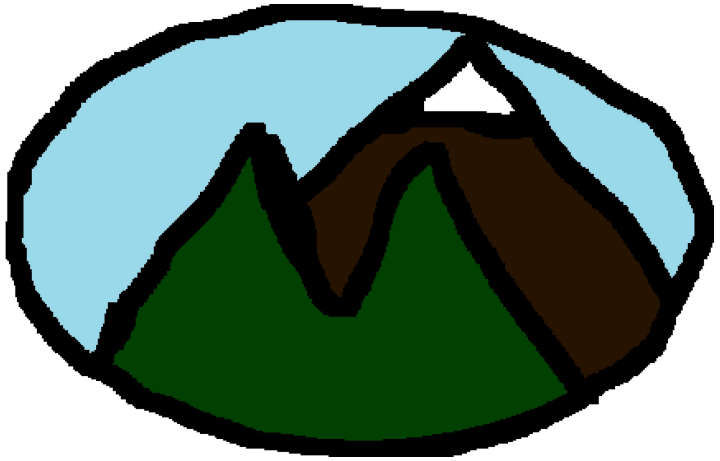
How to Measure Emissions From Chimney Stoves



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Why measure chimney stove emissions?

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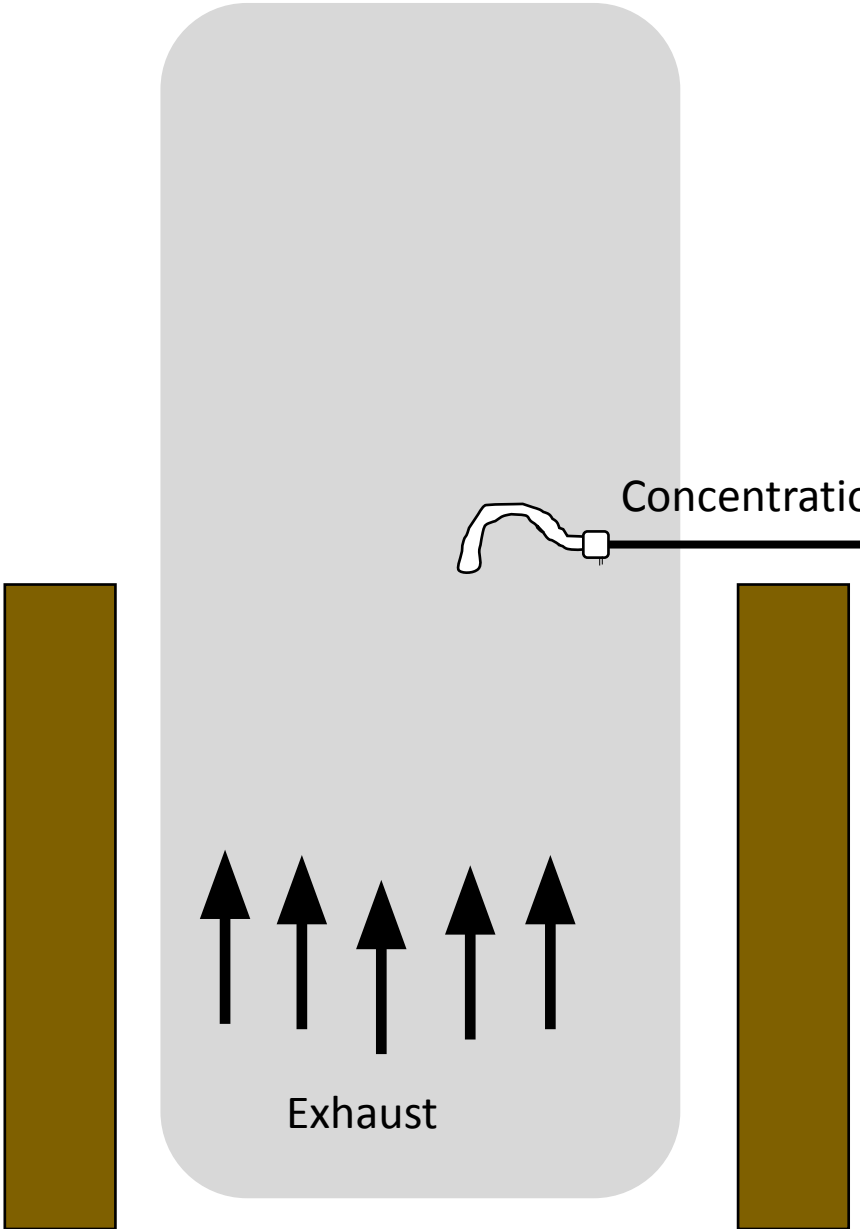
How:

