Understanding the Fate and Behavior of Per- and Polyfluoroalkyl Substances (PFAS) in Wastewater Systems

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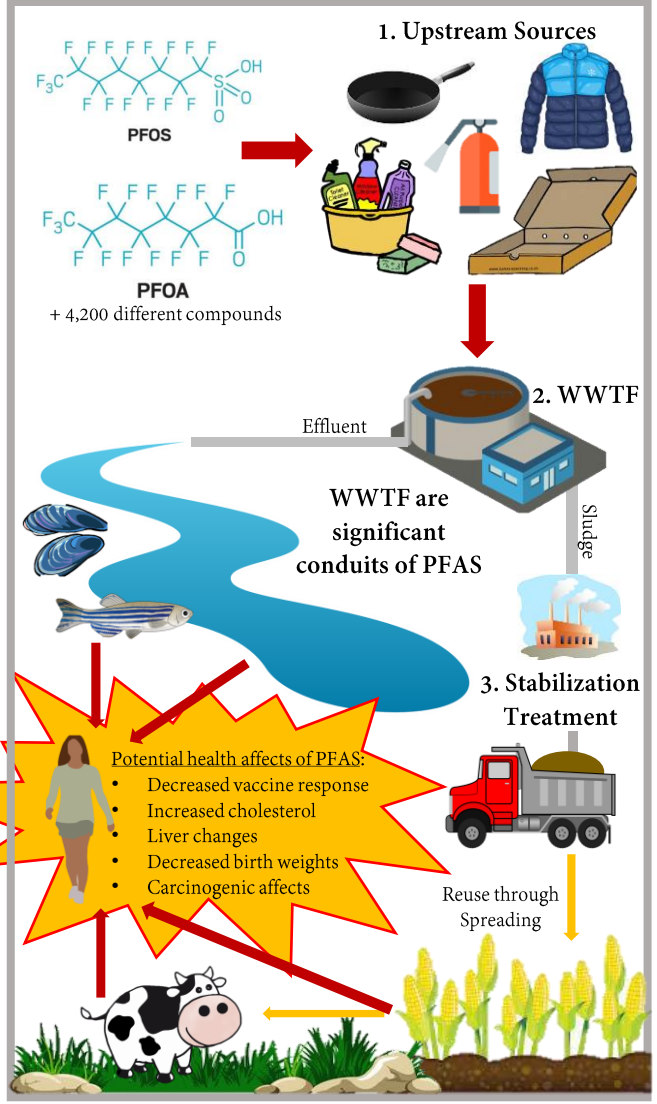
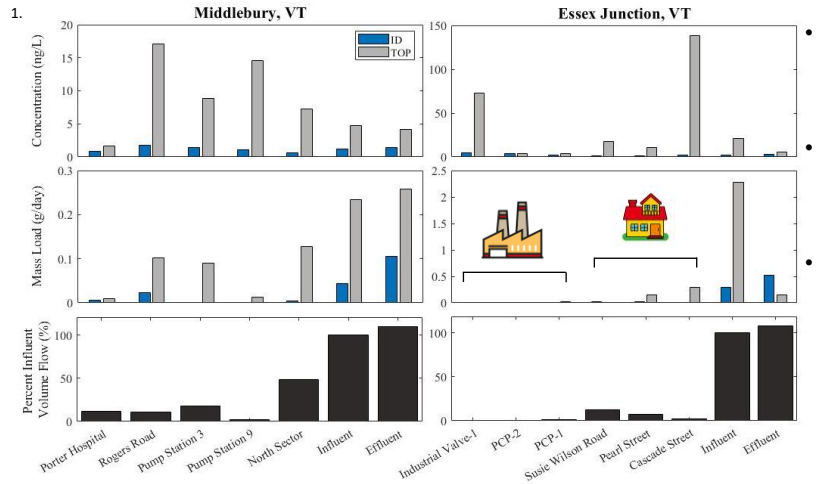
What are PFAS and why do we care?



