progress in assessing stove emissions in the field and laboratory

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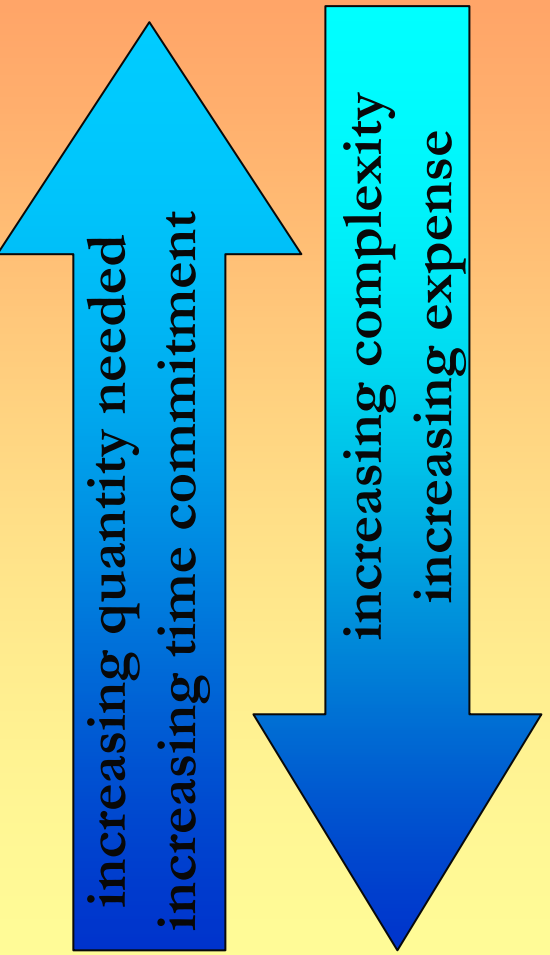
ETHOS Conference
Kirkland, Washington
29 January 2005

Last year's proposal



I. In-field monitoring

- confirm improvements
- rapid feedback to stove artisans

II. Stove design lab

- evaluate design choices
- demonstrate emission improvements

III. High-end (university) testing

- validate less-expensive measurements
- understand nature of emissions

Summary of measurements needed

- Carbon monoxide
- Particulate matter
- Some way of relating measured pollutant to fuel burned
- Real-time data collection; data reduction

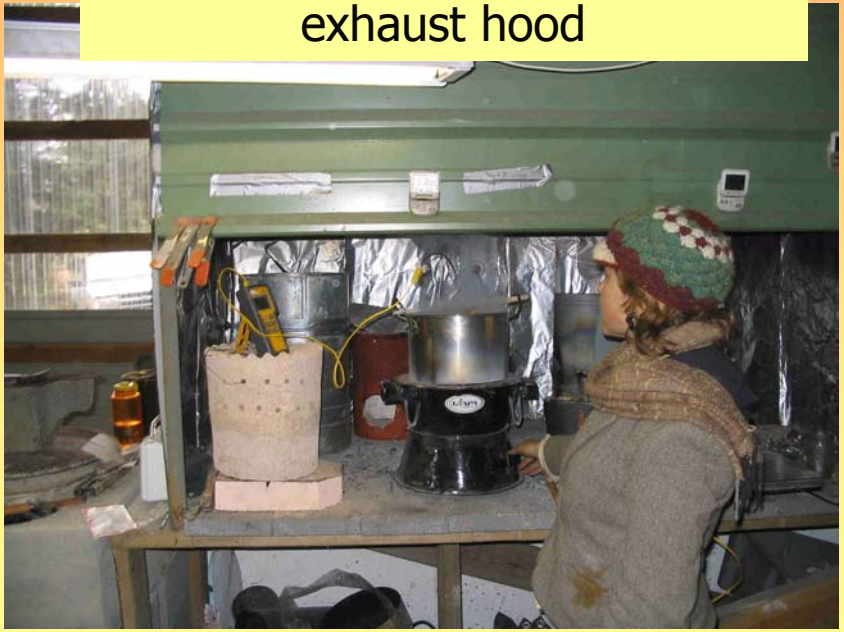
Emissions
(direct from stoves)

Room concentrations
(proxy for exposure)

