

Nanoparticle emissions from road vehicles in Asian and European cities and allied health implications

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Epidemiological evidence has accumulated in recent years to demonstrate the association between human health effects and exposure to airborne nanoparticles (referring here to those below 300 nm since these contribute over 99% of total particle number concentrations, PNCs, in ambient environments). Vehicles can add up to 90% of total PNCs in polluted cities where vehicle numbers are increasing, as is likely to be the case with the nanoparticle emissions and hence the exposure of urban dwellers (Kumar *et al.*, 2013).

This work examines the nanoparticle emissions from road vehicles in Asian and European urban environments, the levels of ambient and roadside PNCs, discusses the elementary reasons for the differences in PNC levels, and analyses the health impacts. About 45 sampling locations in 30 European cities are evaluated (Kumar *et al.*, 2012). As summarised in Figure 1, the average PNCs at the roadside and urban background sites were found to be $3.82 \pm 3.25 \times 10^4 \text{ cm}^{-3}$ and $1.63 \pm 0.82 \times 10^4 \text{ cm}^{-3}$, respectively. A sample review of PNCs in Asian environments was conducted which, as expected, showed notably higher PNCs than those found in European environments.

Preliminary estimates of total particle number emissions from road vehicles in Delhi were made in current and future years (Kumar *et al.*, 2011). The results revealed the typical characteristics of traffic emissions and exposure in typical Asian cities, highlighting the largest contribution from the heavy duty vehicles, followed by passenger cars, to total particle number emissions despite their modest contribution to vehicle kilometres travelled. The introduction of zero sulphur motor fuels in Europe is having a beneficial impact upon airborne nanoparticle concentrations, and the use of diesel particle filters should further improve the situation in the more developed countries, but problems will remain for many years to come, especially in the less developed world.

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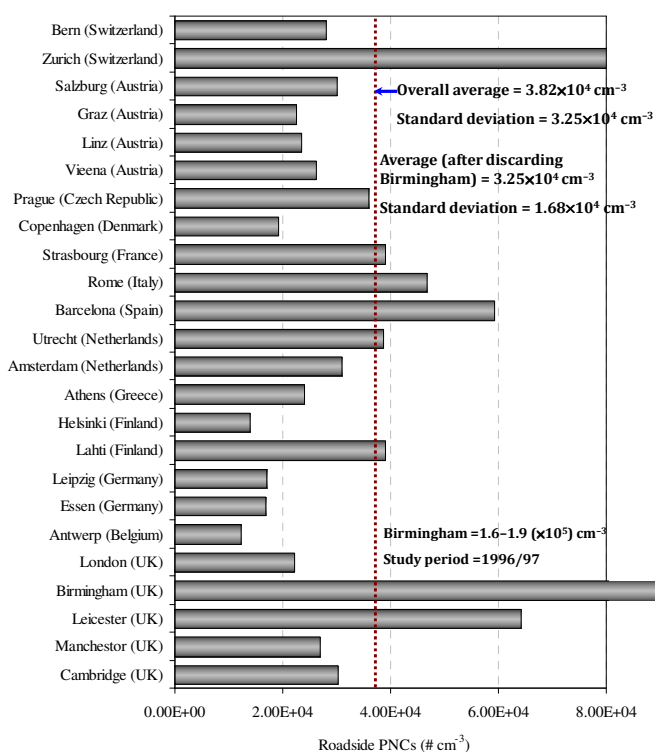


Figure 1. Typical roadside average PNCs at various locations in European cities (source: Kumar *et al.*, 2012).

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