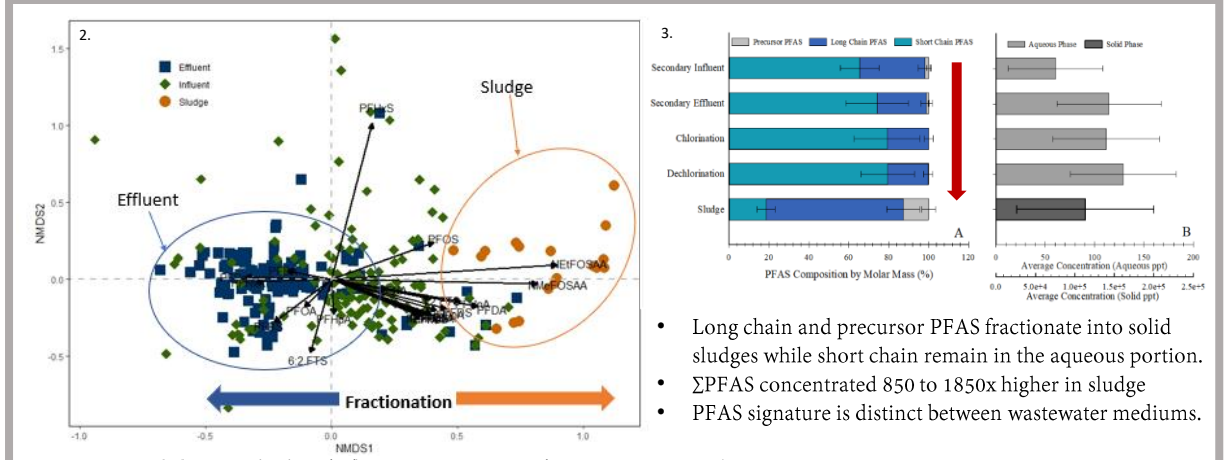
1. Upstream (Before Wastewater Treatment): Municipal PFAS Source Assessment



- Residential and commercial sectors contribute significant mass flows of PFAS and precursor compounds to the sewer system.
- Mass flow calculations are incredibly important over concentration measurements to understanding PFAS sources in municipal systems.
- Sampling strategies used in this project will be modified for future use in additional municipalities to reduce PFAS release.

Figure 1. PFAS concentrations, mass load, and percent influent volume flow from two VT municipal sampling series (Adams et. al In Prep)

2. Wastewater Treatment: Understanding PFAS Sequestration Behavior



- Long chain and precursor PFAS fractionate into solid sludges while short chain remain in the aqueous portion.
- ΣPFAS concentrated 850 to 1850x higher in sludge
- PFAS signature is distinct between wastewater mediums.

Figure 2. Non-multidimensional scaling of influent PFAS measurements for 18 Vermont WWTFs (AOSIM, Figure S1, p<0.001, R=0.3234; Pairwise ADONIS, INF & EFF p<0.001, INF & Sludge p<0.001, EFF & Sludge p<0.001). (Adams et al. In Prep)

Figure 3. A) Relative abundance (percentage of total molar mass) of short chain, long-chain, and precursor PFAS through the wastewater treatment process, and B) total PFAS for aqueous and sludge samples. Bars and whiskers represent average and standard deviation for four WWTFs. (Adams et al. 2021 NEWEA Journal)

3. Biosolids Processing

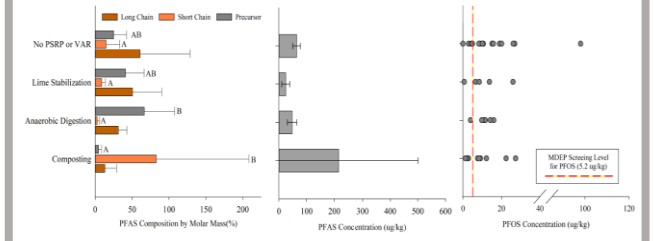


Figure 4. A) Relative abundance of long-chain, short-chain, and precursor/fluorotelomer PFAS, B) average ΣPFAS, and C) PFOS concentrations at each sampling location for different biosolid treatment, including processes to significantly reduce pathogens (PSRP) or vector attraction reduction (VAR) processes. (Adams et al. 2021 NEWEA Journal)

- PFAS composition in biosolids influenced by stabilization treatments
- Concentration unaffected; most samples above MDEP screening levels for PFOS and PFOA

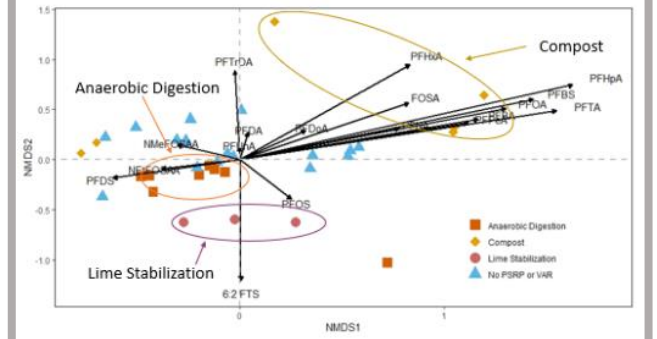


Figure 5. Adams et al, in preparation. Non-multidimensional scaling of sludges and biosolids PFAS measurements for 18 Vermont WWTFs (AOSIM, Figure S1, p=0.002, R=0.3463; Pairwise ADONIS, AD & CP p=0.006, AD & LS p=0.430, AD & NPSRP p=0.363, CP & LS p=0.009, CP & NPSRP p=0.002, LS & NPSRP p=0.066).

Works Cited and Acknowledgments

ASTDR. (2018). *Toxicological Profile for Perfluoroalkyls, Draft for Public Comment.* 852.

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