ERM WEBINAR SERIES: FAST FLUORINATED FACTS
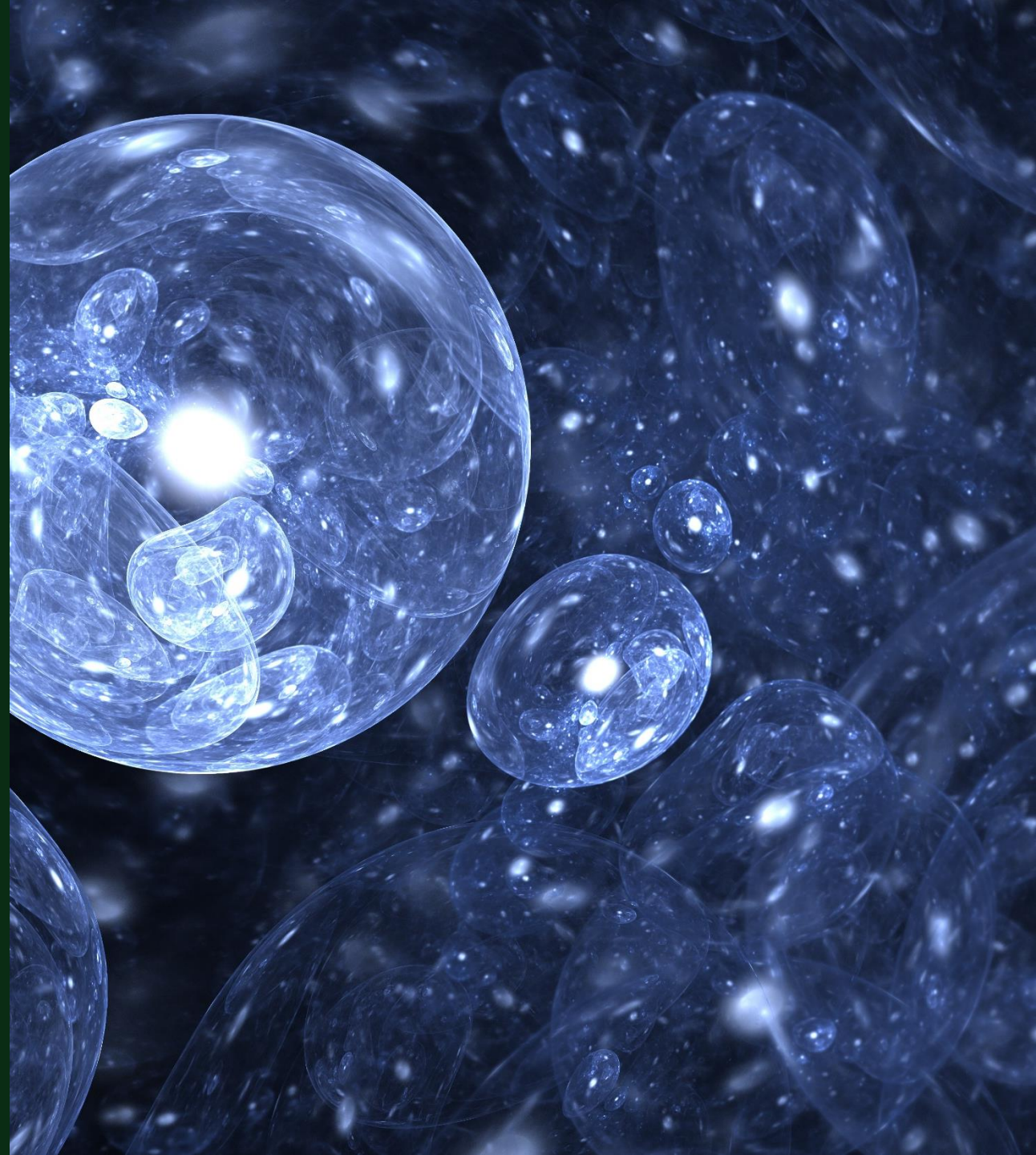
PFAS in the News

Unknown PFAS Liabilities: PFAS Source Identification and Strategies to Manage Effluent Discharge Liabilities

