



NC DEQ PFAS Study on Wastewater Treatment Plants and Biosolids Summary

Study performed in 2023

Power Point created Dec. 2025

(slightly modified from version presented to the EMC on Nov 13, 2025)



Study Goal



To improve our understanding of the sources of PFAS pollution and its occurrence in wastewater discharges and biosolids.

Study Objectives



1. Investigate the prevalence of PFAS in wastewater treatment systems at select sites in NC.

2. Examine PFAS in wastewater influent, effluent, biosolids, and soil from fields where biosolids have been repeatedly land applied.

3. Generate foundational knowledge of PFAS in wastewater and biosolids for public information, future minimization efforts and to inform regulatory decision making.

Purpose and Context of the Pilot Study

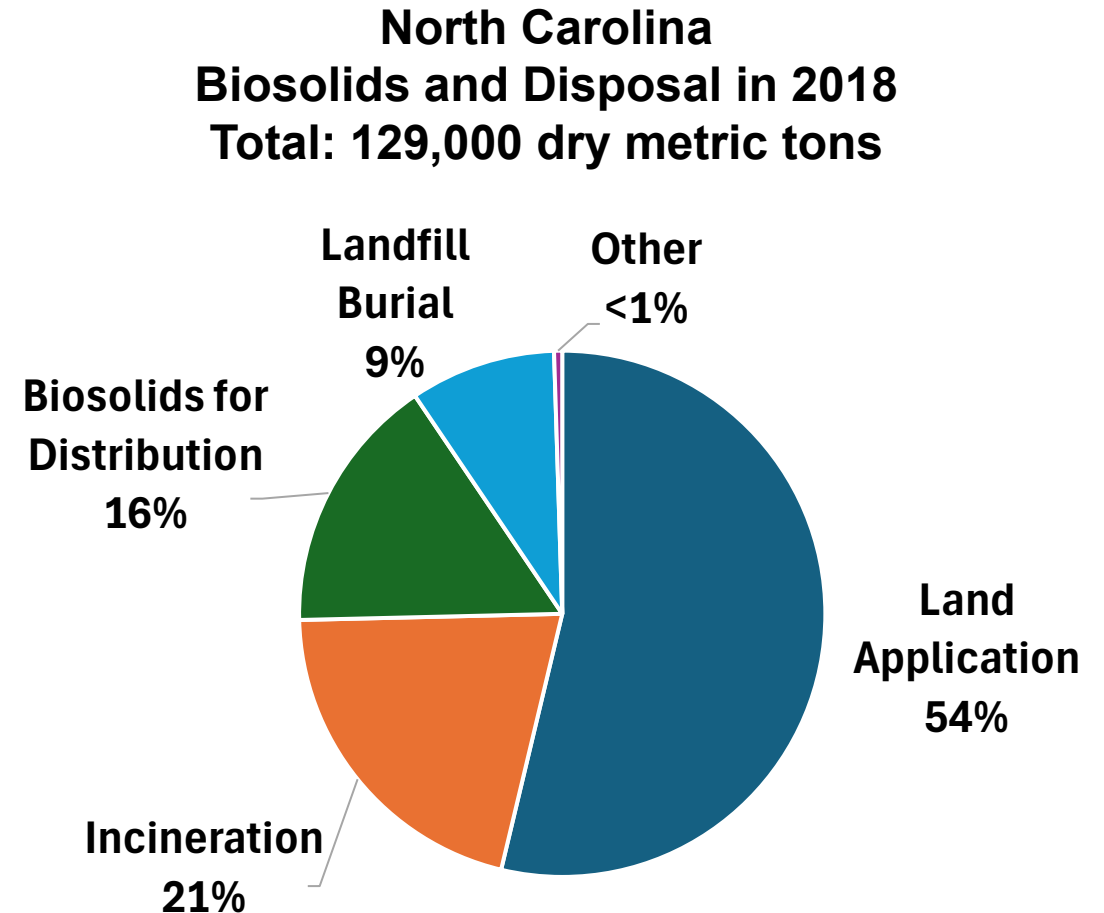
The intention of this study was to develop a preliminary dataset in collaboration with partners and stakeholders. These results represent early findings intended to inform future study design and identify opportunities for more comprehensive data collection and analysis. These findings are exploratory and not intended to serve as the basis for regulatory decisions.

The data shown in this presentation includes the different types of permitted facilities sampled based on available resources in partnership with host sites. While the number and type of facilities were not intended to represent a statistically significant sample size, the findings do provide important information on the range of PFAS concentrations measured and highlight opportunities for more comprehensive study designs moving forward.

Note: Measurements related to PFAS chemicals unique to the Chemours Fayetteville Works facility are still under review and will be reported in the near future.

What are Biosolids?

