PFAS Air Insight® TECHNOLOGY

A Battelle solution to measure PFAS contamination in ambient air

Per- and polyfluoroalkyl substances (PFAS) are a large class of chemicals that are widely used for many commercial and industrial applications. During the production and disposal of these products, PFAS can be emitted into the air. Long-range atmospheric transport can potentially carry PFAS to other environments.

OUR SOLUTION

Battelle has developed our PFAS Air Insight® technology to measure the amount of PFAS in ambient air to better understand potential exposures and to inform possible human and environmental health risks. Our work can also inform and guide the development of and compliance with health-based concentration limits.

HOW WE DID IT

We followed a stepwise process to qualify our sampling method to be fit-for-use. Our approach included investigating and optimizing the performance of the requisite instrumental analysis methods, the extraction and media handling methods, and the air sampling method in its entirety.

Battelle's PFAS Air Insight® approach is a modification of EPA Compendium Method TO-13A, in which ambient air (including total suspended particulate) is collected at ~200 L/min over 24 hours through a glass fiber filter (GFF) (to capture ionic, particle-bound PFAS) placed in front of a polyurethane foam (PUF)/XAD (divinylbenzene polymer)/PUF "sandwich" (for the neutral, volatile PFAS). Surrogate, isotopically labeled volatile PFAS are added to the sampling media pre-sampling and pre-extraction to track method performance. Sampling media are extracted by sonication or accelerated solvent extraction (ASE) for optimal method performance and PFAS recovery.

Given their expected ubiquity, we focused our efforts on the measurement of:

- Eight neutral PFAS:
  - 4:2, 6:2, 8:2 and 10:2 fluorotelomer alcohols (FTOHs)
  - N-MeFOSA and N-EtFOSA (methyl and ethyl perfluorooctane sulfonamides)
  - N-MeFOSE and N-EtFOSE (methyl and ethyl perfluorooctane sulfamidoethanols)
- 24 ionic PFAS:
  - Straight chain perfluoro C4 to C14 carboxylic acids
  - Straight chain perfluoro C4 to C10 sulfonic acids
  - Various sulfonamidoacetic acids, sulfonamides, and fluorotelomer carboxylic acids and sulfonates

Polyurethane foam (PUF) media before (left) and after (right) air sampling

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Neutral PFAS are quantified using gas chromatography mass spectrometry (GC/MS) by the method of internal standards. Ionic PFAS are analyzed by isotope dilution high performance liquid chromatography tandem mass spectrometry (LC/MS/MS). Extraction of the sampling media was by sonication or accelerated solvent extraction (ASE).

Battelle's approach integrates low solvent volumes, short extraction times, and optimized extraction techniques to maximize recoveries. Combined with Battelle's analytical expertise, PFAS Air Insight® delivers quality data in a research field of growing interest and need.

FILLING CRITICAL KNOWLEDGE GAPS WITH PFAS Air Insight®

PFAS and their contamination of sewage sludge generated at wastewater treatment plant (WWTP) processing are of increasing concern. An estimated 20% of all the sludge from WWTPs is incinerated, yet little is known about the release of PFAS into the atmosphere during the thermal treatment of this waste. To assess our method's overall fitness for purpose, we deployed our PFAS Air Insight® technology to conduct a first-of-its-kind study to measure the PFAS in the ambient air upwind and downwind of a full-scale sewage sludge incinerator.

Preliminary results indicate that with our PFAS Air Insight® ambient air sampling technology, we were able to measure airborne PFAS at concentrations between ~1 and ~1000 ng/m3. Volatile PFAS were dominated by FTOHs, while PFBS and PFOA were the prevalent ionic PFAS measured. We are presently finalizing the study results and we anticipate publishing them in the peer-reviewed scientific literature in the fall of 2020.

PS-1 high-volume air sampler with media installed

Battelle PFAS Air Insight® samplers (foreground) with incinerator stack (background)

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800.201.2011 | solutions@battelle.org | www.battelle.org/pfas

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