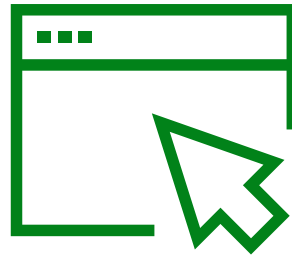OCTOBER 2ND, 2025

Sustainability is our business

Welcome Participants

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Your **lines have been muted** to ensure our presenters are not distracted by background noise

Attendees are encouraged to **participate by using the chat/Q&A** via the chat box function – select "All Panelists and Attendees" or only "All Panelists"

A link to the **recording of this session & slides** will be provided in our follow-up email sent next week

Safety Moment

Avoid PPE, clothing, and materials that contains PFAS:

- PPE or clothing treated with thermal or stain-resistant chemicals

- PPE or clothing treated for insect resistance and ultraviolet protection

- PPE or clothing items with any of the brand or product names found to contain PFAS (e.g., Gore-Tex®, Teflon, etc.)

- Materials or equipment that contains polytetrafluoroethene (i.e., polytetrafluoroethene-coated aluminum foil, Gore-Sorbers™) or any other material containing a fluoropolymer.

- Personal care products, like sunscreen or insect repellant, that may contain PFAS

- Handling pre-wrapped food or snacks during sample collection

- Waterproofed paperwork (i.e., Rite in the Rain® field books).

PFAS Sample Collection

Agenda/ Contents

Speakers

Eric Litman, M.S.

Senior Scientist, Partner

Rachel Smolinski, Ph.D.

Managing Technical Consultant,
Scientist

What is Environmental Forensics?

Environmental forensics is "the **systematic and scientific evaluation** of physical, chemical, and historical information for the purpose of developing defensible scientific and legal conclusions regarding the source of a **contaminant release** into the environment."

R.D. Morrison and B.L. Murphy
Environmental Forensics - Contaminant Specific Guide (2006)
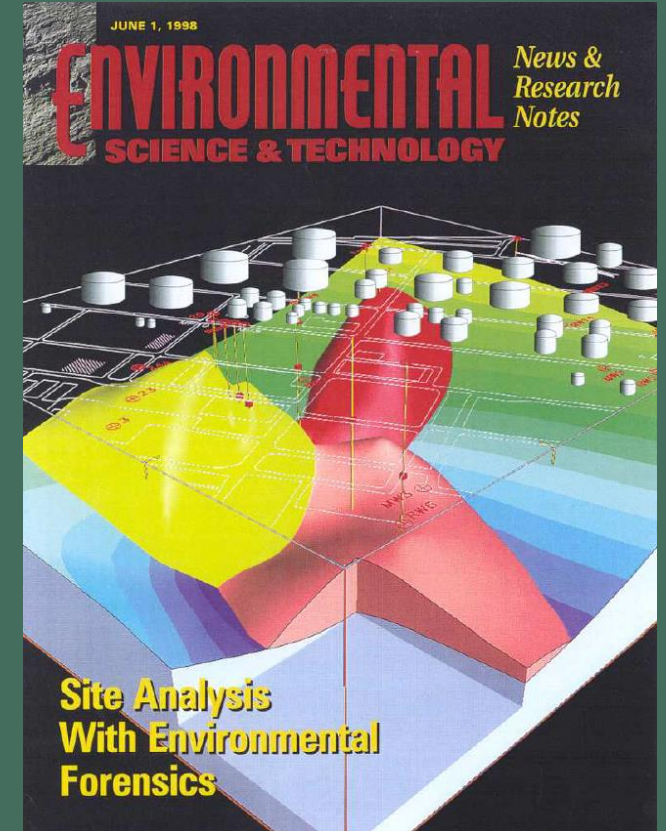
What is Environmental Forensics?

