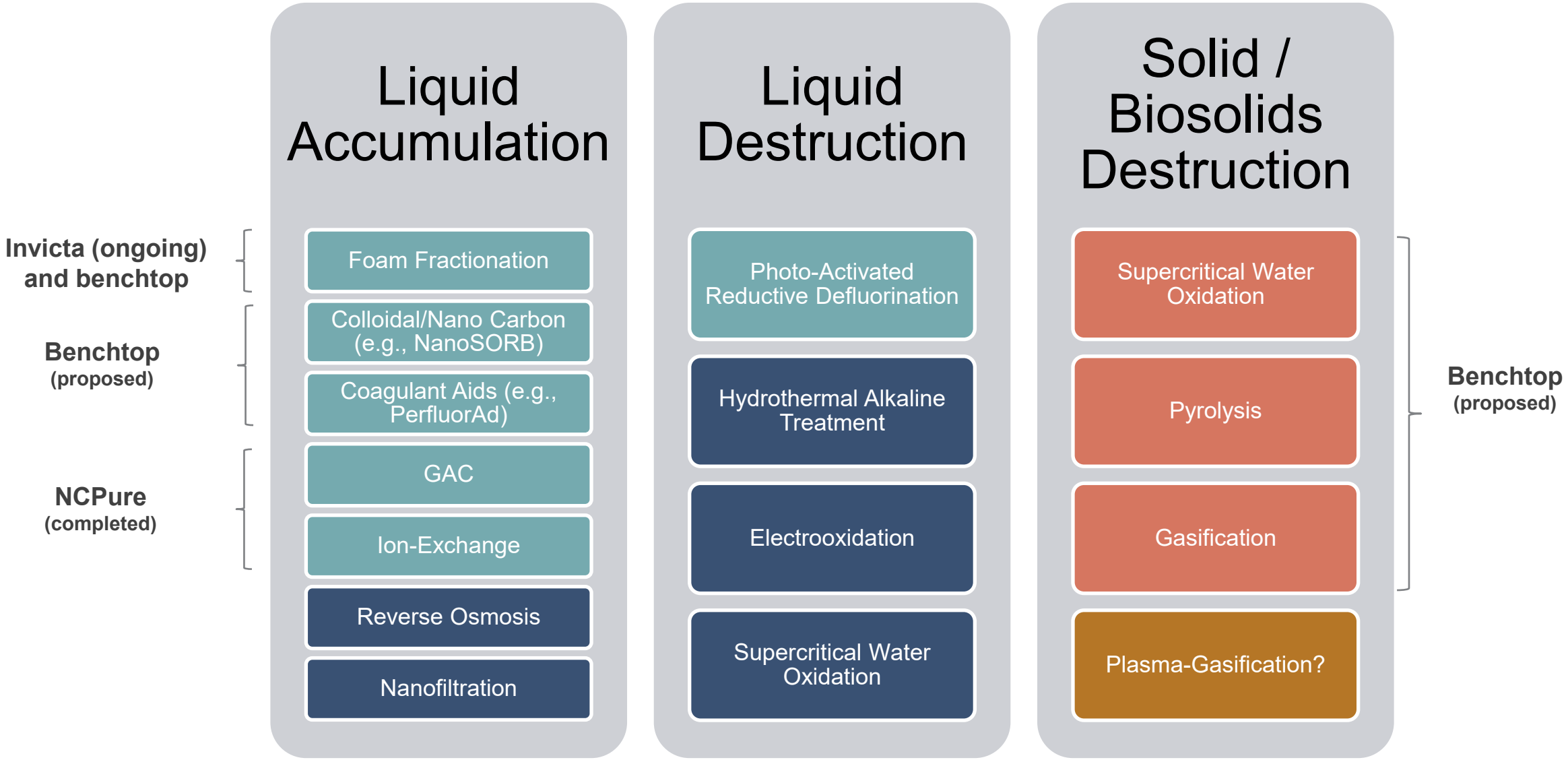


Translating to Practice for EBWWTP



**Liquid streams include primary influent, leachate, mixed liquor, secondary effluent*

State of Practice: Liquid and Solids Treatment



Questions?

Thank you!

klandry@hazenandsawyer.com