

The Science of PFAS 2025

Piecing Together the Puzzle

Raleigh, North Carolina, USA
11 - 13 March 2025

ISBN: 979-8-3313-2162-8

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The information and opinions expressed in these papers/presentations are solely of the authors and should not be considered as having the endorsement or support of the Association.

Compilation Copyright © (2025) by Air & Waste Management Association.
Copyright of the individual papers are retained by the authors.

Additional copies of these and other A&WMA conference proceedings will be available through the A&WMA Online Store. To place an order, please visit the Online Store at www.awma.org or contact the A&WMA Publications Order Department at onlinestore@awma.org, +1-412-232-3444 (phone) or +1-412-232-3450 (fax).

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact Air and Waste Management Association at the address below.

Air and Waste Management Association
One Gateway Center, 3rd Floor
420 Fort Duquesne Blvd.
Pittsburgh, Pennsylvania 15222-1435
USA

Phone: +1-800-270-3444
+1-412-232-3444
Fax: +1-412-232-3450

info@awma.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

FINAL PROGRAM

TECHNICAL TOUR – Monday, March 10

EPA Facilities Tour at Research Triangle Park

Monday, March 10, 11:30 am – 3:30 pm

The tour is sold out. Foreign nationals attending are not allowed to bring any electronics on the premises, including phones, computers, tablets, smart watches, headphones, and more. All tour participants must travel via the group bus to the EPA unless they are an EPA employee.

Registered participants should meet in the hotel lobby 15 minutes prior to departure. Lunch will be on your own prior to departing the hotel.



TECHNICAL PROGRAM – Tuesday, March 11

Registration

7:30 am – 5:00 pm

Grand Ballroom Foyer

Continental Breakfast

7:30 am – 8:30 am

Grand Ballroom 1-3 and Foyer

OPENING KEYNOTE PLENARY

8:30 am – 10:20 am

All conference sessions will be in the Grand Ballroom 4-5

Welcome and Introduction 6

Michele Karnes, Coterie Environmental

Leah Blinn, A&WMA President, Civil & Environmental Consultants

Lara Phelps, US EPA, Office of Research and Development (ORD),
Center for Environmental Measurement and Modeling (CEMM)

Keynote Plenary sponsored by our General Sponsors 1



Maureen Gwinn, Ph.D., DABT 10
Acting Assistant Administrator, US EPA
Office of Research and Development (ORD)



D. Reid Wilson N/A
Secretary, North Carolina Department
of Environmental Quality (DEQ)



Kenneth Waldroup 18
Executive Director of Cape Fear Public
Utility Authority (CFPUA)

10:20 am – 10:40 am Networking Break and Exhibition Viewing

Networking Breaks are sponsored by our Silver Sponsors



FINAL PROGRAM

TECHNICAL AGENDA – Tuesday, March 11, con't.

SESSION 1: USING SCIENCE TO IDENTIFY SOURCES

Co-Chairs: Elizabeth Denly, TRC, and James McCord, US EPA

10:40 am – 11:05 am

Using Positive Matrix Factorization (PMF) to Distinguish Between PFAS Sources N/A

Bethany Parker, Arcadis

11:05 am – 11:30 am

Application of High-Resolution Mass Spectrometry and Machine Learning Tools for PFAS Forensic Analysis at a Wastewater Treatment Plant 48

Shalene Thomas, Battelle

11:30 am – 11:55 am

Two Case Studies: Exploring Commercial, Industrial, and Wastewater Sources of PFAS 60

Brittany O'Brien-Drake, Jasmine Stefansky, NY Department of Environmental Conservation

11:55 am – 12:05 pm

Question and answer period

12:10 pm – 1:10 pm
Lunch for all attendees
Grand Ballroom 1-3

SESSION 2: PFAS HEALTH EFFECTS

Co-Chairs: Loren Lund, Jacobs, Mike Devito, US EPA

1:10 pm – 1:35 pm

A Review of Current and Emerging PFAS Health Effects and Regulatory Developments in the US 77

Jamie DeWitt, Oregon State University

1:35 pm – 2:00 pm

Towards the Development of Chemical Categories for PFAS and their Application to Bioactivity Screening 92

Mike DeVito, US EPA Center for Computational Toxicology and Exposure

2:00 pm – 2:25 pm

PFAS Surface Water Quality Criteria: Health Effects and Other Considerations, Challenges, and Research Needs 103

