COMMUNITY ASSESSMENT OF FREEWAY EXPOSURE & HEALTH

CAFEH Newsletter

SPRING 2014

Modeling Ultrafine Particle Levels: A Thesis

By: Allison Patton

The level of ultrafine particles (UFP) varies based on distance from the highway as well as daily and seasonal changes; these variations must be taken into account to estimate an individual's exposure to UFP. I addressed this problem as the topic of my environmental engineering Ph.D. thesis at Tufts University.

With a team of students and community members, I drove a mobile monitoring laboratory (picture) to measure levels of UFP and other traffic-related air pollutants at different distances from the highway. Data collection took place over the course of three years. The team collected air pollutant measurements for a year in each of three pairs of near-highway and urban-background neighborhoods: Somerville, Dorchester/South Boston, and Chinatown/Malden. I then compared how wind patterns, temperature, and highway traffic affected air pollution levels in the neighborhoods. In general, pollutant levels were elevated near highways and had measurable decreases within the 400 m (1300 ft) from the highway. The distribution and levels of air pollution were different in the different CAFEH neighborhoods, even though those neighborhoods are only a couple miles apart on I-93.

Using the measurements of UFP, I developed four statistical models that describe UFP (Continued on page 2)

Time Activity Patterns of Pollution Exposure Associated with Cardiovascular Risk

By: Kevin Lane

The CAFEH study has shown that ultrafine particle (UFP) concentrations vary greatly in both space and time. Location, time of day and the microenvironment are essential to accurately determine exposure to mobile source pollution with a high spatial variability such as UFP. We know that people do not spend all their time 24 hours a day, 365 days a year at their homes so it is important to account for exposures away from a person's place of residence. We accomplish this by conducting what is referred to as Time-Activity Adjustment (TAA).

Every CAFEH participant was asked to complete a time-activity questionnaire that asked them to report whether they were in one of 5 microenvironments (inside home, outside home, school/work, other non-highway, travel on highway) for each hour of the day during their most recent weekday/workday and weekend/non-workday. Using the time-activity information we adjusted the particle number concentration (PNC), value for each hour of the year to account for when people were away from their place of residence and used the adjusted values to calculate a time-activity adjusted PNC annual average (TAA PNC). The PNC is an estimate of the level of UFP. TAA PNC varies across the different CAFEH neighborhoods with the highest annual averages observed in (Continued on page 2)

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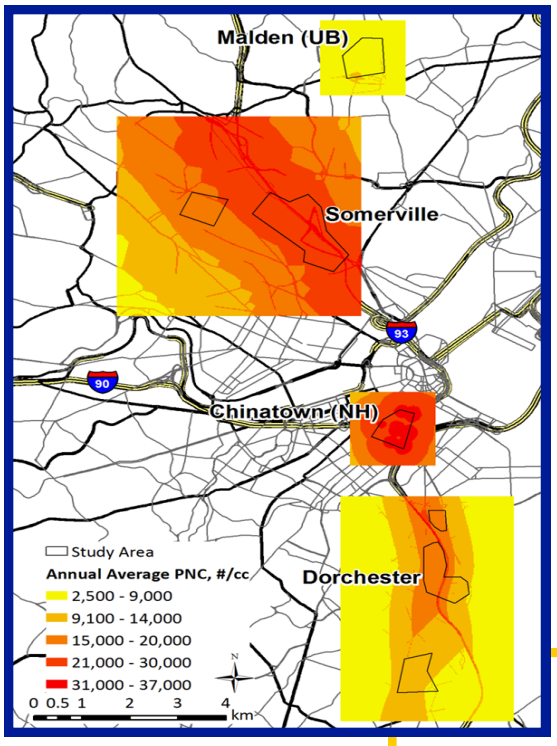
levels based on weather, traffic, and location (Figure 1). Factors that changed over time were important to describe the changes in UFP over the course of a day or year, but location relative to I-93 and other busy roads was important to explain differences across parts of the study areas. All of the models incorporated wind speed and direction, highway traffic, temperature, and day of week. UFP levels were lower on windy or hot days and higher when the highway traffic was heavier. Higher UFP levels were predicted on and near major roads, and in near-highway areas, especially in Somerville and Chinatown.



The results of this thesis suggest two additional analyses that could build on the existing CAFEH study. First, it was assumed that UFP levels on residential streets would be similar to UFP levels at homes. All of this work was done using measurements on roads. Future work should involve measuring air pollution at some people's homes to see whether the results are the same. Second, measurements were made of pollutants other than UFP. As an extension of the CAFEH study, these other pollutants could also be modeled to see how different pollutants are associated with cardiovascular disease risk. This multi-pollutant analysis would add rigor to the CAFEH findings at minimal additional cost because the datasets have already been developed.

Figure 1. Annual average UFP level measured as the Particle Number Concentration (PNC) for Malden, Somerville, Chinatown, and Dorchester.

Time Activity Patterns of Pollution Exposure Associated with Cardiovascular Risk (continued from pg 1)

Chinatown, followed by Somerville, Dorchester and South Boston and then Malden.

One of the primary analyses of CAFEH is to examine the association of biomarkers of cardiovascular risk with TAA-PNC. Preliminary analysis using the Somerville CAFEH subset indicate that TAA PNC was significantly associated with C-reactive protein and Interleukin-6; a 1% change in PNC resulted in a 1.98% change in CRP ($p < .01$) and a 1.25% change in IL-6 ($p < .01$). Analyses for other CAFEH study areas are currently being developed.

