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Particle emissions from traffic and biomass burning – Results of several studies in Denmark

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The presentation will give an overview of investigations of particle sources performed under the Danish particle programme. Measurements of PM10, PM2.5 and ultrafine particles were conducted in busy street canyons, urban background and rural locations. Road traffic, wood stove emissions and long-range transport could be identified as the main sources. Here we will focus mainly on the traffic emissions.

<u>Traffic emission factors:</u>

Emissions of **particle number** from traffic are totally dominated by tail-pipe emissions in the ultrafine size range. Measurements of particle size distribution (size range 10-700 nm), NOx and CO performed simultaneously at kerbside and urban background were analysed in detail. Particle number emission factors and size distribution for the traffic source in Copenhagen could be estimated under real world driving conditions. The estimated emission factors compare well with estimates reported in the literature. The particle size distribution can be described with 3 log-normal modes. Modern Diesel engines used by taxies dominating the night traffic could be associated with a size distribution shifted to smaller particle sizes compared to the average traffic source.

There is an ongoing debate whether health effects caused by particles are due to specific chemical and physical characteristics of particle fractions and if so, which characteristics. Some evidence points towards the solid fraction of the particle (soot) being considerably related to the health effects.

Therefore, we investigate here the size distribution of the less-volatile fraction of aerosols by means of several Differential Mobility Particle Sizers (DMPS) and a thermodenuder (TD). During a 6 weeks campaign in May /June 2004, a TD was operated at 3 different temperatures 125˚C , 225˚C and 450˚C. For the total particle number concentrations the share of the non-volatile fraction is decreasing with increasing temperature, from about 30% at 125˚C to about 20% at 450˚C.

Particle mass emissions from traffic can be divided into three main groups: **A)** Direct exhaust emissions that are predominantly found in the fine fraction (PM2.5) and are documented in different emission databases (e.g. COPERT, HbEfa). **B)** Emissions from brakes wear that are to about equal amount present in the fine and coarse (PM10-PM2.5) fraction and correlate well with the direct emissions and other vehicle emissions e.g. NOx. Largest uncertainty is connected with **C)** emissions from road abrasion, tyre wear and road dust re-suspension that are mostly found in the coarse fraction and are often less correlated with the exhaust emission due to an influence from 'external factors' as road condition (wetness, salting, sanding, road material) and use of studded tyres.

Emission factor estimates for PM10/ PM2.5 based on measurements and literature studies will be presented.

Wood stove emissions:

The influence of local residential wood-combustion was studied in two small rural towns with widespread use of wood combustion for heating. Measured compounds were PM10, PM2.5, particle size distribution, CO, NOx, soot, elemental and organic carbon (EC/OC). Source profiles for wood combustion, traffic and long range transport could be found by principal component analysis.