Integration of all available information and data to defensibly assess the source(s) of environmental contamination:

01	Site History		**06**	Transport Modeling
02	Regulatory History		**07**	Numerical Analysis
03	Manufacturing Processes		**08**	Spatial Analysis
04	Chemical Fingerprinting		**09**	Allocation
05	Geology & Hydrology			

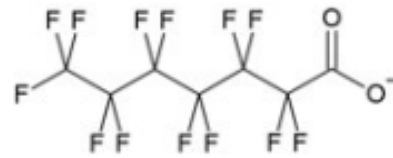Reduce Technical Uncertainty ⟶ Greater Defensibility

PFAS Under Regulatory Scrutiny

...and eight specific compounds have received the most attention.
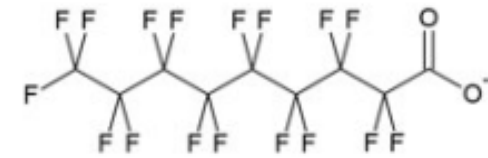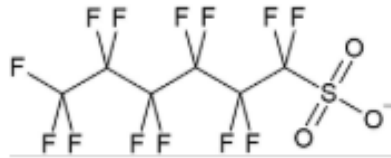

PFOS (perfluorooctane sulfonate)
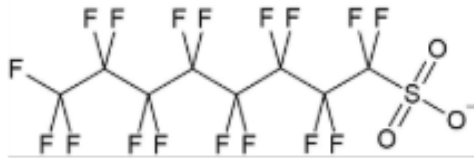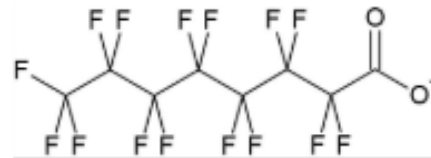
PFHpA (perfluoroheptanoic acid)
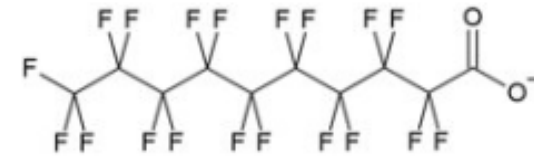
PFNA (perfluorononanoic acid)
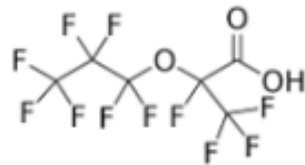
PFHxS (perfluorohexane sulfonate)
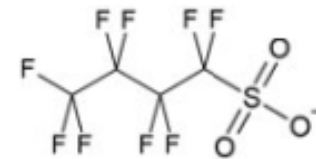
PFOA (perfluorooctanoic acid)

PFDA (perfluorodecanoic acid)

GenX (HFPO-DA)

PFBS (perfluorobutanesulfonate)

PFAS Forensic Chemistry

Purpose of PFAS Forensics
- PFAS Source Characterization
- Extent of site exposure (fate and transport)
- Product stewardship and manufacturing
- Supporting treatment technologies

PFAS Analytical Methodologies
- Total fluoride (adsorbable and extractable)
- Target Analyte Methods (1633, 537, TOP Assay)
- Non-Target Analysis (NTA)
- Novel Methods in Development

PFAS Forensic Analytical Framework
- Geospatial Analysis (source area identification)
- Regulatory Review (MCLs, UCMR screening)
- Anthropogenic background determinations
- Historical review (manufacturing, site operations)
- Compositional analysis and comparison to reference library
- Statistical analysis (source attribution-allocation)

AFFF Source Characterization

Source: Lance Cpl. Shawn Valosin/U.S. Marines

EPA
United States Environmental Protection Agency
Office of Water
www.epa.gov   December 2024

Method 1633, Revision A

Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS

EPA
United States Environmental Protection Agency
Office of Water
www.epa.gov   January 2024

Method 1621

Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC)

Method 1621   January 2024

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Tiered Analytical Framework

Tier I: Preliminary Data Review
1.
- EPA Method 1633 and TOF Data Quality
- Regulatory Review
- Site or Manufacturing History
- Geospatial Concentration Gradients
- Mass balance of target analyte and total fluorine data

