# DEVELOPING A LAND USE REGRESSION MODEL FOR ULTRAFINE PARTICLE CONCENTRATIONS IN VANCOUVER, CANADA

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**Background and Aims:** Epidemiologic studies have associated adverse health outcomes with exposure to traffic-related air pollutants, principally $NO_2$, at levels below those showing effects in controlled exposure studies. (1) This suggests the importance of related contaminants in the traffic exhaust mixture such as ultrafine particles (UFP) (<0.1µm in diameter). Presently, no routine monitoring for UFP exists in North America and little information is available regarding UFP spatial distribution.We measured particle number concentrations (PNC) in Vancouver to develop a land use regression (LUR) model for use in epidemiologic studies and to identify important factors influencing concentrations.
**Methods:** During a three-week sampling period in spring 2010, PNC were measured with portable condensation particle counters (CPC3007, TSI®, Shoreview, MN) for one hour at eighty locations previously used to characterize spatial variability in nitrogen oxides. PNC was measured continuously at four additional locations to assess temporal variation.
LUR modeling was conducted using geographic predictors, including: road length, vehicle density, intersection and bus stop density, land use type, fast food restaurant density, population density and elevation.
**Results:** The range of measured (one-hour median) PNC values was highly variable, 1500 - 105000 particles/$cm^3$, (mean [SD] = 18200 [15900] particles/$cm^3$). Pearson correlations of PNC with two-week average NO, $NO_2$ and $NO_x$ concentrations at the same sites were 0.59, 0.61 and 0.65. A preliminary LUR model ($R^2$ = 0.44) for temporally-adjusted PNC included ln-distance to nearest major road, area of industrial land within a 750m radius and density of bus stops within 100m.
**Conclusions:** Measured PNC was highly correlated with measured nitrogen oxides. However, geographic predictors explained a smaller proportion of variability in PNC levels than found previously for nitrogen oxides, suggesting some common sources and additional unknown factors accounting for PNC spatial variability. (2) A subsequent UFP LUR model will incorporate wind speed and direction.
**References:**

1. World Health Organization. Air quality guidelines, global update: particulate matter, ozone, nitrogen dioxide and sulfur dioxide. [Online]. 2005. [cited 22 January 2010]. Available from: URL: http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf
2. Henderson SB, Beckerman B, Jerrett M, Brauer M. Application of land use regression to estimate long-term concentrations of traffic-related nitrogen oxides and fine particulate matter. Environ Sci Technol. 2007;41:2422-8.