Stove design lab at Aprovecho

Fully functional measurement lab

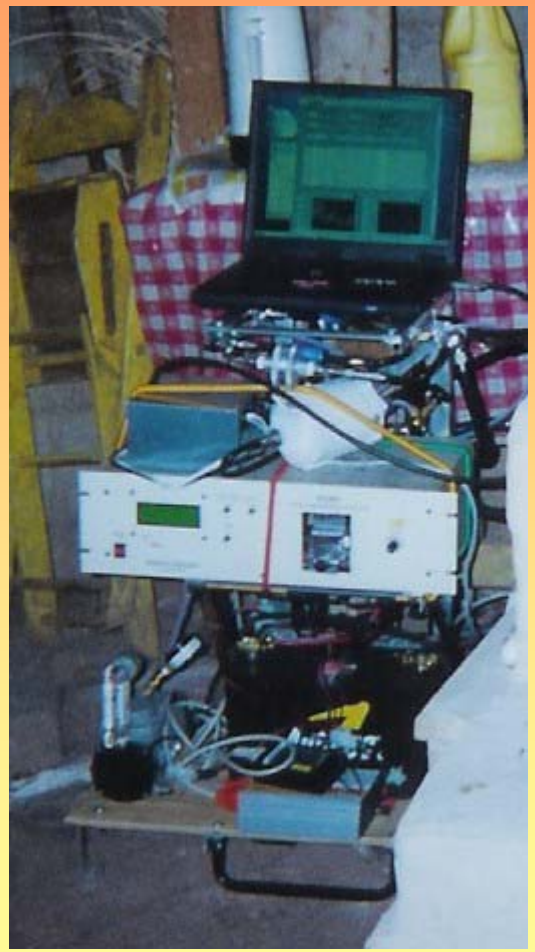
Emissions with Dale Andreatta's exhaust hood



Room concentrations in simulated kitchen

Results from 16 stoves– please see Dean Still's poster!

"Lab on a cart"



Christoph Roden, PhD student

Size: 24" x 36" x 19"
Power: 12v car battery
Runtime: approximately 5 hours
Cost: About $14k

Measurements:

Similar to Aprovecho, with some additions

- Real-time CO and CO_2
- Real-time optics
  - nephelometer (approximately particle mass)
  - absorption meter (particle color/type)
- Particles also collected on filters for later chemical analysis

Honduras project

umbrella:
Trees, Water, & People

- Stove Improvement
  AHDESA & Aprovecho
- Dissemination
  AHDESA & TWP
  (Stuart Conway's talk)
- Monitoring
  UIUC & AHDESA

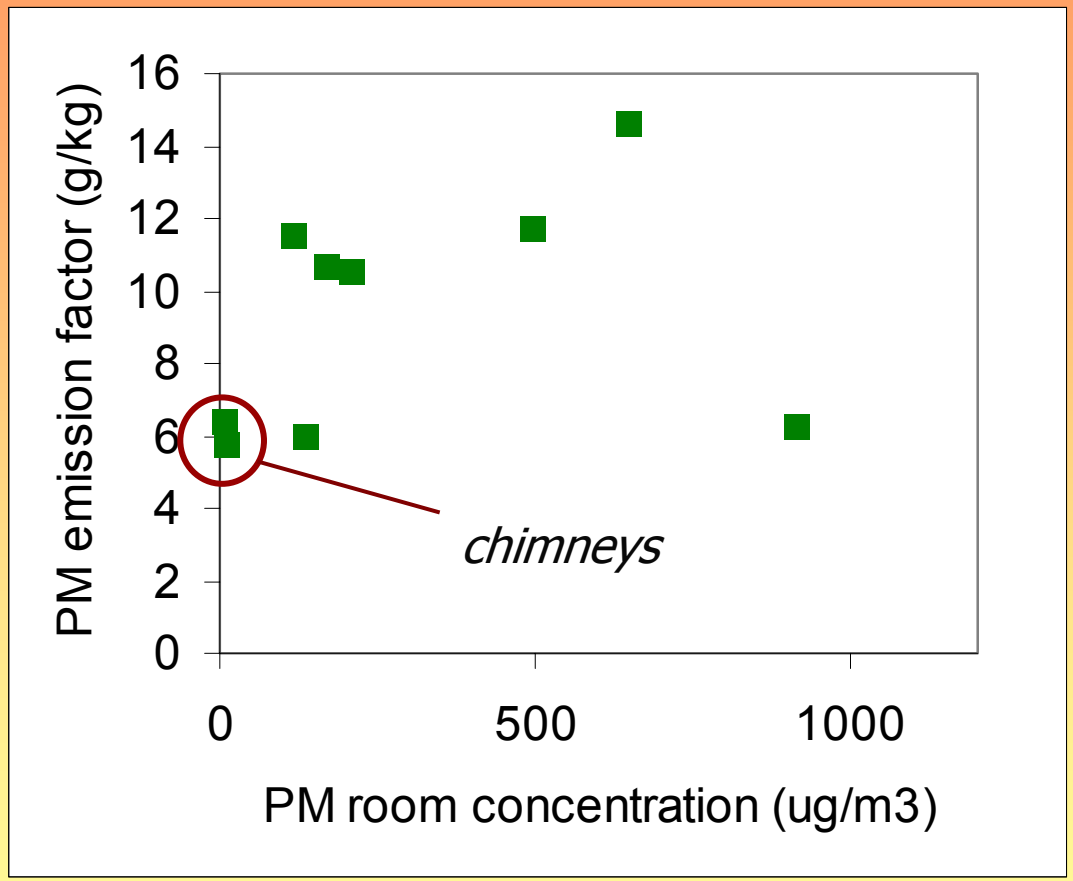
funded by PCIA
UIUC participation largely funded by NSF