- Biosolids is sewage sludge that has been treated to meet the requirements in the EPA's regulation entitled, "Standards for the Use or Disposal of Sewage Sludge."
- Federal and state regulations require reductions in pathogens and the potential to spread disease.
- Uses:
 - Land application
 - Sold to public as soil amendment
 - Managed as waste (incineration, landfilled)



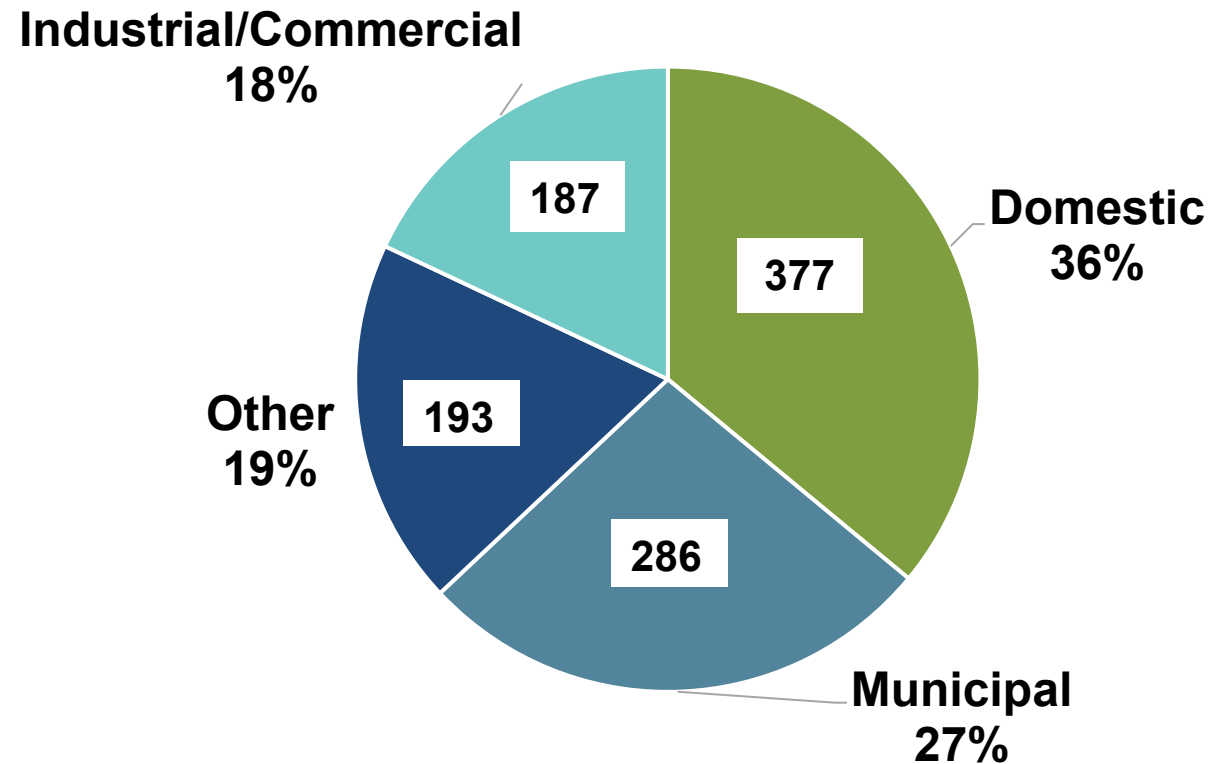
Other includes land and surface disposal and landfill alternative daily cover. Source: National Biosolids Data Project

Types of Facilities Sampled

Facilities selected based on size and three operating characteristics:

1. 100% Domestic wastewater treatment plants (n=3)
 - 100% domestic and receives no industrial wastewater
2. Industrial wastewater treatment plants (n=8)
 - Receives industrial wastewater
3. Municipal wastewater treatment plants (n=26)
 - Receives wastewater from significant industrial users, commercial, and residential sources

Number of Individual NPDES Wastewater Permits in NC



Other - primarily includes groundwater remediation facilities and water treatment plants.

Influent PFAS Data Summary

PFOS (min-max; mean)

- **100% Domestic** (4 – 14; 9 ppt)
- **Municipal** (3 – 38; 16 ppt)
- **Industrial** (3 – 121; 55 ppt)

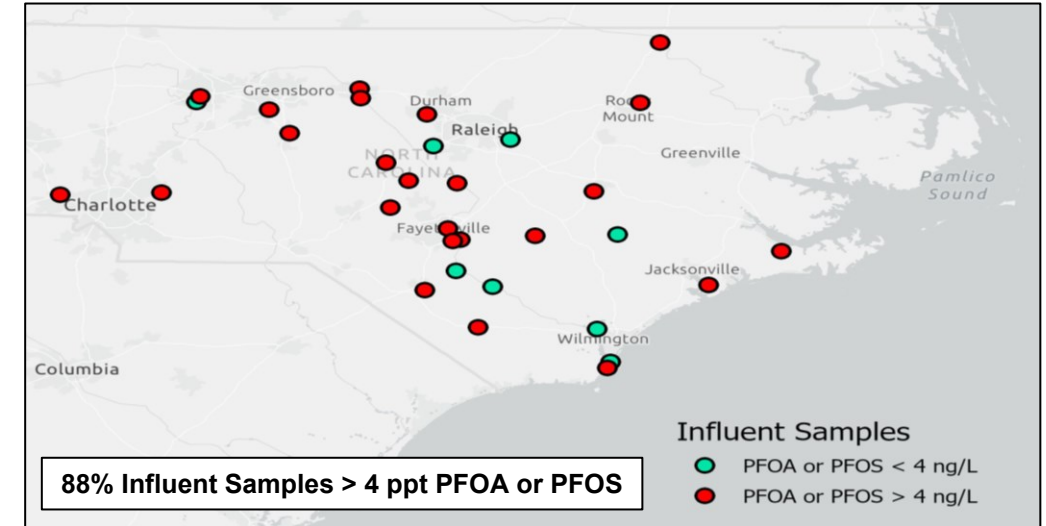
PFOA

- **100% Domestic** (3 – 8; 6 ppt)
- **Municipal** (2 – 88; 13 ppt)
- **Industrial** (3 – 51; 21 ppt)

