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AEROSOL BLACK CARBON CLIMATOLOGY AT THE ST. LOUIS - MIDWEST SUPERSITE. *JAY R. TURNER, Neil D. Deardorff, Bradley P. Goodwin, Jason S. Hill, Washington University, St. Louis, MO; Min-Suk Bae, James J. Schauer, University of Wisconsin, Madison, WI*

Under the St. Louis – Midwest Supersite program, aerosol black carbon (BC) measurements were conducted at three sites using the Magee Scientific Aethalometer (TM). These sustained measurements resulted in a thirty-nine month time series for the East St. Louis, IL, urban site (April 2001 – June 2004), a three-month time series for the Park Hills, MO, rural site (mid-August 2001 – mid-November 2001), and a four-month time series for the Reserve, KS, rural site (September 2002 – December 2002). All sites included contemporaneous daily-integrated elemental carbon measurements using offline thermal-optical analysis (ACE-ASIA protocol which conforms to NIOSH 5040); the East St. Louis site also featured semi-continuous elemental carbon measurements using Sunset Laboratory OCEC field analyzers. The purpose of this presentation is twofold: to provide insights into aerosol black carbon climatology at these sites; and to exploit the contemporaneous carbon measurements to gain insights towards interpreting the black carbon data.

For the first two years of measurements at the East St. Louis site (April 2001 – March 2003), period-average BC and EC concentrations were 1.01 and 0.82 micrograms per cubic meter, respectively. The BC/EC ratio exhibited a recurring seasonal pattern over the two-year period; quarterly geometric means of the daily BC/EC ratio ranged from 1.0 in the fall/winter to 1.6 in the spring/summer. At all three sites, the BC/EC ratio was positively correlated with sulfate, and we are investigating whether this relationship arises from sulfate-induced enhancement of the aerosol black carbon absorption or from sulfate behaving as a surrogate for different carbon emission fields with varying physical and/or chemical properties for the carbon-containing component.

Following the methodology of Watson and Chow (2001), the high time resolution (five-minute average) Aethalometer BC data was decomposed into high- and low-frequency components. The high-frequency signal is presumably indicative of nearby sources while the low-frequency signal likely represents urban- and larger-scale contributions. Annual-average diurnal profiles for East St. Louis exhibit a low-frequency signal dominated by atmospheric ventilation (including a midday minimum in the BC concentration) and a high-frequency signal which is higher during the daytime hours than during the nighttime hours. This reflects nearby vehicle activity patterns that are not significantly attenuated by atmospheric ventilation. Weekday profiles for both components show a local maximum in BC corresponding to morning rush hour; the rush hour peaks are suppressed and/or absent on weekends. Overall, these patterns are consistent with our conceptual model for the high- and low-frequency components of the BC signal.

Reference:
J.G. Watson and J.C. Chow (2001) J. Air Waste Manage. Assoc., 51, 1522-1528.

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MINIATURIZED TAPERED ELEMENT OSCILLATING MICROBALANCE PERFORMANCE IN A PERSON-WEARABLE DUST MONITOR.. *JON C. VOLKWEIN, Robert P. Vinson, and Donald P. Tuchman; CDC/NIOSH PO Box 18070, Pittsburgh, PA 15236*

A personal dust monitor (PDM) was developed to measure respirable coal mine dust mass to provide accurate exposure data. The PDM uses a tapered element oscillating microbalance to measure the mass of dust deposited on a filter, continuously displays cumulative exposure concentration, and records this as well as other environmental and instrument data for subsequent analysis. The accuracy and precision of the instrument was determined by comparison to gravimetric filter samplers for shift length samples in the laboratory and in four mines. Zero drift, effect of temperature fluctuations, and impact of water sprays on mass determinations were measured. Laboratory results with different coal types and size distributions showed that there is a 95% confidence that the individual PDM measurements were within ±25% of the reference measurements. Laboratory data show that the stability of the mass measurement is similar to that of standard microbalance mass determinations. Mine test results indicate that data taken with adjacent PDM and reference samplers are indistinguishable. Trials are underway to evaluate the long term durability and accuracy of the instrument under typical use conditions.