

## Introduction: how and why this document was created

This document contains an introduction and four other parts

1. What are particulates? This section takes an article from Tufts University and reduces it to a 2-page summary.
2. Scientific references on evidence that areas under aircraft arrival paths and communities around airports have air pollution similar to that found close to highways
3. Scientific references on the association between air and noise pollution and children's health
4. Scientific references on the association between air and noise pollution and adult's health

The document is meant to give an overview of recent, high-quality scientific studies of noise and air pollution from aircraft. It shows that air pollution from airplane arrivals is similar to air pollution from highway traffic. It then reports strong evidence that exposure to this type of pollution is associated with increased risk of autism and asthma in children and in cardiovascular disease, mortality, lung cancer, and chronic obstructive pulmonary disease (COPD) in adults. Should we be concerned? Yes, concerned enough to request, support, even demand, air quality testing and studies of noise and effects of ultrafine particles on health.

There are many more health studies and findings, but (most of) the studies included here are well-regarded by experts in these fields. Although the Logan health study was not peer-reviewed, it is included because of its relevance to our location.

One topic in section 4 (adults) was included because of some residents concerns about a possible breast cancer cluster in Milton. As noted in that section, the evidence of association between pollution and breast cancer is not strong, but worth flagging as a possibility given some residents' concerns.

It is not news that pollution from engines that burn petroleum products is bad for our health.

**However, questions remain as to how much of the pollution from the aircraft that fly over Milton is in our air or on our homes, cars, etc.** We need studies that measure pollution to have a better understanding of this. With respect to noise pollution, we know from personal experience that many residents have anxiety, sleep-disturbance, limited outdoor time, and other physical and mental health reactions to the excessive noise from the concentrated flight paths over most of Milton.

We should not overstate these results but should continue to gather more information; it is the responsible thing to do for Milton's residents and also for the residents in cities and towns where similar burdens from planes exist.

Social justice here and elsewhere.

Big thanks to [Wig Zamore](#), CAC representative from Somerville, for his help in identifying quality studies and for his review of the penultimate version of this document and to [Michael Baumgartner](#) for his translation of the article about the environmental study done in Germany on airplane noise.

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# What are Particulates?

[Big Road Blues](http://now.tufts.edu/articles/big-road-blues-pollution-highways) <http://now.tufts.edu/articles/big-road-blues-pollution-highways>

*This story first appeared in the Summer 2012 issue of Tufts Medicine magazine. David Levin is a freelance science writer based in Boston. This is an abridged version of the original article. For the complete article, please see the link above.*

“When it comes to air pollution, the main thing that really affects people is particulates —not gases,” says Doug Brugge, the study’s principal investigator and a professor of public health and community medicine at Tufts. Most of the mortality, most of the economic impact [of fine and ultrafine particulates] are coming from cardiovascular disease. It’s not primarily asthma or lung cancer,” says Brugge.

Because of their small size—some are just a few molecules across—tiny particulates are essentially minuscule bullets, delivering toxins deep into the body where larger particles can’t reach. “The Environmental Protection Agency estimates that they cause 80,000 or 100,000 deaths a year in the United States, and maybe four million or more worldwide,” Brugge says.

Over the last 30 years, growing numbers of studies have shown that smaller particulates emitted by trucks and cars barreling down our nation’s highways can promote heart disease and strokes. The EPA regulates these tinier hazards, to a point, but Brugge is concerned that the agency hasn’t gone far enough to safeguard the health of roadside residents.

## **Small, Smaller, Smallest**

Fine and ultrafine particles are much smaller than the width of a human hair, with ultrafines posing the greater potential risk to human health. Particulates come in a few different flavors, each smaller than the next, and each with its own implications for public health. Coarse particulates (known as “PM10” in the public health world) measure about 10 microns across—roughly one-seventh the width of a human hair. They’re mostly made up of dust from construction, vehicular tire and brake wear and the road surface itself. As particulates go, they’re not as high on Brugge’s hit list.

It’s the really tiny stuff, he says, that poses the real danger: fine particulates (PM2.5) — particles smaller than 2.5 microns—and “ultrafines” (PM0.1), the smallest of the small, at 0.1 microns and below. These are created almost exclusively by combustion. As a car or truck engine runs, its exhaust gases condense into minuscule blobs within seconds of leaving the tailpipe. Some blobs are made up of unburned oil and gasoline; others form out of the countless chemical byproducts of burning fossil fuels.

Yet Brugge says there’s reason to think that ultrafine particles, which the EPA does not regulate, are even more insidious than their larger counterparts. Unlike fine particulates (PM2.5), which don’t change much from day to day, ultrafines can fluctuate dramatically over the course of a morning or afternoon, depending on the weather and how many cars and trucks are on the road. Ultrafines are also confined to a relatively small area. While fine particulates disperse over an entire city, their tinier cousins stick close to major highways, often spiking dramatically within a few hundred meters of the source.

