



## Indoor and Outdoor Measurements of Particle Number Concentration in Near-Highway Homes

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Studies have shown that being exposed to particles in highway pollution can harm health in a significant way, including higher heart and lung disease mortality and a higher incidence of lung cancer, asthma and cardiovascular disease. Ultrafine particles (UFP) are defined as particles in the air that are less than 100 nanometers in size. For comparison, a normal human hair is about 75,000 nanometers in diameter. Because of their small size, these particles can easily infiltrate the bloodstream and contribute to negative health effects. Few studies have looked at the exposure to ultrafine particles indoors and their effects on health. It is important to study these particles, as people tend to spend most of their time indoors. In this study, researchers sought to identify the differences between the concentration of particles outdoors and indoors based on a home's distance from the highway Interstate-93 in Somerville. Additionally, they wanted to better understand the environmental and behavioral factors that may affect infiltration of UFP into these Somerville homes.

### How was it done?

A subset of participants from the CAFEH study were selected by Dr. Christina H. Fuller for indoor/outdoor monitoring from three categories: residences with a distance

of less than 100 meters from I-93, 100-400 meters and more than 1000 meters from the highway. Water-based condensation particle counters (WCPC) served to measure indoor and outdoor particle number concentration, which is comprised mostly of UFP. These counters, housed in a box, contained two sampling lines which alternately collected a one minute average UFP levels from indoor and outdoor air. The researchers also made use of weather information: a stationary site on a roof near I-93 collected information on wind speed, wind direction, temperature and humidity. In order to gain a more thorough understanding on the effects of behavioral and environmental factors, a questionnaire was answered by participants including information about demographics, smoking, air-conditioner and window use, heating type and home age.

### What did they find?

Researchers found that near-highway homes had higher indoor UFP, while homes in the background area (>1000m from the highway) had lower indoor UFP. The relationships between indoor and outdoor particle number concentration seemed to be influenced by the use of air conditioning. Homes with a window AC unit or central air conditioning had a lower concentration of UFP than those without either.

Outdoor ultrafine particles were found to be the most important predictor for indoor UFP. Researchers also found that other important predicting factors in the amount of indoor UFP were the temperature, day of the week, time of day, wind speed and direction. These results show that a variety of factors are important in determining the presence of UFP, which in turn may affect health, even when people are indoors.

### Why is it important?

While we often consider the effects of outdoor pollution on our health, we rarely think about how we are exposed to inside our home. For residents living in the study area, ultrafine particles appeared to easily enter homes near highways. The results of this study show higher indoor/outdoor ratios than previous studies, which did not do sampling under typical living conditions. This study is notable because it examines conditions that have not been researched before and provides evidence for a link between the quality of outdoor and indoor air.

### What can you do?

There are many factors that people cannot control, including the weather and traffic, but there are ways to reduce indoor air particles. When traffic is heavy, you could keep windows closed. In this study, the use of central air conditioning (and less so, window AC units) seemed effective at lowering the amount of UFP inside. Use of air conditioning during the summer may be an alternative to opening a window. You can also reduce exposure to particles generated indoors from sources like smoking whose harmful effects are well documented. Chose not to smoke and avoid secondhand smoke. Additionally, you can participate in a research study to help researchers gain a better understanding of the presence of UFP in homes and how it affects health. You may learn more about air pollution and work with your community to reduce exposures.

### For more information, contact:

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