



Research summary: Mobile monitoring of particle number concentration and other traffic-related air pollutants in a near-highway neighborhood over the course of a year.

By: Christine Papastamelos

Car emissions from highways contain many types of pollutants that can be harmful to a person's health. People who live close to highways are exposed to a higher level of these pollutants. Some of these pollutants are particles that, when breathed in, can do harm to the lungs and heart. Ultrafine particles are the smallest and possibly the most dangerous of these particles. Because they are so small, they can get inside the body more easily where they may cause disease. Particle number concentration (PNC) is a measure of the amount of particles in the air. Most of the particle number concentration is made up of the extremely small ultrafine particles. PNC varies with distance from the highway, time of the day, weather and traffic conditions.

Researchers from Tufts University, involved in the Community Assessment of Freeway Exposure and Health Study, explored how distance from the highway, along with other factors, affected the concentration of pollutants in a part of Somerville near a highway. This study aimed to better understand how much near-highway residents are exposed to pollutants from highway emissions.

How was it done?

A mobile monitoring van containing sensitive air monitoring equipment was used to measure the concentration of particles. This mobile lab was driven along a fixed route, monitoring PNC in the Winter Hill neighborhood (close to I-93) in northeast Somerville. Particle concentrations were also measured using the mobile lab in a neighborhood distant (greater than 1000m) from I-93. Monitoring of PNC happened in shifts between September 2009 and August 2010. Monitoring was done at different times of the day, on different days of the week, and during different seasons of this year-long period. Distance from the highway, traffic conditions, wind speed and wind direction were all measured.

What did they find?

Researchers found that the highest concentrations of particles were in the near-highway neighborhood. The concentration of these particles decreased with distance from the highway. The lowest concentrations were found in the neighborhood distant from I-93. PNC was also higher in the winter and spring and lower in the summer and fall. In addition, concentrations were higher on weekdays compared to weekends. Morning hours with busy traffic



Figure 1: The colored dots highlight the monitoring route. Concentration of particles increases during the busy morning hours. The most concentrated areas are down wind (in the direction the larger black arrow is pointing).

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(6am-8am) had higher levels of particle concentration than later hours of the day.

Wind direction and speed also affected the PNC of the neighborhoods studied. Near-highway homes were exposed to higher concentrations of particles when they were downwind from the highway. For example, if winds were blowing from the west, then PNC would increase around homes in the east. Particle concentration also increased when winds were calm.

PNC mainly reflects the concentration of the smaller ultrafine particles. However, separate measurements recorded the mass of fine particles ($PM_{2.5}$) per cubic meter, which are larger than ultrafine particles. Unlike the concentration of ultrafine particles, the amount of these larger particles did not vary with distance from the highway. Measurements of fine particles differed very little between the near-highway neighborhood and the distant neighborhood.

Why is it important?

These findings show trends in particle concentrations in a near-highway neighborhood. This study shows that particle concentration can vary based on distance from the highway, time of the day, weather, and season. These trends can help near-highway residents understand when and where they are more exposed to highway pollutants. Furthermore, these findings reveal that the concentration of ultrafine particles is higher closer to the highway, while larger fine particles do not share this trend. This information is useful to researchers studying the effects that higher concentrations of ultrafine particles have on the health of near-highway residents.

The findings can also guide decisions on siting and designing of sensitive land uses like residential homes, schools, hospitals, and open space to protect the health of the occupants.

What can you do?

There are ways to reduce your exposure to pollutants if you live close to a major highway. Try to keep your windows closed during the morning when traffic is heaviest. Also, try to do outdoor activities during later hours of the day in a location that is not next to busy roads and highways.

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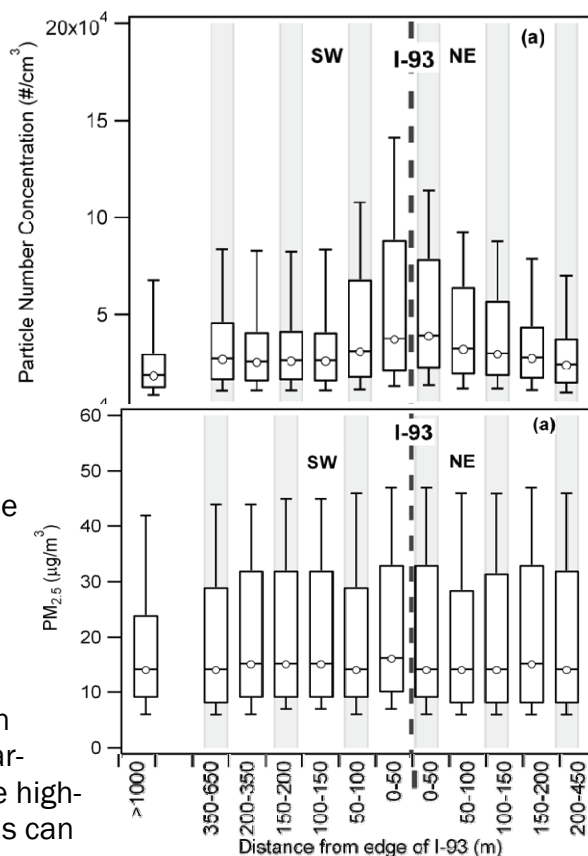


Figure 2:

PNC varies with distance from I-93, while $PM_{2.5}$ stays approximately the same.

To learn more about this research, please refer to the following source:

Padro-Martinez L, Patton A, Trull J, Zamore W, Brugge D, Durant J 2012. Mobile monitoring of particle number concentration and other traffic-related air pollutants in a near-highway neighborhood over the course of a year. *Atmospheric Environment* 61:253-264.

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