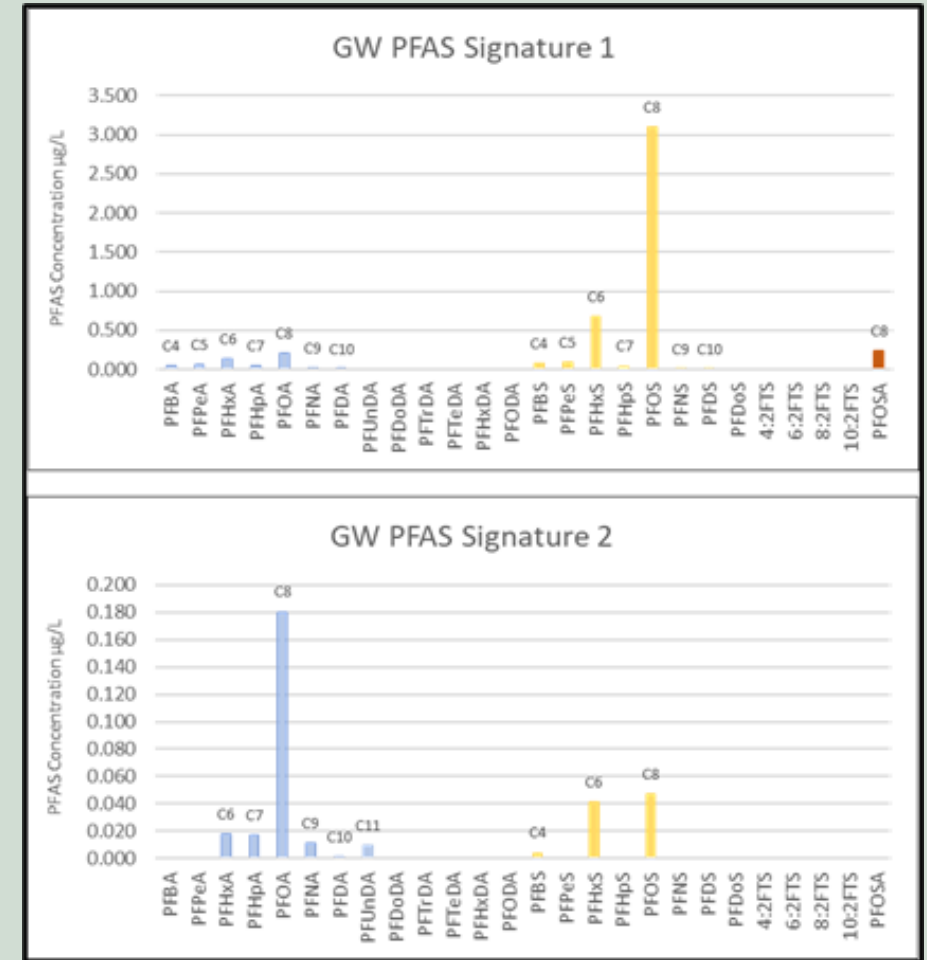## Tier II: PFAS Fingerprinting
2.
- Distribution of Target Analytes
- Compositional Source Analysis
- Diagnostic Chemical Features
- Comparison to Reference Library of PFAS Signatures

Tier III: Non-Target Analysis
3.
- Full NTA Evaluation
- Screening of Suspect Lists
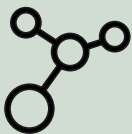
Compositional Source Analysis

PFAS Reference Library

Fluorochemical Commercial Products
- AFFFs
- Fluoropolymers
- Fluorosurfactants
- Volatile Fluorinated Chemicals

Manufacturing Types
- Electro Chemical Fluorination (ECF)
- Fluorotelomerization (FT)
- PFAS Byproducts

Analytical Reference Material Uses
- Source Characterization
- Non-target Analysis
- Project specific quality control sample
- Evaluate Lab Performance

PFAS Reference Library Materials
- AFFFs (historic and current use)
- Textiles and Textile Coatings
- Food paper coatings
- Teflon Products
- Carpet and Carpet Treatments
- Adhesives
- Semi-Conductor Coatings

