Methodology for Assessing Associations Between Exposure to Indoor Generated Airborne Particles and Health Effects in Residential Habtitants

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There is a basic lack of knowledge considering particles of indoor origin and their impact on human health. Most of our knowledge is generated from epidemiological studies based on measurements of outdoor particles. We know however that even though outdoor fine particles penetrate to the interior of buildings, indoor generated particles often dominate the particle concentrations. Airborne particle measurements are frequently being conducted in workplace environments, but very few, designed to find associations between aerosol concentrations and health outcomes, in residential homes (Schneider *et al.*, 2003). This could be due to the fact that health limit values hardly can be applied in these settings, and hereby there are few political incitements to monitor this type of environment. However, humans, at least in the industrialized part of the world, do spend a big part of their lives in their homes, and are hereby subjected to indoor generated airborne particles.

The aim of this study is to characterize the air quality in residential dwellings (in terms of time resolved particle mass and number concentrations, number distributions, soot fractions, temperature, relative humidity and CO_2 levels), correlate this data to various indoor activities and study associations between exposure to airborne particles and health effects/symptoms of the inhabitants.

For seven consecutive days detailed air measurements (using for example LightHouse, DustTrak, MiniDISC, Nanotracer and MicroAeth) are conducted in randomly selected homes (N=42) in the area of Lund in southern Sweden. The instruments are placed centrally in the home, but not in immediate vicinity to the kitchen stove. All measurements were made during off-pollen season. The CO_2 data is used to calculate the air exchange rate according to a method developed by Bekö et al at DTU, Copenhagen. Petri dishes are also placed in each home to collect potential allergens. In one home, measurements are made with a Scanning Mobility Particle Sizer (SMPS, 10-1000 nm), Aerodynamic Particle Sizer (APS, 0.5-20 um) and a Time-of-Flight Aerosol Mass Spectrometer in addition to the instruments mentioned above. In every location the habitants are asked to fill in detailed activity logs. Using these logs, the origin and duration of peak particle concentrations are identified and quantified.

A thorough examination of each home – e g construction year, floor and wall materials, and ventilation system - is conducted according to a structured protocol. The participants also fill in a 9 page questionnaire covering topics such as current and previous health status, professional history, habits of smoking, using incense, cleaning and eating.

After the measurement period a medical examination is conducted of persons over the age of 18 in each home. This includes acoustic rhinometry (Rhin 2000, S.R. Electronics, Denmark; wideband noise; continuously transmitted) with measurements made under standardized conditions (sitting), after five minutes rest. By means of acoustic reflection the minimal cross-sectional areas (MCA) on each side of the nose were measured from 0 to 22 mm and from 23 to 54 mm from the nasal opening. Also, the volumes of the nasal cavity on the right and left side were measured from 0 to 22 mm and from 23 to 54 mm. The examination also includes non-invasive measurements of the tear film break-up time using a Tearscope (Keeler Tearscope Plus). Finally, the nitric oxide (NO) in exhaled breath (FENO) is analyzed by NIOX-mino (Aerocrine, Stockholm, Sweden). The nitric oxide measurements reveal the level of inflammation in the airways.

To account for any outdoor air variations the Lund air is monitored constantly (number- and mass concentration) during the indoor measurement campaign period from a station on top of the Ingvar Kamprad Design Center in northern Lund. This data is used when peaks in indoor particle concentration occurs in several homes simultaneously, whose origin cannot be accounted for in the activity logs.

Preliminary results show that the methodology supplies quantitative measures on physiological effects and non effects that can be related to air quality in the home. It also reveals common indoor aerosol sources and their relative strength. A wide variety of particle generating activities can be studied due to the large number of participating homes.

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