

# Fire and Smoke Testing - Flat Sheet Media Correlations and Ancillary Support Testing Under Fire Scenarios

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## Abstract

Previous testing of High Efficiency Particulate Air (HEPA) filters at the Institute for Clean Energy Technology at Mississippi State University under fire scenarios only involved assembled filters. These tests showed a variability in filter performance from unknown sources. There is a need to characterize filter performance on a component level under controlled fire scenarios so these variables can be understood and controlled with the intent of improving repeatability. This poster describes the filter components, fuels, combustion processes, and other variables that may impact filter loading under accident fire scenarios.

## Flat Sheet Media

- Correlate media performance per unit area for scaling to larger assembled filters
- Parallels testing with assembled filters
- Data can be used for odd filter sizes for estimation purposes
- Testing can be conducted much more quickly and efficiently
- Testing parameters can be tested in large numbers to observe variability in results
- Measurements may include: differential pressure, temperature, relative humidity, flowrate, microscopy, and mass collected on flat media

## Equivalence Ratio

- Equivalence ratio does affect the byproducts of combustion
- Previous testing did not measure this variable
- Gas analysis of combustion products may provide insight
- Measurements may include: Combustion gas analysis, GC-MS, and oxygen content for equivalence ratio

## Fuel Composition

- Study how much fuel composition impacts filter performance
- Can a representative fuel, or subcategory of fuels, be constructed to simulate most fire scenarios?
- Can particle size distributions for individual fuels be characterized and used to construct distributions for mixtures?
- Experiment with alternative methods for fuel combustion



Figure 1. Example of current fuel (left) and combustion (right).

## Chemical Effects

- Combustion byproducts can be corrosive
- Is this damaging to media and filter components: separators, potting material, frames, etc.?
- Determine if combustion byproducts degrade filter components
- Effects will vary with fuel composition
- Measurements may include: Autopsy/media analysis of test filters/media for chemical effects

## References

[1] Environmental Protection Agency, Washington, DC. Method 202-Dry Impinger Method for Determining Condensable Particulate Emissions From Stationary Sources, 2017.

## Condensable Content

- Condensable content may have an impact on filter performance
- This is not accounted for in previously collected data
- Variability in previous testing results may be due to this phenomena
- Method 202 or similar sampling train may be used
- Measurements may include: flowrate and mass collected

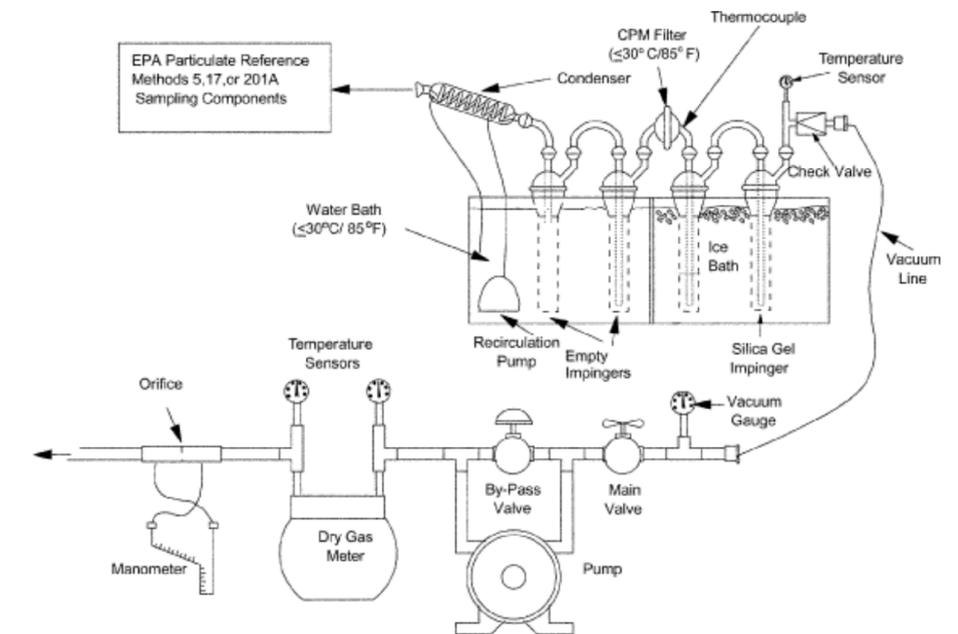


Figure 2. EPA 202 sampling train example[1].

## Wall Deposition/Plate Out

- Characterization of particle loss in ducting
- Smoke reaching filter with no wall losses is a conservative assumption
- Effectively measuring losses is a challenge