

Fine Particle Concentrations at Different Floor Levels in Chinatown

By Sherry Hou

Background

Air pollution caused by traffic can be harmful to human health. Pollutants from traffic, such as ultrafine particles (UFP) and $PM_{2.5}$, may have negative effect on human health. $PM_{2.5}$ particles are less than four one hundred thousandth of an inch, while UFP are extremely small particles less than four millionths of an inch and about 25 times smaller than $PM_{2.5}$. Because of their size, UFP can easily enter a person's lungs when breathed in and pass into the blood stream.

Some scientists suspect that chronic exposure to UFP may be damaging to one's cardiovascular health. Very few studies have looked at the concentration of these fine particles in relation to height from the ground. As the particles travel away from a source, tiny particles tend to stick to each other and grow into larger particles. Therefore, people living on higher floors in a building might experience lower concentrations of UFP than people who live closer to ground level and traffic.

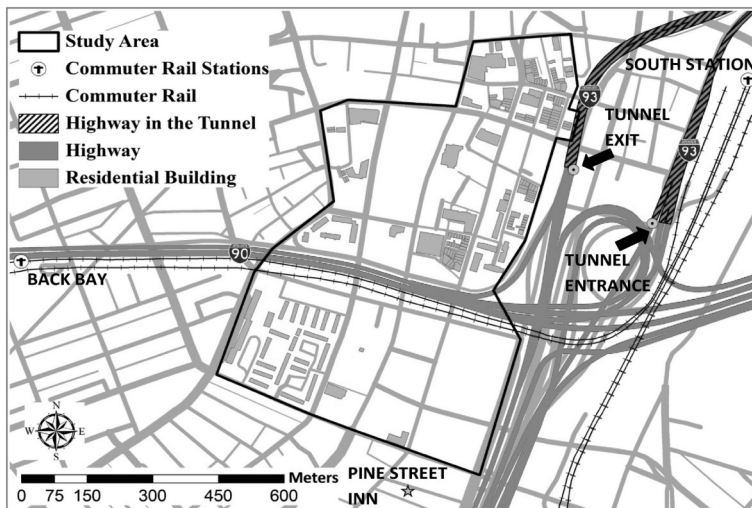


Figure 1: Map of the study area in Chinatown and the monitor site at Pine Street Inn.

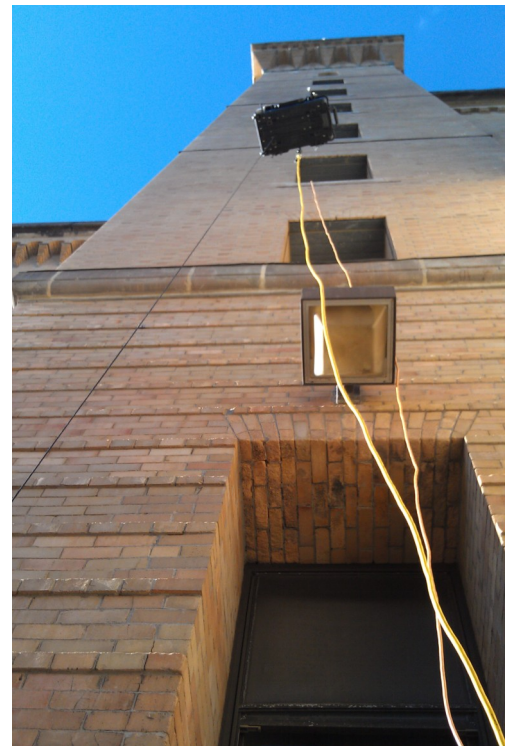


Figure 2: A photo of the monitor being pulled up and down along the side of Pine Street Inn building

How was it done?

The instruments that measure UFP and PM_{2.5} were placed on a pulley system to travel up and down a tower connected to the Pine Street Inn located a hundred meters west of the I-93 highway in Chinatown. Every Friday for ten weeks, the researchers would use the machines to measure the concentration of particles at different heights. The height of the building was categorized by floors into first and second, third and fourth, fifth and sixth, and seventh to eleventh.

Using geographic information system (GIS) and census information, the researchers then determined the number of people living on each floor category in Chinatown and the distance between these buildings and the highway. This information could be used in future research to figure out how many people living in higher buildings are exposed to UFP and PM_{2.5}.

What did they find?

The study found that concentration of UFP and PM_{2.5} above the sixth floor was a little smaller than the lower floors. However, the researchers did not find significant differences in particle concentrations across the bottom six floors. In other words, measuring UFP level at ground level is a reasonably accurate way to estimate UFP and PM_{2.5} up to about the sixth floor of buildings.

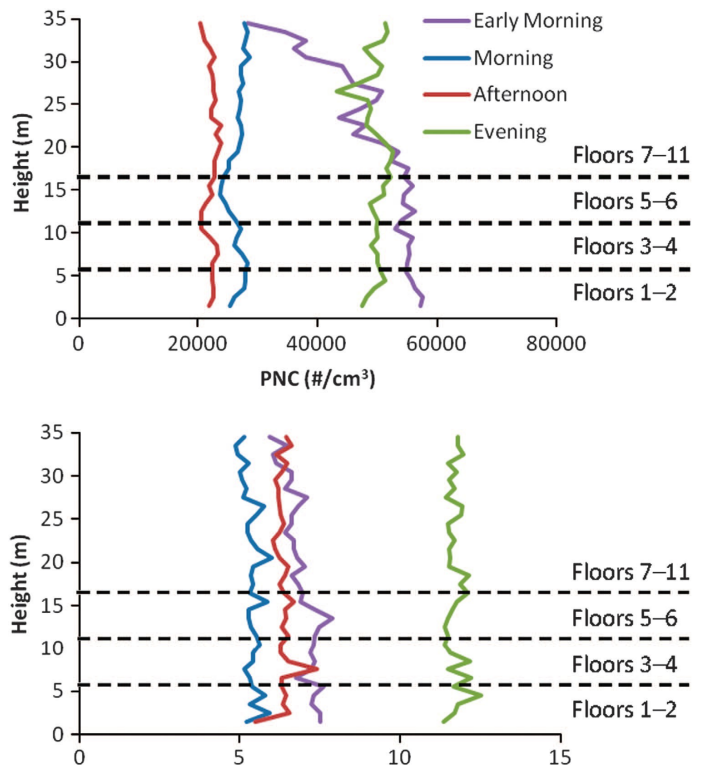


Figure 3: Daily variation of UFP and PM_{2.5} concentrations at different height along the Pine Street Inn building. Concentration of UFP was approximated using particle number count per cubic centimeter (PNC).

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To learn more about this research, please refer to the following source:

Wu C-D, MacNaughton P, Melly S, Lane K, Adamkiewicz G, Durant JL, Brugge D, Spengler JD. **Mapping the vertical distribution of population and particulate air pollution in a near-highway urban neighborhood: Implications for exposure assessment.** *Journal of Exposure Science and Environmental Epidemiology* (2013).