Research plan

This research project comprises the following components:

Recruitment of subjects

We plan to recruit 45 healthy, non-smoking adult volunteer subjects to conduct personal exposure measurements and measurements in the home and the workplace. Selection will take no specific account of age, gender or ethnic background. Homes and workplaces from subjects will be tobacco smoke free. The subjects will be selected according to several key determinants in 3 groups that will represent different levels of exposure to VOC, such as:

- Group 1 (N=15). Subjects exposed to VOC in occupational environments (e.g. petrochemical workers, motor mechanics, bus drivers, etc)
- Group 2 (N=15). Subjects living or working in new buildings (e.g. less than 1year old) or buildings that had undergone redecoration in the previous year.
- Group 3 (N=15). Subjects not occupationally exposed and not living/working in new or renovated buildings will be recruited as controls.

Sampling methodology and ambient sample collection

Subjects in Groups 1 and 3 will be sampled once. Subjects in Group 2 will be sampled twice. The first sampling will be done at the beginning of the project, when the buildings are considered as new or freshly redecorated, and the second sample will be collected after 12 months of the initial sampling.

A bespoken personal sampler will collect one VOC 24-h sample into sorbent tubes and one PTFE 24-h filter for the analysis of $PM_{2.5}$, PAH and quinones. Additionally, a MicroAethalometer AE51 (Magee Scientific) will be deployed collecting 5-min real time data over the 24-h sampling period. Samples will be collected also at the home and workplace of the subjects concurrently with PE.

Subject Questionnaires

A range of questionnaires and time-activity diaries will be generated in order to collect information from subjects (e.g. locations visited, time spent at location, level of exertion, age, gender) and microenvironment locations (e.g. ventilation, indoor sources) such as to understand the air toxic concentrations measured.

Analysis of ambient samples

The ambient samples analysis will be analysed by thermal desorption coupled with a GCMS (VOCs) or solvent extracted and analysed by GCMS (PAH and quinones). $PM_{2.5}$ will be analysed gravimetrically. Black Carbon real time data will be downloaded from the AE51 MicroAethalometer. All analytical data will be suitably quality controlled.

Assessment of microenvironment /event contribution to personal exposures

The average contribution of each microenvironment to the personal exposure will be calculated. In the case of black carbon, since data is available in 5-min intervals, the contribution of specific event or activities to personal exposures will be also identified. This will enhance source apportionment of different activities or situations and will help the proposal of measures to reduce the overall dose to these pollutants.

Modelling of lung dose

Lung dose will be calculated considering the concentration of pollutant in the breathing zone, the duration of exposure and the minute ventilation.

Biomonitoring and analysis of biomarkers in urinary samples

Each volunteer subject will collect a urine sample via mid-stream spot samples into plastic vials at the end of each personal exposure period (i.e. following morning after sampling). Subsamples of the urine will be measured for creatinine, unmetabolised VOCs and 1,4-benzoquinone. All analytical data will be suitably quality controlled.

Metabolomic analysis of urine samples

A subsample of the collected urine will be analysed using NMR spectroscopy following the methodology described by Viant et al (2007).