Short Summary of the EFCA Symposium on Ultrafine Particles– Brussels May 10th -11th, 2017

Seventy experts from more than 12 different European countries participated in the 6th symposium on ultrafine particles (UFP) to discuss aerosol related health effects indoors and outdoors, urban air pollution on different scales, engineered nanoparticles in ambient air, airborne aerosol measurements, emission reduction, and abatement strategies in 11 sessions. The symposium was completed by a panel discussion on emissions and abatement strategies for ultrafine particles.

UFP especially from vehicle exhaust are associated with cardiovascular morbidity and mortality by multiple mechanisms. Also cognitive decline could be associated with particulate air pollution but it was pointed out how rare and demanding useful epidemiological studies are. The initial response of lung cells on combustion aerosols include oxidative stress, inflammation and apoptosis. For lung cells the overall biological response-strength differs considerably for different aerosol sources and is not well correlated with the deposited particle mass. The health risk of the use of fuel additives, the estimation of the toxicity with integrated dose monitoring techniques and the relationship of indoor to outdoor ultrafine particle levels were described, as well as the challenges for science and regulation. The potential release and atmospheric fate of engineered nanoparticles bares still significant uncertainties. Ultrafine particle number concentrations observed near and downwind of big airports like Amsterdam or Frankfurt reach very high peak values. A pattern between the mortality risk and the distance to the airport was not clearly visible but it cannot be excluded that the UFP contribution of air traffic can lead to an excess mortality risk or impact on morbidity.

UFP have a significant climate impact. New particle formation generates half of the cloud condensation nuclei in the Earth atmosphere with highly oxidized organic compounds from the biosphere having a substantial influence on particle formation and growths. Airborne measurements of UFP showed their global distribution and the importance of vertical mixing for their concentration variations especially in urban areas.

Air quality in Europe did improve significantly over the past years as shown by available trends and the assessments performed under the Convention on Long Range Transboundary air pollution (CLRTAP) and the EU Thematic Strategy on Air Pollution (TSAP). As a consequence, transboundary transport gains increasing importance which can clearly be seen e.g. in low emission zones like Leipzig. However, particulate mass is still a health issue: concentrations decrease slowly, and further exceedances of limit values can be expected especially for urban areas. Particles filters are considered a substantial success with significant positive health effects especially in abatement of Diesel engine emissions. Modern gasoline engines now emit more particles compared to Diesel engines with filters. Particle number limits are now required as metric to reach next levels in air pollution reduction e.g. to define meaningful values for low emission zones. Jet turbines emit UFP less agglomerated, more compact, and smaller than e.g. Diesel soot; with increasing thrust primary particle size grows and internal particle structure changes from amorphous to semi-crystalline. Regulatory developments for future non-volatile particle mass and number emissions regulation are ongoing as well as airport initiatives for scientifically robust and improved UFP monitoring and health studies focusing on aircraft gas turbine emissions.

While primary sources of UFP are rather well known and mitigation options are available this is much less well known for secondary sources. An abatement strategy for traffic could be dedicated mobility concepts and e-mobility. New standards for air traffic are on the way, however, air traffic is increasing strongly and thus requires accelerated research for the effects of UFP related with jet engines. The final discussion about emissions and abatement strategies led to the conclusions that it is the responsibility of policy to set emission limits especially for pollutants which are linked like NOx and UFP. A limit value for NO_2 was adopted in 1999, came into force in 2010, and is still not complied to everywhere. Public awareness is needed and an initiative for UFP limits as well. Ultrafine secondary organic aerosols and their health effects deserve special attention in particular for man-made precursors. Aircraft engine emissions are a special case since they are regulated by global standards. Better air quality standards related to health effects are needed suitable not only for toxicology but also for epidemiology. Abatement measures for UFP should take into account their health costs and the importance of long range transport.

UFP Organizing Committee