- Measure emissions & room concentration simultaneously
- Gather in-field measurements of emission rates
- Train AHDESA in monitoring
- Gather information for other projects

Homes are fairly open.

- 14 homes tested (12 with room monitoring)
- Temperate climate
- Kitchens:
  - open windows (no glass)
  - detached from house, with open walls
- Somewhat unexpected observations:
  - fire continually hot
  - extensive consumption of construction debris
  - presence of refrigerator reduces cooking time
  - very large wood pieces

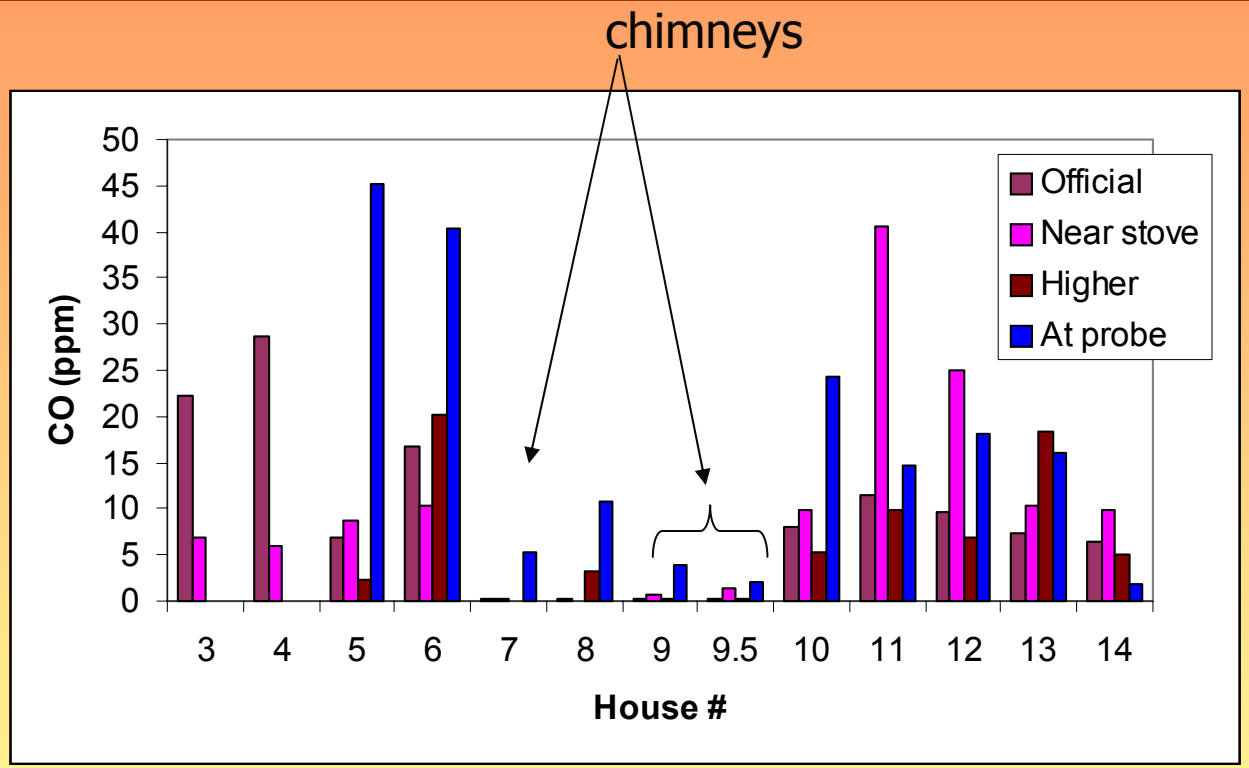
Emissions vs room concentrations



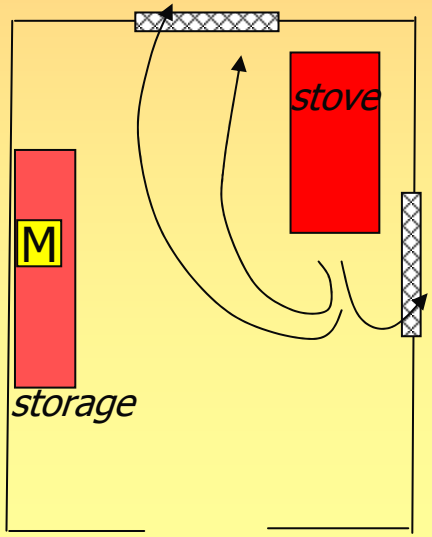
Chimneys appear effective in more than one way (but note small sample size)

- Remove pollutants from room

Variations in room concentrations



typical kitchen layout

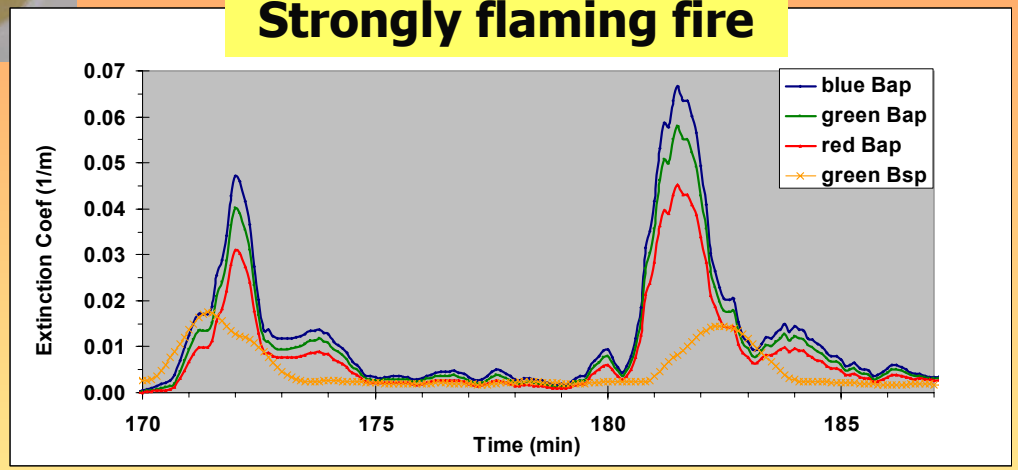


- Measured with 4 HOBO dataloggers
- "Near-stove" higher than "Official" by ~50-200%
- Need to have discussion about locations

