

TRANSIENT EXPOSURE TO VEHICLE EXHAUST PLUMES INSIDE NEW DELHI AUTO-RICKSHAWS

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Background and Aims: Air pollution exposures in roadway microenvironments are of concern in part because of the large number of people exposed, high concentrations, and close proximity between people and vehicle emissions. Few studies have investigated the characteristics of short-duration exposure to vehicle exhaust on roadways. We use data from New Delhi to explore the nature of transient on-roadway exposures to high pollutant concentrations.

Methods: We measured real-time (1 Hz) exposure to fine particle (PM_{2.5}) and black carbon (BC) mass and ultrafine particle number (PN) concentrations inside auto-rickshaws, a common type of unenclosed vehicle in India. The dataset consists of 180 h of driving during 62 trips along a single route in New Delhi; we investigate here transient (~ 15 – 60 s) concentration variations. To quantify the contribution of these peak exposure events to cumulative on-roadway exposure, we use a moving window function to mathematically separate distinct spikes from the baseline on-roadway concentration.

Results: Peak instantaneous exposures contribute substantially to total on-road exposure. For the median trip, incremental exposure attributable to transient concentration spikes accounted for 16%, 41%, and 50%, respectively, of trip-integrated PM_{2.5}, BC, and PN exposures. After subtracting simultaneously measured urban background concentrations, transient spikes accounted for ~50% of on-roadway PM_{2.5} exposure and ~60% of on-roadway BC and PN exposure.

Conclusions: For the dataset under consideration, transient exposures to poorly diluted vehicle exhaust plumes constitute an important fraction of the total on-roadway air pollution exposure. The health effects of such short duration (< 1 min) exposures to peak levels of vehicle air pollution are poorly understood. However, the possibility for nonlinearity in dose-response relationships suggests that this aspect of on-roadway exposure may merit further attention.