Loren Lund, Jacobs

2:25 pm – 2:50 pm

Assessing PFAS Toxicity and Risk in North Carolina: A Regulator Perspective 114

Frannie Nilsen, North Carolina Dept. of Environmental Quality

2:50 pm – 3:00 pm

Question and answer period

3:00 pm – 3:20 pm
Networking Break and Exhibit Viewing

SESSION 3: PFAS MEASUREMENT METHODS, PART 1

Co-Chairs: Bill Troxler, Focus Environmental, and William Roberson, US EPA

3:20 pm – 3:45pm

PFAS Air Testing for Stationary Sources 122

Jesse Rocha, Alliance Technical Group

3:45 pm – 4:10 pm

False Positives, False Negatives, and Interferences, Oh My! 139

Elizabeth Denly, TRC Companies

4:10 pm – 4:35 pm

ENTails Toolkit (Resources for Non-targeted Analysis) 149

James McCord, US EPA

4:35 pm – 4:45 pm

Question and answer period

4:45 pm – 5:15 pm Dedicated poster viewing in the Grand Ballroom 1-3

5:15 pm – 6:15 pm Networking Reception in the Exhibit Area and continued poster viewing

* Student Poster Contest

View the posters and vote on site in the categories of technical depth, innovation, and presentation. The best student poster will receive an award.

Poster awards provided by:

Coterie ENVIRONMENTAL

FINAL PROGRAM

TECHNICAL AGENDA – Tuesday, March 11, con't.

Thank you to our Gold Sponsors for sponsoring the Networking Reception



TECHNICAL POSTERS

Co-Chairs: Johnsie Lang, Arcadis, Erin Shields, US EPA

Thermal Plasma Arc Treatment to Mineralize Per- and Polyfluoroalkyl Substances in Impacted Media N/A

Jishnu Adhikari, Arul Ayyaswami, Jitendra Kewalramani, Tetra Tech

Evaluation and Visualization of PFAS Fate and Transport 161

Candace Beauvais, Scott Anderson, Rob Perkinson, Tetra Tech

*** Tracing PFAS in Homes: Results and Lessons Learned From the IPA Campaign** 162

Clara Eichler, Naomi Chang, Glenn Morrison, Jason Surratt, Barbara Turpin, UNC-Chapel Hill

Treatment of Co-Mingled PFAS and 1,4-Dioxane Contamination Using Flow Reversal Reverse Osmosis (FR-RO) 163

Max Finder, ROTEC

Ultrashorts: Measurement and Relevance for Remediation Monitoring N/A

Jamie Fox, Bharat Chandramouli, SGS North America

Identifying and Communicating PFAS Exposure Risks From Rural Private Wells 164

Jennifer Hoponick Redmon, Erica Wood, Chamindu Liyanapattirana, Andrea McWilliams, Riley Mulhern, AJ Kondash, Kelly Hoffman, RTI International; Jacqueline MacDonald Gibson, NC State

*** Intraparticle PFAS Distribution and Factors Controlling PFAS Adsorption to Granular Activated Carbon** N/A

Sarangi Joseph, Detlef Knappe, North Carolina State University; Tsengming Chou, Matthew Libera, Stevens Institute of Technology

Rapid and Inexpensive Delivery of Particulate Carbon for In Situ PFAS Treatment in Groundwater 165

Bonani Langan, GSI Environmental Inc.

Filter Considerations for PFAS Sample Preparation 166

Lindsay Lozeau, Gunjan Shah, Amy Laws, EMD Millipore Corporation; Ranjani Muralidharan, Sigma Aldrich, Inc.

Upstream Strategies and Considerations for PFAS in Lithium-Ion Battery Recycling 167

Zachary Neigh, Holly Brown, Joshua Collins, William Neese, Rob Fraser, Tanya Hodkinson, Hatch (Environment and Sustainability)

A Preliminary Study of the Effectiveness of a Functionalized Sawdust for PFAS Absorption N/A

Joshua Pridemore, Daniel Knecht, Maobing Tu, Mingming Lu, University of Cincinnati

The Application of the AIM Reactor for Real-Time PFAS Detection N/A

Veronika Pospisilova, Spiro Jorga, Abigail Koss, Maya Abou-Ghanem, Tofwerk USA

*** Behavior of PFAS During Thermal Reactivation of Spent Granular Activated Carbon (GAC)** 168

Nathen Silsby, Stefanie Silsby, Lan Cheng, Detlef Knappe, North Carolina State University; Stephen Jackson, Bill Preston, US EPA

