Relationship between Indoor and Outdoor Concentration of Aerosol Particles in Different Types of Archives

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RELATIONSHIP BETWEEN INDOOR AND OUTDOOR CONCENTRATION OF AEROSOL PARTICLES IN DIFFERENT TYPES OF ARCHIVES

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Aerosol particles are one of the major pollutants in outdoor and indoor air. They may negatively influence health, but also have negative effects on ecosystems and cultural heritage. Particulate matter (PM) can be harmful for works of art by causing soiling and chemical damage, depending on particle size and chemical composition [1]. The study includes indoor/outdoor monitoring of air quality in four archives in the Czech Republic, representing different outdoor environments: Zlatá Koruna (rural), Třeboň (small town), Teplice (industrial area), and Prague (large city with traffic). The archives in Zlatá Koruna, Třeboň and Teplice are only naturally ventilated, while archive in Prague is equipped with ventilation and filtration system. The measurements were performed during 4 intensive campaigns in different seasons of the year at every location. The measurements included particle number concentrations and size distributions determined by an Ultrafine Particle Monitor (TSI, USA) and an Aerodynamic Particle Sizer (TSI, USA). Both instruments sampled alternately from indoor and outdoor, covering the size range 20–20,000 nm. In Prague only indoor measurements were performed, because the archive is absolutely isolated from the outdoor environment. The aim of this study is to investigate concentrations and sources of PM in the indoor environment of the archives, and to establish the relationship between the indoor and outdoor environment. The results showed that concentrations of fine particles in the indoor environment of the archive in Prague were relatively stable and low (about 10^2 particles/cm^3), but concentrations of coarse particles were increased by restorers and visitors. The temporal variation of fine particles in the naturally ventilated archives (Zlatá Koruna, Třeboň, Teplice) indicated outdoor air as a main source of particles in the indoor environment. Average values for the indoor/outdoor ratios of the particle number concentration had a maximum between particle diameters of 0.1 – 1 μm (Fig. 1), which indicates a maximum penetration factor and low indoor deposition velocity of these particles. The penetration at Třeboň was higher probably due to simple windows with gaps, compared to double glassed windows at Zlatá Koruna and Teplice. The results were confirmed by measurements of the ventilation rate.

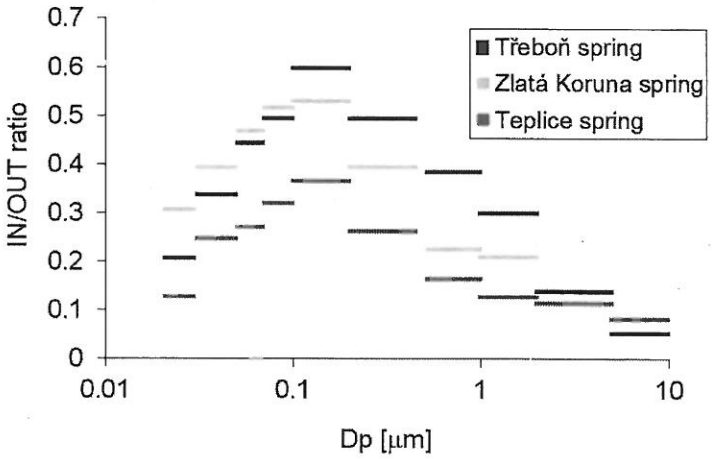

Figure 1. Indoor/outdoor ratios of particle number concentrations versus particle size during the spring campaign in Třeboň, Zlatá Koruna and Teplice.

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[1] Hatchfield, P. B. (2005) *Pollutants in the Museum Environment.* Archetype Publications, London.