



## COMMUNITY ASSESSMENT



OF FREEWAY EXPOSURE & HEALTH



# Research summary: Near-highway distribution of ultrafine particle pollution on a winter morning in Somerville

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Among the air pollutants from highway traffic, ultrafine particulates (UFP) are thought to be some of the most harmful. UFP are particles that are smaller than 100 nanometers across (100 billionths of a meter, or less than four millionths of an inch) made up of sulfate, metals and hydrocarbons. Their small size allows UFP to enter the blood stream through the lungs when they are breathed in. Frequent exposure to UFP, particularly in the form of highway exhaust, may contribute to heart disease. To study these risks, it is important for researchers to be able to estimate the amount of UFP to which a person is exposed. The concentration of pollution in the air tends to be higher if an area is closer to a highway, but it changes rapidly based on factors like weather, temperature, and wind speed and direction. This makes it more difficult to estimate a person's exposure based on their location.

Researchers from Aerodyne Research, Inc. and Tufts University, contracted by the Mystic View Task Force, conducted a study to better understand how the concentration of pollutants, including UFP, next to Interstate-93 in Somerville, MA changed over the course of one typical winter morning.

### How was it done?

To determine how the concentration of UFP and other pollutants changed between 6:00 AM and 11:00 AM on January 16<sup>th</sup>, 2008, researchers repeatedly drove a van carrying monitoring equipment on a route of local roads near Interstate 93 (I-93) in Somerville. The van was equipped with instruments that continuously monitored the concentration of UFP and other pollutants, like carbon dioxide and nitrogen dioxide. It had a global positioning system (GPS) so that the instruments' readings could be matched with their location. The temperature, wind speed and wind direction for the time period were recorded at a station nearby in Medford. Hourly vehicle counts on I-93 were provided by the Massachusetts Highway Department.

### What did they find?

The researchers found that concentrations of particles close to the highway were higher and varied more throughout the

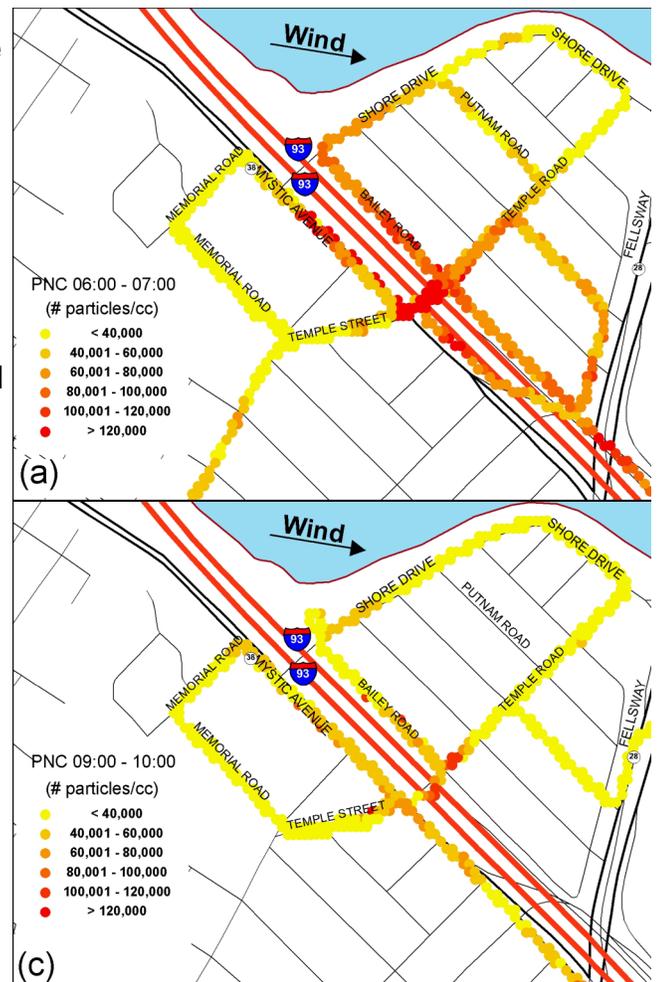
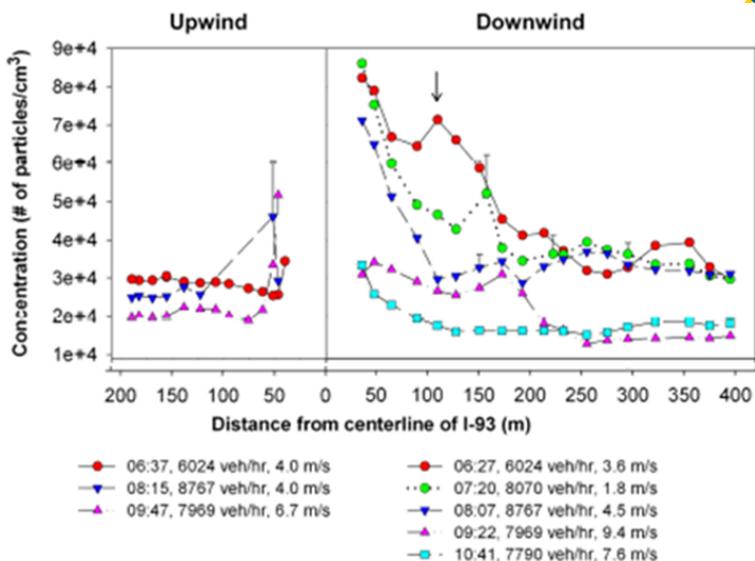


Figure 1: Ultrafine particle (UFP) concentration in the study area in Somerville from 6 AM to 7 AM (a) and 9 AM to 10 AM (c). The darker the red shown on the map, the higher the concentration of UFP that was found at that location. The two darkest shades are levels of UFP similar to those found on highways.

morning than those in areas that were farther away from the highway. As seen in figures 1 and 2, in the early morning, from 6 AM to 8 AM, particle concentrations were higher, particularly in areas closest to the highway. This is most likely because during the early morning temperatures and wind speeds were lower, causing less dilution of particles. Areas that were upwind of the highway had lower concentrations of particles than areas downwind.



**Figure 2: Graph of ultrafine particle (UFP) concentration by distance from I-93 for five times in the morning. Downwind of the highway, UFP shows higher levels during readings taken in the early morning (6:27, 7:20, and 8:07) closest to the highway. UFP concentration decreases as time progresses, with less UFP found later in the morning.**

### Why is it important?

These findings will be helpful to researchers studying the health effects of UFP. In order to determine whether breathing in UFP causes conditions like heart disease, researchers compare levels of blood markers of heart disease in people with different amounts of UFP exposure. The knowledge that spending time close to the highway will expose someone to more UFP during times of low temperature and wind speed, such as the early morning, will make it easier for researchers to determine people's actual levels of exposure. This should produce more accurate tests of association between UFP and health, and may eventually provide evidence to support the regulation of UFP.

### What can you do?

If you live close to a highway, it may be advisable to sleep with windows closed to avoid breathing in air from the outside during the early morning when UFP levels are highest. Likewise, if you jog or exercise in the early morning, it might be best to do so away from the highway.

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

Durant JL, Ash CA, Wood EC, Herndon SC, Jayne JT, Knighton WB, Canagaratna MR, Trull JB, Brugge D, Zamore W, Kolb CE 2010. Short-Term Variation in Near-Highway Air Pollutant Gradients on a Winter Morning. Atmos Chem Phys 10:8341-8352. <http://www.atmos-chem-phys.net/10/8341/2010/acp-10-8341-2010.html>