*** Ultrashort-chain PFAS are Products of Perfluoroalkylether Acids in Total Oxidizable Precursor Assay** N/A

Sarah Teagle, Lan Cheng, Detlef Knappe, North Carolina State University Department of Civil, Construction, and Environmental Engineering

Evaluating the Thermal Decomposition of PFAS: Identifying Products of Incomplete Combustion N/A

Nathan Weber, Jonathan Krug, William Roberson, James Mattila, Preston Burnette, Matt Allen, William Preston, and William Linak, Oak Ridge Institute for Science and Education, Office of Research and Development, US EPA

*** Method Development for Quantifying PFAS in Various Source Samples Using Thermal Desorption-GC/MS** 169

Gabrielle West, University of North Carolina and US EPA ORD Center for Environmental Measurement and Modeling, M. Ariel Geer Wallace, Jonathan Krug, US EPA ORD CEMM

Student posters eligible for the contest are identified by a * before the title and a slightly different color. Don't forget to vote for the best using the QR code!

FINAL PROGRAM

TECHNICAL AGENDA – Wednesday, March 12

Registration

7:00 am – 5:00 pm

SESSION 4: PFAS IN WATER

Co-chairs: Jeffrey McDonough, CDM Smith, and Phillip Potter, Ph.D., US EPA

8:00 am – 8:25 am

PFAS in Precipitation 170

Dr. Paul Edmiston, College of Wooster

8:25 am – 8:50 am

PFAS Fate and Transport (In Situ) 183

Dr. Ian Ross, CDM Smith

8:50 am – 9:15 am

Performance of Commercial Labs in the Application of EPA PFAS Methods for Wastewater Analysis 204

Cher Lindelen, Waruna Kiridena, Amanda Miller, Giffe Johnson, NCASI

9:15 am – 9:25 am

Question and answer period

9:25 am – 9:50 am

Networking Break and Exhibition Viewing

SESSION 5: PFAS IN APPLIED BIOSOLIDS

Moderators: Andrew Gremos, Ramboll, Stephanie Bolyard, NC DEQ

9:50 am – 11:25 am

Biosolids as a beneficial use — This panel will discuss the challenges with and potential considerations for continued land application of biosolids.. Speakers include:

- **Elizabeth Biser**, Biser Strategies N/A
- **Adam Ulishney**, North Carolina Department of Environmental Quality N/A
- **Erik Martin**, Ramboll 217
- **Erin Bulson**, Waste Management N/A

11:25 am – 1:00 pm

Lunch sponsored by our Platinum Sponsor

Lunch Presentation

Legal Challenges with Data Collection for PFAS-Related Matters 222

- Edward (Ned) B. Witte, Partner, Earth & Water Law
- Taryn McKnight, PFAS Practice Leader, Eurofins
- Leonard Mankowski, VP Emerging Contaminants, WSP



Continental Breakfast

7:00 am – 8:00 am

SESSION 6: PFAS IN LANDFILLS

Co-Chairs: Ivan Cooper, Civil & Environmental Consultants, Inc, and Thabet Tolaymat, US EPA

1:00 pm – 1:25 pm

Low-cost Technology to Enhance Biological Treatment for PFAS Removal from Leachate 224

Patrick McKeown, ETC2

1:25 pm – 1:50 pm

Per-and Polyfluoroalkyl Substances Release from Spent Granular Activated Carbon in Solid Waste Facilities 237

Onur Apul, University of Maine

1:50 pm – 2:15 pm

Advanced PFAS Removal from Leachate Using AEC Technology 247

Tonya Chandler, Biolargo

2:15 pm – 2:25 pm

Question and answer period

2:25 pm – 2:50 pm

Networking Break and Exhibition Viewing

SESSION 7: PFAS IN AIR

Co-chairs: Matt Traister, Ramboll, Lara Phelps, US EPA

2:50 pm – 3:15 pm

Landfill Gas Emissions of PFAS 252

Ashely Lin, University of Florida

3:15 pm – 3:40 pm

Modeling and Analysis of Background PFAS Deposition N/A

Krish Vijayaraghavan, Ramboll

3:40 pm – 4:05 pm

The Implications and Timing of the Multi-State Petition to List Certain PFAS Compounds as HAPs 263

Daron Ravenborg, Bryan Cave Leighton Paisner, LLP

4:05 pm – 4:15 pm

Question and answer period

FINAL PROGRAM

TECHNICAL AGENDA – Wednesday, March 12, con't.