Calculate emission metrics (with measurement uncertainty) using two methods:

Stack Flow Method and Carbon Balance Method

Carbon Balance Method



Concentrations

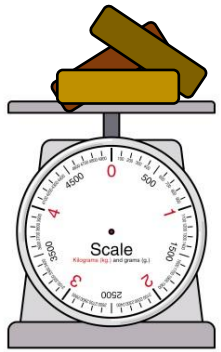
Concentration Ratios

Emission Factors

Emission Rates

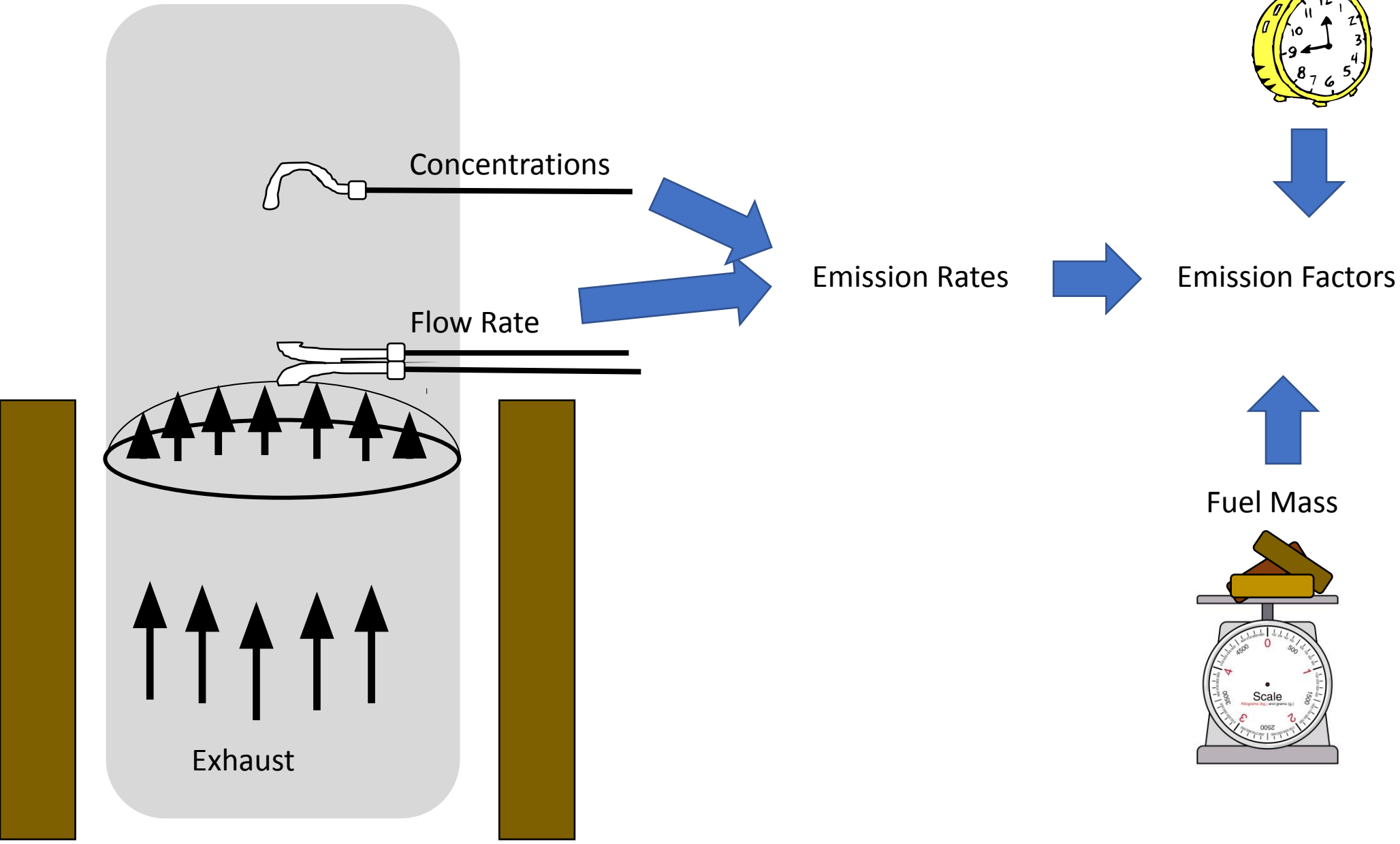
Time

Fuel Mass



Fuel Carbon Fraction

Stack Flow Method



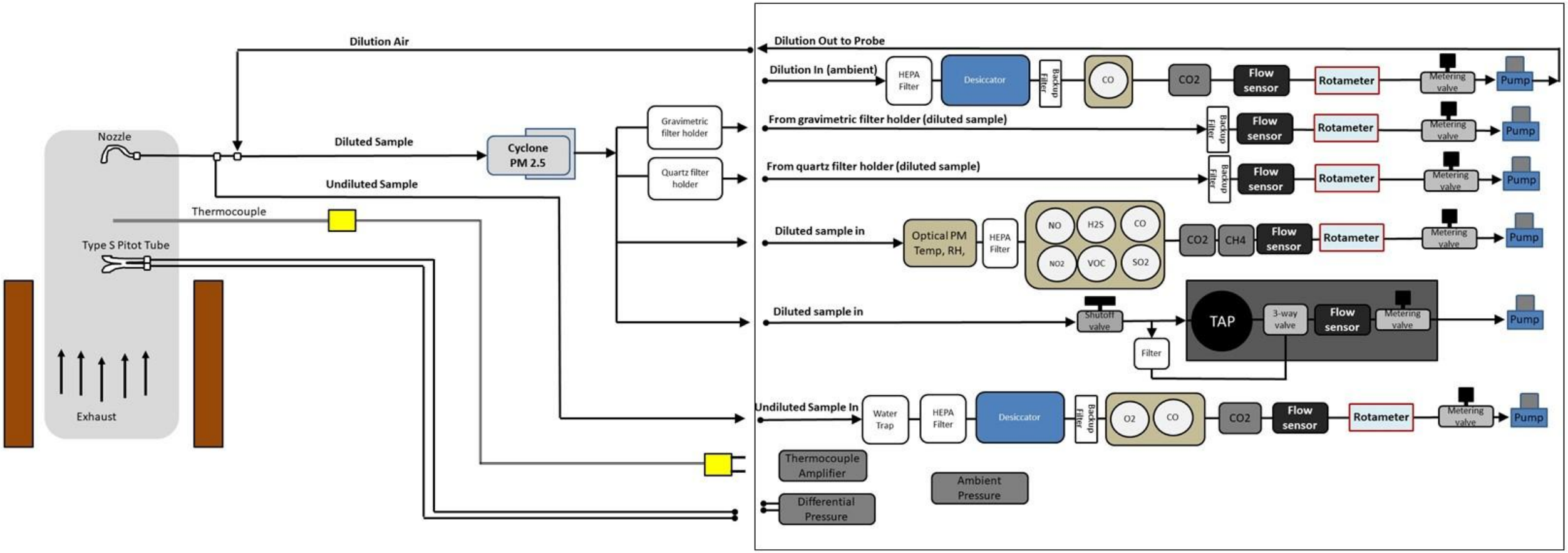
Emission Rates

