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People Living or Working Near Major Freeways Are Exposed to 30 Times the Concentration of Dangerous Particles From Motor Vehicle Emissions

People who live, work or travel within 165 feet downwind of a major freeway or busy intersection are exposed to potentially hazardous particle concentrations up to 30 times greater than normal background concentrations found at a greater distance, according to two recently published UCLA studies.

The studies — published in the Journal of the Air and Waste Management Association and in Atmospheric Environment — show that proximity to a major freeway or highway dramatically increases exposure to “ultrafine” particles (tiny particles less than 0.1 micrometers in diameter), which are linked to neurological changes, mild pulmonary inflammation and cardiovascular problems. The U.S. Environmental Protection Agency (EPA) currently regulates particles less than 2.5 micrometers in diameter, and ultrafines represent the very smallest particles inhaled by the public.

Traffic-related air pollution is of great concern to Los Angeles, which has the most severe particle air-quality problem in the United States. The Los Angeles Basin is home to more than 15 million residents and 10 million vehicles contributing to its daily traffic. Motor vehicle emissions represent the most significant source of ultrafine particles. Moreover, recent toxicological studies have shown that ultrafine particles are more toxic than larger particles, potentially leading to increased mortality and illness with increased exposure to particulate matter.

“We believe this is the first study conducted in the United States that provides a detailed spatial profile of ultrafine particles near freeways,” said William C. Hinds, a professor of environmental health sciences in the UCLA School of Public Health, who co-authored the studies with Yifang Zhu, a doctoral candidate in the School of Public Health.

The studies, conducted through the Southern California Particle Center and Supersite (SCPCS), assessed the size-distribution and concentration of the tiny ultrafine particles near major freeways. The first study focused on Interstate 405, one of the nation’s busiest freeways, with 93 percent of the traffic composed of gasoline-powered cars. The second study looked at the 710 freeway, which has more than 25 percent of its traffic derived from heavy-duty diesel trucks.

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By measuring the number of particles and their size at varying distances from the 405 and 710, Hinds and Zhu concluded that the number of ultrafine particles downwind near both freeways was approximately 25 to 30 times greater than the number upwind. The drop in the number of ultrafine particles occurred rapidly with increasing distance from the freeway, falling to 30 percent of peak concentration at 330 feet. The rapid decrease and dilution in particle concentration was due to several factors, including atmospheric dispersion, coagulation, and wind direction and speed.

Both Hinds and Zhu concur that better understanding of the size and concentration of ultrafine particles is vital, particularly in a city with 85 million vehicle-miles traveled on its freeways on an average day.

“The objectives of the study include providing scientists with a way to predict exposure concentrations to ultrafine particles near freeways in order to facilitate health studies and provide data for the development of an air-quality standard for ultrafine particles,” Zhu said.

The studies also examined the concentrations of carbon monoxide (CO), black carbon (BC) and particle mass. Both CO and BC concentrations are closely related to vehicle emissions. Like ultrafines, CO and BC concentrations decreased significantly (70 percent to 80 percent) within the first 330 feet downwind of the freeway. This confirms the notion that vehicular exhaust is a major source of these pollutants near a major roadway.

The SCPCS — housed in the School of Public Health and the Institute of the Environment at UCLA, and funded by the EPA’s Science To Achieve Results (STAR) program and California Air Resources Board — brings together outstanding scientists from leading universities throughout the nation to create dynamic new ways of investigating the health effects of particulate matter and to secure the protection of public health by better informing policy.

Funding for the studies was provided by the EPA and the California Air Resources Board, and supported by the National Institute of Environmental Health Sciences. Other study authors include Constantinos Sioutas, deputy director of SCPCS and associate professor of environmental engineering at USC, and Seongheon Kim and Si Shen of the department of civil and environmental engineering at USC.

For more information about the study, call Wendy Hunter at (310) 794-5980. To find out more about SCPCS and its research, visit the center Web site at www.scpcs.ucla.edu.