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Dry deposition and resuspension of particle-associated metals near a freeway in Los Angeles

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ABSTRACT

Dry atmospheric deposition represents a potentially large source of pollutant metal contamination in urban stormwater runoff, yet there is a limited amount of research on the relationship between atmospheric emissions and water quality problems in urban areas. In Los Angeles, with air quality that ranks among the worst in the United States, significant quantities of toxic materials are released into the atmosphere every day, and paved road dust represents the largest source of particle-associated metal emissions to the atmosphere. In order to better understand the role of roadways as a source of localized metal deposition, we characterized the horizontal dry deposition patterns of chromium, copper, lead, nickel and zinc upwind and at increasing distances downwind of the I-405 Freeway in coastal Los Angeles. Dry deposition fluxes and atmospheric concentrations of these metals were highest at the site closest to the freeway, and reduced to approximately urban background concentrations between 10 and 150 m downwind of the freeway. Compared with urban background, atmospheric particle size distributions indicated the freeway was a significant source of these metals on large particles > 6 µm in diameter, which deposit close to their source and account for the increased dry deposition flux rates observed near the freeway. The spatial pattern of measured deposition flux was well predicted by a relatively simple line-source Gaussian plume model modified to include particle deposition and resuspension. The model results indicated dilution by vertical dispersion of the plume was the most important mechanism regulating downwind concentrations and deposition.