Total PFAS¹

- **100% Domestic** (61 – 112; 80 ppt)
- **Municipal** (10 – 4124; 380 ppt)
- **Industrial** (5 – 508; 276 ppt)

1. range of (summed) 57 PFAS quantified at each facility, mean of totals from all facilities in permit category



Observations

- Domestic WWTPs had lower average PFAS **entering** the plant than industrial and municipal.
- Municipal and industrial WWTPs had similar incoming mean total PFAS concentrations.
 - Municipal measurements had a greater variance.
- The municipal influent included discharges from industries associated with PFAS.

Effluent PFAS Data Summary

PFOS (min-max; mean)

- **100% Domestic** (3 – 16; 10 ppt)
- **Municipal** (2 – 39; 13 ppt)
- **Industrial** (2 – 86; 36 ppt)

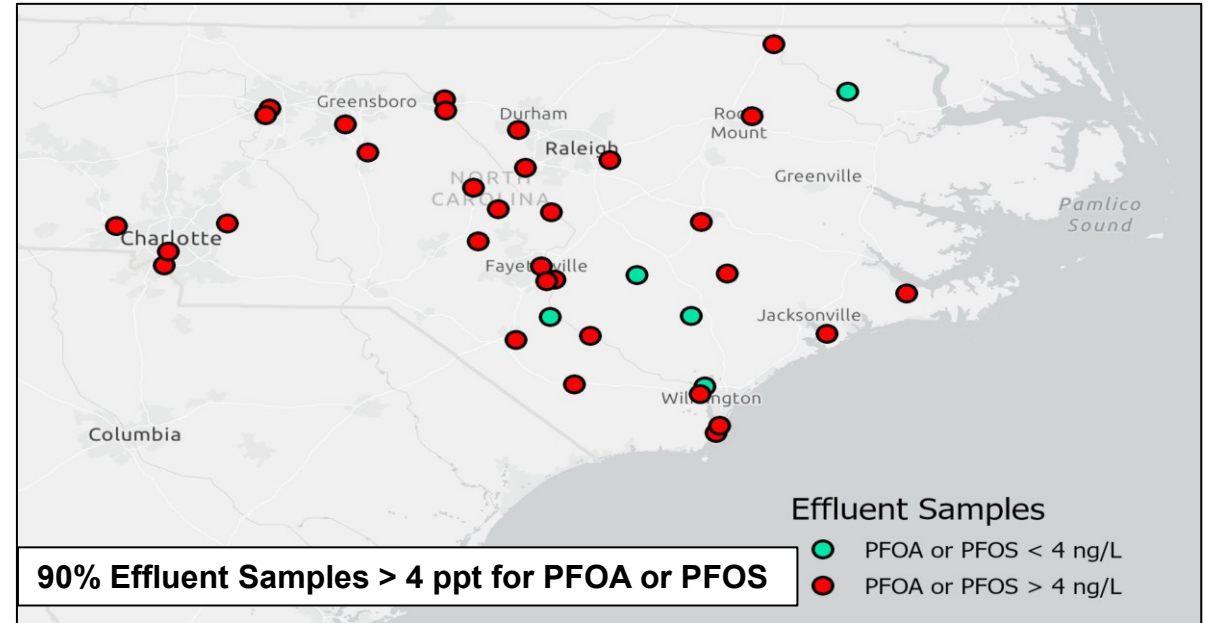
PFOA

- **100% Domestic** (8 – 28; 18 ppt)
- **Municipal** (2 – 95; 15 ppt)
- **Industrial** (1 - 50; 20 ppt)

Total PFAS¹

- **100% Domestic** (94 – 217; 192 ppt)
- **Municipal** (90 – 7828; 533 ppt)
- **Industrial** (3 – 1419; 663 ppt)

1. range of (summed) 57 PFAS quantified at each facility, mean of totals from all facilities in permit category

