

Emission Rates and Optical Properties of Pollutants Emitted from a Traditional and an Improved Wood-Burning Cookstove

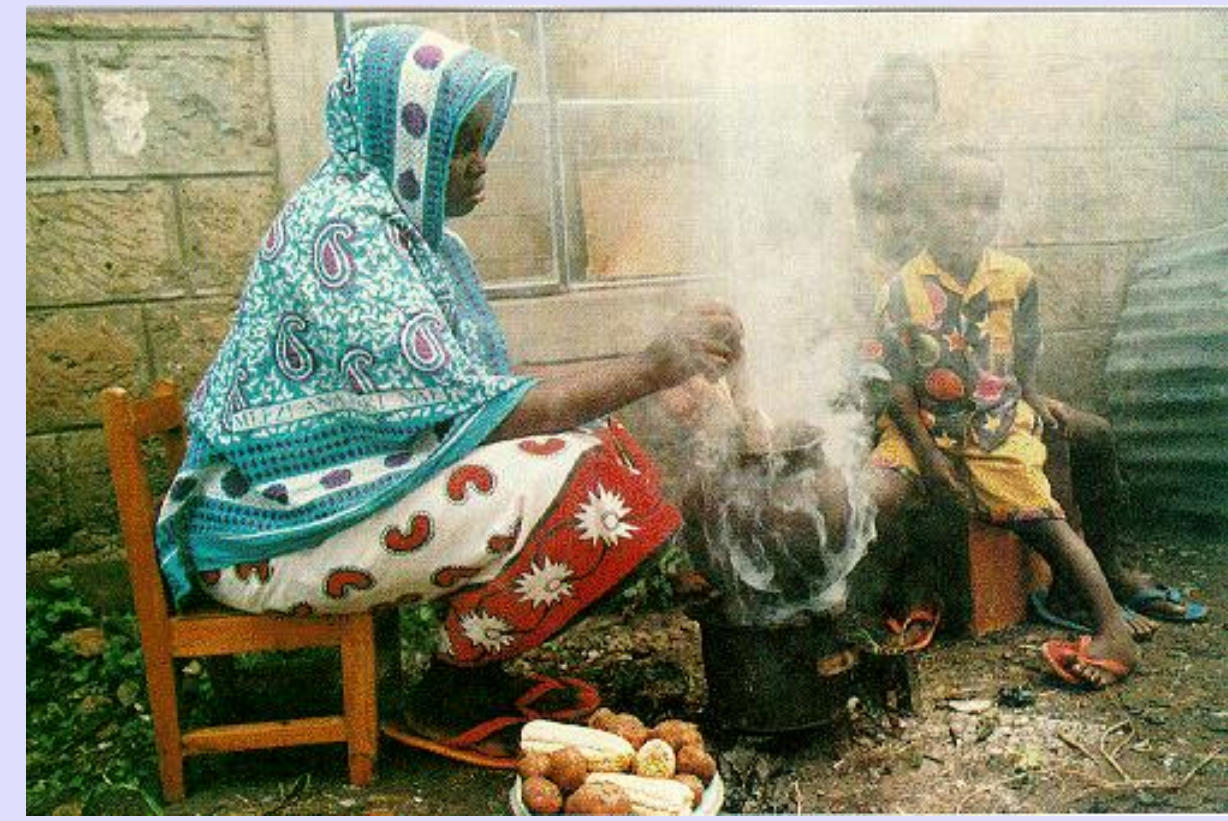
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Cooking in Developing Regions

- Approximately 2 billion people cook over open fires of wood, dung, agricultural waste, and coal



- Inhaled smoke kills 1.6 million annually; women and children have greatest exposure (*WHO, 2005*)

- Black carbon emitted from cookstoves adds substantially to total atmospheric burden (*Bond et al, 2004*)

Residential Biofuel Contribution to Black Carbon Emissions	
India	65%
China	30%
Africa	65%
Global	33%

- Emitted soot contributes to global warming, melting regional glaciers (*Ramanathan and Carmichael, 2008*)

Improved Cooking Methods

- Numerous efforts underway to introduce improved cooktoves in developing regions worldwide



- Improved stoves are designed for increased fuel efficiency, decreased pollutant emissions, cultural acceptability, and affordability

Berkeley-Darfur Stove (BDS)

- Designed to use less wood than traditional “three-stone fire” (TSF)
- Intended to lessen risk of assault and sexual violence women face when leaving Darfur refugee camps in search of wood for cooking
- For more info, visit www.darfurstoves.org