Emission Factors

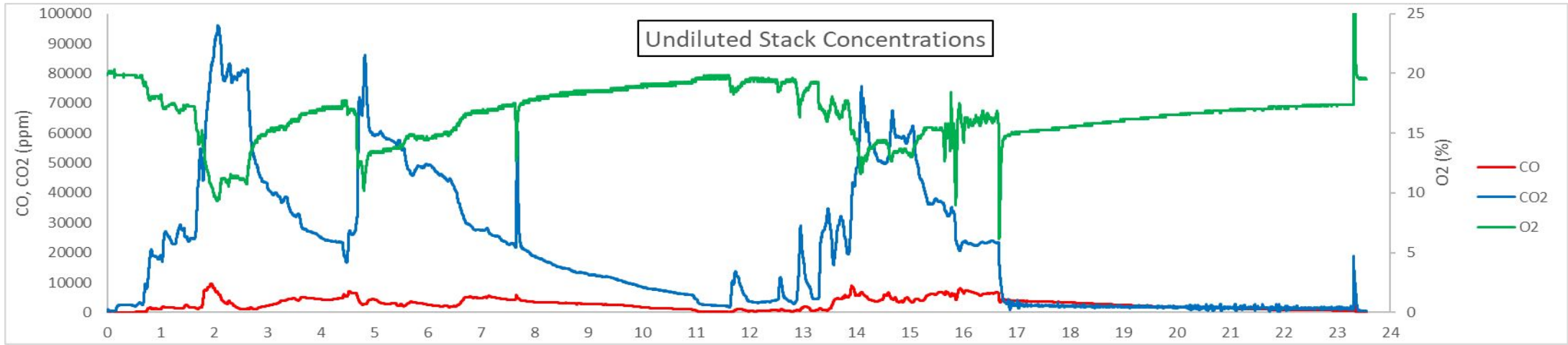
Time

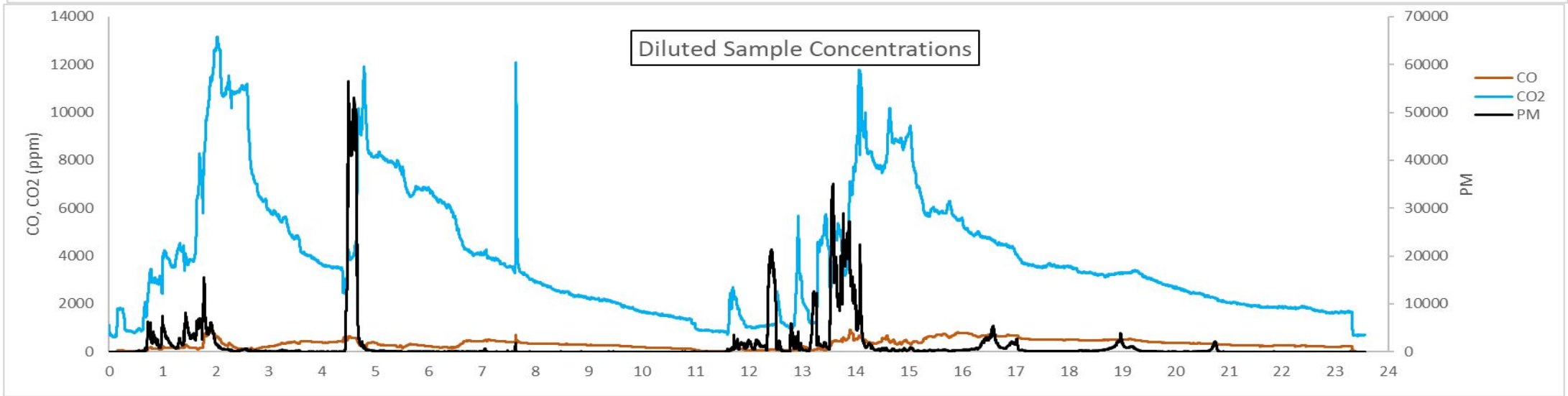
Fuel Mass

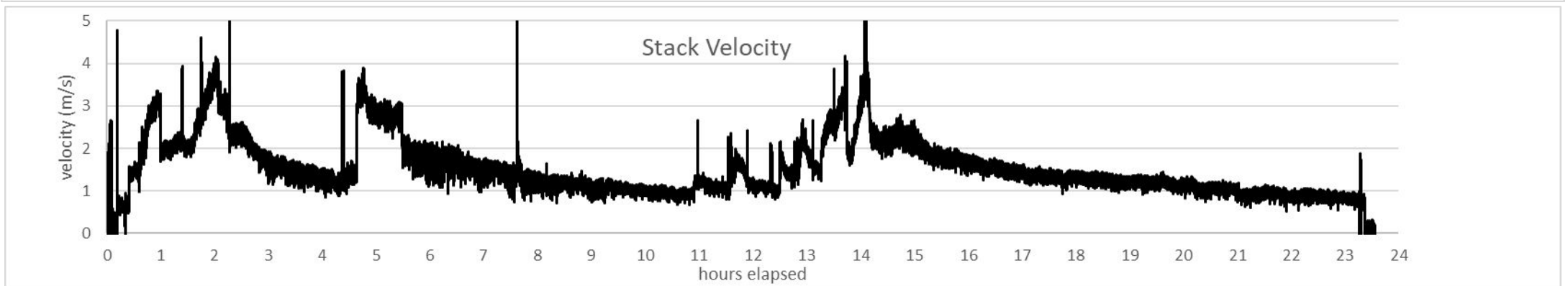
Possum1 Portable Sampling System



Possum1 Portable Sampling System


Undiluted Stack Concentrations
CO, CO2 (ppm)
O2 (%)
CO
CO2
O2


Diluted Sample Concentrations
CO, CO2 (ppm)
PM
CO
CO2
PM

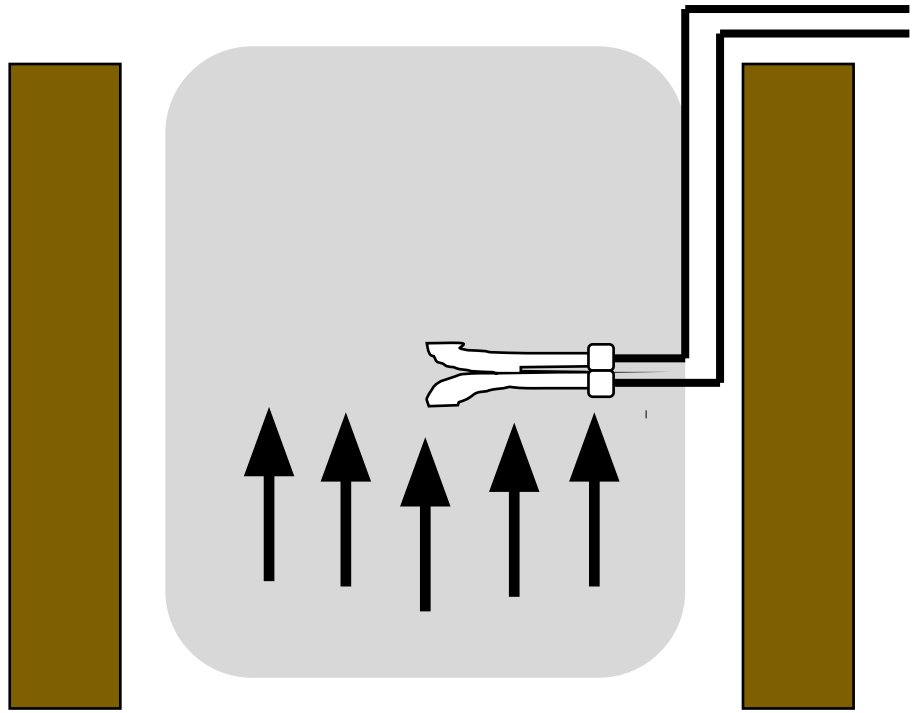

Stack Velocity
velocity (m/s)
hours elapsed

