

Air pollution from freeway extends further than previously thought

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Environmental health researchers from UCLA, the University of Southern California and the California Air Resources Board have found that during the hours before sunrise, freeway air pollution extends much further than previously thought.

Air pollutants from Interstate 10 in Santa Monica extend as far as 2,500 meters — more than 1.5 miles — downwind, based on recent measurements from a research team headed by Dr. Arthur Winer, a professor of environmental health sciences at the UCLA School of Public Health. This distance is 10 times greater than previously measured daytime pollutant impacts from roadways and has significant exposure implications, since most people are in their homes during the hours before sunrise and outdoor pollutants penetrate into indoor environments.

The study was published last month in the journal *Atmospheric Environment*, with Dr. Shishan Hu, a postdoctoral scholar at the UCLA School of Public Health, as lead author.

"To measure the pollution levels, we equipped an electric vehicle with no emissions of its own with fast-response instruments for gaseous and particulate air pollutants, a GPS and video monitor, and instruments to measure temperature and winds," Winer said. "In both winter and summer of 2008, we drove toward and away from Interstate 10 on a route perpendicular to the freeway in Santa Monica between the hours of 4 a.m. and 7 a.m."

A second striking finding of the study was that although traffic volumes are lower in the pre-sunrise hours, the air pollution concentrations measured by the team were higher than even those during daytime [traffic congestion](#) peaks. Concentrations are higher before sunrise even though emissions are lower because of the unique weather conditions. In the pre-sunrise hours, wind speeds are generally very low, and while the wind direction is somewhat variable, the predominant direction is from the northeast in the winter months and the northwest in the summer months.

This means that areas south of Interstate 10 are generally downwind in the pre-sunrise hours and areas north of the freeway are generally upwind; this is consistent with the observation that vehicle-related pollutants are found much further from the freeway on the south side in the pre-sunrise hours, compared with the north side.

"Our research shows that under the low wind speeds and shallow temperature inversions during the early morning, before sunrise, air pollution from freeways is trapped near the surface, limiting dilution and creating a zone of influence many times greater than during the day," said Dr. Suzanne Paulson, a professor in the UCLA Department of Atmospheric and Oceanic Sciences and a co-principal investigator of the study. "These meteorological conditions are very common in the hours before sunrise."

In comparing the winter and summer early mornings, researchers found much higher levels of [air pollution](#) in the winter.

"This is because the sun rises later in the winter, so the early morning period captures more of the early morning rush hour," Paulsen said.

"Our findings confirm previous work showing peak levels of ultrafine particles (UFP) immediately adjacent to the freeway, but we found high

concentrations persisted for up to 1.5 miles downwind of the freeway during the pre-sunrise hours," said Dr. Scott Fruin of the USC Keck School of Medicine. "Elevated UFP concentrations also extended up to 600 meters upwind of the freeway, another strong difference from daytime observations, which typically show little or no vehicle-related pollution directly upwind from freeways."

In the present study, other pollutants, including nitric oxide and particle-bound polycyclic aromatic hydrocarbons, also extended far from the freeway during the pre-sunrise hours.

Other members of the research team included Dr. Kathleen Kozawa and Steve Mara of the California Air Resources Board, which sponsored the study.

"The study raises more questions about the significant health outcomes caused or exacerbated by freeway traffic," Winer said.

Numerous epidemiologic studies have already shown that traffic-related pollution is linked to increased risk of asthma, respiratory illness, cardiovascular disease and premature mortality.

The researchers recommend that residents living near freeways should consider keeping their windows closed at night and minimize outdoor exercise near major roadways in the hours before sunrise.

Source: University of California

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