



Residential Construction and Particulate Pollution

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Overview

- Review types of particulate matter pollution
- Review the health effects of particulate matter pollution
- Review the dispersion of particulate matter pollution
- Recommendations

Types of Particulate Matter Pollution

- Studies of each type include particulate matter that is smaller
- PM_{10}
 - <10 micrometers (dust, pollen)
- $PM_{2.5}$
 - <2.5 micrometers (combustion particles)
 - Strong associations with respiratory and cardiovascular disease
- UFP (Ultrafine)
 - <0.1 micrometers

Health Effects of Particulate Matter Pollution

- $PM_{2.5}$
 - Best studied
 - Strong associations with heart disease, stroke, asthma/COPD
 - Studies likely capturing effects of UFP as well

Local Study of Asthma and Particulate Matter Pollution

- Proximity to traffic (i.e., automobile, truck, and bus) was assessed for students with and without asthma. At each distance category from a student's residence to roadways (25, 50, 100, 150, and 200 meters), students with a diagnosis of pediatric asthma were consistently found to live near a greater volume of traffic than students who did not. The findings were statistically significant.
- The Merrimack Valley Pediatric Asthma Study suggests that contaminants from municipal waste combustors and other stationary sources do not seem to have played a major role in the prevalence of pediatric asthma in the Merrimack Valley. Rather, mobile sources, by virtue of their proximity to residences and their overall magnitude of emissions over time, may be contributing to greater numbers of asthma diagnoses.

Health Effects of PM_{2.5}

- "An increase of 10 mcg per cubic meter (of PM_{2.5}) was associated with a 24% increase in the risk of a cardiovascular event and a 76% increase in the risk of death from cardiovascular disease. The risk of cerebrovascular events was also associated with increased levels of PM_{2.5} (hazard ratio 1.35, 95%CI 1.08-1.68)."

Health Effects of PM_{2.5}

- For comparison: second-hand smoke (US Surgeon General 2006, WHO)
 - Children
 - Risk of hospitalization for acute lower respiratory infection 55%; Risk of new asthma 35%
 - Adults
 - Risk of asthma 97%, lung cancer 21%, heart disease 27%
- Decrease of 10 mcg/cu meter of PM_{2.5} associated with increased life expectancy of 0.77 years (Pope et al., N Engl J Med 2009)
 - Similar effects in Netherlands, Finland, Canada

Comparison

Particulate Matter

- 24% increased risk of cardiovascular event
- 76% increased risk of cardiovascular death
- 35% increased risk of stroke

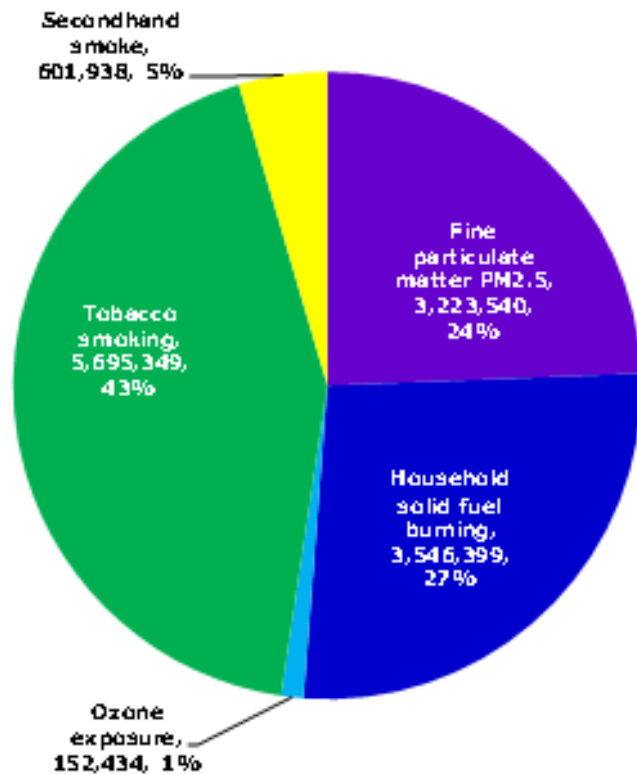
Second-hand smoke

- 77% increased risk of heart disease
- 35% increased risk of asthma in children; 97% increased risk in adults
- 55% increased risk of hospitalization for lower respiratory infections
- 21% increased risk of lung cancer

