

## **EMFO – Abstracts of projects approved in spring 2006**

### **Fine particles and onset of asthma, lung disease and respiratory symptoms**

Body conducting the research: Umeå universitet

Project duration: 2007-2008

It is very important that the exposure-response functions (ERF) assumed in health impact assessments come from epidemiological studies with corresponding exposure variables as those used in the assessments. Exposure data in future assessments comes likely from models with a high geographical resolution. A lot of ERF today used in assessments come from between-city studies rather than from within-city studies, due to lack of more relevant studies. The *FINAL project* will focus on fine exhaust particles and asthma onset as well as other lung disease and respiratory symptoms.

Exposure data as annual means of vehicle exhaust particles (PNC, *PM<sub>exhaust</sub>*) outside homes for study subjects from three cities (Umeå, Uppsala and Gothenburg) will be estimated with a 50-100 m resolution using dispersion models, resulting in more relevant ERF. Health data will be collected from our own survey in these three cities in 2004 with approx. 2800 persons aged 16-70 years, and from the RHINE cohort study with approx. 6000 persons born 1945-73 living in these cities, that were followed-up for 10 years in 2001.

### **Vehicle exhaust particle deposition in the respiratory tract**

Body conducting the research: Lund universitet, Lunds Tekniska Högskola, Fysiska institutionen, Avd. för Kärnfysik

Project duration: 2007-2008

This project complements an on-going EMFO project (Thomas Sandström, Cardio-vascular and respiratory effects of vehicle exhaust, 2005-2007) by measuring human respiratory tract deposition of diesel exhaust particles for a group of healthy adults and COPD patients. These measurements will be performed using a unique instrument recently developed and the Lund Institute of Technology. The particle deposition can be measured fully size-resolved (10-600 nm), fast (15-20 minutes) and accurately. The instrument is mobile, which means that the measurements can be performed in-situ at the place where the particles are formed.

These measurements will enable us to determine the relationship between exposure and actual dose to the human airways. The observed organ-specific and systemic reactions to diesel exhaust studied in the on-going EMFO project can thus be related to the actual dose of particles that the test persons obtained, and not only their exposure. This is expected to result in considerably improved exposure-dose-effect relationships.

## **Particulate air pollution from road traffic, air way disease and lung function in children**

Body conducting the research: Institutet för miljömedicin, Karolinska Institutet  
Project duration: 2007-2008

This study will examine the relation between air pollution from traffic and long-term effects on respiratory health in children. It will be based on a birth cohort with children from Stockholm city, two city-like suburbs and a distant suburb. The 4000 children included in the cohort were born 1994-1996 and have been followed since then with questionnaires to the parents and clinical examinations at ages 4 and 8. Preliminary data from the 4 year follow-up suggest that air pollution from traffic at place of residence influence the risk of respiratory disease with symptoms, decreased lung function and allergy to pollen. In this project we will study the relation up until age 8. Detailed modelling of levels of outdoor particulate air pollution from traffic will be used for homes, day-care centres and schools from birth to the age of eight. The individual exposure data will be analysed with several different indicators of respiratory health, including lung function, asthma diagnosis and symptoms as well as sensitisation to common allergens

## **The Role of Particle Size and Chemical Composition for Health Effects – A Review of the Current Literature**

Body conducting the research: Umeå Universitet, Inst för Folkhälsa och Klinisk Medicin, Lungmedicin  
Project duration: 2006-2007

Particulate air pollution is strongly associated with adverse health effects, including increased morbidity but also mortality, mainly due to cardiovascular and respiratory causes. It has been increasingly evident that the use of PM<sub>10</sub> as a measure of particulate air pollution is a relatively inaccurate parameter, which cannot separate the contributions from different size fractions like coarse, fine and ultrafine particles, or source contributions. It is also unclear what physical and chemical characteristics of the particles that contributes to the toxicological capacity and adverse health effects.

This project is based on the EMFO development programme and is aimed to collect, analyse and make synthesis of the current knowledge of the toxicological properties of traffic related particulate matter, and its link to adverse health effects. This will be done in terms of a literature study by experienced multidisciplinary scientists applying a European perspective.

## **Measurements, modelling and optimization of transient and stationary particle emissions from diesel engines**

Body conducting the research: Volvo Technology AB  
Project duration: 2006-2008

Particle emissions from diesel engines are a serious health issue, especially in urban environments. Particle measurements has mostly been performed at stationary conditions, or by measuring the total amount emitted during a test cycle. The goal of the project is to get a

detailed understanding of how the transient conditions in the engine affect the particle emissions, and how the emitted particles in the exhaust line are transformed and collected in *i.e.* a particulate filter. State-of-the-art analysis equipment will be used for the transient measurements of number of particles, particle size distribution and particle mass. Chemical analysis of the particle composition will be performed in parallel with the transient measurements.

### **PM from SIDI gasoline and alternative fuel engines**

Body conducting the research: General Motors Powertrain – Sweden AB

Project duration: 2007-2008

The fuel consumption for gasoline engines is today an urgent issue, both regarding CO<sub>2</sub> emissions and the raising oil price. One alternative for increased fuel economy in this connection is lean combustion, e.g. stratified direct injection. It is known that lean gasoline engines produce particulate matter similar as for diesel engines. Presently, there are however none legal limits for particulate emissions from gasoline engines in Europe why the aftertreatment systems in this area are less developed compared to diesel applications. The aim of the present project, which is a cooperation between General Motors Powertrain – Sweden AB and the Competence Centre for Catalysis at Chalmers is to study the basics in formation and propagation of particulates and reactions in a particulate reducing after-treatment system for a lean Otto engine running on gasoline or alternative fuels. The target is to increase the knowledge regarding particulates from gasoline engines and how to avoid particulate formation, and use this knowledge to demonstrate a system that reduces the particulates in a lean spark ignition engine.

### **Advanced particulate after-treatment system for heavy duty diesel engines, EU6 and beyond**

Body conducting the research: Swenox AB

Project duration: 2006-2008

The forthcoming emission legislations in Europe (EU6) as well as USA (US10) will most likely require combined aftertreatment systems, *i.e.* a combination of particulate filters and SCR system. Separately, these systems have been commercially available. However, new challenges arise when the two are integrated into one unit, which additionally is highly coupled to the engine management. The integration of the two systems and optimal usage of the filter, not only to reduce particulates but as NO/NO<sub>2</sub> converter and thermal source, are questions that needs further attention. The aim of this project is to further the knowledge of how to optimise different filters to achieve highest particulate reduction, still considering other demands such as fuel economy, and to integrate filters with SCR systems to achieve sustainable solutions for future legislation. The project will focus on the particulate filter part of combined systems and will involve modelling, construction and validation of demonstrators and component testing.