

**Testimony on Behalf of
H.2227, an Act Relative to Reporting on Health Effects of Particulate Matter**

Thank you Chairwoman Fargo and Chairman Koutoujian for the opportunity to address the Committee on Public Health with respect to proposed House Bill 2227. I have worked in the field of environmental health for over 20 years for various public and private agencies and organizations. I am presently a doctoral candidate working closely with Dr. Doug Brugge, an Associate Professor in the Tufts Department of Public Health and Family Medicine and expert in near-highway pollution and health effects. The subject of my doctoral thesis is the health effects associated with traffic pollution in older adults living in Boston, Lowell, and Lawrence. Dr. Brugge wishes to extend his regrets for not being able to be here today.

One of the most susceptible (and overlooked) populations in the US subject to serious health effects from air pollution are those who live very near highways. Approximately 11% of US households are located within 100 meters of 4-lane highways. While it is clear that automobiles are significant sources of air pollution, the exposure of near-highway residents to pollutants in automobile exhaust has only recently begun to be characterized. Several lines of evidence now suggest that steep gradients of certain pollutants exist next to heavily traveled highways and that living within these elevated pollution zones can have detrimental effects on human health.

Based on our review of the literature, the pollutants that have most consistently been reported at elevated levels near highways include ultrafine particles (UFP), black carbon (BC), nitrogen oxides (NO_x), and carbon monoxide (CO). In addition, PM_{2.5}, and PM₁₀ were measured in many of the epidemiologic studies we reviewed. UFP are defined as particles having an aerodynamic diameter in the range of 0.005 to 0.1 microns (um). UFP form by condensation of hot vapors in tailpipe emissions, and can grow in size by coagulation. PM_{2.5} and PM₁₀ refer to particulate matter with aerodynamic diameters of 2.5 and 10 um, respectively. BC (or “soot carbon”) is an impure form of elemental carbon that has a graphite-like structure.

Cardiovascular and pulmonary health effects

Results from clinical, epidemiological, and animal studies are converging to indicate that short-term and long-term exposures to traffic-related pollution, especially particulates, have adverse pulmonary and cardiovascular effects. Most of these studies have focused on, and/or demonstrated the strongest associations between health outcomes and particulates by weight or number concentrations though CO, SO₂, NO₂, and BC have also been examined. Short-term exposure to fine particulate pollution exacerbates existing pulmonary and cardiovascular disease and long-term repeated exposures increases the risk of cardiovascular disease and death.

Much of the epidemiological research has focused on assessing the early physiological responses to short-term fluctuations in air pollution in order to understand how these exposures may alter cardiovascular risk profiles and exacerbate cardiovascular disease. Recent studies show strong associations with traffic pollution exposure and risk of coronary heart disease and atherosclerosis.

Asthma

Evidence that near highway exposures present elevated risk is relatively well developed with respect to child asthma studies. These studies have evolved over time with the use of different methodologies. Most recent child asthma studies have, instead, used increasingly narrow definitions of proximity to traffic, including air monitoring or modeling) and have focused on major highways instead of street traffic. All of these studies have found statistically significant associations between the prevalence of asthma or wheezing and living very close to high volume vehicle roadways controlling for housing conditions (pests, pets, gas stoves, water damage), exposure to tobacco smoke, various measures of socioeconomic status (SES), age, sex, and atopy.

Multiple studies have found girls to be at greater risk than boys for asthma resulting from highway exposure. A recent study also reports elevated risk only for children who moved next to the highway before they were 2 years of age, suggesting that early childhood exposure may be key.

UFP have a high pulmonary deposition efficiency, and due to their surface area-to-volume ratios can carry relatively more adsorbed and condensed toxic air pollutants compared to larger particles. Microscopic analysis has been used to show that UFP can enter cells.

Children's lung function

Using measures of lung capacity, Studies of association of children's lung function with traffic pollutants have used a variety of measures of exposure, including: traffic density, distance to roadways, area (city) monitors, monitoring at the home or school and personal monitoring. Studies have assessed both chronic effects on lung development and acute effects and have been both cross-sectional and longitudinal.

Lung Cancer

Two early studies, the Six-Cities Study and the American Cancer Society (ACS) Study found associations between PM and lung cancer. Follow-up studies using the ACS cohort and the Six-Studies cohort (83) that controlled for smoking and other risk factors also demonstrated significant associations between PM and lung cancer. The original studies were subject to intensive replication, validation, and re-analysis, which confirmed the original findings (84).

Subsequent studies have found associations with traffic pollution and lung cancer (namely the Los Angeles study), but not all were focused on particulates, or the smallest particulates, and some did not find statistically significant associations. Problems that run through all these studies are weak measures of exposure to secondhand tobacco smoke, the use of main roads rather than highways as the exposure group and modeled rather than measured air pollutants.

The plausibility of near-highway pollution causing lung cancer is bolstered by the presence of known carcinogens in diesel PM. The US EPA has concluded after reviewing the literature that diesel exhaust is "likely to be carcinogenic to humans by inhalation".

Policy and research recommendations

Evidence strongly suggests that gradients of pollutants next to highways carry elevated health risks that may be larger than the risks of general area ambient air pollutants. The strongest evidence comes from studies of development of asthma and reduction of lung function during childhood along with increased cardiac health risk including reduced heart rate variability, and building evidence of coronary heart disease and atherosclerosis. There is a need for lung cancer research that uses major highways rather than heavily trafficked roads as the environmental exposure. Policies that have been technology based and regional in orientation do not efficiently address the very large exposure and health gradients suffered by these populations. This is problematic because even regions that EPA has deemed to be in regional PM "attainment" still include very large numbers of near highway residents who currently are not protected. There is a need for more research, but also a need to begin to explore policy options that would protect the exposed population.

Respectfully submitted by:

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