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Consortium on urban air particles and environmental health

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There were several good reasons for establishing the Research Consortium on Urban Air Particles and Environmental Health within the Finnish Research Programme on Environmental Health (SYTTY).

Human exposures to particulate matter in urban air have been associated with increased cardiorespiratory morbidity and mortality even at the current, relatively low levels measured in western countries. However, the exposure assessment methods used in many recent epidemiologic studies have been rather general, and they have not addressed individual differences. Particulate matter pollution in the ambient air has usually been characterized only as daily or annual average mass concentrations of total suspended particulates (TSP) or as particles with an aerodynamic diameter smaller than 10 μm (PM_{10}), measured at one fixed urban site per city. More accurate exposure assessment in epidemiologic studies requires time-activity diary data from exposed persons and real-time measurements of particle number or mass concentrations and particle size distributions in outdoor and indoor microenvironments where these persons visit. An alternative to microenvironmental measurements is continuous monitoring of particulate matter exposure with portable devices. Modern evaluation of the adverse health effects caused by airborne particles requires this kind of information on particulate matter exposure, and a quantitative assessment of the relationship between the estimated exposures and health effects is needed. Therefore a great demand exists for high-quality, reliable, and consistent data to be collected and used in the assessment processes.

The assessment of the health impact of particulate matter in the ambient air of urban environments is a complicated but important task that consists of the following four main stages: (i) release assessment, (ii) exposure assessment, (iii) health consequence assessment, and (iv) risk estimation. The overall evaluation of health risk is the outcome of linking emission release assessment to health consequence assessment via exposure assessment. This linkage requires information on the physicochemical characteristics of particulate matter emissions, on their dispersion and transport in urban air, on exposures to particulate matter, on the numbers of people exposed, and on the quantitative relationship between exposure and health effects. The studies on health risks related to exposure to particulate matter require interdisciplinary collaboration so that causalities prevailing in the chain of processes between emissions and health effects can be understood.

The main objective of the Research Consortium on Urban Air Particles and Environmental Health was to link together elements in the chain of processes from emissions to the mechanisms of adverse health effects (figure 1). This process provided new data for a comprehensive health risk analysis of particulate matter in urban air in Finland. Another objective of the consortium was to create an efficient and stimulating environment in which doctoral students could work and be educated under the influence of many senior specialists in the field.

Six closely linked projects were affiliated to the consortium (table 1). The experimental field work and data interpretation in projects 1, 2, 3, and 4 had common links because the fixed-site monitoring of particulate matter, outdoor-to-indoor transport measurements, modeling, exposure studies, and epidemiologic studies were conducted in Helsinki in 1998 and 1999. The toxicologic projects (projects 5 and 6) refined the source contribution results of projects 1, 2, and 4 and the epidemiologic health results of project 4. In addition, the results on particulate matter modeling from projects 2, 3, and 4 could be utilized for between-project data interpretation. Detailed comparisons of the results were performed at the end of the program in order to obtain a deeper insight into the causalities between the emissions and health effects.

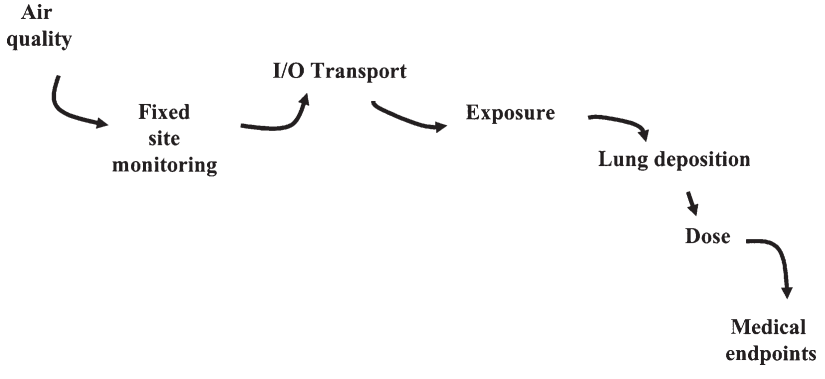

Figure 1. Chain of the processes studied by the consortium.

Table 1. Projects of the consortium.

Name of project	Project leader	Affiliation
1. Relationship between aerosol concentrations in indoor and outdoor air and transport from outdoors to indoors	Professor Markku Kulmala, PhD	University of Helsinki, Department of Physics, Helsinki
2. Elemental analysis and source apportionment of personal $PM_{2.5}$ exposure: application of EXPOLIS $PM_{2.5}$ filters and data (EAS-EXPOLIS)	Professor Matti Jantunen, PhD	National Public Health Institute, Laboratory of Air Hygiene, Kuopio
3. Development of a population-exposure model using atmospheric dispersion modeling together with measured concentrations and personal exposures—EXPAND	Jaakko Kukkonen, PhD	Finnish Meteorological Institute, Air Quality Research, Helsinki
4. Effects of fine and ultrafine particles on respiratory and cardiovascular health	Juha Pekkanen, MD	National Public Health Institute, Unit of Environmental Epidemiology, Kuopio
5. Toxic effects of urban air and diesel exhaust particles on the respiratory tract	Raimo O Salonen, MD	National Public Health Institute, Laboratory of Toxicology, Kuopio
6. Effect of surface properties of mineral dusts on their ability to induce inflammatory response in the lungs	Professor Matti Klockars, MD	University of Helsinki, Department of Public Health, Helsinki

The main benefit of the consortium was the effective cooperation and exchange of information between several projects working on different aspects of the human-exposure and health-effect assessment chain. Such cooperation and exchange were apparent in all phases of the projects (ie, from the planning of the fieldwork to the interpretation of the results). In addition, the supervision and education of doctoral students became more systematic and efficient, and the collaboration of several research institutions even permitted interdisciplinary supervision of some students. All doctoral students, postdoctoral fellows, and senior supervisors of the consortium participated in its courses and workshops, which often had the pleasure of having prestigious foreign scientists as invited plenary speakers.

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