

Measuring Emissions & Exposure

Important:
Emissions and Exposure are not the same!

- **Emission** = what comes out of the stove
- **Exposure** = what people breathe



Emissions vs Exposure

Exposure

- must be measured in the field
- is related to people's habits as well as stove characteristics
- affect personal health in many ways
- ...*immediate problem*

Emissions

- can be measured in the lab (maybe)
- are related to exposure if stove is not vented
- affect
 - neighborhood AQ
 - regional AQ
 - global air chemistry
- ...*longer-term problem*



Emissions *and* Exposure

STOP!

Exposure must be reduced immediately

but...

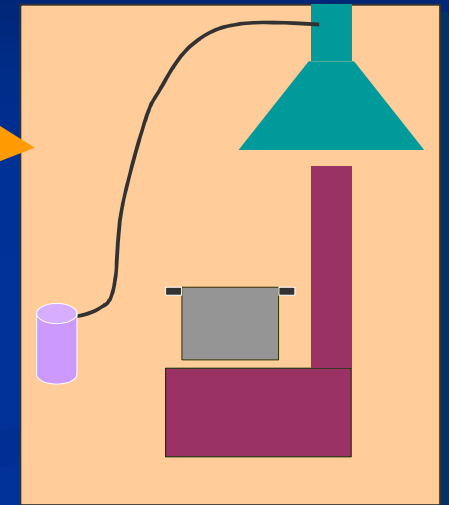
Emissions become important as population densities increase

- Both require similar measurements (add CO₂ to get emissions)
- Emissions are the link with laboratory development
- If possible, measurements of both *might* demonstrate multiple benefits



Emission measurement

- Converging on recommendations!
- Collection method: *Hood*
- Pollutants to measure: *CO and PM*
(and more in testing lab)
- Data acquisition: *Real-time when possible*



Measurement scenarios

increasing quantity needed
increasing time commitment

increasing complexity
increasing expense

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



II. Test case at Aprovecho Research

- Hood (developed & delivered by Dale Andreatta)
- Pollutants:
 - CO via NDIR
 - PM via light scattering (not perfect)
 - Emissions inferred using CO₂
 - Also measuring O₂ to assess combustion
- Data Acquisition:
 - Computerized with LabView
- Status: Funded by Murdoch

Plan: Take same measurements to field (TamiCart) & compare with exposures



III. University backup

In addition to the “basics”

- Colorado State (Bryan Willson)
 - Gas composition
- University of Illinois (Tami Bond)
 - Particle characterization: chemical & physical
- Outreach & integration with other universities abroad



Emission only; others are working on efficiency, etc.



Tami Bond
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Outstanding questions

Amazing that these still exist!

- The **chimney** question
 - What's quickest, broadest, most feasible way to reduce *exposure* over the long term?
- The **representativeness** question
 - To what extent do lab measurements look like field measurements?
 - Can we design improvements in the lab that affect real stoves?
- The **confirmation** question
 - What *minimum* amount of measurement ensures that a new stove is effective?