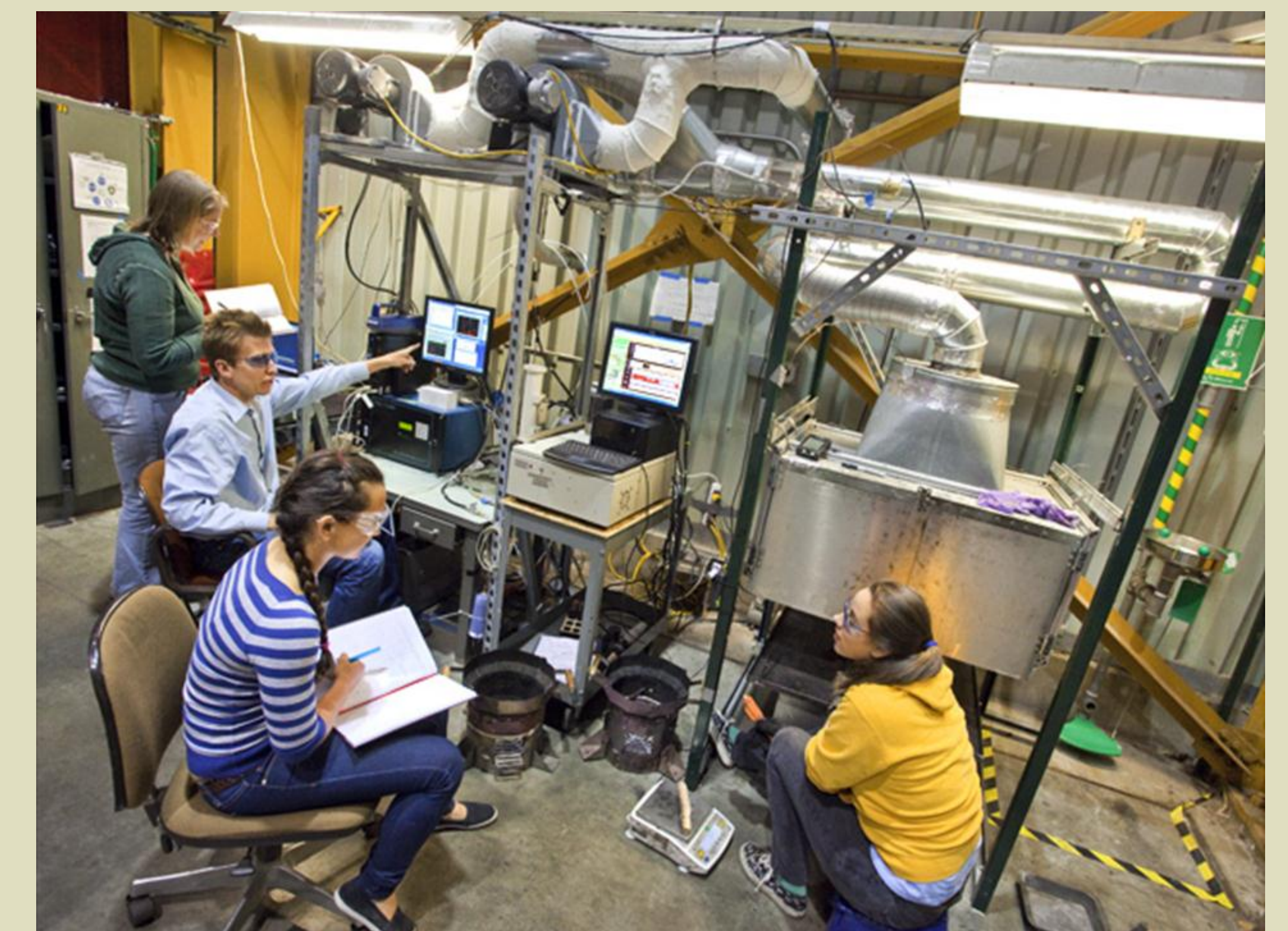
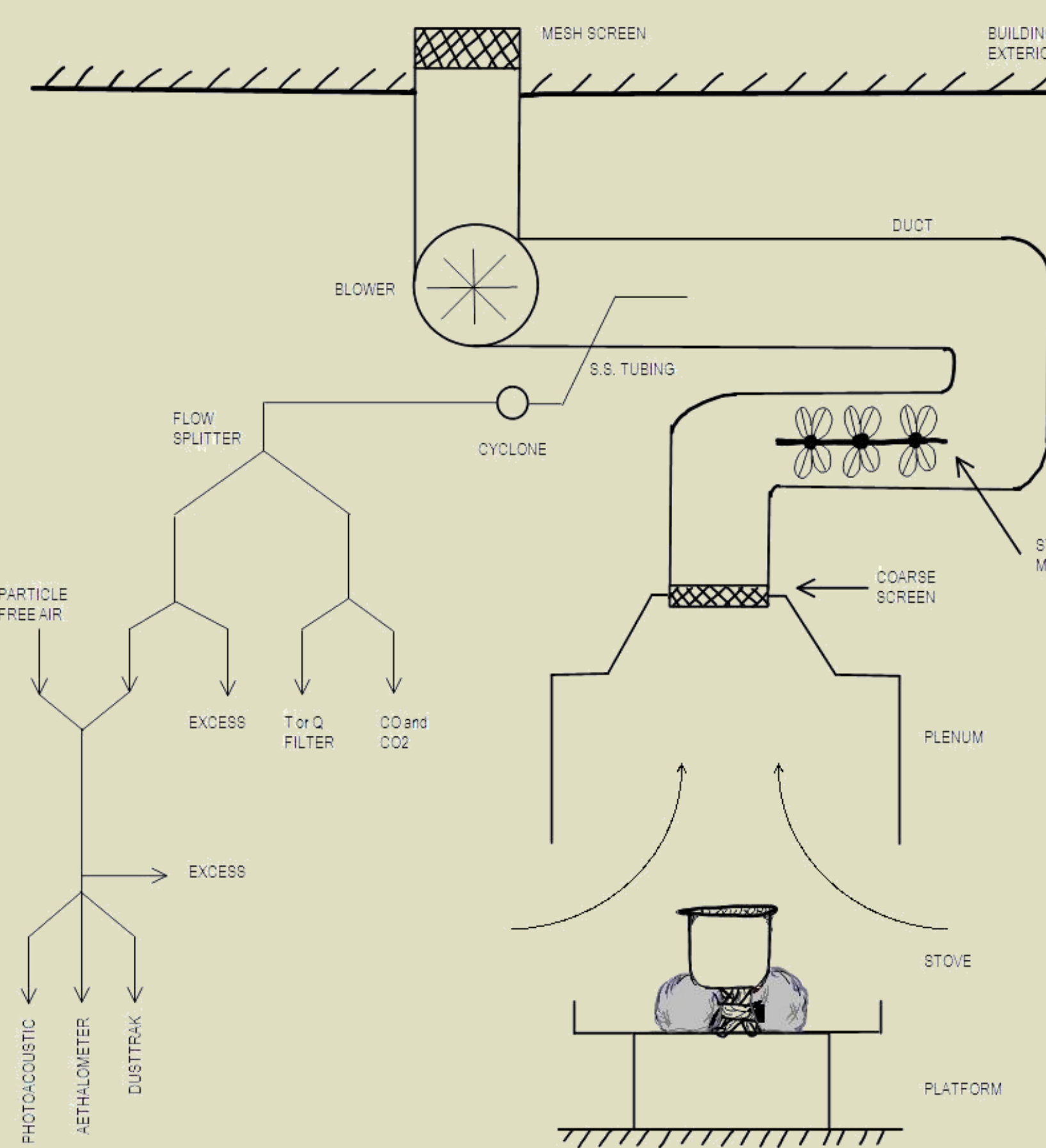
TSF