Results

	Stack Flow Method	Carbon Balance Method
PM Emission Rate (g/hr)	5.720 ± 0.76	5.721 ± 0.82
CO Emission Rate (g/hr)	180.350 ± 20.4	180.349 ± 32.2
CO_2 Emission Rate (g/hr)	1876.5 ± 380.7	1876.4 ± 497.8
PM Emission Factor (g/kg)	1.876 ± 0.510	1.877 ± 0.321
CO Emission Factor (g/kg)	58.123 ± 6.76	58.123 ± 4.28
CO_2 Emission Factor (g/kg)	549.30 ± 74	549.29 ± 34

Challenges

- Particle loss
  - Nozzle
- Undiluted sample conditioning
  - Drying
    - Desiccant
    - Ice bath
    - Thermo-electric chiller
  - Ice formation
- Velocity measurement
  - Near detection limit
  - Velocity profile at chimney outlet

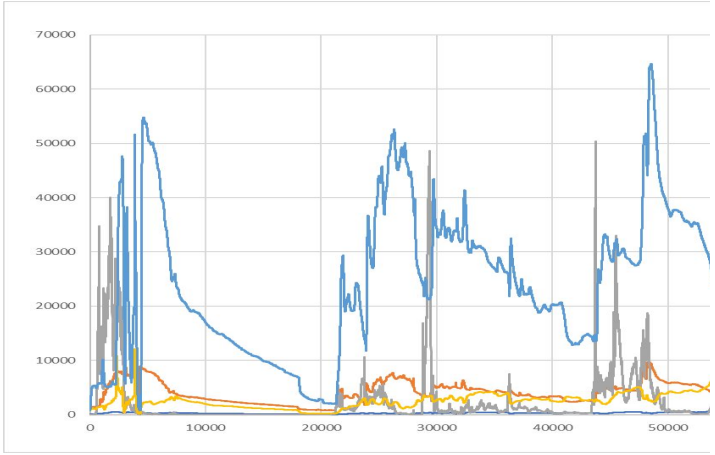


Other Emissions Equipment Options for Measuring Chimney Stove Emissions

none!

Just use your eyes

Emissions Video Data



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Thanks