School Children’s Personal Exposure to Ultrafine Particles in Urban Environments

M. Mazaheri¹, M. Mokhtar¹, R. Jayaratne¹ and L. Morawska¹

¹ International Laboratory for Air Quality and Health, Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Queensland 4001, Australia

Keywords: ultrafine particles, personal exposure, Nano Tracer, schools.

Presenting author email: m.mazaheri@qut.edu.au

This work was motivated by the limited knowledge on personal exposure to ultrafine (UF) particles, and it quantifies school children’s personal exposure to UF particles, in terms of number, using Philips Aerasense Nano Tracers (NTs). This study is being conducted in conjunction with the “Ultrafine Particles from Traffic Emissions and Children’s Health (UPTECH)” project, which aims to determine the relationship between exposure to traffic related UF particles and children’s health (http://www ilaqh.qut.edu.au/Misc/UPTECH%20Home.htm). To achieve this, air quality and some health data are being collected at 25 schools within the Brisbane Metropolitan Area in Australia over two years. The school children’s personal exposure to UF particles in the first 17 schools are presented here. These schools were tested between Oct 2010 and Dec 2011. Data collection is expected to be complete by mid 2012.

Four NTs are available for this project, 3 of which are used for data collection and one is the reference unit. The NT is a hand-held battery-operated instrument that measures particle number concentration up to \(10^6\) cm\(^{-3}\) and particle size in the range of 10-300 nm within the breathing zone. At each school, three to six 8 to 11 years old school children, who gave consent to participate in the study, were asked to carry the NT and a global positioning system (GPS) all the times for a total period of 24 hours. The children were instructed to wear the NT around the waist using a dedicated belt and were requested to have it in his or her close proximity during the 24 hours of measurements when it was not being worn (e.g. during sports activities, when using the bathroom and sleeping). Each child and their parents or guardians were asked to record their travel times and activities, during non-schooling and schooling hours, and the time and duration when the sampler was not with the child at any particular time.

63 children in the 17 schools (S01 – S17) participated in this study. Time series of the UF particle number data during the 24 hours of measurements for each child are used to identify the peak concentrations in the first instance. Each child’s exposure was quantified over a total of 24 hours, as well as for school hours only, non-school hours, and commuting.

Figure 1 shows the children’s average exposure to UF particles during schooling activities (indoors and outdoors) over the 24 hours of data collection at each individual school. These preliminary results show that children’s exposures during indoor and outdoor activities were lowest at S09 and highest at S03 and S02, respectively.

Figure 2 shows the children’s average exposure to UF particles during after school hours and transport over the 24 hours of measurements. The non-schooling hours also includes commuting and is affected by many factors relating to different children activities during after school hours. Children attending S07 and S08 had higher exposures during commuting and S01 had the lowest.

Preliminary analysis indicates that the results are consistent with the general characteristics of the schools and local traffic conditions during the data collection.

This work was supported by the ARC, DTMR and DET through Linkage Grant LP0990134.