BDS



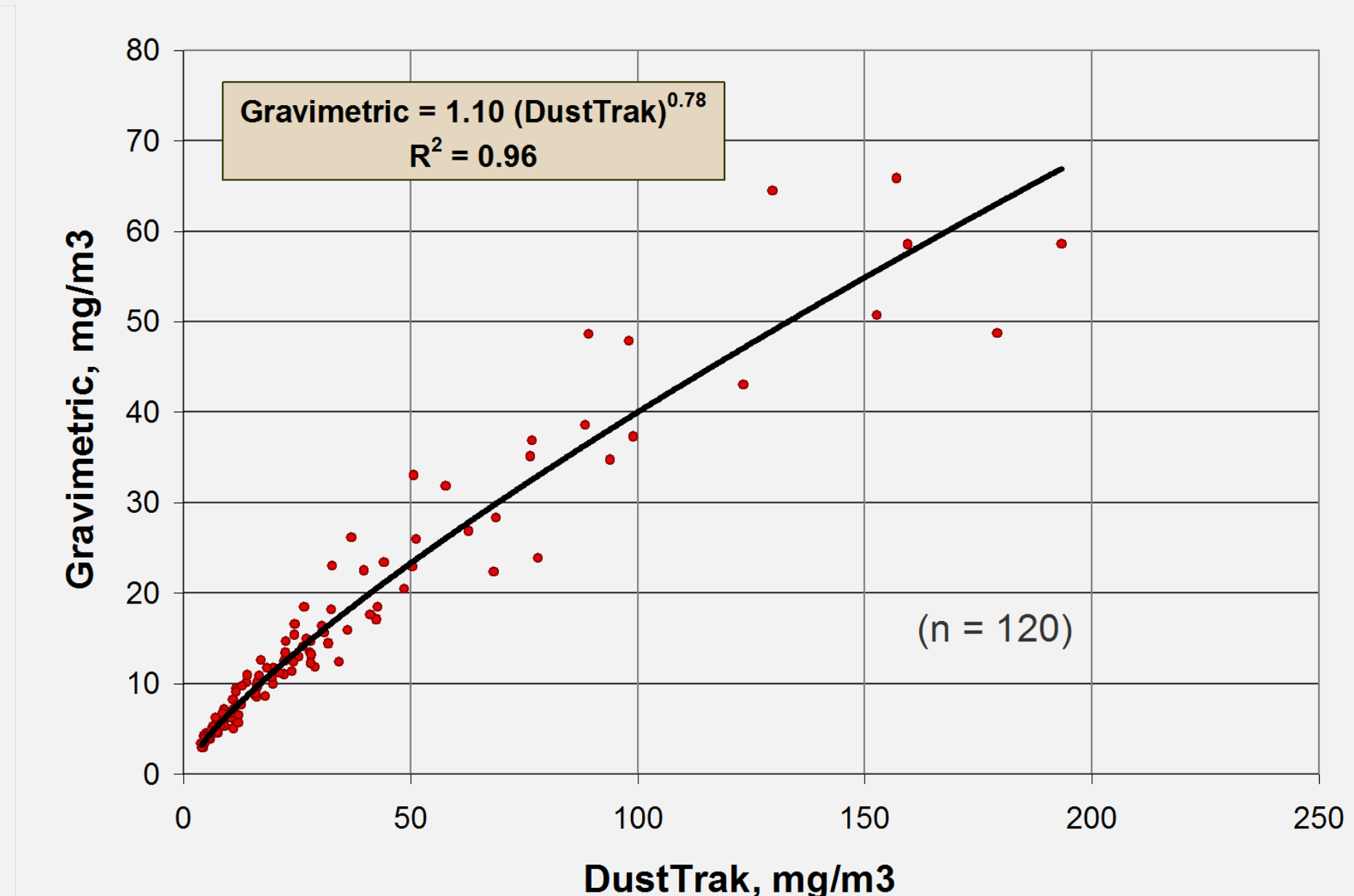
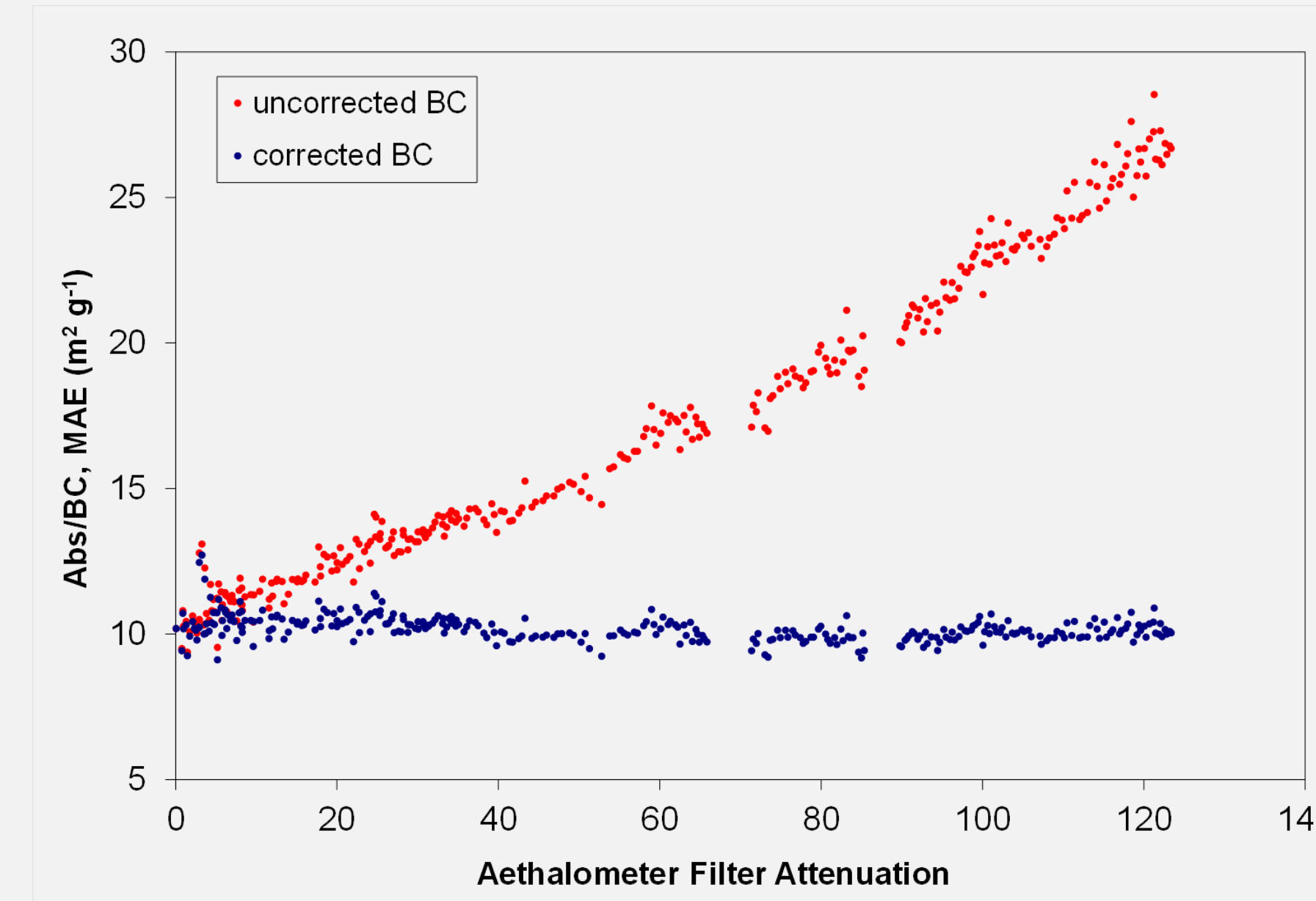
Lawrence Berkeley Lab Cookstove Testing Facility



