Air Emissions Testing for PFAS

Methods, Procedures & Challenges

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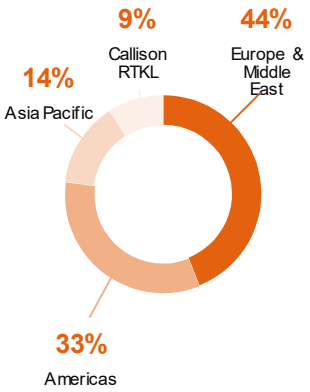
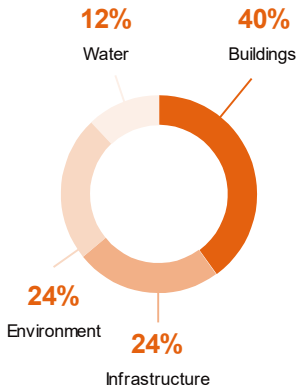
Arcadis at a glance – well diversified

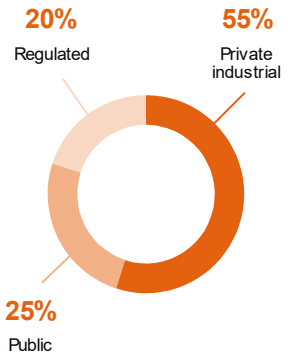
Geographies



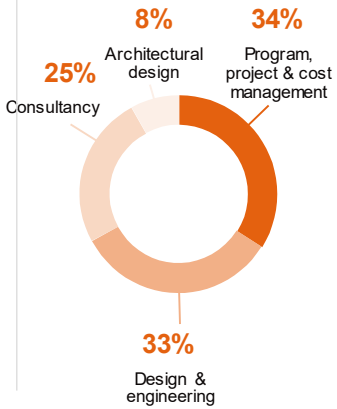
Businesses



Clients



Services



- Fourth largest Design/Engineering & Consulting Organization
- €600+ billion market annually (excl. Construction)
- Services provided during all phases of asset creation

€ 3.5bn
Gross Revenues

~ 28,000
People Globally

35,000+
Projects Annually

#1 In our industry
Sustainalytics
ESG Risk Rating score

Air Quality Community of Practice

Our Air Quality Community of Practice is comprised of over 130 professionals, scientists and engineers with expertise in various emission source permitting and compliance, dispersion modelling, air quality management programs and fence line monitoring.

Presentation Abstract

The potential for deposition of per- and polyfluoroalkyl substances (PFAS) from source emissions is becoming an important focus in forensic investigations of soil, ground water and surface water contamination. While the science of testing PFAS particularly in air continues to evolve, the procedures for testing point source emissions are complex and require consideration of varying process conditions. High temperature combustion sources, textile coating facilities, electroplating operations and other potential PFAS contributors pose varying challenges in the efforts to test emissions.

This presentation will provide an overview into the science and logistics of successfully collecting PFAS from point-source emissions that are released in the air. Stack testing methodologies and proper sampling handling will be an integral part of this discussion focusing on the following topics:

Detailed Review of Current Test Methodologies

Preparation (and timing) for Test Events

Precision and Accuracy of Available Methodologies

Emission Limits (or Lack Thereof)

What is PFAS?

What we know and we don't…

Per- and polyfluoroalkyl substances (PFAS) are a group of chemicals used to make fluoropolymer coatings and products that resist heat, oil, stains, grease, and water.

There are thousands of different PFAS, some of which have been more widely used and studied than others and are found in many different consumer, commercial, and industrial products.

They are long lasting chemicals, components of which break down very slowly over time.

Due to it widespread use and their persistence in the environment, many PFAS are found are present at low levels in a variety of food products and in the environment.

This makes it challenging to study and assess the potential human health and environmental risks.

