

Monitoring of Air Toxic Particulate Pollutants from Heavily Trafficked New Jersey Turnpike: An Urban Community-Wide Project

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Abstract

This study was specifically designed to identify ambient air quality gradients of particulate matter (PM_{2.5}), total suspended particles (TSP) and associated 16 Polycyclic Aromatic Hydrocarbons (PAHs)/10 trace metals (Al, Cd, Cr, Cu, Fe, Ni, Pb, Sc, V and Zn) at three different distances (50m, 100m and 150m) from the New Jersey Turnpike (NJTPK), one of the busiest highways in the USA. Ambient air samples were collected by a high volume air sampler and a Partisol-Federal Reference Method (FRM) PM_{2.5} low volume air sampler for periods of 24 hours and every 6 days between September 2007 and September 2008. PAH (16) concentrations (gas + particle phases) were higher compared to other suburban sites less impacted by heavy traffic. The average of gas phase Σ PAH concentration (21.03 ng/m³) along the gradient accounts for ~85% of the total atmospheric PAHs concentration (24.49 ng/m³), which is 5-6 times higher than particle phase (3.42 ng/m³). The average concentrations of PM_{2.5} and TSP were 13.51 μ g/m³ and 42.71 μ g/m³, respectively. TSP and PAHs showed decreasing concentrations as the distance from the highway increased, however PM_{2.5} did not show a significant difference with distance. This gradient was mainly attributed to the emissions from diesel engine exhausts since a significant correlation was found between the number of diesel vehicles and concentrations of Σ PAH. The mass-size distributions of trace-metals derived from vehicle emissions were investigated to characterize their concentration during two intensive (summer and winter) sampling periods. Concentrations of ten trace metals in PM_{2.5} showed gradients as a function of distance. In addition to spatial variation, these ambient air pollutants were investigated for their seasonal/diurnal variations with meteorological parameters, and traffic counts. The profiling of these air toxics will not only help characterize the degree and extent of the current air pollution problem near high traffic highways and the risks to the local communities, but also establish a baseline for future reference.