Are Wastewater Treatment Plants and Biosolids a Significant Source of PFAS?

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Background/Objectives. Wastewater treatment plants (WWTPs) are known sources of per- and polyfluoroalkyl substances (PFAS). Conventional sewage treatment methods do not efficiently remove PFAS, and they accumulate in the sludge, are discharged through the effluent or as biosolids to the environment (ITRC, 2018). Some of the most frequently detected PFAS are perfluoroalkyl acids (PFAAs), which are also dead-end products of other PFAS referred to as precursors, that biodegrades during the sewage treatment. PFOS is particularly of interest due to bioaccumulation in fish which has resulted in low surface water criterion in Michigan. Land application of biosolids on agricultural lands has been used in the United States to manage the disposal of biosolids produced by WWTPs. The land application of biosolids to agricultural lands is becoming a concern as more studies are reporting uptake of PFAAs in various plants and potential impacts to surface water and groundwater. To better evaluate the potential PFAS impacts to the surface waters and agricultural fields in Michigan, a statewide sampling of WWTPs and biosolids-applied agricultural fields was performed.

Approach/Activities. In Michigan, there are over 250 WWTPs out of which 90 facilities are receiving industrial wastewater under Industrial Pretreatment Programs (IPPs). To evaluate the potential PFAS presence in the WWTPs, the Michigan Department of Environmental Quality (MDEQ) requested all of the WWTPs that are receiving industrial wastewater to sample their discharge effluents and assess the possible sources of PFAS. In Michigan, over 80,000 dry tons of biosolids are land applied each year. The evaluation of three agricultural fields was performed for a WWTP that was found to have a PFOS concentration of 2,500 in the ng/L in the effluent and 2,100 µg/kg in the biosolids. Samples of soil, surface water, and groundwater were collected from all three agricultural fields. The initial evaluation of the three agricultural fields resulted in a statewide PFAS sampling of 50 WWTPs which included influent, effluent, and biosolids samples. Soil and surface water samples were also collected from an additional 20 agricultural fields where biosolids were land applied. All of the samples were analyzed for 24 PFAS compounds. To better understand potential PFAS sources as well as the fate and transport of PFAS the linear and branched isomers for PFOA, PFOS, and PFHxS were quantified separately.

Results/Lessons Learned. The current statewide PFAS sampling provides a robust evaluation of potential PFAS impacts to the WWTPs and biosolids in Michigan. The results from the entire statewide program will be presented for all 50 WWTPs and 20 agricultural fields with detection frequencies and concentrations of all 24 individual PFAS in various environmental matrices. The use of linear and branched isomers to identify potential PFAS sources and building a robust fate and transport conceptual site model will be presented. Potential correlation between soil PFAS concentrations and different soil types, total organic carbon, and groundwater will be presented. Potential screening values for biosolids and effluent discharge concentrations that could be used to evaluate WWTPs will be discussed.