Comparison of Nine Co-located PM2.5 and CO Monitors and Characterization of Airborne Particle Size in Wood-Burning Kitchens

Air pollution studies and subsequent policy actions depend on accurate and comparable instrumentation. While filter-based methods are considered the gold standard, health problems may be caused by exposures too short for these “gravimetric” devices to measure. Devices that measure real-time concentrations of particulate matter (PM) and carbon monoxide (CO) are essentially required to show linearity with a gravimetric device before being released on the market. However, the fact that all correlate with a certain gravimetric device does not necessarily mean they will correlate with each other, even when calibrated to the specific aerosol of interest and employed with a gravimetrically-derived correction factor. In this experiment, we co-located six PM samplers (Sioutas PCIS, pDR, Cassella Microdust, BGI triplex cyclone with SKC personal pump, TSI DustTrak, UCB particle monitor) and three CO samplers (Drager tube, Drager PAC III, Onset HOBO) in Guatemalan wood-burning kitchens for thirteen sampling days of approximately 20 hours each. Using the PCIS and TSI Dust Trak, we also characterized particle size distribution and evaluated the effect this may have on device agreement. When including the most coarse fraction of the PCIS (all 5 filters), we found excellent agreement (overall ratio UCB/PCIS=1.0 + 0.1for all 13 sampling days) with concentrations reported by the UCB photoelectric chamber derived from smoke detector technology. Including this same coarse fraction the overall ratio of PCIS/pDR gravimetric was 1.73 + 0.51, showing more variability