Global Burden of Disease -- 2010

2010 GBD Attributable Deaths from Air Pollution and Smoking Only

Fine particulate matter PM2.5	3,223,540
Household solid fuel burning	3,546,399
Ozone exposure	152,434
Tobacco smoking	5,695,349
Secondhand smoke	601,938



	Disability-adjusted life-years (%)
Physiological risk factors	
High blood pressure	53%
High total cholesterol	29%
High body-mass index	23%
Diet high in sugar-sweetened beverages	2%
Air pollution	
Ambient particulate matter pollution	22%
Household air pollution from solid fuels	18%
Other environmental risks	
Lead exposure	4%

Table 2: Proportion of ischaemic heart disease disability-adjusted life-years attributable to individual risk factors, worldwide, 2010

Lim et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012; 380: 2224–60.

Health Effects of UFP

- Relatively new area of research
- Few human studies
- Work at Tufts has found an association of UFP with C-reactive protein (CRP), a marker of cardiovascular inflammation strongly associated with heart disease and stroke

Time-activity exposure adjustments: LN PNC association with LN hsCRP

Model	% Change	95% CI
Residential Annual Average	1.14	(-0.06%, 2.35%)

Additive Models	% Change	95% CI
Inside Home	1.16	(-0.08%, 2.4%)
Outside Home	1.24	(0.01%, 2.46%)
School / Work	1.36	(0.03%, 2.69%)
Other (Non-Highway)	1.51	(0.09%, 2.94%)
Highway Travel	1.86	(0.32%, 3.14%)
Central Air (≥ 18.3 C)	1.79	(0.49%, 3.09%)

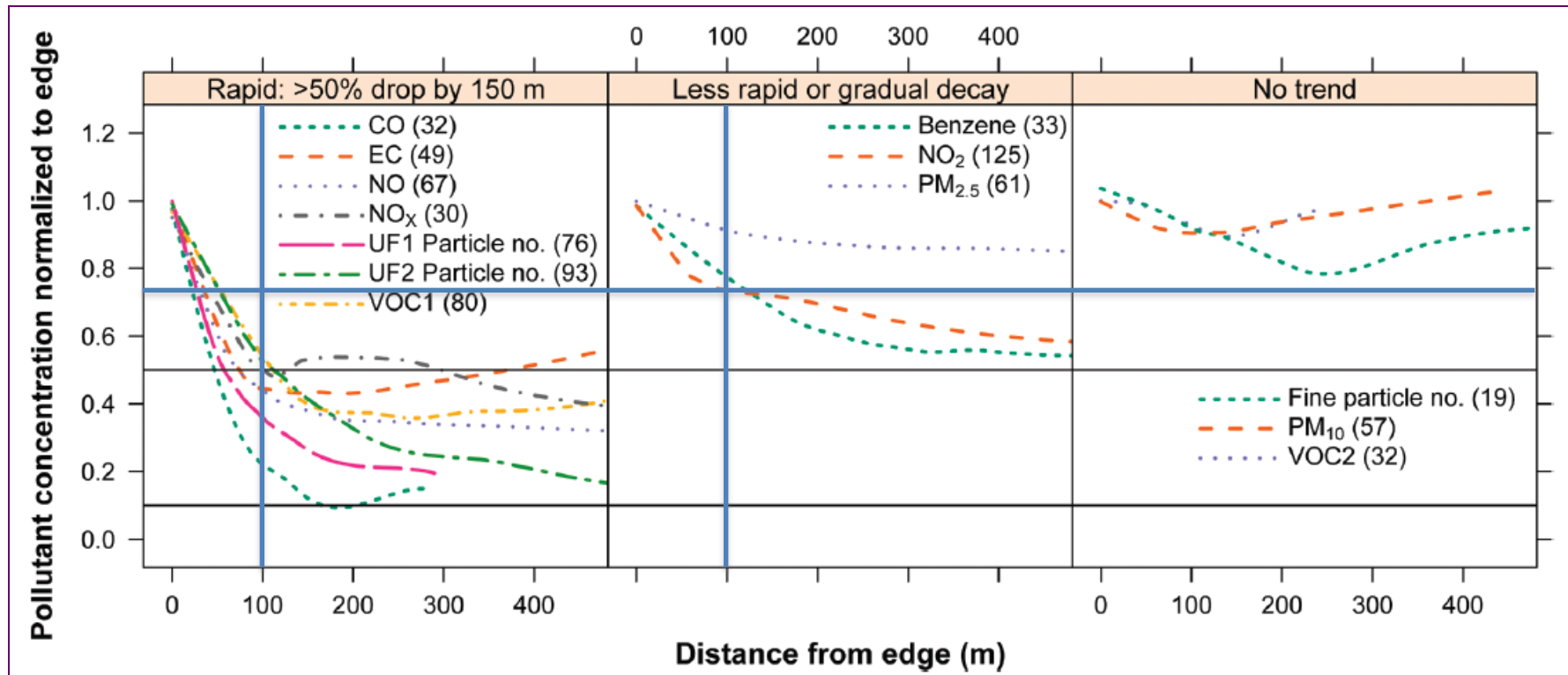
*All models adjusted for age, gender, smoking status and BMI.



