

Development and evaluation of a lightweight sensor system for emission sampling from open area sources

Xiaochi Zhou^{1,2}, Brian Gullett³, Bill Mitchell³, Johanna Aurell^{3,4}

¹Student Service Contractor, U.S. EPA Office of Research and Development; ²Duke University, Department of Civil and Environmental Engineering; ³U.S. EPA Office of Research and Development;

⁴University of Dayton Research Institute

Abstract

A new sensor system for mobile and aerial emission sampling was developed for open area sources, such as open burning. The sensor system, termed “Kolibri”, consists of multiple low-cost air quality sensors measuring CO₂, CO, and black carbon, samplers for particulate matter with diameter of 2.5 µm or less (PM_{2.5}), and volatile organic compounds (VOCs). The Kolibri is controlled by an Arduino-based motherboard which can record and transfer data in real time through an Xbee radio module. Selection of the sensors was based on laboratory testing for accuracy, response time, selectivity, and precision. At a laboratory burn facility, the Kolibri was compared against continuous emission monitors (CEMs) and another sampling instrument (the “Flyer”) used in over ten open area sampling events. The test included simultaneous sampling of two Kolibri systems, CEMs, and the Flyer for multiple biomass burns. Our results showed that the emission factors determined by the two Kolibri were consistent and agreed well with those from the laboratory CEMs and the Flyer. In the future, the Kolibri system can be applied to various open area sampling challenge such as fires, lagoons, flares, and landfills.