Spatial variation of air pollutants in a multilevel office building

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Within-building spatial variability of indoor air quality may influence substantially the reliability of human exposure assessments based on single point samples, but have hitherto been little studied. To investigate and understand the within-building spatial variation of air pollutants, field measurements were conducted in a 7 level office building in Brisbane, Australia. The building consists of 3 sections (A side, Meddler and B side).

A portable unit consisting of a P-Trak, DustTrak and Q-Trak, was assembled on a small trolley and moved to the various locations around the building. The average particle number (PN) concentration (in the range 0.020-1.0µm), particle mass concentration ($PM_{2.5}$) and CO and CO_2 levels, as well as temperature and relative humidity, were simultaneously measured by P-Trak, DustTrak and Q-Trak Plus, at diffident locations inside and outside of the building during working hours in two typical weather conditions in Brisbane. At each sampling location, the sampling period was 5 minutes (with a logging interval of 10 seconds), and average measurements were obtained by sampling at different sub-locations within the office area including the working area, corridor, conference room and rest areas. The measurements were repeated twice at each location.

The average PN and $PM_{2.5}$ concentrations at various locations are presented in Figure 1. From Figure 1, some results can be drawn. Average particle concentration levels varied from location to location within the building, especially for PN. Indoor PN and $PM_{2.5}$ concentration levels in the underground car park, lifts and entrances were considerably higher (about 3 times for PN and 40% for $PM_{2.5}$) than those measured in the offices. Average PN concentration levels also varied from office to office within the building, in the range from 1.17×10^3 particle cm^{-3} to 6.68×10^3 particle cm^{-3}. Average indoor PN concentrations at level 7 were higher than those at other levels. This is due to there being an entrance at level 7 to the roof area of the building. It was found that the particle concentration in a printer room (24.0×10^3 particle cm^{-3} for PN and 7 µg m^{-3} for $PM_{2.5}$) was significantly higher than the average office concentration (3.7×10^3 particle cm^{-3} for PN and 5 µg m^{-3} for $PM_{2.5}$), which indicated that printers are a major indoor source of particles in this building.

A summary of the average indoor and outdoor PN, $PM_{2.5}$ and CO_2 concentration levels is given in Tables 1. From Table 1, it can be seen that both outdoor average PN and $PM_{2.5}$ concentration levels were higher (about 3 times for PN and 2 time for $PM_{2.5}$) than indoor average particle concentration levels. However, outdoor CO_2 levels were lower than indoor levels. It also can be noted that the highest $PM_{2.5}$ concentration for both indoor and outdoor was collected from the underground car park. There were also clear particle concentration differences between A side and B side for both outdoors and entrances.

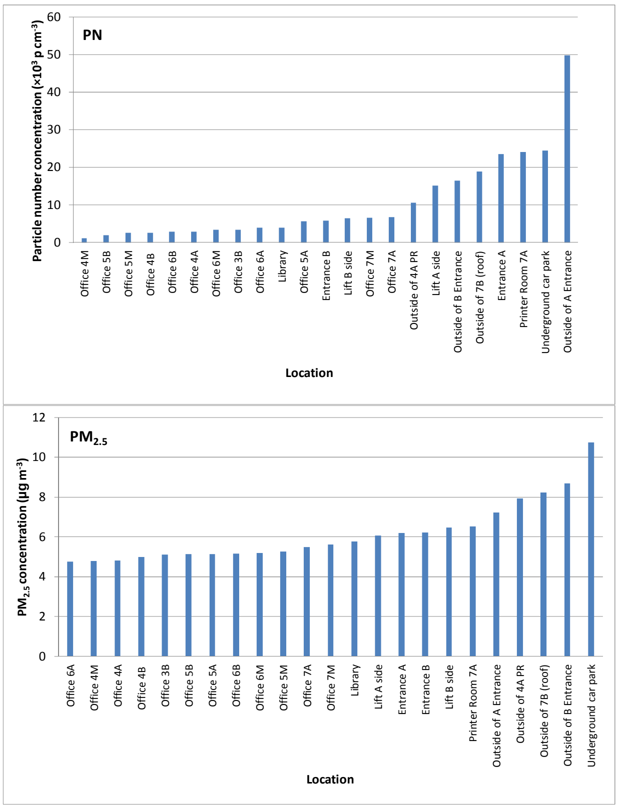

Figure 1. The average PN and $PM_{2.5}$ concentrations at various locations

Table 1. Summary of indoor and outdoor average concentration of the pollutants

	PN ($\times 10^3$ p cm^{-3})		$PM_{2.5}$ (µg m^{-3})		CO_2 (ppm)	
	In	Out	In	Out	In	Out
Average	7.74	24.0	6	8	767	496
S.D	7.84	17.6	1	1	206	115
Min	1.17	10.6	5	7	459	435
Max	24.4	49.9	11	9	1192	668
Median	3.98	17.7	5	8	795	439

CO concentration levels also varied from location to location within the building. However, CO concentration levels were clearly lower than the NEPM ambient air quality standards (8 hours: 9.0 ppm).