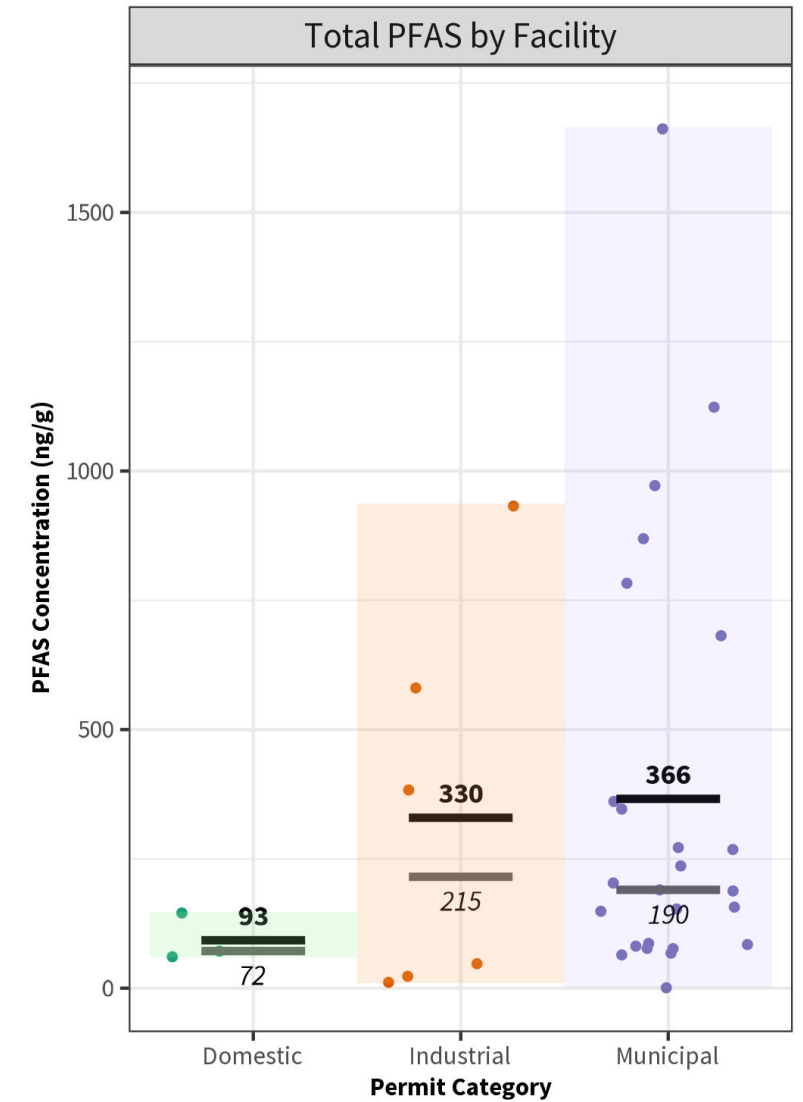
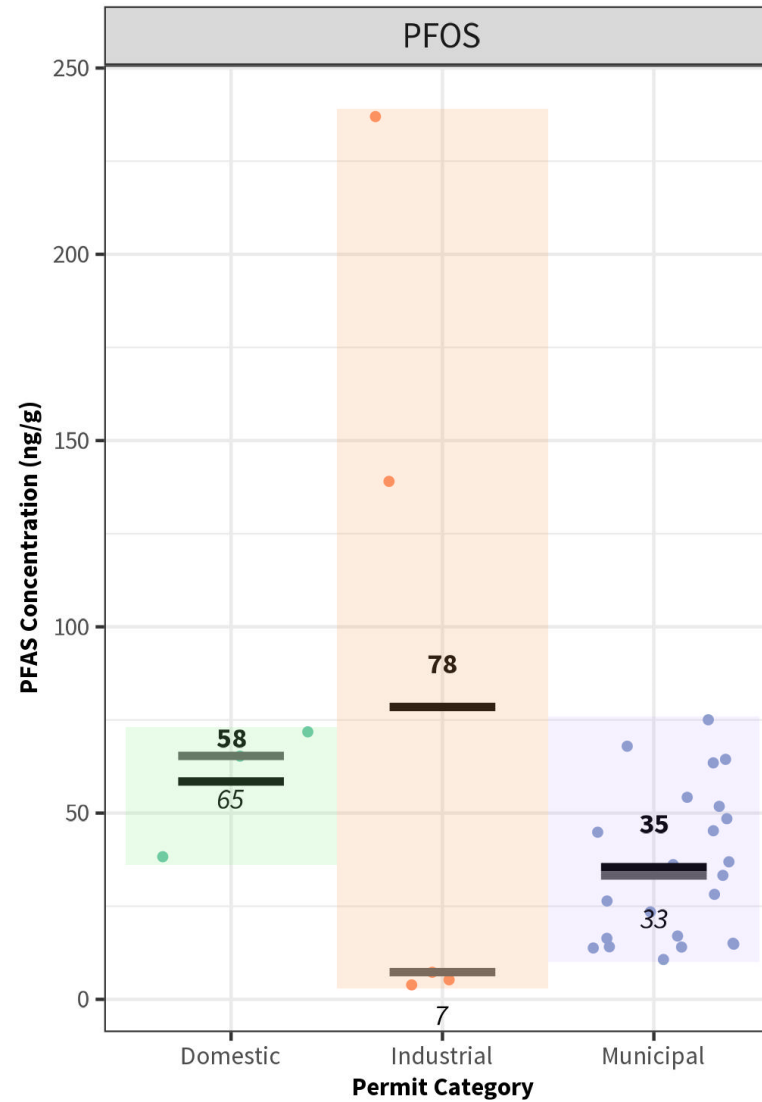
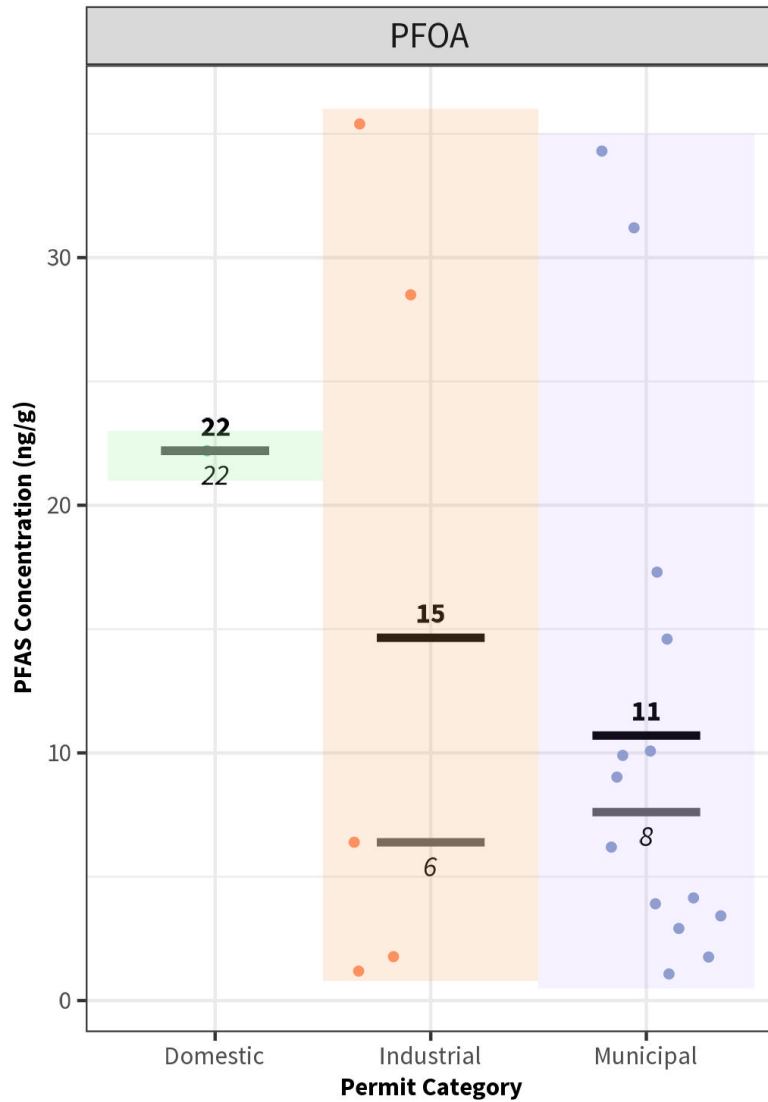


