

Publication

Iron, manganese and copper emitted by cargo and passenger trains in Zurich (Switzerland): Size-segregated mass concentrations in ambient air

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)**ID** 4519748**Author(s)** Bukowiecki, Nicolas; Gehrig, Robert; Hill, Matthias; Lienemann, Peter; Zwicky, Christoph N.; Buchmann, Brigitte; Weingartner, Ernest; Baltensperger, Urs**Author(s) at UniBasel** [Bukowiecki, Nicolas](#) ;**Year** 2007**Title** Iron, manganese and copper emitted by cargo and passenger trains in Zurich (Switzerland): Size-segregated mass concentrations in ambient air**Journal** Atmospheric Environment**Volume** 41**Number** 4**Pages / Article-Number** 878-889**Keywords** railway; aerosol; emissions; abrasion; trace metals; iron**Mesh terms** Science & TechnologyLife Sciences & BiomedicinePhysical SciencesEnvironmental SciencesMeteorology & Atmospheric SciencesEnvironmental Sciences & EcologyMeteorology & Atmospheric Sciences

Particle emissions caused by railway traffic have hardly been investigated in the past, due to their obviously minor influence on air quality compared to automotive traffic. In this study, emissions related to particle abrasion from wheels and tracks were investigated next to a busy railway line in Zurich (Switzerland), where trains run nearly exclusively with electrical locomotives. Hourly size-segregated aerosol samples (0.1-1, 1-2.5 and 2.5-10 μm) were collected with a rotating drum impactor (RDI) and subsequently analyzed by synchrotron radiation X-ray fluorescence spectrometry (SR-XRF). In this way, hourly elemental mass concentrations were obtained for chromium, manganese, iron and copper.. which are the elements most relevant for railway abrasion. Additionally, daily aerosol filters were collected at the same site as well as at a background site for subsequent analysis by gravimetry and wavelength dispersive XRF (WD-XRF). Railway related ambient air concentrations of iron and manganese were calculated for the coarse (2.5-10 μm) and fine (<2.5 μm) particle fraction by means of a Mn/Fe ratio investigation. The comparison to train type and frequency data showed that 75% and 60% of the iron and manganese mass concentrations related to cargo and passenger trains, respectively, were found in the coarse mode. The railway related iron mass concentration normalized by the train frequency ranges between 10 and 100 $\text{ng m}^{-3} \text{ h}$ iron in 10 m distance to the tracks, depending on train type. It is estimated that the personal exposure next to a busy railway line above ground is more than a magnitude lower than inside a subway station.

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