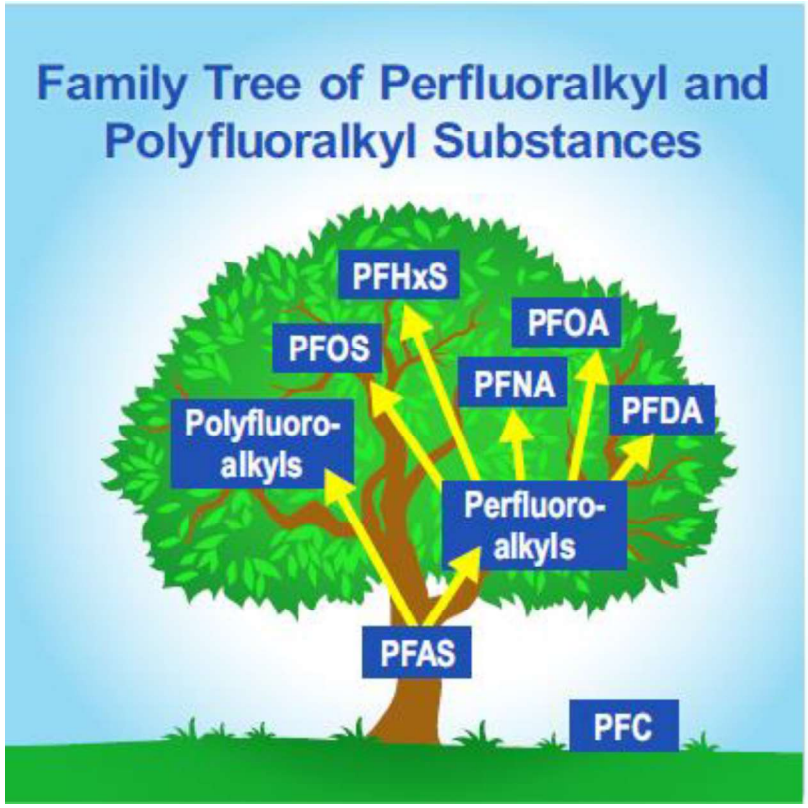


Image Source: ArcGIS Online

Increasing our understanding of risk to human health and the environment

What are the best ways to find and measure PFAS?

Field testing and laboratory analytical methods are an evolving science for measuring the level of PFAS

How harmful are PFAS?

Toxicity evaluations are underway for understanding how harmful PFAS is.

How are people exposed to PFAS?

Many scientific studies are being conducted to determine the origin, how they move through the environment and how people are exposed.

Potential Exposure Pathways for PFAS

- Working in occupations such as firefighting or chemicals manufacturing and processing.
- Drinking water contaminated with PFAS.
- Eating certain foods that may contain PFAS, including fish.
- Swallowing contaminated soil or dust.
- Breathing air containing PFAS.
- Using products made with PFAS or that are packaged in materials containing PFAS.

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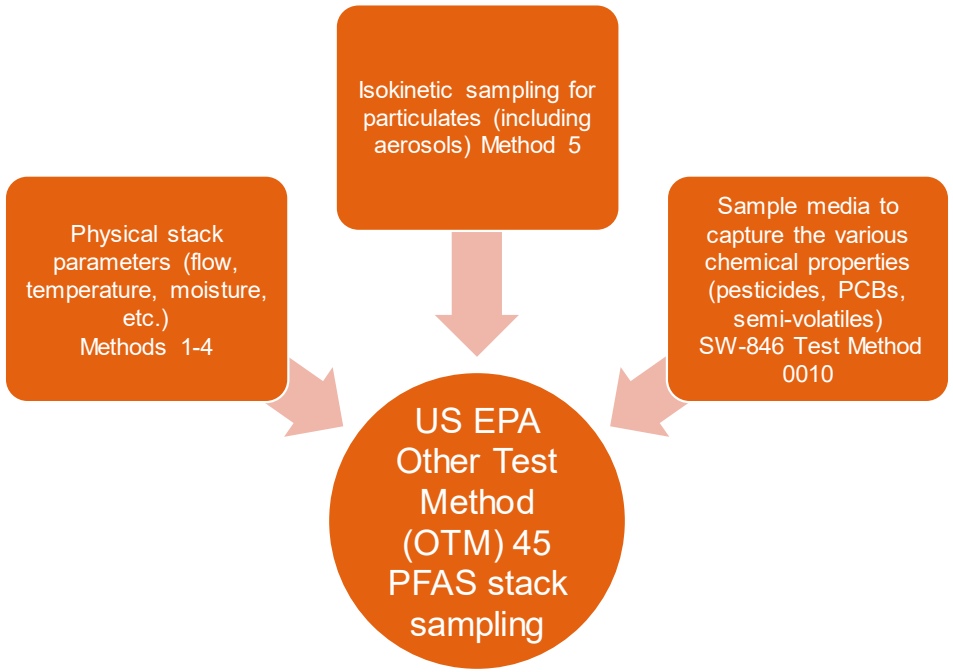
PFAS in Air

Known to transport long distances and deposition from the emission source

Transformation of certain PFAS occur while being airborne.