Observations

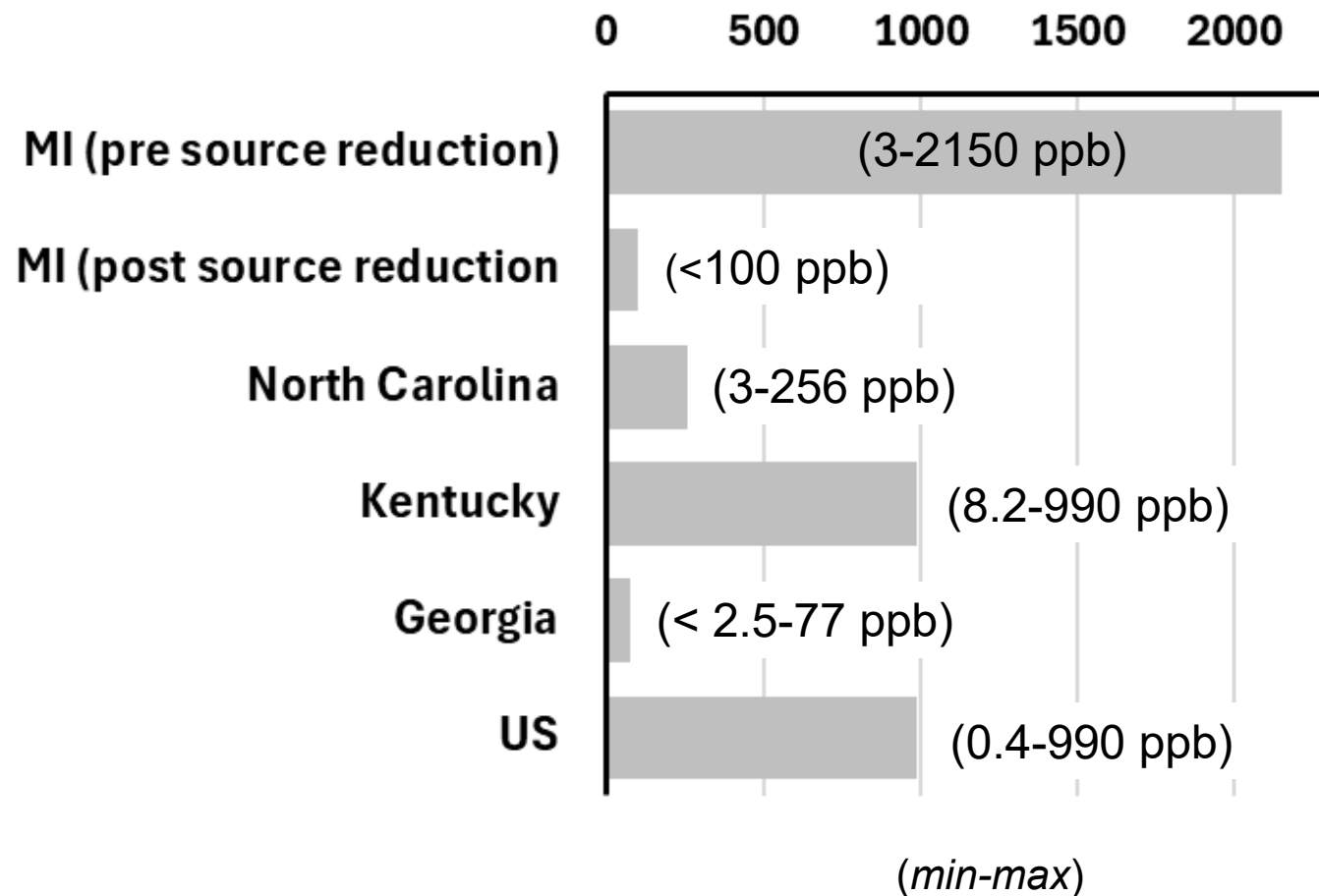
- The 3 Domestic WWTPs generally had lower average PFAS **leaving** the plant.
- PFOA and PFOS concentrations in industrial discharges were the highest.
- Mean Total PFAS effluent concentrations at all WWTP types were greater than influent concentrations.

