Executive Summary

The USDA Forest Service, Missoula Technology and Development Cen-ter (MTDC) is evaluating commer-cially available optical instruments that measure particulate concentrations in real time. Forest and fire managers and air-quality specialists need such information when smoke particulates from burning biomass generate air-quality concerns. Airborne particulates, especially particles smaller than 2.5 μm in diameter ($PM_{2.5}$), pose potential health, visibility, safety, and nuisance problems. Measuring these airborne particulate concentrations is very important to land managers as they use prescribed fire in forests and rangelands.

The key items of MTDC's evaluation are accuracy in measuring or estimating smoke concentrations, comparison of results from identical instruments (instrument comparison), reliability, operational characteristics such as portability, power requirements, data collection, and cost. The data were collected in the laboratory and in a field setting.

The five brands of optical real-time instruments we evaluated had few fundamental differences. Accurately estimating ambient particle concentrations based on their light-scattering and absorption properties is difficult. Many variables affect the optical characteristics of particles, increasing the difficulty real-time instruments have in accurately estimating the mass concentration of particulate. However, optical instruments can estimate the direction of change in the concentration of particulates and the magnitude of the overall ambient particulate concentration.