

Innovative Sampling and Analysis Techniques for Stack Sampling of PFAS Compounds in Air Emissions from Stationary Sources

February 2020

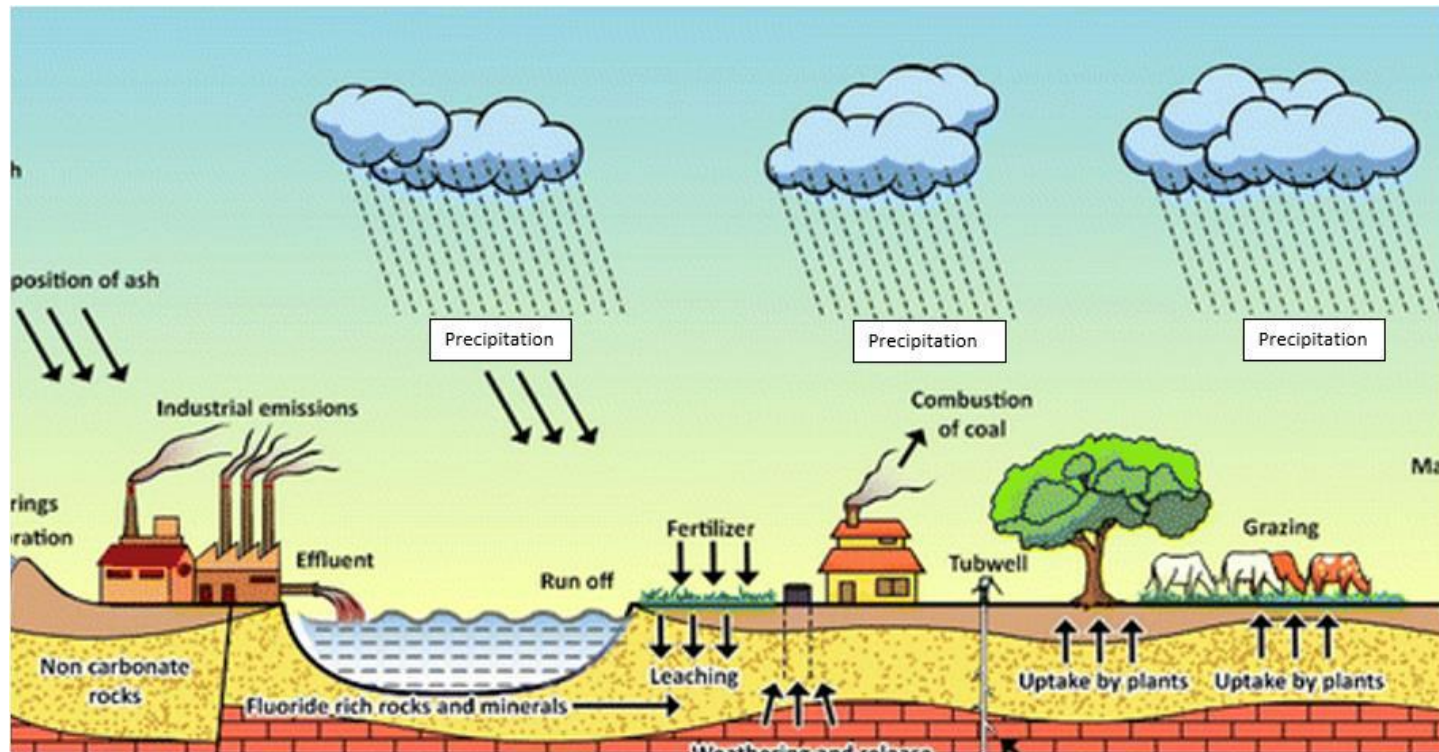
Per- and Polyfluoroalkyl Substances (PFAS)

PFAS in Air Source Emissions

- Focus has been on PFAS in drinking water, GW, and soil
- Very little focus on Air to date
- No EPA validated stack testing methods for PFAS
- No EPA validated ambient air monitoring methods for PFAS
- No regulatory standards for PFAS in Air



Why Air?