PFAS Non-Target Analysis
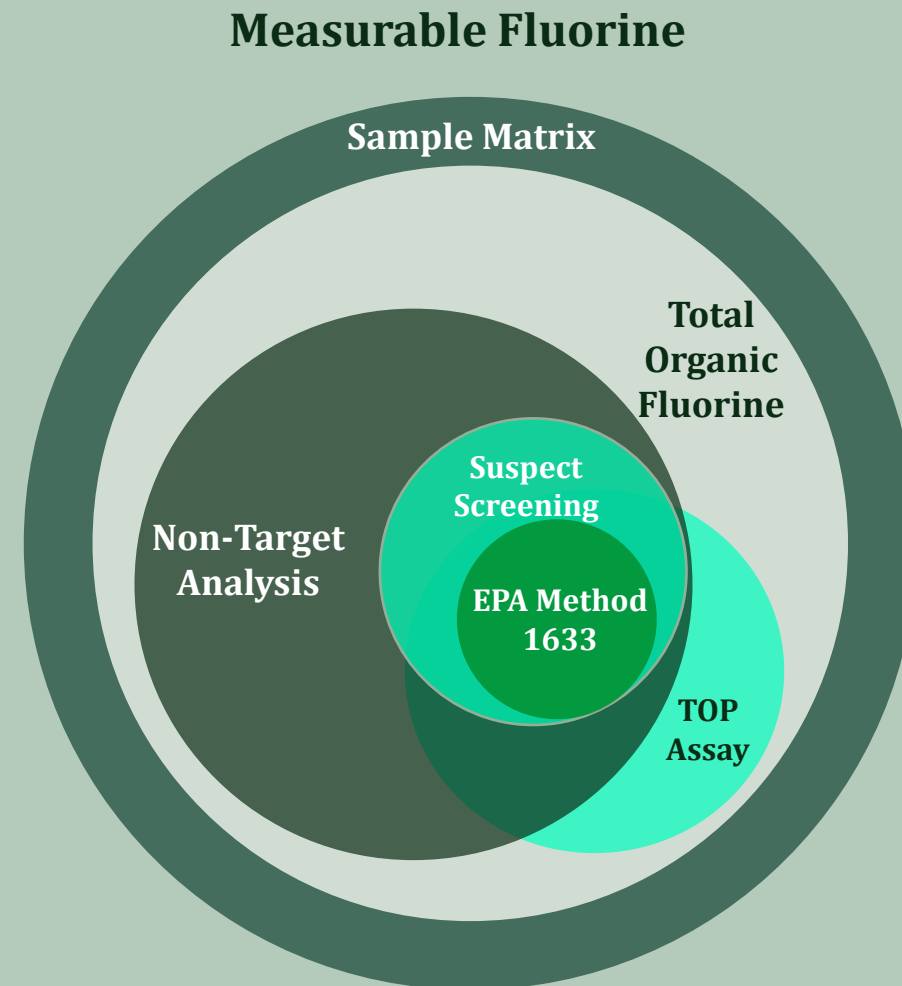
What is PFAS Non-Target Analysis?

- 1,000s of PFAS in commercial products and the environment (EPA 1633 ~ 45 analytes)
- High resolution mass spectrometry used to measure PFAS not measured by conventional EPA methods (qTOF, Orbitrap, HRMS)
- Quality Control framework is needed for reliability (e.g., SRT, Schymanski, etc.)
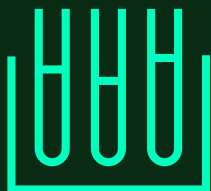
Forensic NTA Framework

- Suspect analytes ("suspected" PFAS)
- Advanced chemical characterization and source identification
- Conceptual Site Models
- Inform treatment technologies (e.g., non-target short chains)

NTA Challenges

- Not a fishing expedition - clear purpose and hypothesis for effective use
- Products are most often qualitative
- Robust review process is needed to evaluate data usability
- NTA produces a large volume of raw data – if NTA is not properly focused the data is not manageable or useful

Measurable Fluorine — Sample Matrix — Total Organic Fluorine — Non-Target Analysis — Suspect Screening — EPA Method 1633 — TOP Assay

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Fast Fluorinated Facts: PFAS Forensics

