from Feb 2005 AAAR Specialty Conference
8C-3

PERFORMANCE EVALUATION OF A RECENTLY DEVELOPED WATER-BASED CONDENSATION PARTICLE COUNTER. SUBHASIS BISWAS, Philip M. Fine, Michael D. Geller, and Constantinos Sioutas,* , University of Southern California, LA, CA. Susanne V. Hering, Aerosol Dynamics, Inc. Berkeley, CA.

This study focuses on the intercomparison of the performance of a newly developed water-based condensation particle counter (WCPC) and a butanol-based reference CPC (TSI 3022A). Four test aerosols (ammonium nitrate, ammonium sulfate, adipic acid, glutaric acid) were generated in the laboratory before the instruments were deployed at four field locations (USC/downtown LA, I-710 Freeway, Pacific coast/ocean aerosol, LAX Airport). Both instruments sampled the same incoming aerosol. Selected experiments utilized a differential mobility analyzer (DMA) to select a particle size upstream of the CPCs. Evaluation of performance was based on response of the instruments, particle composition, number and size. The results indicated good correlation between the two CPCs, with R2 values ranging from 0.91-0.99. The size fractionated experiments were performed after selecting a particular size with a scanning mobility particle sizer (SMPS). The WCPC performed better for laboratory particles with small mobility diameters (10-50 nm) due to the hygroscopic nature of these particles and relative lower detection limits of the WCPC. The particle number concentration has a pronounced impact on the performance of WCPC. It demonstrated better detection of particle concentrations between 0 and 40,000 particles/cm3, with WCPC/ TSI 3022A ratio between 1-1.4. Due to differences in the photometric mode calibration of these instruments, the ratio drops to 0.6-0.8 between 40,000-100,000 particles/cm3. However, the ratio rises again for lab aerosols to1.0-1.1 after 100,000 particles/cm3. The TSI 3022A-CPC appears to have a lag period of 2-3 s from the WCPC as determined from time response and correlation plots. This lag may be caused in part by the difference in the time constant, a dynamic characteristic relating to the time required for a particle to clear the measurement zone of an instrument. Time constants were measured to be 0.78s and 9.5s for the WCPC and the TSI-3022A CPC, respectively. Results of this evaluation show that the WCPC is a reliable particle counting technology for particle concentrations in many normal ambient environments (< 40,000/cm3).