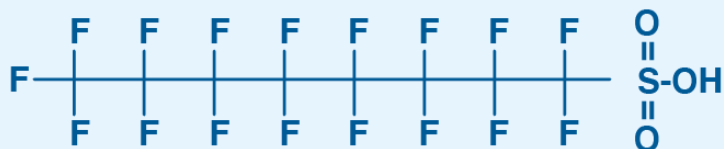


<https://www.picswe.com/>

What PFAS Are We Looking For?

- Method 537.1
 - Method 537.1 is a solid phase extraction (SPE) liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected per- and polyfluorinated alkyl substances (PFAS) in drinking water.
 - 18 PFAS Compounds
- Method 533
 - Determination of PFAS in drinking water by isotope dilution anion exchange SPE and LC/MS/MS.
 - 29 PFAS Compounds
- Third Unregulated Contaminant Monitoring Rule (UCMR 3 List 1)
 - 6 PFAS Compounds
- Other PFAS (Over 6,000 PFAS Compounds)

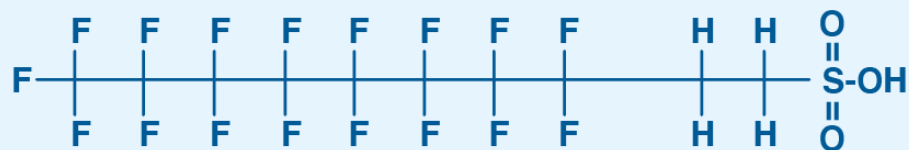
Per versus Poly PFAS



perfluorooctane sulfonic acid
(PFOS, CAS 1763-23-1)