PFAS Non-Target Analysis

NTA Workflow: Basic required steps

- Chemical feature extraction from raw data
- Prioritize features of interest
- QA/QC of features
- Blank filtering
- Repeatability
- Significance from background
- Annotate subset of features
- Assign confidence via manual review
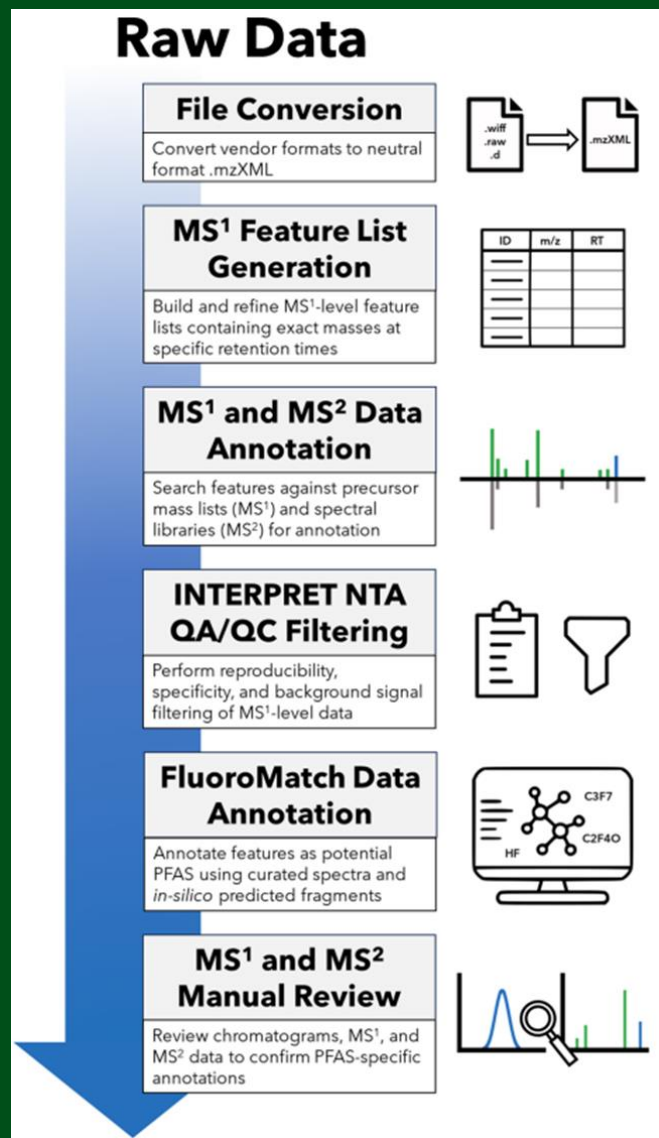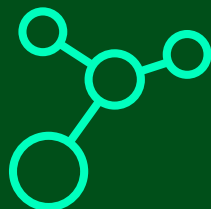

Whitehead et al, 2025

PFAS Non-Target Analysis

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Strengths and Uses

- Chemical prioritization
- Influent/effluent comparisons
- Improved site resolution, fingerprints
- Transformation product identification
- Numerous tools openly available

Quadrupole Time of Flight (qToF)

Smolinski et al, 2025

PFAS Non-Target Analysis
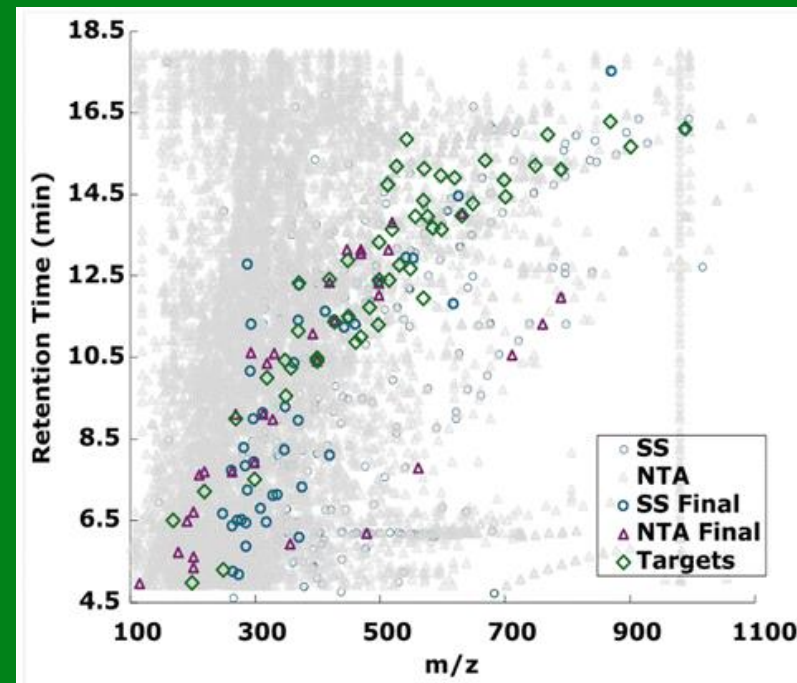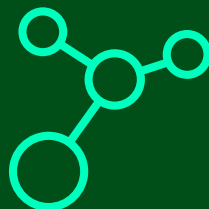
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Limitations/ Misapplications of NTA