Conclusions Thus Far

- Particular matter pollution shows strong associations with respiratory and cardiovascular health problems
- Mobile sources (e.g. vehicular traffic) are associated with these problems
- Increasing distance from those sources reduces the risks
- The relative risks of exposure to particulate matter pollution are in the same range as other risks which are regulated by governments

Dispersal Pattern of Near Highway Pollutants



Federal Regulation

PM ₁₀	150 µg/m ³	24-hour
PM _{2.5}	15.0 µg/m ³	Annual (Mean)
PM _{2.5}	35 µg/m ³	24-hour

California Regulation

- No schools within 500 ft of highway
- Recommend no residences within 500 ft

Recommendations

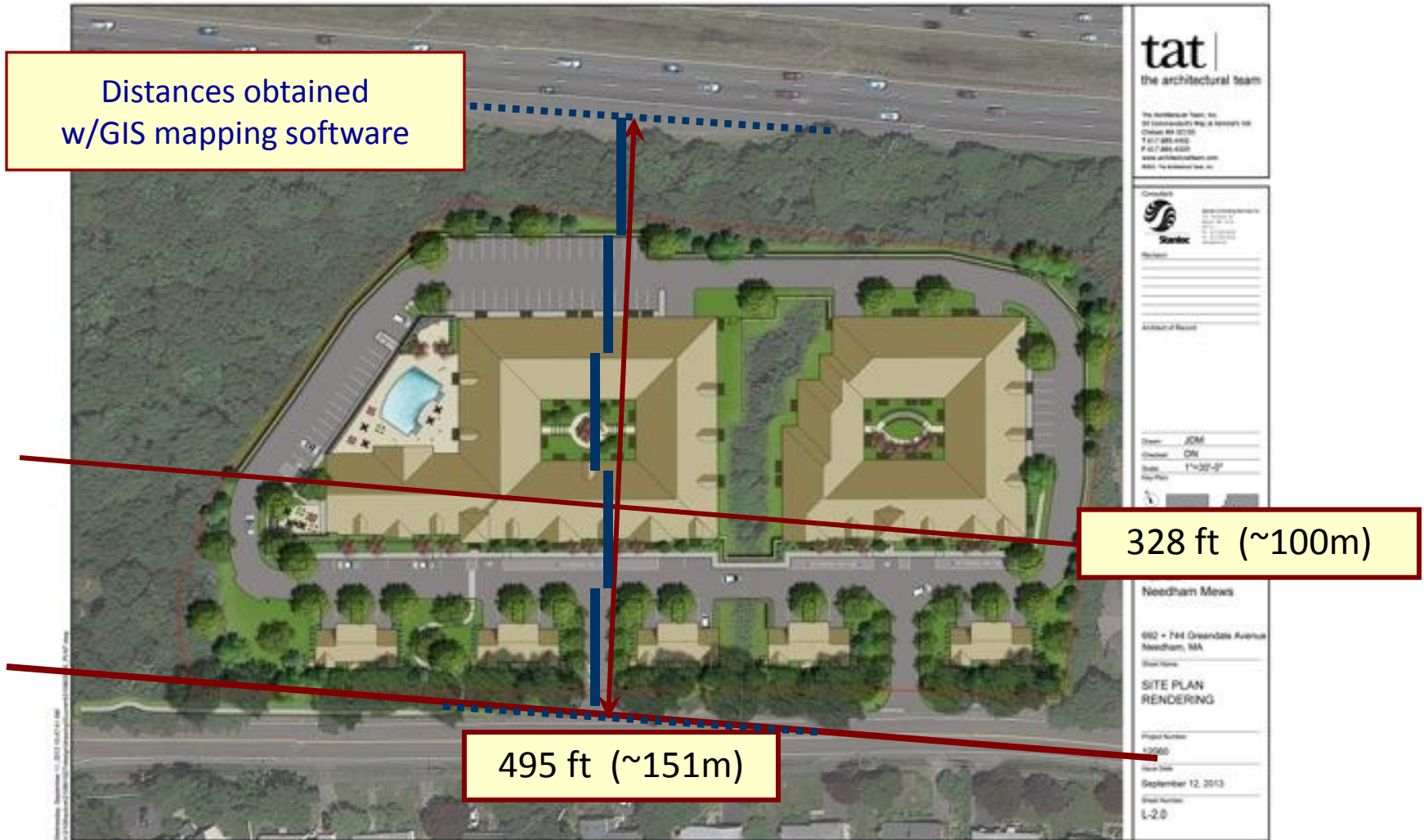
- New residential construction should be greater than 100 meters (328 feet) from major highways, ideally >150 meters (about 500 feet)
- Mitigating risks close to highways
 - Windows facing highways should be fixed/sealed
 - Forced central air filtration systems to meet or exceed filtration with properly maintained MERV-16 electrostatic filters
 - Recreational facilities (bike paths, pools, etc.) should be >100 meters from the highway and shielded
- Consider particulate particle study of similar sites