Testing for PFAS in air is still an evolving science.

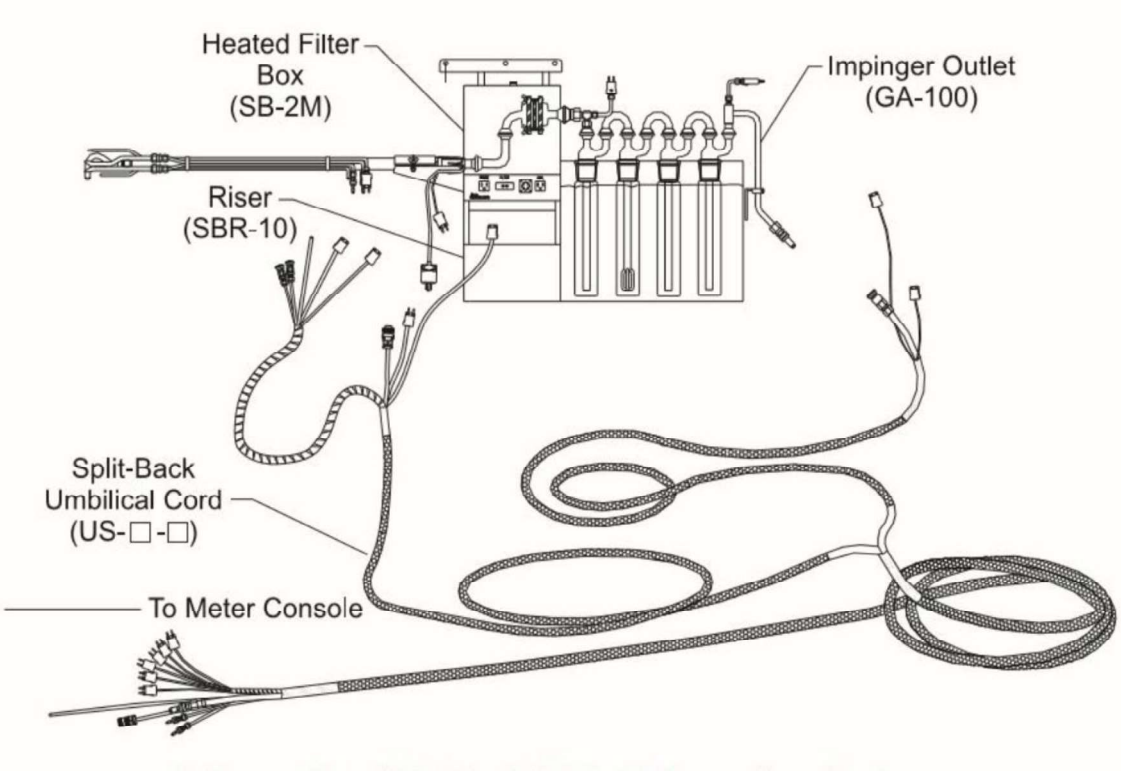
Overview of Testing Methods



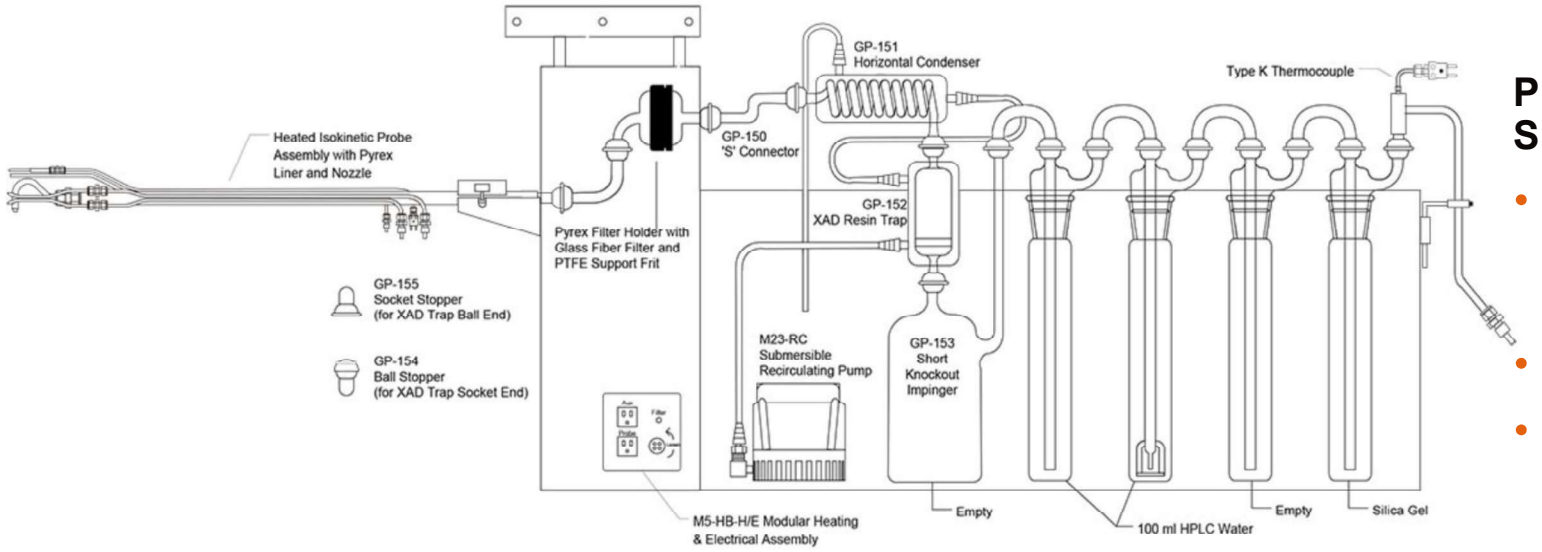
USEPA Test Method 5

ISOKINETIC TESTING FOR PARTICULATE

- $V_{sample} = V_{stack}$
- **Preliminary measurements needed**
- **Nozzle diameter is critical**
- **Maximum sample draw rate 0.75 cfm**
- **Leak check required**
- **“Front Half” before filter**
- **“Back Half” behind filter.**



SW-846 Test Method 0010: Modified Method 5 Sampling Train



PESTICIDES, PCBs, SEMIVOLATILES

- **Additional components added to M5 Train**
- **Multi-fraction analysis**
- **HR GC/MS analysis after extraction.**

US EPA Other Test Method OTM 45

PFAS SAMPLE TRAIN -

- Recently posted procedures provided by USEPA (OTM45)
- Recovery solvent MeOH/NH4OH
- All Sample Containers HDPE
- Results in many fraction analyses
- Emission limits not established.