Biosolids PFAS Data Summary

(Results reported on a dry weight basis; black line with **bold** value = average, gray line with *italicized* value = median)
please note different scale for Total PFAS graph



PFOS in Biosolids - Comparison with Other States



KY, GA, and US data from EPA 2025 draft sewage sludge risk assessment

- Several states have thresholds for PFOA and PFOS for land application of biosolids:
 - MI, NY, WI have limits;
 - MD has recommendations
- 11 states have monitoring requirements for PFAS in biosolids
 - Broad application: CO, MI, MA, MD, RI, TN, VT, WI, NY
 - Adopted, in development: WA
 - Can require monitoring: NH

1 ng/g = 1000 ppt = 1 ppb

Estimated Mass of PFAS Leaving WWTPs Sampled in NC

(estimated on an annual basis)

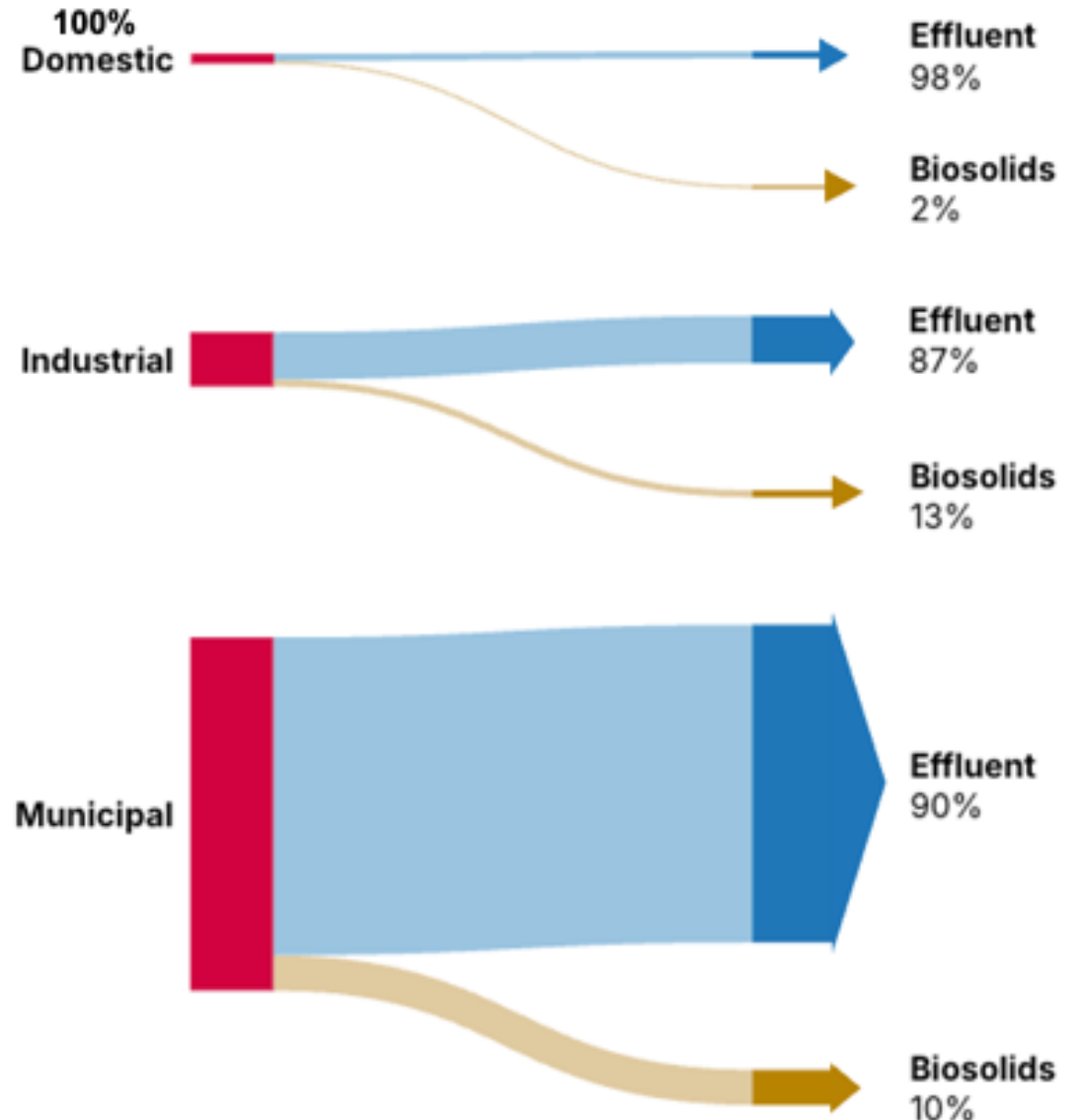
PFAS enters WWTP from domestic, municipal, and/or industrial sources



