

Research Summary: Concentration of pollutants while traveling in an urban highway tunnel

By: Darrel Gachette

Traffic-related air pollution exposes people to ultra fine particles (UFPs); the smallest size particles. UFPs from major roadways are suspected of being associated with increased risks of heart related diseases, and problems with the lungs. Some of the people exposed to dangerous particles are those who live in communities near high levels of traffic, and those who commute on highways, major roadways, or pass through tunnels. Some of the highest levels of UFPs are found in tunnels.

Researchers from the Department of Civil and Environmental Engineering at Tufts University measured the number of particles (PNC) in the Central Artery Tunnel on I-93 in Boston, MA.

How was it done?

Data was collected in the Central Artery Tunnel in Boston, MA using the Tufts Air Pollution Monitoring Laboratory (TAPL). The TAPL has equipment that counts the number of particles in the air as it is driving. The TAPL was driven through the southbound and northbound tunnels at the same speed as tunnel traffic.

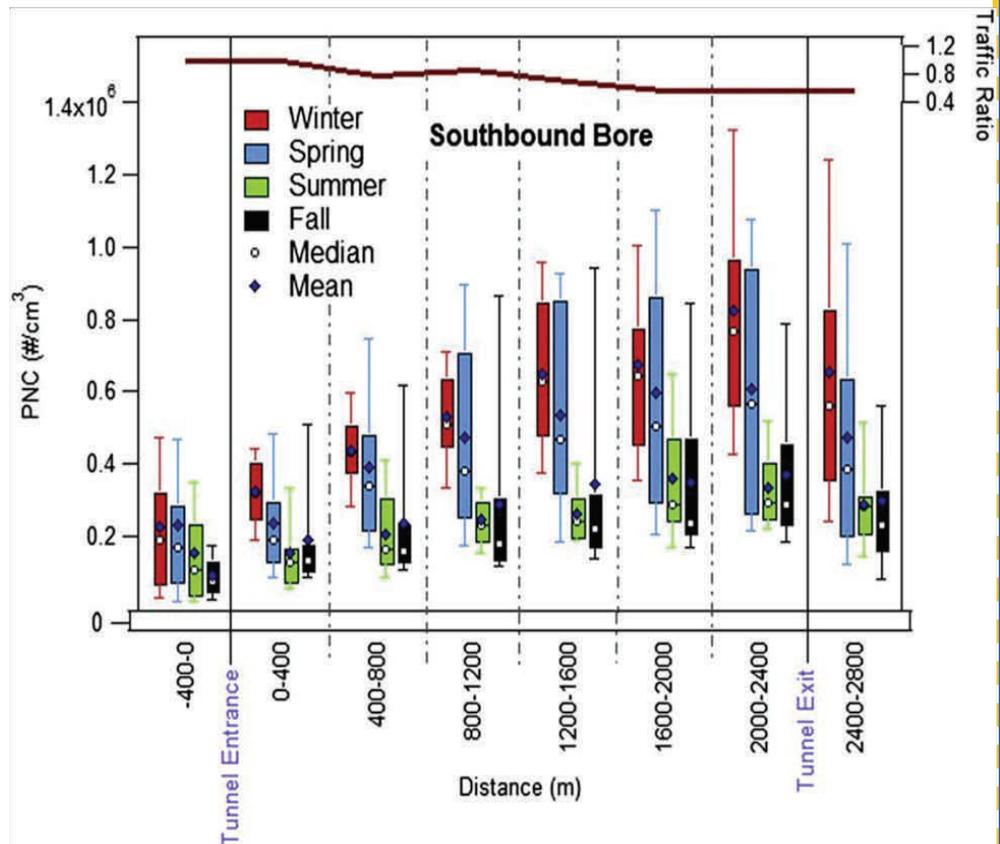


Figure 1. PNC (the number of particles) increases with the distance traveled in the southbound tunnel. The concentration of particles is higher during the winter (red) and spring (blue).

The TAPL collected data over one year, starting in September 2010 and ending in September 2011, including all four seasons. Particles were measured a total of 36 days during the year, at times between 5:00AM and 8:00PM; with one trip through the northbound tunnel and

one through the southbound tunnel each time. Collection was also done repeatedly on two consecutive days, to see the daily variation in particle concentration.

What did they find?

The researchers found that particle levels were higher during the colder, winter and spring months than during the warmer, summer and fall months, as seen in Figure 1. This higher level of UFPs during the colder months is due to more UFPs being generated at colder temperatures. For the daily PNC count, it was observed that in the morning the number of particles was twice as high as in the afternoon; this can also be explained by colder temperatures in the morning hours as compared to the afternoon. In addition to colder temperatures, the increase in the particle number count is also attributed to an increase in particles inside the tunnel relative to the outside of the tunnel. The number of UFPs increases while traveling deeper into tunnels (Figure 1).

Why is it important?

This study will help determine the amount of pollution people are exposed to while driving through tunnels. The results will allow for the continued study of the increased health risks of people exposed to pollutants while on highways or tunnels, by assigning more accurate exposure for the time people spend in these environments.

What can you do?

If you travel through tunnels and highways while driving to work, home, or other places, you could keep your windows shut and run your car's A/C or heater on recirculation to decrease your exposure to pollutants.

For more information contact:

John Durant
Dept. of Civil and Environmental Engineering
Tufts University
John.Durant@tufts.edu

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

Perkins, Jessica L.; Padró-Martínez, Luz T.; Durant, John L. **"Particle number emission factors for an urban highway tunnel"**, Atmospheric Environment, 2013,