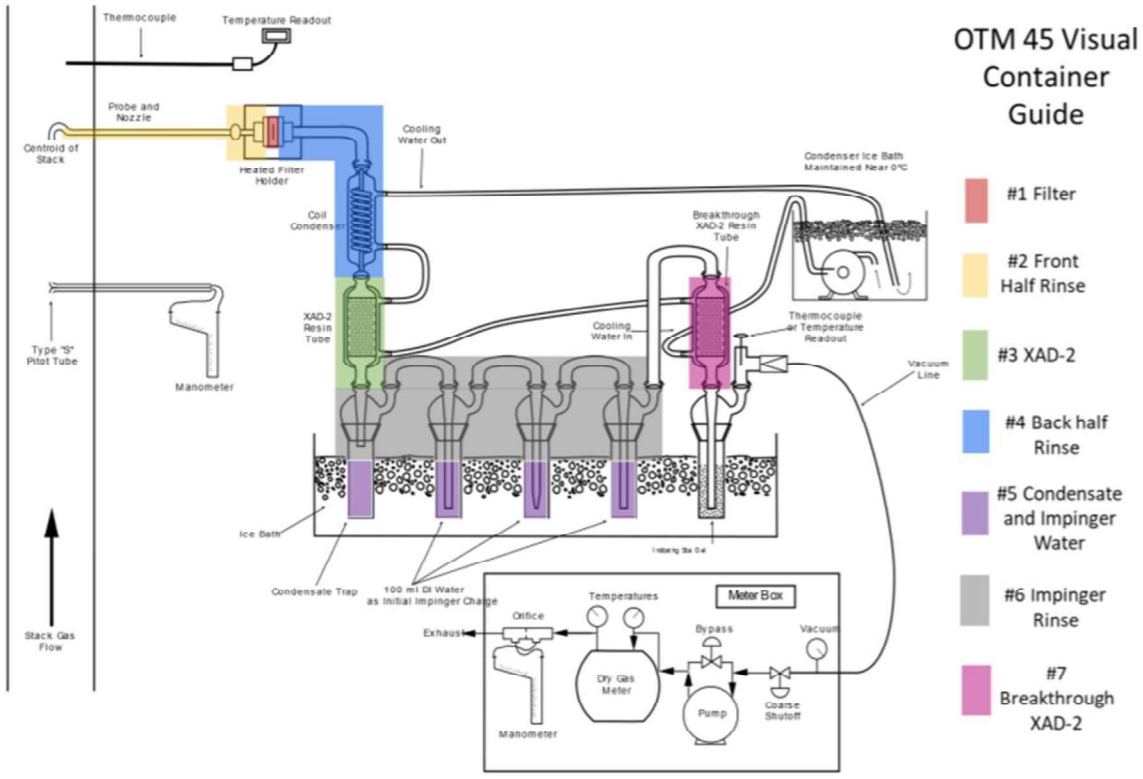


Figure OTM-45-1. Sampling Train

Source Test: Preparation and Execution

Development of Sampling Test Plan/Protocol

Coordination of Process Operations and Test:

- *Duration of tests vs Duration of production*
- *Continuous operation vs batch operation*
- *Continuous production*

QUALITY CONTROL

Field Sample Media Blank (Trip Blank) -

- Provided by laboratory
- All sample media represented
- used to “interpret” results.

Sample Train Proof Blanks (Glassware Unused) –

- Fully assembled train
- One for each test series
- Use same reagents and equipment

Well Organized, Covered and Clean Sample Recovery Area is Key to Successful Results!!

QUALITY CONTROL

Sample Train Field Blank (Glassware Used) -

- Similar to Sample Train Proof Blank.
- After a Test Run is Completed

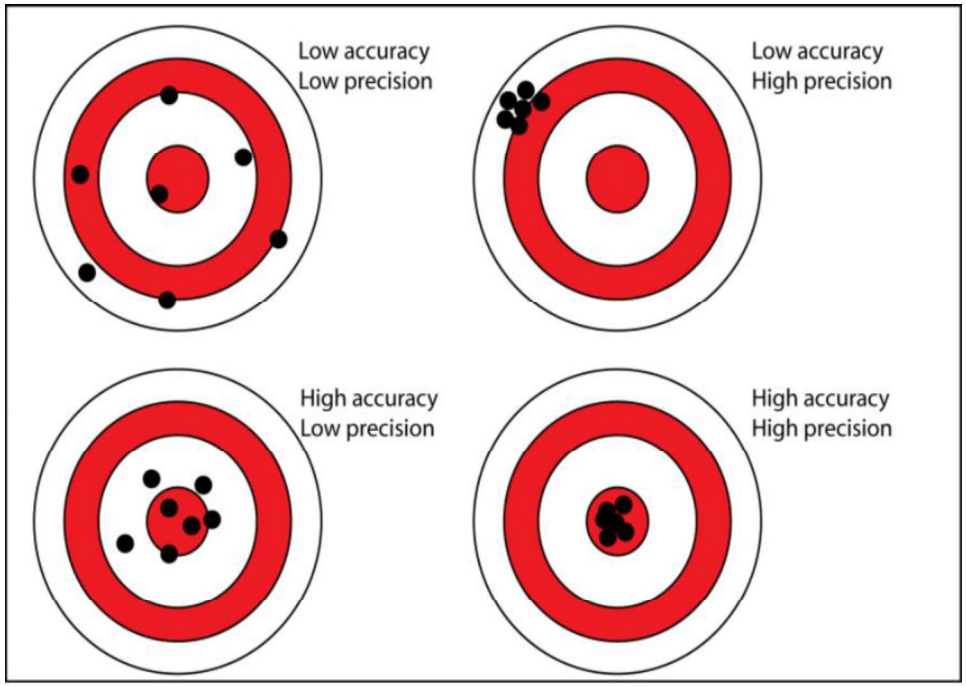
Pre-Sampling Standard Recoveries –

- Spiking of XAD-2 resin
- Spike Recovery 70-130% - Target
- Recovery 50 – 70% May be Acceptable
- Recovery <50% Invalid Test

