Characterisation and Sources of Ultrafine Particles in an Inner City Urban Area

M.M. Rahman, M. Mazaheri, S. Clifford and L. Morawska

International Laboratory for Air Quality and Health, Institute of Health and Biomedical Innovation, Queensland University of Technology, GPO Box 2434, Brisbane QLD, 4001, Australia
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Presenting author email: mdmahmudur.rahman@hdr.qut.edu.au

Exposure to atmospheric ultrafine particles (UFPs, D<100 nm) has been of increasing concern because of their potential impact on health. Motor vehicle emissions are considered the major source of UFPs in the urban airshed, as the combustion of both petrol and diesel fuels leads to emission of particles in this size range (Ban-Weiss *et al*, 2010; Morawska *et al*, 2008). New particle formation events (NPFs) and major facility operations such as air or seaport have also been identified as major sources of UFPs in urban airshed (Cheung *et al*, 2010; González *et al*, 2011; Mazaheri *et al*, 2013). However, the contribution of those sources to ambient UFP concentrations has not been comprehensively characterized.

This study aims to determine and quantify the contribution of vehicular traffic and non-traffic sources contribution (e.g., airport, oil refineries, and seaport) to total ambient particle number concentration (PNC) in an urban location in Brisbane, Australia. Various exploratory statistical tools were used to analyze the collected data, with the dataset consisting of total PNC, particle number size distribution (PSD, D = 8 to 400 nm), $PM_{2.5}$, PM_{10}, NO_x, CO, meteorological parameters and traffic counts during a year-long measurement campaign in an inner city urban location in Brisbane.

Our results show a 32% increase of total PNC during midday compared to morning (6 to 9 am) and evening (5 to 8 pm) peak traffic times. Analysis of the PSD data showed that the majority of particles (84%) were smaller than 100 nm in diameter and the midday increase in PNCs were observed for particles with diameters smaller than 30 nm.

Figures 1 and 2 show the overall diurnal trend of the total mean PNC and hourly traffic counts during weekends and weekdays for the entire measurement campaign. It demonstrates the increase in total mean PNC during midday on weekdays although the corresponding traffic counts at a nearby road are lower at these times (Figure 1). Based on the criteria described by Dal Maso *et al* (2005) and the measured PSD data, we attribute the increase to NPF events. The midday increase in PNC was not observed during weekends; i.e. PNC and traffic counts had the same trend (Figure 2).

NE wind was linked to a ≤ 41% increase of total PNC, compared to all other direction. Up wind emission sources located at NE direction (e.g., airport, oil refineries, and seaport) are hypothesized to contribute to total PNC.

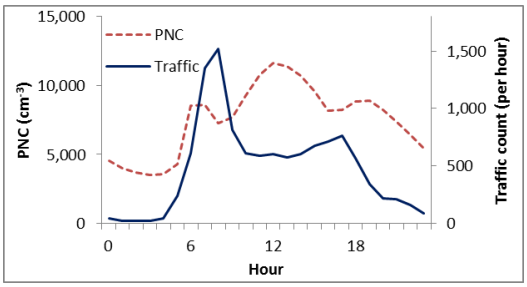

Figure 1. Total mean PNC and hourly traffic count during weekdays.

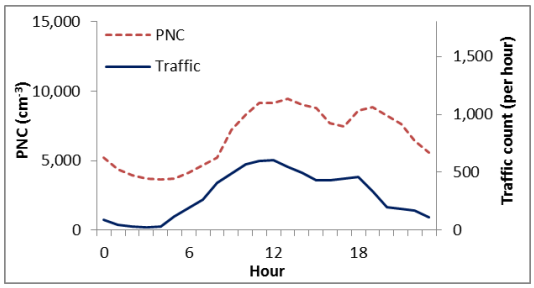

Figure 2. Total mean PNC and hourly traffic count during weekends.

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