SESSION 8: PFAS MEASUREMENTS METHODS AND TECHNIQUES, PART 2

Co-Chairs: Bill Troxler, Focus Environmental, and William Roberson, US EPA

4:15 pm – 4:40 pm

Performance Testing of a Volatile PFAS Method Applicable to Indoor Air, Soil Gas, and/or Sewer Gas 277

John Zimmerman, US EPA

4:40 pm – 5:05 pm

Method 1633 vs Method 8421 Data Comparison 292

Stephen Somerville, Pace Labs

5:05 pm – 5:30 pm

Analysis of Ultrashort Chain PFAS 305

J. P. Verhuel, Enthalpy

5:30 pm – 5:40 pm

Question and answer period

TECHNICAL AGENDA – Thursday, March 13

Registration

7:00 am – 3:00 pm

Continental Breakfast

7:15 am – 8:00 am

SESSION 9: PFAS TREATMENT AND DESTRUCTION METHODS

Co-Chairs: Kavitha Dasu, Battelle, and Jonathan Krug, US EPA

8:00 am – 8:25 am

Evaluation PFAS Emissions in Flue Gases: Insights from Multi-Facility Assessments N/A

Johan Strandberg, IVL Swedish Environmental Research Insitute

8:25 am – 8:50 am

Applying Thermal Conduction Heating for PFAS-Impacted Soil Remediation 318

Lauren Soos, TRS Group

8:50 am – 9:15 am

PFAS Waste Destruction using Industrial Supercritical Water Oxidation (iSCWO) 331

John Follin, General Atomics

9:15 am – 9:40 am

An In-Situ Alternative to Pump and Treat for PFAS-impacted Groundwater 340

Brendan J. Lazar, P.E., TRC Corporation

9:40 am – 9:50 am

Question and answer period

9:50 am – 10:00 am

Networking Break and Exhibition Viewing

SESSION 10: CHALLENGES WITH PFAS TREATMENT RESIDUALS — A UTILITY PERSPECTIVE

Co-Chairs: Johnsie Lang, Arcadis, and Marc Mills, US EPA 350

10:00 am – 11:30 am

With significant advancements being made in PFAS treatment technologies, managing the residuals generated during these processes still presents a critical challenge. This session addresses the complexities and emerging solutions for handling, transporting, and disposing of PFAS-laden byproducts in a safe and sustainable manner. Panelists will discuss different methods for residual management being implemented by drinking water treatment providers.

Speakers include:

- **Dr. Detlef Knappe**, Center for Environmental and Health Effects of PFAS, North Carolina State University 355
- **Ben Kearns**, Cape Fear Public Utility 359
- **Joseph Pearce**, Aqua America 365
- **AnneLu DeWitt**, Clean Harbors N/A
- **Richard Sanchez**, Revive Environmental 368

Student poster awards will be announced at the end of this session.

11:40 am – 12:10 pm

Grab-and-go Lunch and Exhibition Viewing

FINAL PROGRAM

TECHNICAL AGENDA – Thursday, March 13, con't.

SESSION 11: PFAS INVESTIGATIONS AND REGULATIONS AT THE STATE LEVEL

Co-chairs: Taryn McKnight, Eurofins, and Adam Driscoll, Barr Engineering

12:10 pm – 1:40 pm

This panel session will explore the growing issue of PFAS contamination and the regulatory responses being implemented at the state level. The session will provide several examples of state-led investigations into PFAS contamination in water, soil, and air, and how state agencies are developing regulations to mitigate exposure and clean up affected areas.

Speakers include:

- **Dustin Leypoldt and Ray Holberger**, South Carolina Department of Environmental Services 373
- **Mike Penzone**, Delaware Department of Natural Resources and Environmental Control 388
- **Amy Delinsky**, North Carolina Department of Environmental Quality 399

Conference Wrap-up and Conclusion

Lara Phelps, US EPA CEMM

Thank you for attending!
We hope to see you at future A&WMA conferences.
Check out www.awma.org/events for details.

About the Air & Waste Management Association



The Air & Waste Management Association is a not-for-profit, nonpartisan professional organization that enhances knowledge and expertise by providing a neutral forum for technology exchange, professional development, networking opportunities, public education, and outreach to more than 5,000 environmental professionals in 65 countries. A&WMA also promotes global environmental responsibility and increases the effectiveness of organizations to make critical decisions that benefit society. For more information, please visit www.awma.org.