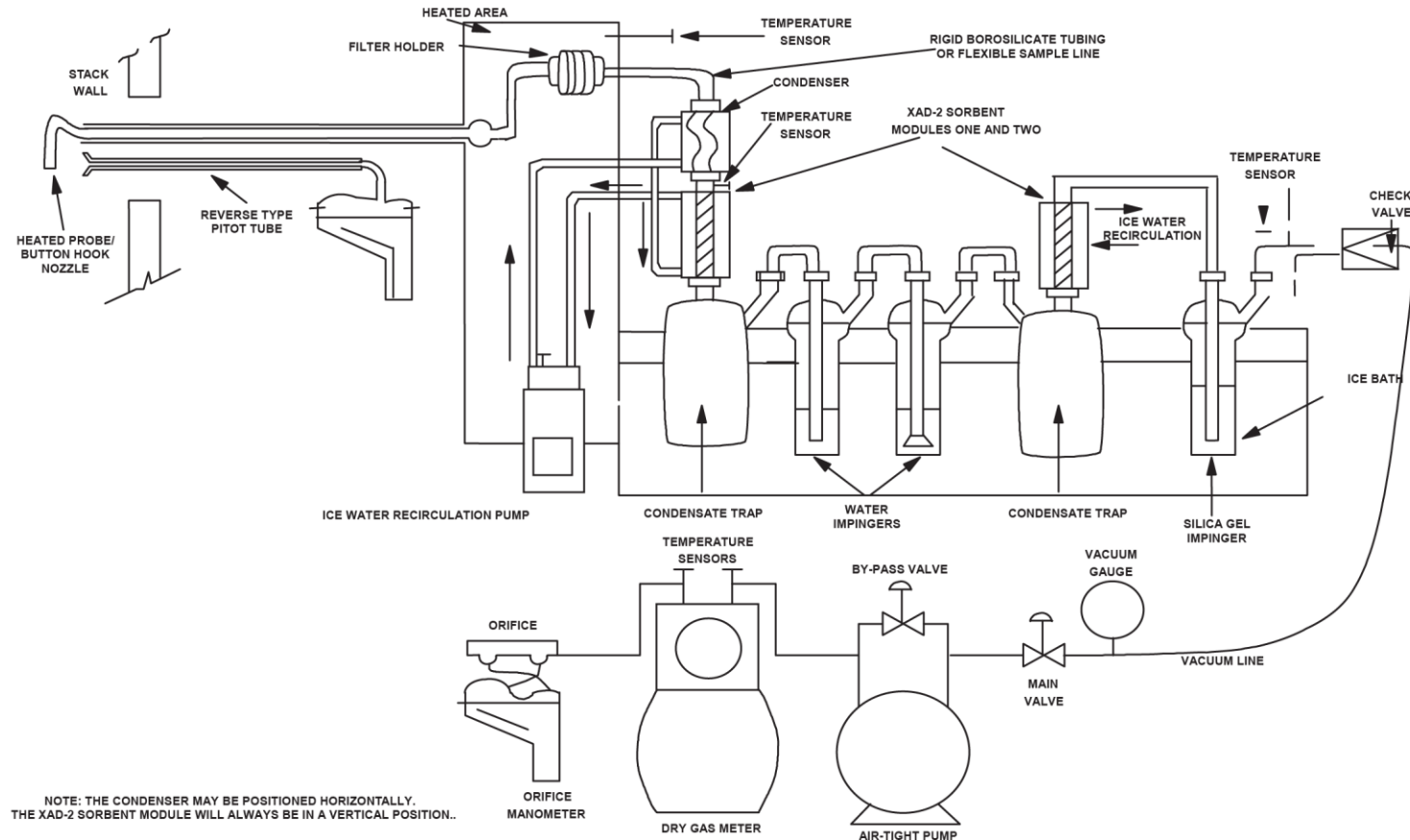


perfluorooctanoic acid
(PFOA, CAS 335-67-1)



8:2 fluorotelomer sulfonate
(8:2 FTS, CAS 039108-34-4)

Modified EPA Method 0010 Isokinetic Train



- Isokinetic Sampling Method
- Seven Sample Fractions
- LC/MS/MS Analysis
- Can be Modified with Additional Impingers