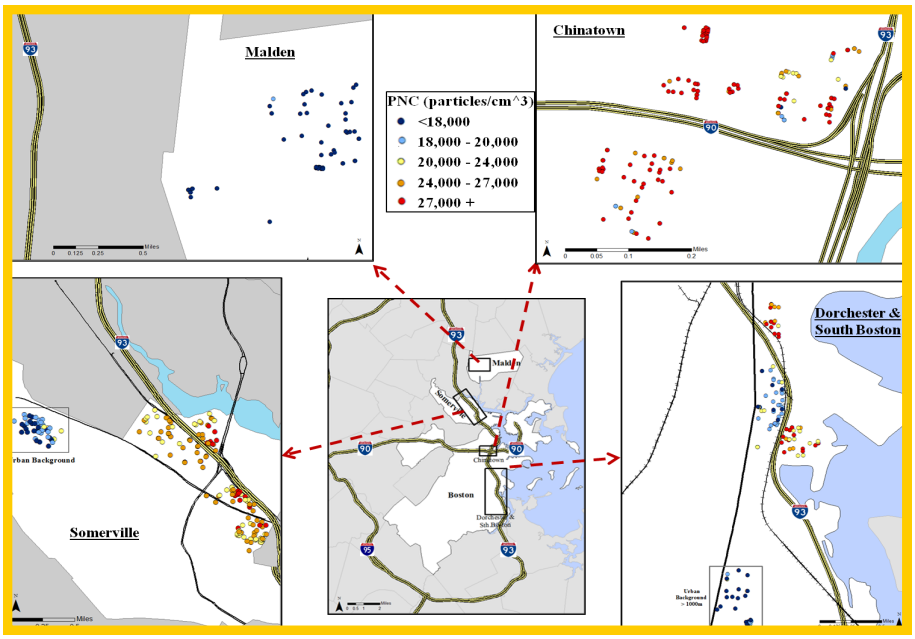


Figure 2. Annual average PNC adjusted for TAA values for Malden, Somerville, Chinatown, and Dorchester.

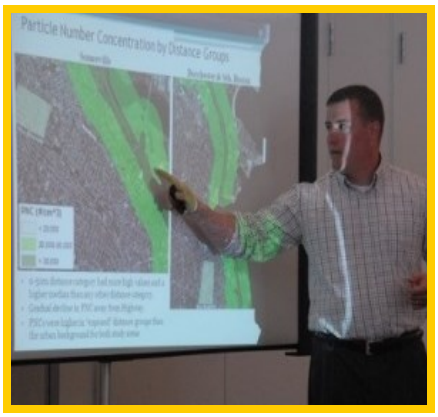
Newsletter Spotlights

Allison Patton

Allison Patton (Tufts University) recently successfully defended her thesis in which she developed models that predict ultrafine particle concentrations in the CAFEH study areas based upon traffic, seasonal, and meteorological patterns and data.

Kevin Lane

Kevin Lane (Boston University) is a doctoral student set to defend his thesis which involves health associations between ultra fine particles and cardiovascular health markers. To do this he also serves as the geographic information system specialist to correctly map and predict the levels of exposures for the participants in the CAFEH study area.



Update on Kresge-Funded Project

By: Doug Brugge

In June 2013, we were funded by the Kresge Foundation to undertake a three-year effort to influence policy and practice aimed at protecting people living next to highways in Chinatown and Somerville. This is a direct outgrowth of our community-based participatory research approach. We are committed to not only doing research, but also translating our findings and those of others into action.

This project expands the participation in CAFEH. Besides some of our longtime collaborators – Tufts, Somerville Transportation Equity Partnership, Chinese Progressive Association, The City of Somerville – we have also added the Metropolitan Area Planning Council and the Boston Public Health Commission.

Our starting aims have been to work with the City of Somerville to implement one or more policies that would be protective of near highway exposures. And to influence the design of one or more buildings in Chinatown in ways that reduce exposure to occupants.

As we near the end of our first year of this project we are gearing up for a design charrette to be held in early May. The charrette will being together a multidisciplinary group of experts to consider “tactics,” things like vegetative barriers, sound walls, in-building ventilation and siting of parks and bike paths, in order to make two proposed developments more protective.

Recent & Upcoming CAFEH Events

CAFEH Advisory Board Meeting

When: Tuesday, June 3, 2014 (9AM-1PM)

Where: Sackler Room 114, 145 Harrison Ave

This year's Advisory Board meeting and Community Report Back will take place **on June 3rd, 2014 from 9:00AM to 1:00PM in Sackler Room 114 located at 145 Harrison Avenue, Boston, MA, 02111.** CAFEH participants, community members, volunteers, and everyone is encouraged to attend.

Announcement to CAFEH Participants:

Attention CAFEH Participants: a mailed questionnaire on noise exposures is expected to be sent out soon. Please look for it and respond.

Website!
http://sites.tufts.edu/cafeh/

CAFEH Partners

Tufts University

Somerville Transportation Equity Partnership

Boston Public Health Commission

Boston University School of Public Health

MAPC Metropolitan Area Planning Council — Smart Growth & Regional Collaboration

Boston Chinatown Resident Association

Harvard School of Public Health

Committee For Boston Public Housing (CBPH)

City of Somerville — Municipal Freedom Gives National Strength — Somerville, Mass.

Chinese Progressive Association

FUNDED BY:

NIEHS ES015462; NHLBI CA148612; HUD MALHH0194-09; EPA STAR FP-91720301-0; EPA STAR FP-917349-01-0; P.E.O. Scholar Award and Kresge Foundation

Working together on a study to examine the effect of air pollution of traffic on the health of people living near major highways.

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