**Wastewater
Treatment Plant**

**Effluent
(liquid)**

**Biosolids
(sludge)**



Soil PFOS Data Summary

19 Land Application Fields (17 Non-Discharge Residual permittees; 2 fields sampled twice)

13 Municipal application fields (sources include WWTPs with industrial discharges)

3 Industrial application fields

3 Mixed use application fields (multiple sources, including both industrial and municipal)

1 Compost Distribution Facility (1 Non-Discharge permittee, total of 2 samples)

Facility processes Class A municipal and industrial biosolids into compost for bulk distribution
PFOS range (11.8-16.4 ppb); PFOA range (3.75-4.61 ppb)

Land Application Fields:

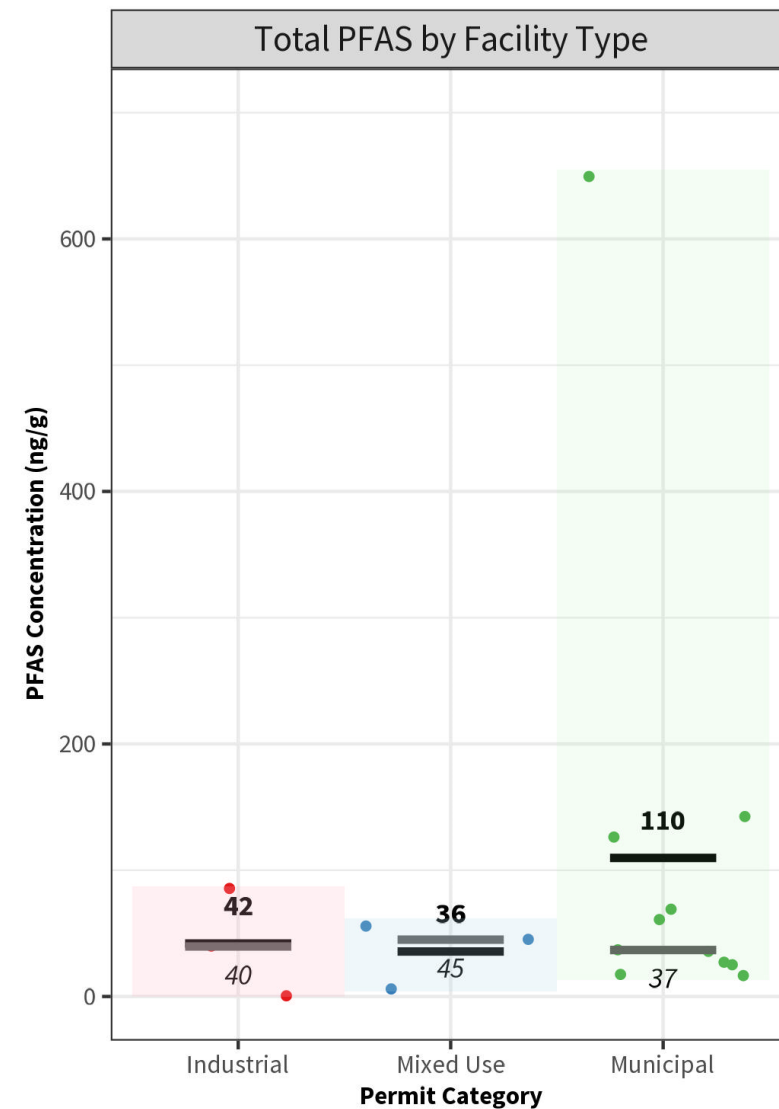
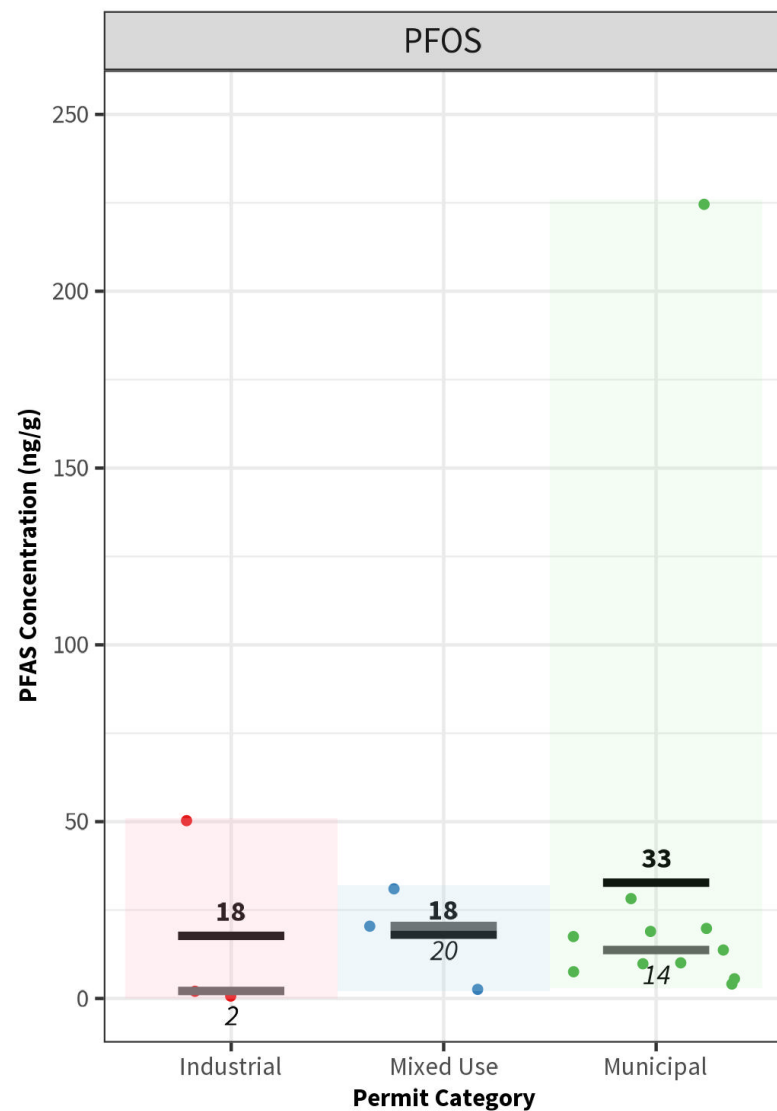
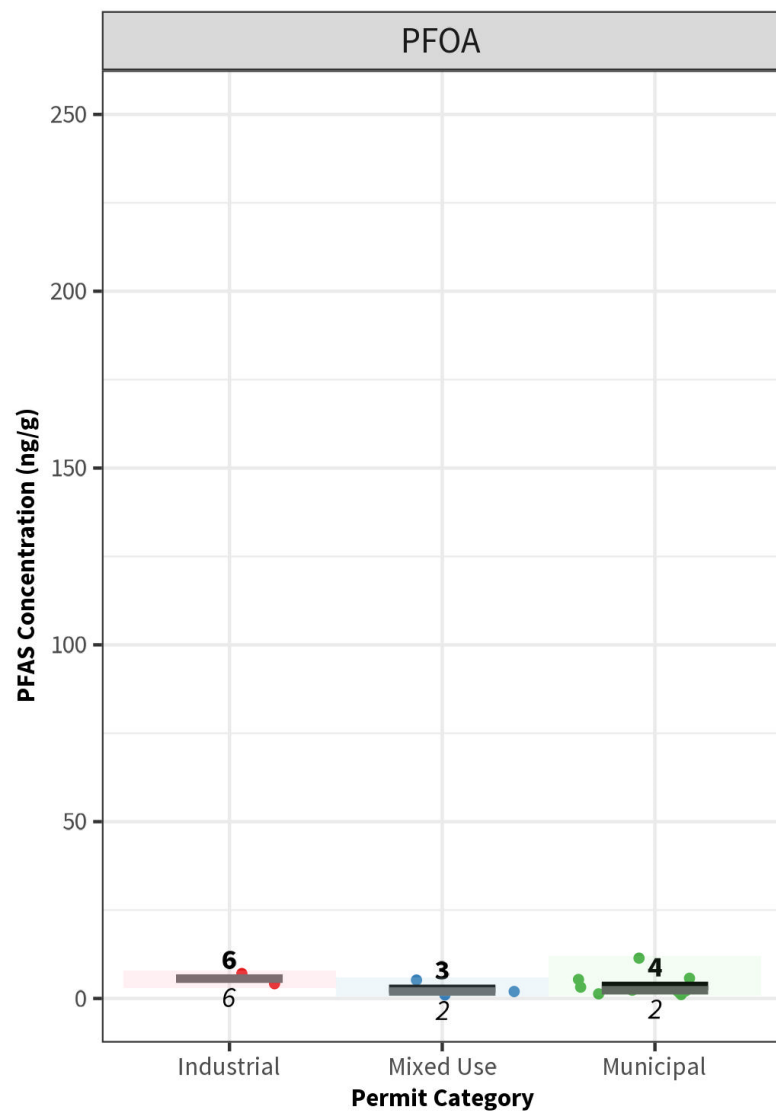
- Soil collected from fields used to grow crop cover not for human consumption.
 - Ex: grass, hay, corn, wheat, soybeans

Observations:

- PFOS was detected at 100% Domestic, Municipal, Mixed Use, Industrial application sites, and the Compost facility.

Soil PFAS Data Summary

(Results reported on a dry weight basis; black line with **bold** value = average, gray line with *italicized* value = median)
please note different scale for Total PFAS graph



1 ng/g = 1000 ppt = 1 ppb

Conclusions

What ends up in Biosolids?

- PFOS was detected in biosolids.
- PFOS concentrations were consistent with other states (NC: 3-256 ppb, US: 0.4-990 ppb).
- 2-13% of Total (quantified) PFAS from WWTP plants was found in biosolids.

Soils

- PFOS was present in soils after repeated biosolids application (0.7-348 ppb).

What ends up in Surface Water?

- 87-98% of Total (quantified) PFAS leaving WWTPs are in effluent discharged to surface water.

Facility Type

- PFAS were detected in all facilities across wastewater, biosolids, soil, & compost samples.
- The majority of treatment facilities had influent and effluent detections above 4 ppt for PFOA and/or PFOS.
- Domestic influent and effluent average Total PFAS concentrations were lower than average Total PFAS in municipal and industrial wastewaters.