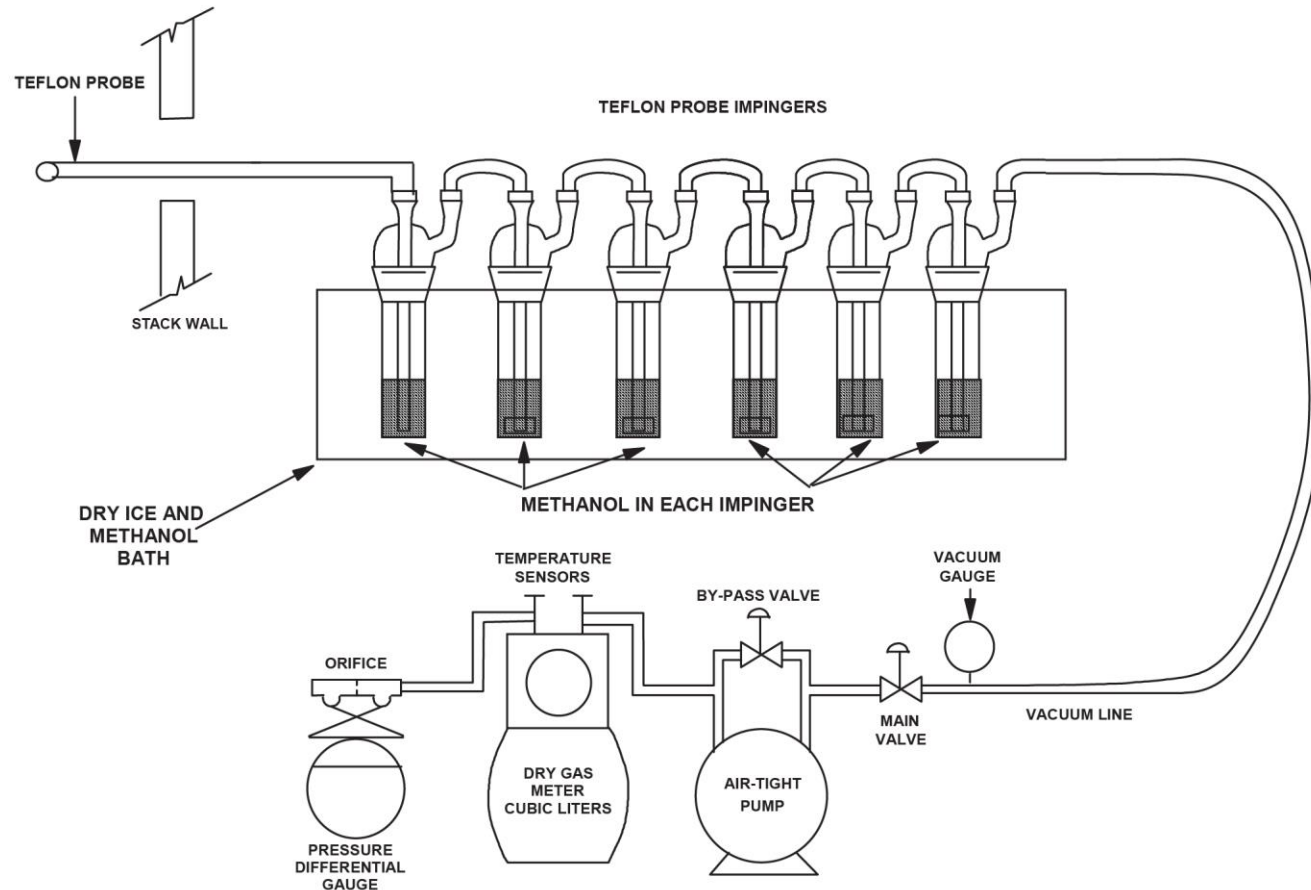
Modified EPA Method 0010 Isokinetic Train