Recommendations

- The Board notes that there may be liability risks should a resident develop a health condition attributable to living in proximity to a highway if adequate disclosure is not provided
- Should the evidence become stronger, the Board may consider requiring a written disclosure to residents (similar to current lead paint disclosures for residential home sales)

Q & A

Plan with distances from I-95

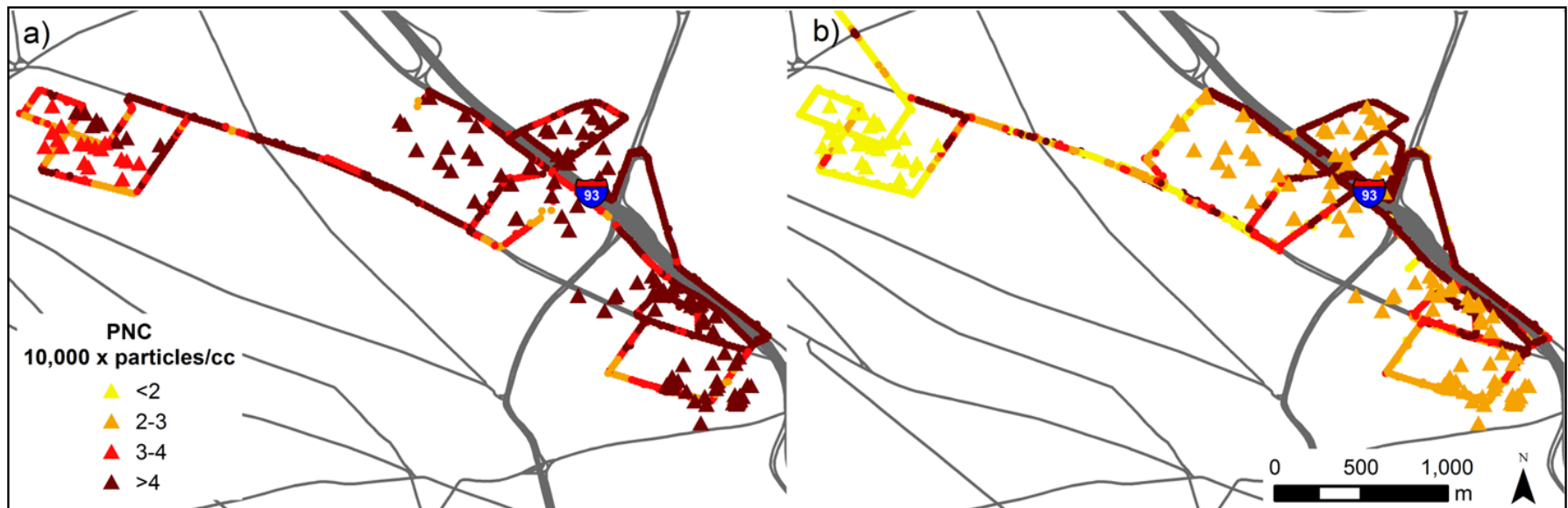


Measured and predicted PNC

Somerville Study Area

Winter Morning

Summer Morning



January 6, 2010

07:00-08:00

-6 ° C, 4 m/s winds from WNW

July 21, 2010

06:00-07:00

22 ° C, <1 m/s winds from SSW