Aethalometer (BC) and DustTrak (PM_{2.5}) Calibration

$$BC_{corrected} = \frac{BC_0}{0.88 \exp\left(\frac{-ATN}{100}\right) + 0.12}$$

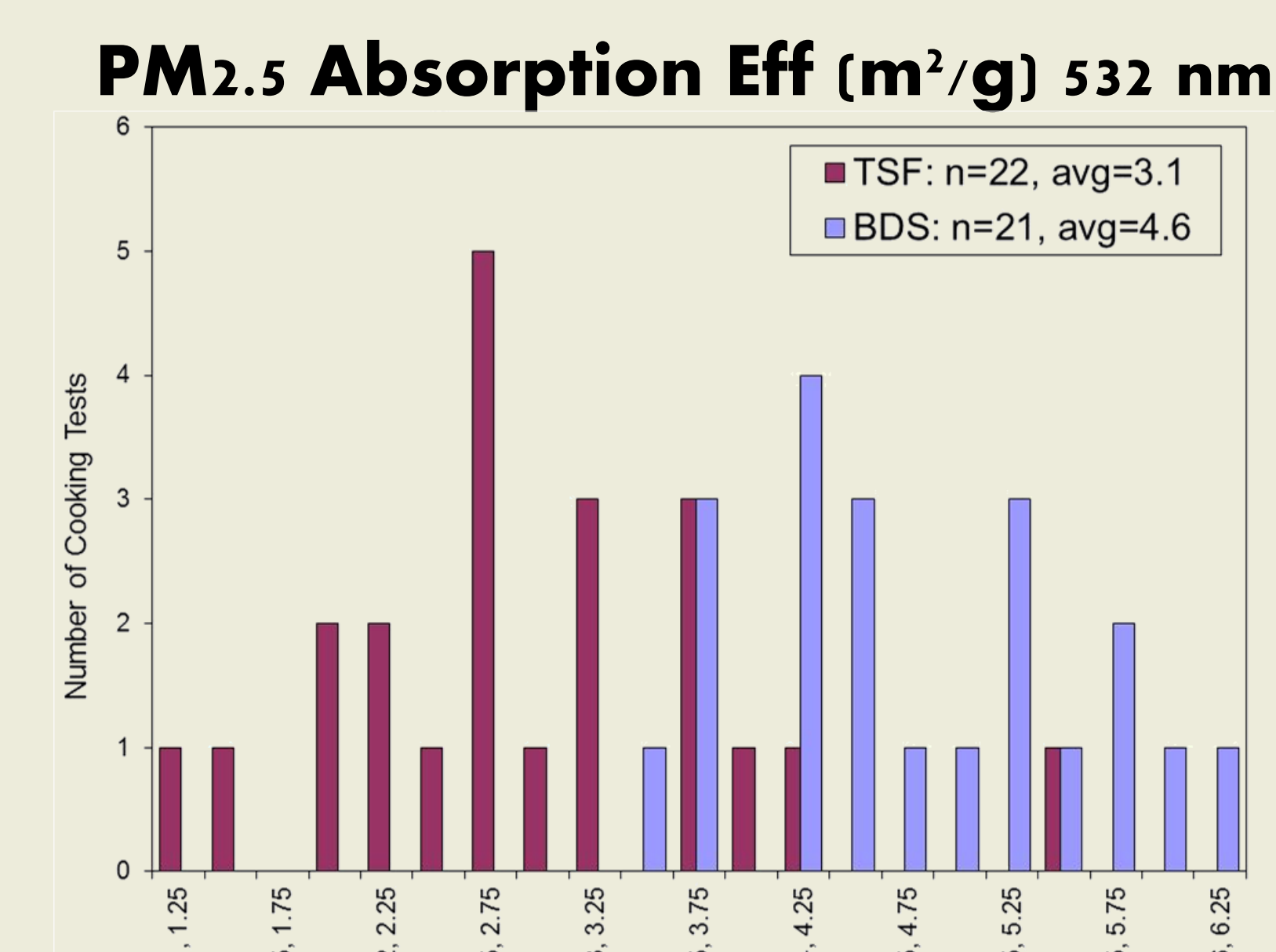
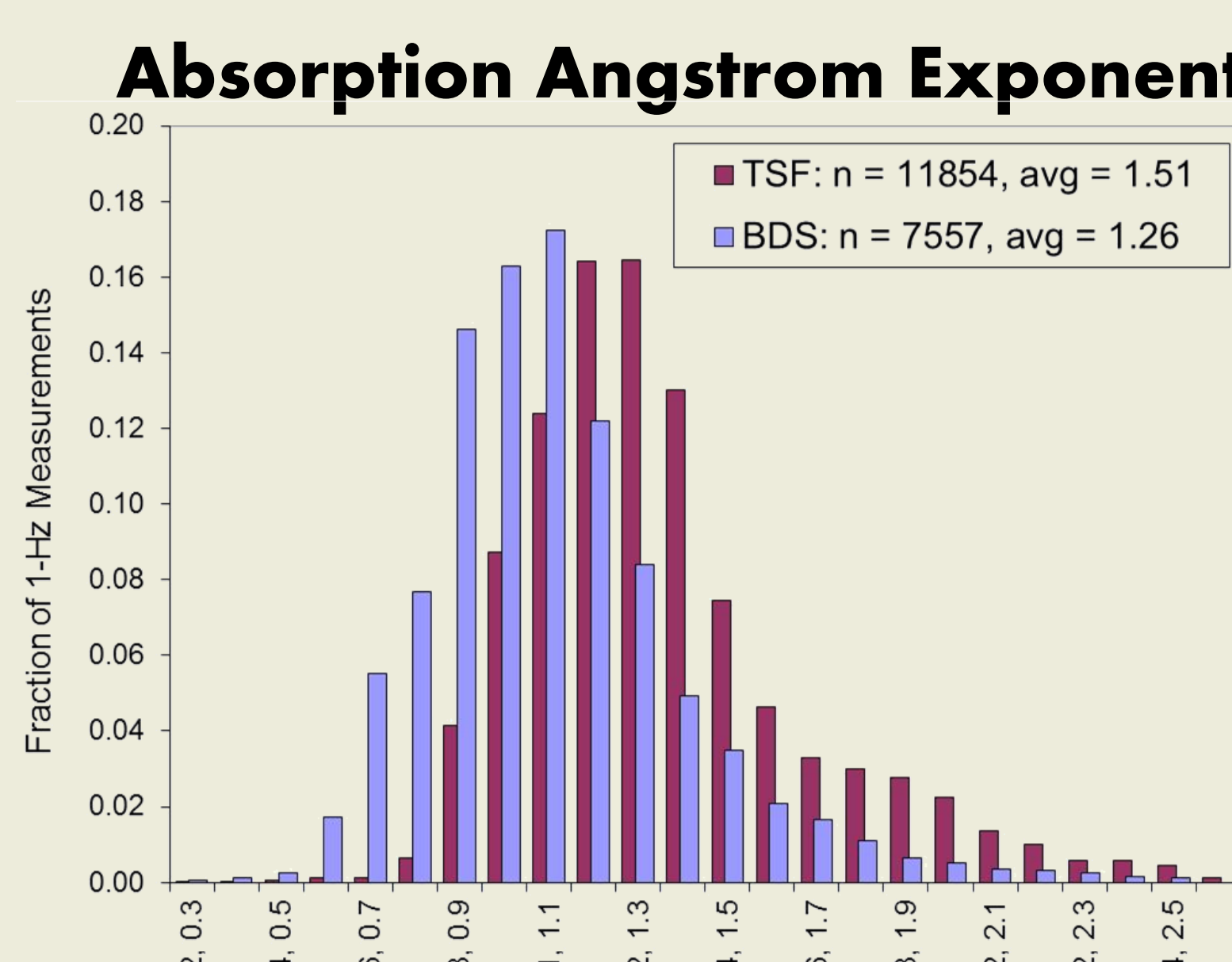