Modified EPA Method 0010 Isokinetic Train

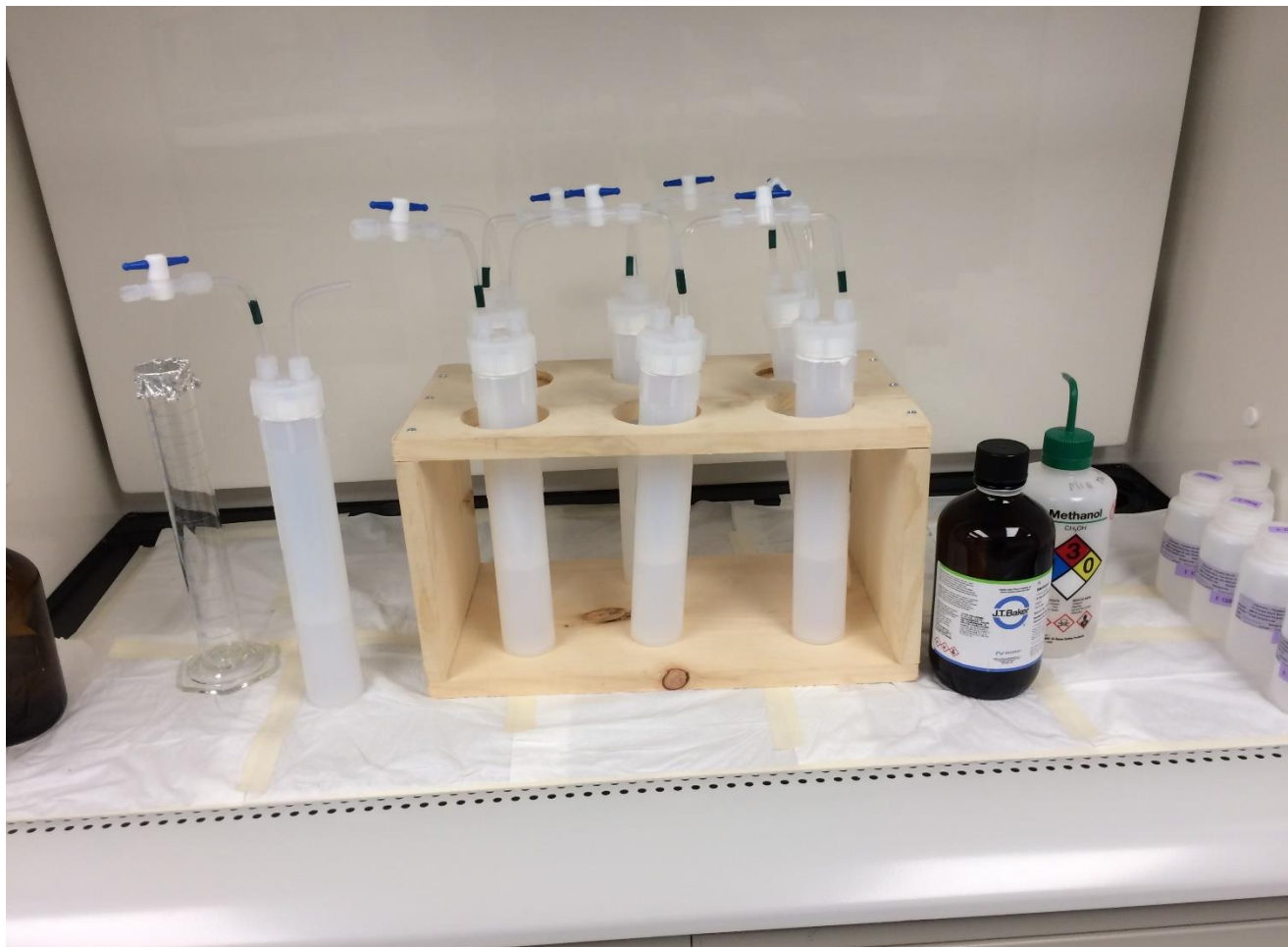


Modified EPA Method 18 Cryogenic Train

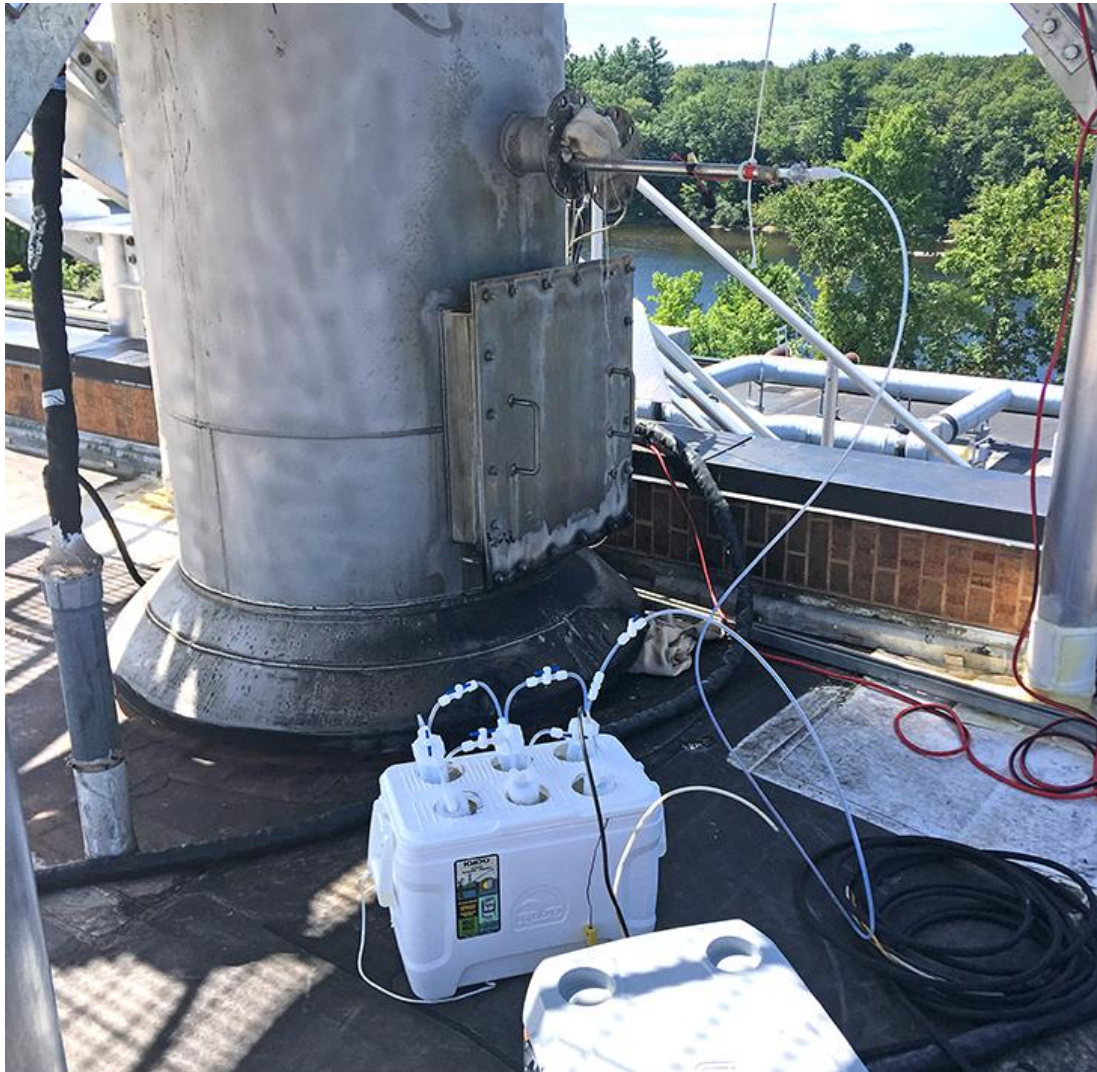


- Non-Isokinetic Sampling Method
- Multiple Impingers, Multiple Sample Fractions
- GC/MS Analysis
- Methanol Bath Chilled to -100 °F

