Regional Composition of $PM_{2.5}$ Measured at Urban, Rural and "Background" Sites in the Tennessee Valley

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Summary

Implementation of the 1997 fine particulate matter National Ambient Air Quality Standard (NAAQS) on a national basis has been delayed until a 3-yr record of mass data (including $PM_{2.5}$ mass) could be developed. Strategies for $PM_{2.5}$ controls, if needed, will require chemical composition as well as mass data, and the former is just becoming available in many areas from the EPA speciation network and other sources. $PM_{2.5}$ mass and chemical composition data have been collected by TVA in the Tennessee Valley since 1997. These data suggest that annually averaged fine particle mass levels are about equal to the annual $PM_{2.5}$ NAAQS, and that organic material and sulfates constitute the largest fractions of this mass (Tanner and Parkhurst, 2000). A larger data set is now available from sampling in the TN Valley during all 4 seasons during 2001. These data were obtained using dual collocated FRM samplers operated simultaneously at an urban site in Chattanooga, a rural site in Lawrence County, TN, and a "background" site collocated with the IMPROVE site at Look Rock, TN.

At the background site, the mass levels for one-month periods of every-third-day sampling varied from 6.4 $\mu g/m^3$ in winter to 19.0 $\mu g/m^3$ during the summer period with an all-sample average of about 12 $\mu g/m^3$. Sulfate was the largest component of mass, but significant ammonium nitrate was found only during the winter period. Particulate organic carbon was a major component of fine mass (26-41 %, average 33%) throughout the entire year.

Mass concentrations at the rural site were generally higher than the background site (except in summer) but the all-sample average was below the annual $PM_{2.5}$ NAAQS. Sulfate and organic mass fractions were predominant, and again nitrate levels were negligible except in the winter sampling period

At the urban site, mass levels averaged from 15 $\mu g/m^3$ in winter to 20 $\mu g/m^3$ in the summer, with the largest component over all seasons being organic C, and with significant ammonium nitrate levels in winter. There were small but significantly greater elemental carbon levels at the urban site than at either the rural or background sites; this trend was especially noticeable in the winter period.

Overall, results show a consistent pattern with highest contributions to fine mass from organic carbon and sulfates, relatively higher carbonaceous levels in urban vs. rural and background sites, and highest contributions from sulfates only at the background site and in the summer season. These trends are quite consistent with other mass data obtained by EPA in the Southeastern U.S. and mass and composition data obtained by the SEARCH network (ref)