

## **BLACK CARBON INSTRUMENT INTERCOMPARISON BY SOURCE TYPE**

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Black carbon (BC) is an important short-term climate forcer that has been associated with adverse health effects. Combustion systems are the primary source of atmospheric BC. However, since BC is not a regulated pollutant, emission factors for many source types remain scarce. Additionally, the U.S. Environmental Protection Agency measures elemental carbon (EC) in its ambient monitoring networks and uses EC in its emissions inventory. Therefore, the majority of source emissions have been quantified as EC, which continues to be assumed to be equivalent to BC.

There are multiple EC- and BC-measuring instruments, from which results can vary widely, even for a simple hydrocarbon flame (Yelverton et al. 2014). Therefore, the objective of this study was to apply a wide range of measurement methods to quantitatively investigate BC and EC emission factors from multiple fossil fuel and biomass combustion systems (stationary diesel generators, coal-fired power plant, cookstoves, prescribed burning of forests, grasslands and agricultural residues). Because fresh emissions with minimal or no atmospheric aging are reported in emissions inventories, emissions were measured in the exhaust stack or at near-source conditions. BC concentrations in these emissions were quantified using a single particle soot photometer (SP2), a three wavelength photo-acoustic soot spectrometer (PASS-3), and an aethalometer (AE-22, AE-33, AE-51). EC on filters collected simultaneously was determined using a Sunset Labs carbon analyzer using the NIOSH 5040 method.

BC concentrations ranged from 50% to 280% EC concentrations, depending upon the source. The aethalometer BC and PASS-3 BC correlated well, but the aethalometer BC was generally 50% greater. This difference may be due in part to the choice of instrument calibration factor or mass specific absorption coefficient. The greatest agreement among measurement techniques was seen for biomass burning sources, including cookstoves. The largest BC-EC differences were observed with stationary diesel generators (on average 180%), and were most pronounced (180 – 280%) when a diesel particulate filter was in use. These results suggest that current inventories relying on EC as a surrogate for BC emissions may considerably underrepresent stationary source diesel BC emissions.

Yelverton, TLB, Hays, MD, Gullett, BK, Linak, WP (2014) Environmental Engineering Science 31:209-215.