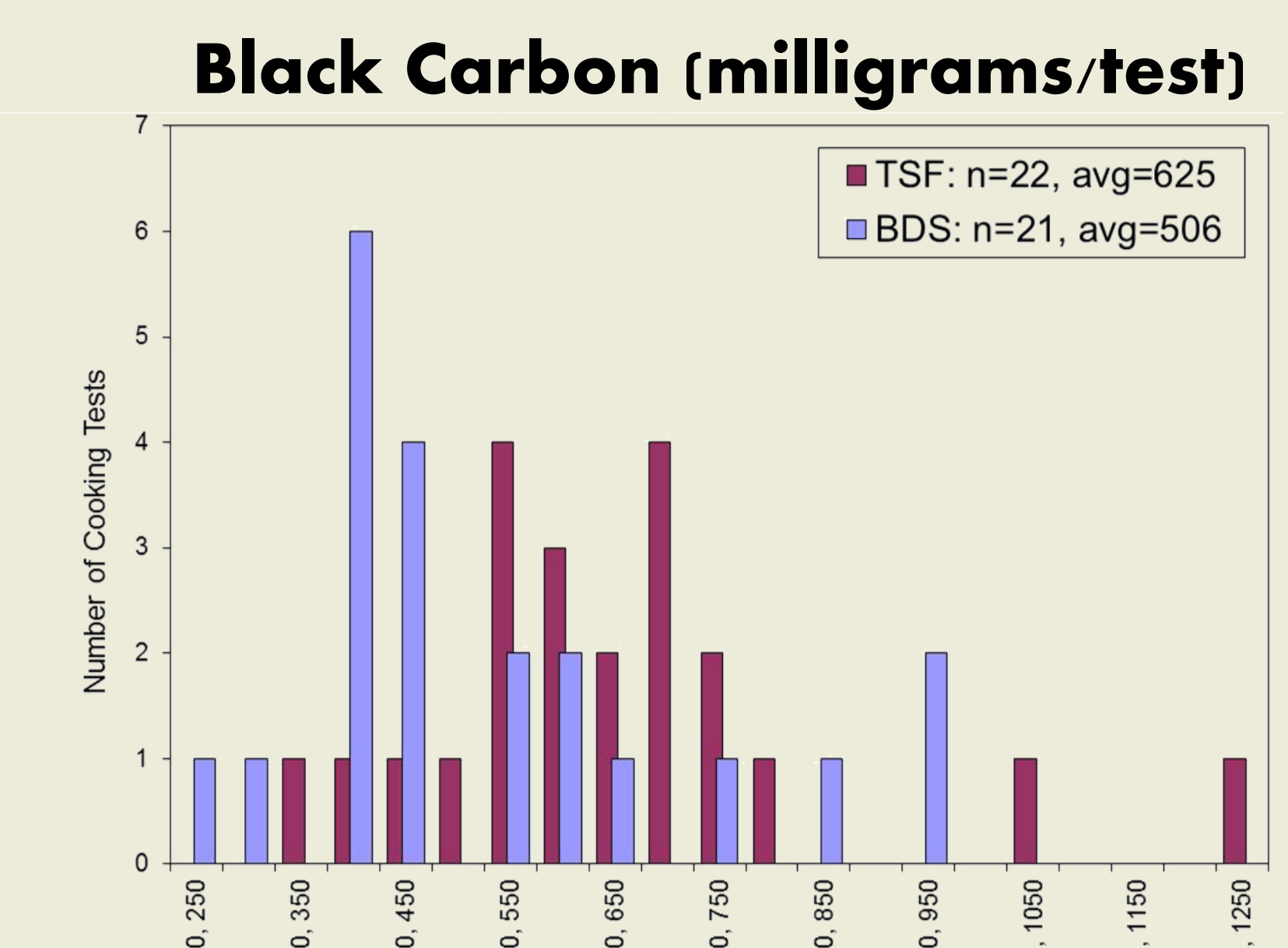
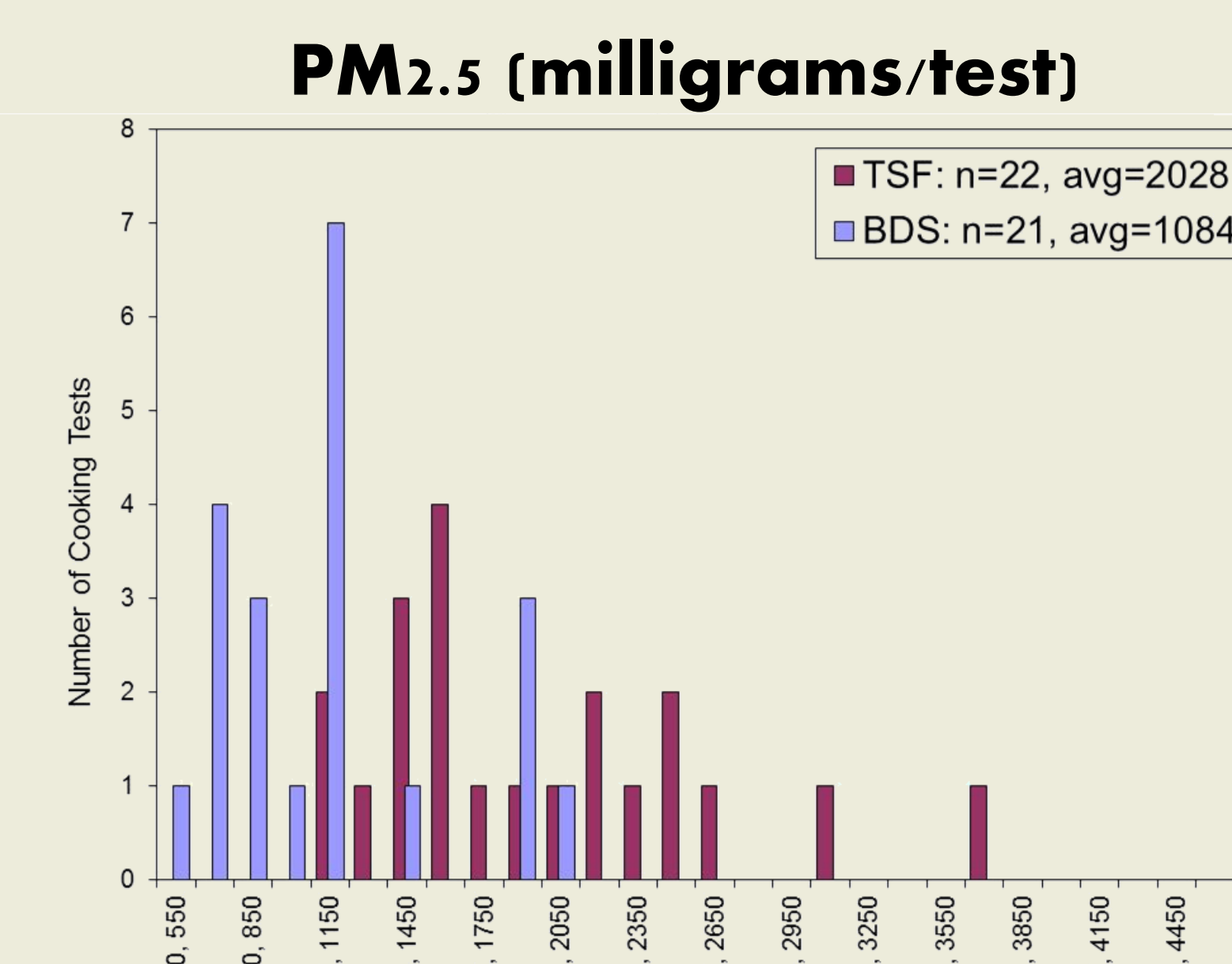
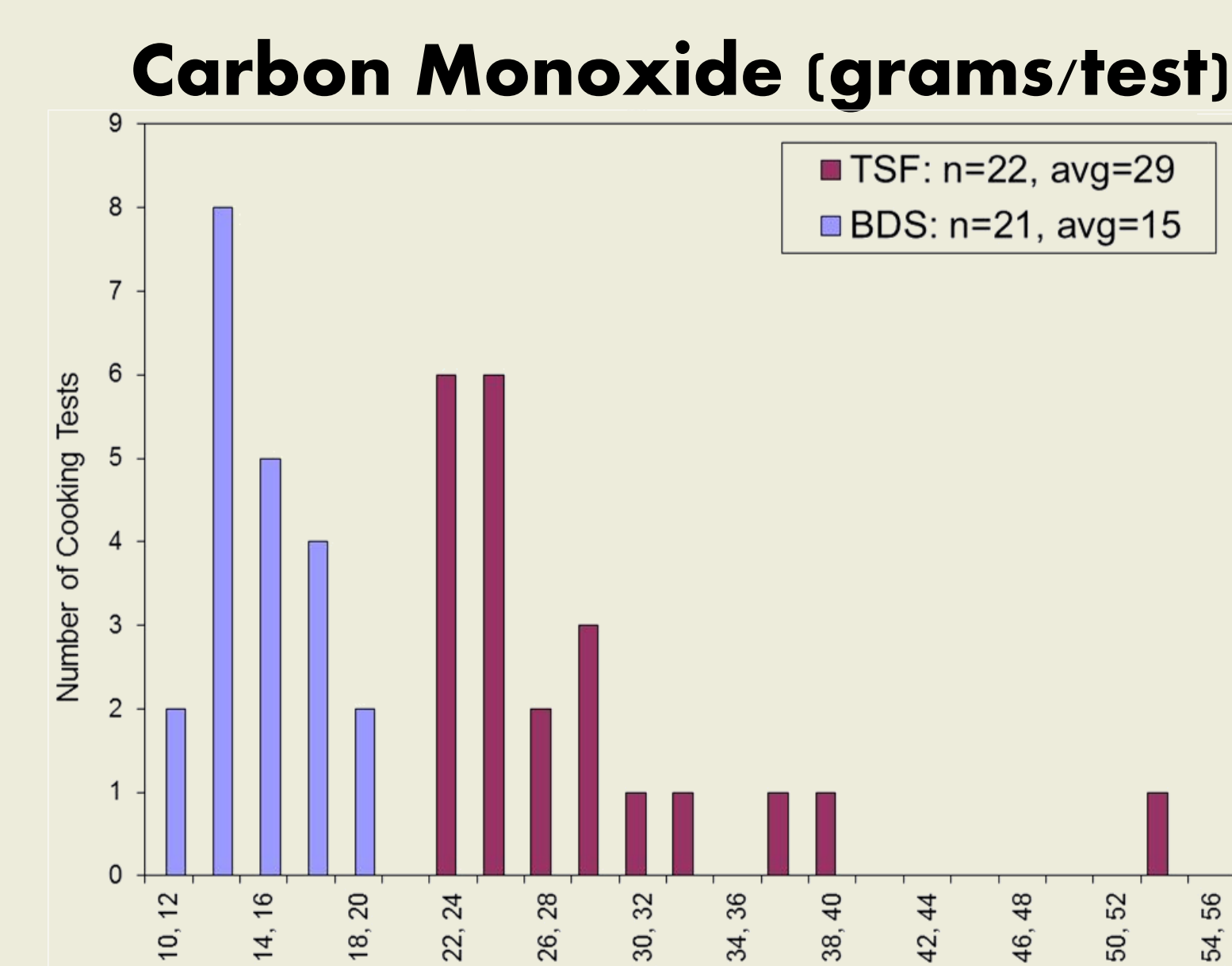
Above equation corrects aethalometer BC data for filter darkening artifact



Comparing with photoacoustic absorption confirms aethalometer “loading effect” (*Kirchstetter and Novakov, 2007*)

1-Hz PM calibrated by comparing to filter-based gravimetric mass

Pollutant Emissions: BDS v TSF (Test: Bring water to boil, simmer 15 min)



- BDS emits ~half as much CO and PM, and ~same BC compared to cooking with the traditional TSF
- BDS particles tend to be more black than brown and have higher MAE_{532nm}