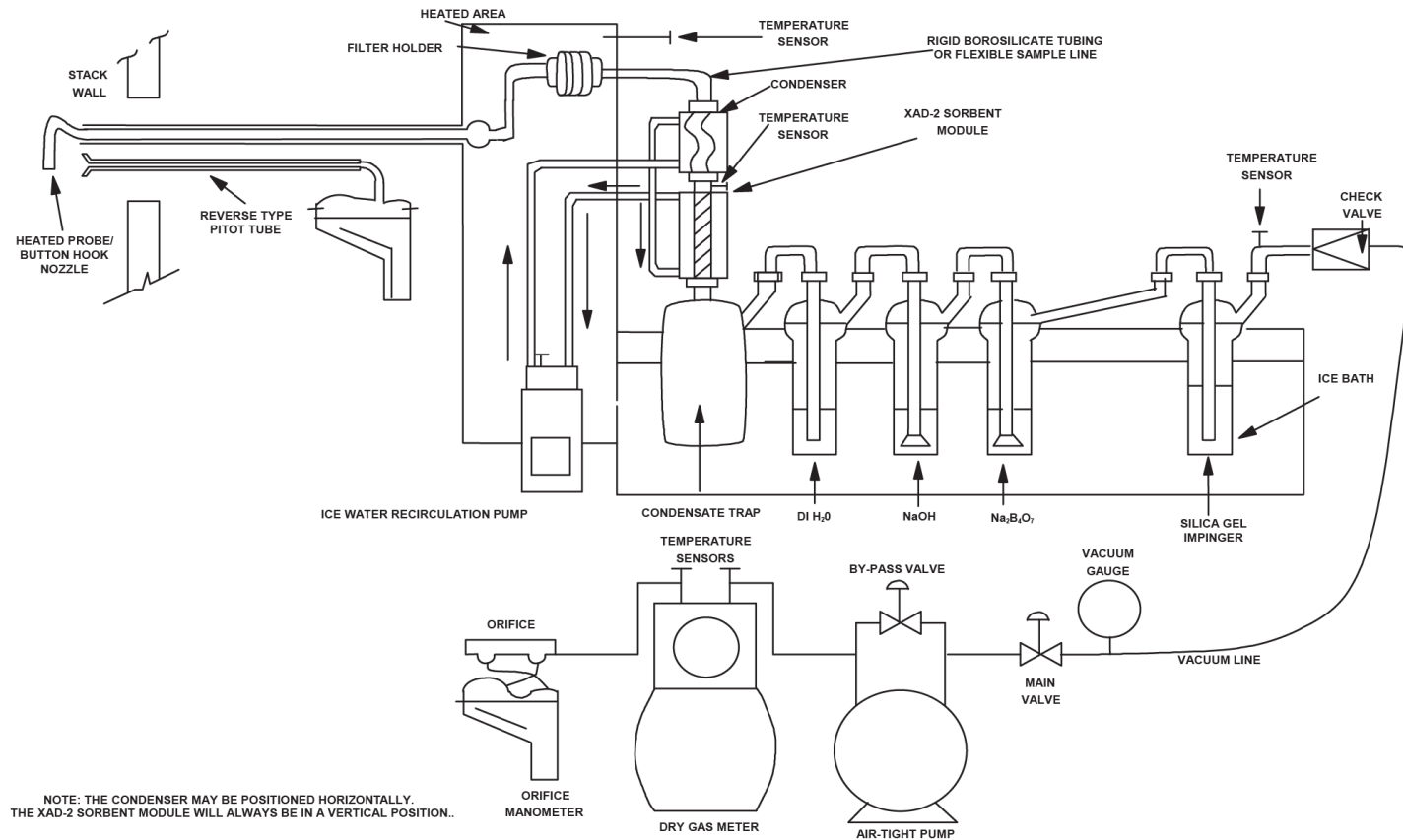
Modified EPA Method 18 Cryogenic Train



Modified EPA Method 18 Cryogenic Train



Other PFAS Sampling Train



- Isokinetic Sampling Method
- Seven Sample Fractions
- LC/MS/MS Analysis
- Can be Modified with Back Half Filter

Detection Levels

- Modified Method 0010 detection limits
 - 0.50ng equal to ppt in-stack PFAS concentrations
- Modified Method 18 detection limits
 - 2.5ng to 50ng equal to ppt in-stack PFAS concentrations

Processes Tested by Weston

- Chemical Manufacturing
- Coating Operation
- Sewage Sludge Incinerator
- Carbon Regeneration Unit



Potential Sources of PFAS Air Emissions

- Chemical Manufacturing
- Coating Operations
- Sewage Sludge Incineration
- AFFF (DoD)
- Refineries
- Pulp and Paper
- Waste Incineration
- Power Generation
- Others



PFAS Air Pollution Control Systems

- Thermal Oxidation
- Scrubbers
- Carbon Beds
- Air Stripper
- Afterburner/Scrubber
- Others



Future

- EPA 2019 PFAS Action Plan
- EPA validation and promulgation of stack testing methods
- Legal action by state regulatory agencies
- Regulatory agencies will determine which industries and processes will be regulated, which PFAS compounds will be measured, and will establish air emission limits
- Lawyers, Engineers, Chemists, and..... Stack Testers

Acknowledgements and Contacts

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Questions?

