Measurement of Fine Particulate Matter (Nonvolatile and Simi-volatile Fractions) in Fresno, CA.

Abstract

Semi-volatile material, including ammonium nitrate and semi-volatile organic material, is often not measure by traditionally used sampling methods including the FRM and the R&P TEOM Monitor. An intensive sampling campaign was performed at the EPS Fresno, CA Supersite during December 2003. Measurements of fine particulate matter, including both the semi-volatile and nonvolatile fractions of the aerosol were made. Several real-time mass instruments were employed during the study. The recently developed R&P FDMS Monitor has been shown to measure total PM2.5 mass including both semi-volatile carbonaceous material and ammonium nitrate. The PC-BOSS, an integrated sampler, has also been shown to measure semi-volatile carbonaceous material and ammonium nitrate, resulting in integrated total PM2.5 concentrations. Good agreement was observed between the PC-BOSS and the R&P FDMS Monitor during this study. Several real-time measuring systems including the R&P Differential TEOM, the Met One BAMs, and a GRIMM Monitor were also employed during the study, and comparisons of total PM2.5 mass were made with the R&P FDMS Monitor. Agreement among these various monitors was generally good. However, differences were often seen under conditions of high semi-volatile species concentrations. Reasons for the observed differences in the real-time mass measurement systems are explained by the composition and complexity of the measured aerosol, most importantly the composition of semi-volatile organic material. In contrast, the PM2.5 FRM and the R&P TEOM Monitor (operating at 50 0C) did not reliably measure semi-volatile material.

Measurements were also made with several continuous species monitors. A recently commercialized Dionex GP-IC instrument was extensively field tested for the first time during this study. Sulfate, nitrate and ammonium concentrations were determined by the Diones GP-IC Comparisons were made between the Dionex GP-IC and an R&P Sulfate Monitor and an R&P Nitrate Monitor. Good agreement was observed between sulfate concentrations measured by the Dionex GP-IC and the R&P Sulfate Monitor. However, significant differences were observed during the episodes of high humidity between nitrate concentrations measured by the GP-IC and R&P Nitrate Monitor. Continuous particulate carbon measurements wee made by an R&P Carbon Monitor, Sunset Labs Carbon Monitor, and an Anderson Aethalometer. Sums of all th major species of an urban aerosol, as determined by the various continuous species monitors, were made and compared to total $PM_{2.5}$ Concentrations measured by the R&P FDMS Monitor. Differences observed in measurements can be explained by the ability of the various measurement systems to accurately measure semi-volatile organic material and ammonium nitrate. Comparisons were also made between the R&P FDMS and the FRM, and observed differences are explained.

Rational for Session Choice:

Evaluations of five PM2.5 mass measurement systems are made in this paper. Mass measurement averages are compared to the PC-BOSS and th eR&P FDMS Monitor which have been shown ot measure total PM2.5 concentrations. These data are compared with FRM data. Continuous

species monitors were also used in this study to determine inorganic and carbonaceous material in the aerosol. These data were used to obtain a sum of all the major species of an urban aerosol and compared to total concentrations. Differences are explained by the ability of the respective monitors to accurately determine both semi-volatile carbon and nitrate.

Key Words: Semi-volatile material, Fine particulate Material, PM2.5, R&P FDMS, PC-BOSS, Dionex GP-IC.