



# FAMU-FSU Engineering

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

## Technical Awareness Group (TAG) Meeting No. 2 Monday, October 31, 2022, 11:00 am – 12:00 pm Eastern Time Meeting location: Zoom

**Project Title:** Per- and Polyfluoroalkyl Substances (PFAS) in Landfill Gas Emissions

**TAG Members:** Bruce Marvin (Geosyntec Consultants), Chao Zhou (Geosyntec Consultants), Claudia Mack (Geosyntec Consultants), Kevin Warner (Geosyntec Consultants), Terry Johnson (Waste Management Inc.), Sterling Carroll (Florida Rural Water Association), Joseph Dertien (Florida Department of Environmental Protection), Kerry Tate (Florida Department of Environmental Protection), Lauren J. Coleman (Florida Department of Environmental Protection), Owete S. Owete (Florida Department of Environmental Protection), Shanin Speas-Frost (Florida Department of Environmental Protection), Walsta Jean-Baptiste (Florida Department of Environmental Protection)

**Principle Investigator:** Youneng Tang

### **In Attendance:**

John Schert, Joseph Dertien, Karam Eeso, Kevin Warner, Mojtaba Nouri Goukeh, Terry Johnson, Walsta Jean-Baptiste, Youneng Tang

### **Background**

The meeting was called to order by Dr. Tang at 11:00 AM. Dr. Tang began by introducing volatile PFAS and their existence in various consumer and industrial products and in landfills. He noted that the concentration of volatile PFAS is usually very low in landfill gas emissions. Then, he summarized previous studies on preconcentrating and measuring PFAS.

### **Research Questions and Team**

Dr. Tang presented three research questions, including 1) How to preconcentrate volatile PFAS in air, water, and solid? 2) How much volatile PFAS is in landfill gas emissions? 3) What is the fate of PFAS in lab-scale landfills?.

The research team mainly consists of Youneng Tang (principal investigator), Mojtaba Nouri Goukeh (graduate student), and Karam Eeso (undergraduate student).

### **Methods and Results**

- Three methods were used in this study for preconcentrating representative, volatile PFAS, including a commercially available preconcentrator, solid phase microextraction (SPME), and solvent extraction combined with SPME. By combining SPME and gas chromatography–mass spectrometry (GC-MS), the quantification limits ranged from ng/L to tens of ng/L for air and water samples. By further adding solvent extraction, the quantification limits ranged from ng/g to tens of ng/g for solid samples.
- Seven landfill gas samples were taken from a municipal solid waste (MSW) landfill cell, a construction & demolition (C&D) landfill cell, and ambient air. 6:2 FTOH and 8:2

FTOH were the dominant PFAS in direct landfill gas emissions (e.g., under the final landfill cover) with their concentrations ranging from less than the quantification limit to 10 ng/L. The PFAS concentrations in the ambient air of the landfill cells were at least three orders of magnitude lower than those in the direct landfill gas emissions.

- Fifteen lab-scale landfills (five types with each type in triplicate) were operated at 55 °C for 159 days in this project. SPME was an effective method for preconcentrating FTOHs in the headspace of the lab-scale landfills. 6:2 FTOH was detected in the headspace of the triplicate lab-scale landfills containing popcorn bags. The emission rate was stable throughout the experiment at approximately  $1.6 \times 10^3$  ng/(L-d). Three PFAS were detected in the liquid of the lab-scale landfills containing carpet or masks.

### **Group Discussion**

Major comments and suggestions from the TAG:

- A TAG member asked about the comparison between the concentrations measured in this study and the previous studies. Replies from the research team: Regarding landfill ambient air, the PFAS concentrations reported in this study were at the same order of magnitude as in the previous studies. The literature has very limited data on volatile PFAS in direct landfill gas emissions; therefore, we could not compare that.
- A TAG member asked about the safety practice during experiments in the lab. Replies from the research team: The lab-scale landfills were capped to simulate the anaerobic condition inside landfills. Researchers were not exposed to volatile PFAS generated by the lab-scale landfills.
- A TAG member asked about the difference between volatile and non-volatile PFAS in terms of their permeation through landfill liners. The research team had a discussion with this TAG member and commented that they did not know such data available in the literature and it would be a very interesting future research topic.

The meeting was adjourned at 12:00 PM, minutes taken and submitted by Mojtaba Nouri Goukeh.