- Time intensive, therefore more expensive
- Low-level analytes can be difficult to confirm
- Limited to analytes within method scope (e.g. extraction, ionization)
- Results can vary between labs/analysts

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Fast Fluorinated Facts: PFAS Forensics

Case study:

PFAS Investigation Confidential Chemical Manufacturing Facility

Location: North America

Industry: Chemicals

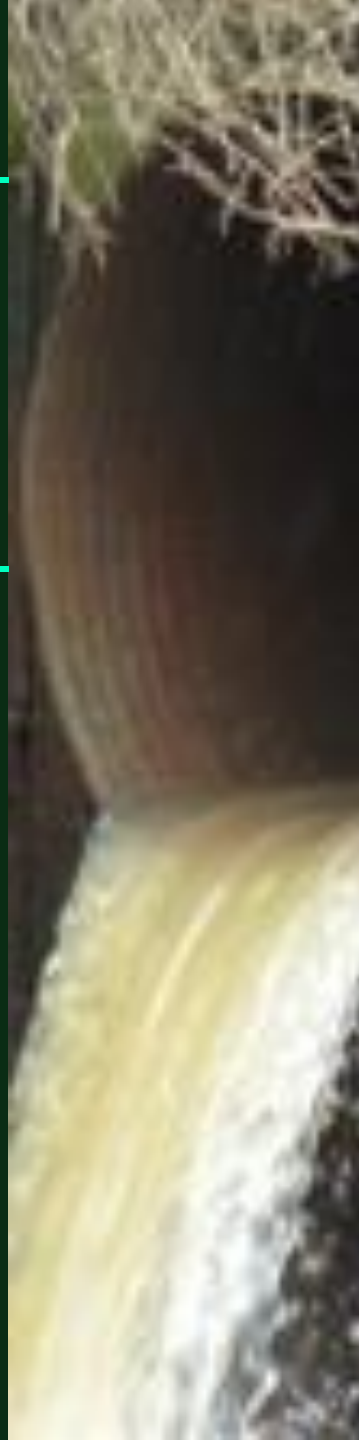Service: Forensic Chemistry

Background

The client requested technical support due to PFAS detected in facility effluent during unannounced surveillance monitoring conducted by a regional water treatment authority.

Technical Approach

ERM implemented a tiered forensic strategy to manage PFAS effluent liabilities.

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Fast Fluorinated Facts: PFAS Forensics

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Process

- **Tier I**
  Conducted effluent and influent sampling and PFAS laboratory analysis. Reviewed PFAS laboratory data to ensure data usability and evaluate PFAS liabilities. PFAS effluent results exceeded guidelines established by the wastewater utility.

- **Tier II**
  PFAS effluent data was then compared to site influent data and to UCMR 3 and 5 data to determine if PFAS was present in the public water system. It was determined that PFAS effluent concentrations were greater than influent and PWS UCMR PFAS concentrations and required further evaluation.

- **Tier III**
  A forensic analysis of the PFAS data was conducted to evaluate potential sources and compare data to known source characteristics found in published literature and/or the ERM PFAS reference material library. The PFAS signature detected in effluent was consistent with several potential PFAS-containing fluoropolymers.

- **Tier IV**
  A forensic evaluation of the facility was then conducted to identify potential PFAS sources. This included a review of site history, manufacturing operations, on-site wastewater system, and the development of an inventory of raw materials, chemical intermediates, products, waste streams and consumables.

Case study:

PFAS Investigation
Confidential Chemical
Manufacturing Facility

Location: North America

Industry: Chemicals

Service: Forensic Chemistry

Outcome

The forensic analysis identified the former use of a fluoropolymer in manufacturing operations. After further testing, it was determined that residues of the fluoropolymer remained in a wastewater holding tank and was a continued source of PFAS to site effluent.

Value

- Provided technical support to evaluate and identify PFAS sources.
- Interfaced with wastewater utility to communicate analytical and investigation activities.
- Evaluation provided the necessary information needed to mitigate PFAS source and eliminate the PFAS liability.
- The removal of the PFAS source brought the facility back into compliance with the local wastewater utility and ended the enforcement action.

Questions

Thank you