Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 9, 4521-4536, 2009
www.atmos-chem-phys.net/9/4521/2009/

Relationships between size-fractionated indoor and outdoor trace elements at four retirement communities in southern California

A. Polidori[1], K. L. Cheung[1], M. Arhami[1], R. J. Delfino[2], J. J. Schauer[3], and C. Sioutas[1]
[1]University of Southern California, Department of Civil and Environmental Engineering, 3620 South Vermont Avenue, Los Angeles, CA 90089, USA
[2]Department of Epidemiology, School of Medicine, University of California, Irvine, Irvine, CA, 92697, USA
[3]University of Wisconsin-Madison, Environmental Chemistry and Technology Program, 660 North Park Street, Madison, WI 53706, USA

Abstract. Indoor and outdoor water soluble trace elements (TEs) were analyzed on quasi-ultrafine (UF), accumulation, and coarse PM filter samples collected at four retirement communities, three located in the San Gabriel Valley and one in Riverside, CA. Our analysis indicates that a complex mix of vehicular, industrial, and soil-related emissions was responsible for the elemental concentrations measured at the three San Gabriel sites, while regional transport, soil re-suspension and, to a lower degree, local traffic contributed to TE levels observed in Riverside. In the quasi-UF mode, the magnitude of indoor/outdoor concentration ratios (I/O) for elements of anthropogenic origin was highly variable, reflecting the spatial heterogeneity of combustion sources in the study area. Indoor/outdoor ratios in accumulation mode PM were closer to 1, and more homogeneous across sites, indicating that elements associated with this size fraction penetrate indoors with high efficiencies. The lowest overall I/O ratios were obtained for elements found in coarse particles, consistent with the fact that only a small portion of coarse outdoor PM infiltrates indoors. The potential of S and other TEs to serve as tracers of indoor-penetrated particles of outdoor origin was also examined. Our results suggest that using the I/O ratio of S (I/O_S) as a surrogate of the infiltration factor for $PM_{2.5}$ [$Finf(PM_{2.5})$] might lead to an overestimation of the indoor $PM_{2.5}$ originating outdoors. This is in contrast with what was reported in previous studies conducted in the Eastern US, where S has been consistently used as a reliable tracer of outdoor $PM_{2.5}$ infiltrating indoors. Our differences may be due to the fact that in the Los Angeles basin (and in general in the Western US) $PM_{2.5}$ includes a number of semi-volatile labile species, such as ammonium nitrate and several organic compounds, which volatilize either entirely or to a substantial degree upon building entry.

Final Revised Paper (PDF, 1098 KB) Supplement (29 KB) Discussion Paper (ACPD)

Citation: Polidori, A., Cheung, K. L., Arhami, M., Delfino, R. J., Schauer, J. J., and Sioutas, C.: Relationships between size-fractionated indoor and outdoor trace elements at four retirement communities in southern

California, Atmos. Chem. Phys., 9, 4521-4536, 2009. Bibtex EndNote Reference Manager