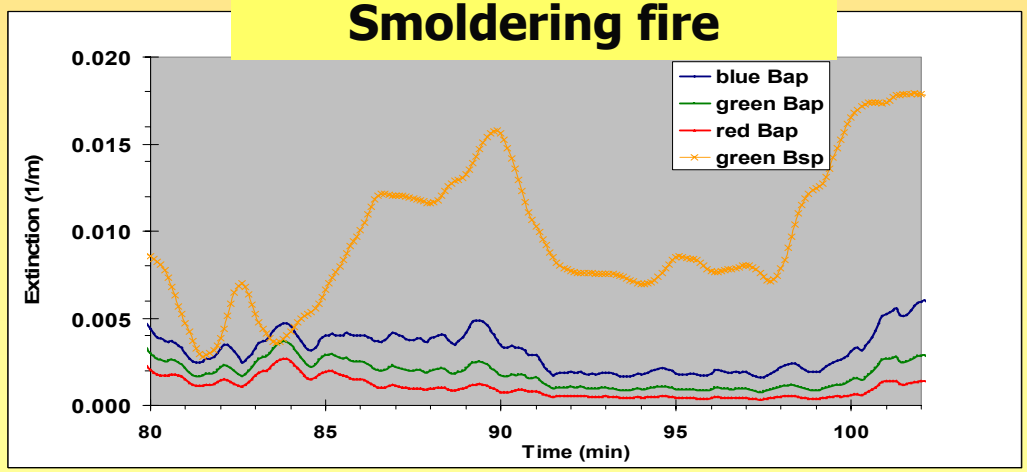
Evaluating our present PM measurement (I)

- Weighing filters:
  - well-accepted method
  - requires balance, patience, & practice
  - no real-time feedback
- Real-time optics:
  - gives immediate feedback
  - requires assumption about particle properties

Strongly flaming fire



Smoldering fire

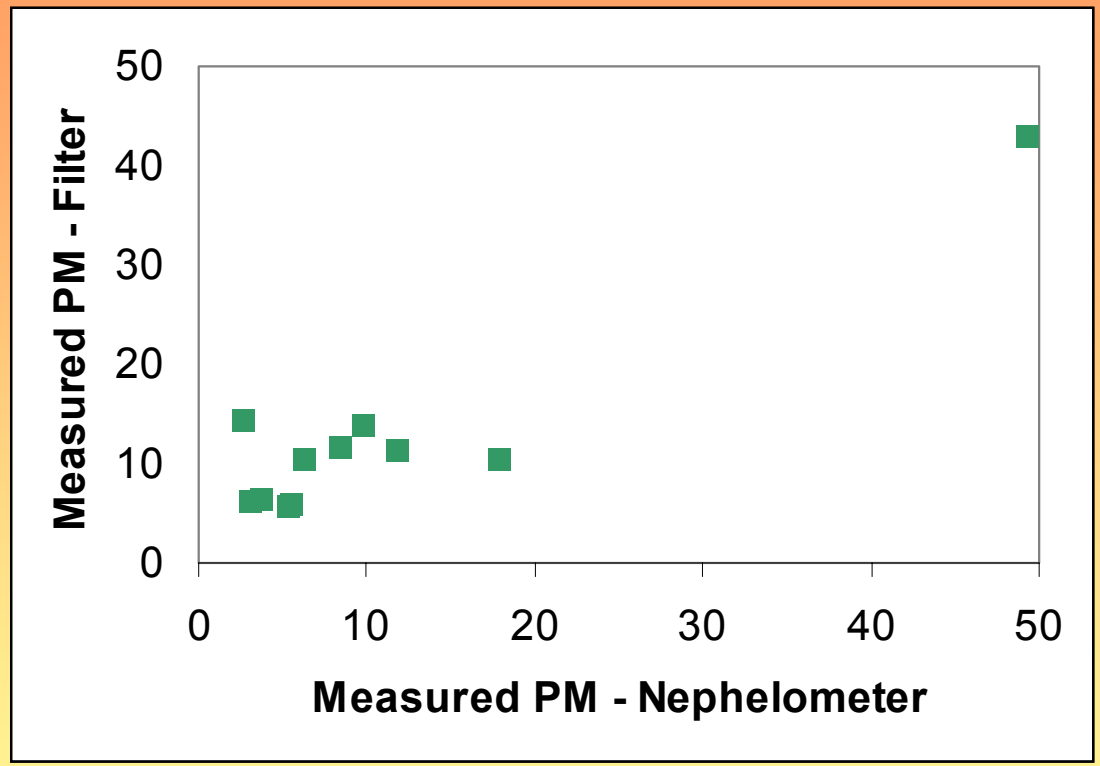


Evaluating our present PM measurement (II)

Our present investigation: *what factors* can make this measurement more accurate?

chemical composition

particle sizes



Can the "cart" get smaller & cheaper?

- Cost without particle monitoring: $650 (CO, CO2, data logging)
  - Still need a laptop – We'll be working on that
- Biggest need:
  Small, cheap particle monitoring
  (Kirk's device?)