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## The concentrations and composition of and exposure to fine particles (PM2.5) in the Helsinki subway system. Atmos Environ

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**ABSTRACT**

Fine particulate matter (PM2.5) and particle number concentrations were monitored in the Helsinki subway system during a two-weeks' measurement campaign in March 2004. The PM2.5 samples was analysed for elemental composition and carbon fraction. The average daytime PM2.5 concentrations were 47 (±4) and 60 (±18) μg m−3 at the two underground subway stations and 19 (±6) and 21 (±4) μg m−3 at a ground level station and in subway cars, respectively. For the same measurement period, the corresponding PM2.5 concentrations at the urban background and street canyon monitoring sites were 10 (±7) and 17 (±10) μg m−3.The particle number (D<500 nm) concentrations and size distributions at the underground subway station were very similar to those measured at the urban background monitoring site indicating that the source of particles of this size is street traffic. The average daytime particle number concentration was 31 000 (±14 000) particles cm−3 compared to 27 000 (±17 000) particles cm−3 at an urban background monitoring site (D<320 nm). The average daytime black carbon concentration was 6.3 (±1.8) μg m−3, the concentration of elemental carbon 4.0 (±2.0) and organic carbon 7.4 (±1.6) μg m−3.The most enriched element in PM2.5 samples was iron, the concentration of which ranged from 0.7 (±0.3) μg m−3 at the ground level subway station to 29 (±7) μg m−3 at the underground subway station. Other enriched elements included Mn, Cr, Ni, and Cu. We calculated that 30 min commuting +9 min stay at the stations per day increased the exposure to PM2.5 mass by only approximately 3% compared to staying in urban traffic environment, but the exposure to iron in PM2.5 increased nearly 200%, to Mn 60%, and to Cu 40%. [less]