Secondary XAD-2 Breakthrough –

- Should be <30% of total
- >10% add the Fraction results

Typical Challenges on Test Methods – Precision vs Accuracy



What affects the accuracy of the test?

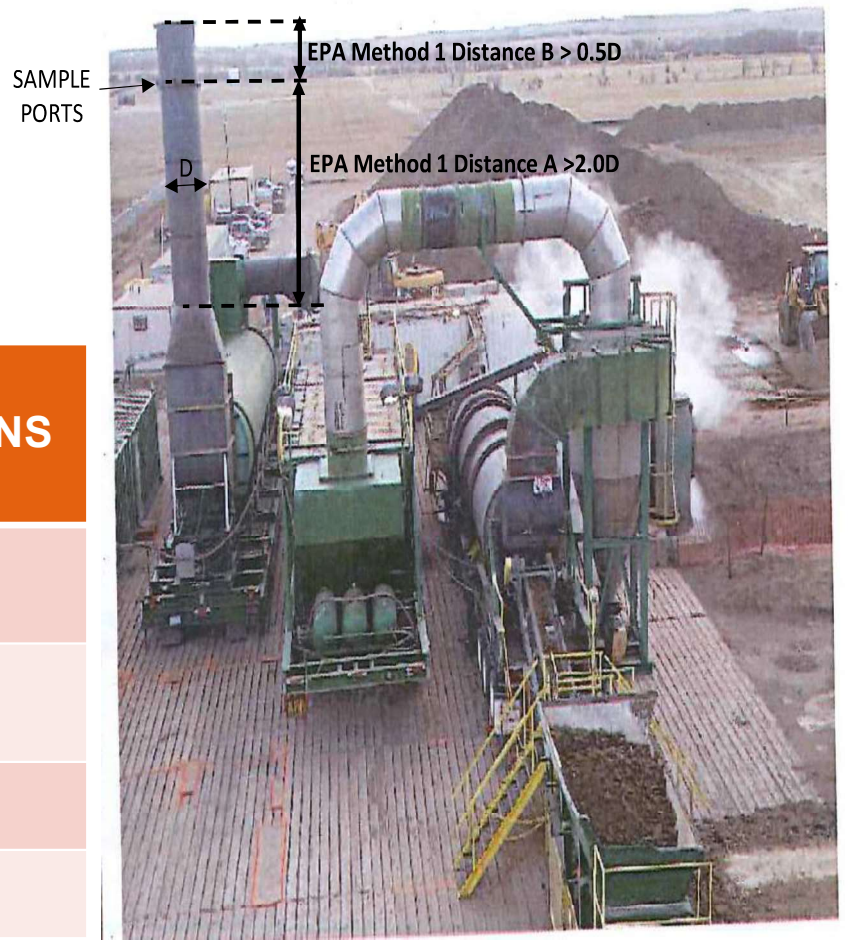
- Sample Volume Measurement
- Stack Velocity and Volumetric Flow
- Determination of Moisture
- Cross-contamination (laboratory and field)

What affects the precision of the tests?

- Proper Performance
- Knowledgeable and Experience of the Field Team
- Laboratory Handling and Analysis.

EMISSION LIMITS (OR LACK THEREOF)

- No established emission limits
- Likely to be driven by modelling.
- Field test results in published studies



SITE	IN-STACK CONCENTRATION (ng/m^3)	MASS EMISSIONS (lb/hr)
NORTH CAROLINA 2019	8,050	8.8E-05
NORTH CAROLINA 2018	500,000	2.5E-02
NEW HAMPSHIRE	680	2.1E-04
NEW HAMPSHIRE	1.9	2.7E-08

Thank You