## **What are Particulates? (continued)**

### **Matters of the Heart**

“Larger particles can’t cross the barrier from the lungs to the bloodstream,” says David Weiss, who has worked on analyzing neighborhood health surveys. “But the ultrafine particles can.”

“For people who move away from the highway, it’s like they quit smoking,” says Wig Zamore, a longtime resident of Somerville with a master’s degree in urban planning. Over the past decade, Zamore has worked with community groups on public health and clean-air issues, and is a member of the CAFEH steering committee, a group of academics and community members who help guide the study’s research.

“Their risk pretty immediately starts to go down, and for the people who move closer to a highway, their risk immediately starts to go up over a matter of just a couple years,” he says, citing a 2009 study by the University of British Columbia.

### **One City’s Response**

Kevin Stone, a field team member for CAFEH, has lived in the Ten Hills neighborhood for 25 years. He says that many of his neighbors simply haven’t heard about the potential health risks of living near a highway. “This one friend of mine lives at the top of the hill, right next to the highway. He’s got all his windows wide open, and he’s saying, ‘Isn’t this just a great view of Boston?’” Stone laments, shaking his head. “I’m saying to myself, ‘You don’t even realize what you’re sucking in right off of I-93. You’re getting really exposed to this stuff!’” At the very least, Stone says, he’d like to see warning signs posted on the bike path that runs alongside the interstate. It’s a small gesture, but it is something that would give residents an idea of what they might be breathing during rush hour.

## **Pollution from aircraft arrivals is similar to pollution from highways**

The FAA has imposed new concentrated flight paths (called RNAVs) on Milton and on cities and towns across the country. They have not studied the health effects on people living below these paths.

Pollution from the burning of petroleum products in aircraft engines at altitudes less than 3,000 feet tends to stay in the atmosphere where we live and breathe. Planes on the arrival paths over Milton fly at less than 3,000 feet, often at 1,700 and Massport has reported that some are even lower.

### **The LAX study of Ultrafine Particles from Arrivals<sup>i</sup>**

A May 2014 study found a doubling of **ultrafine particle number (UFP) concentrations** extending east more than 10 miles downwind from the LAX airport along the arrival path for the airport's two parallel runways. UFP concentrations were four times higher than background concentrations at a distance of six miles.

At its furthest point, Milton is about 10 miles from the runway ends for the parallel runways at Logan called "the 4's" (4R and 4L, for the right and the left runways). At highway 93 and Granite Ave, the arrivals are about 5 miles from the runway ends.

["LAX may be as important to LA's air quality as the freeway system," Fruin said.](#) Scott Fruin is the senior author on the article published on this work in Environmental Science and Technology. Also, lead author, Neelakshi Hudda, said "Other airports generally have less steady wind directions, which would make these measurements more difficult," Hudda said. "Similar impacts are probably happening, but their location likely shifts more rapidly than in Los Angeles."

### **What does this study mean for Milton?**

It is likely that Milton residents are exposed to increased concentrations of UFP from the more than 50,000 jet arrivals over our town each year. Experts expect that the dramatic finding of twice the number of UFP at 10 miles out might be a worst case scenario because other airports have more change in wind direction than the Los Angeles area typically experiences. Measuring UFP and other pollutants when the FAA uses the 4's for arrivals is needed to know for sure.

Since this study, two more have shown increases in UFP along flight paths and around airports in Toronto and the Netherlands<sup>ii iii</sup>.

**Planes and concentrated flight paths, similar to vehicles on major highways, have been shown to increase ultrafine particle number concentrations.**

**A synopsis of recent scientific findings published in respected journals related to traffic and aircraft pollution and children's health, specifically *autism, cognition, and asthma***

**Traffic-Related Air Pollution, Particulate Matter, and Autism<sup>iv</sup>**

Exposure to traffic-related air pollution, nitrogen dioxide, PM2.5, and PM10 during pregnancy and during the first year of life was associated with autism. Further epidemiological and toxicological examinations of likely biological pathways will help determine whether these associations are causal.

**Does Traffic-related Air Pollution Explain Associations of Aircraft and Road Traffic Noise Exposure on Children's Health and Cognition? A Secondary Analysis of the United Kingdom Sample from the RANCH Project<sup>v</sup>**

**Air pollution exposure levels** at school were moderate, were not associated with a range of cognitive and health outcomes, and did not account for or moderate associations between noise exposure and cognition. **Aircraft noise exposure** at school was significantly associated with poorer recognition memory and conceptual recall memory after adjustment for nitrogen dioxide levels. **Aircraft noise exposure** was also associated with poorer reading comprehension and information recall memory after adjustment for nitrogen dioxide levels. **Road traffic noise** was not associated with cognition or health before or after adjustment for air pollution.

**Childhood Incident Asthma and Traffic-Related Air Pollution at Home and School<sup>vi</sup>**

Asthma risk increased by about 50% with modeled traffic-related pollution exposure from roadways near homes and near schools. Traffic-related pollution exposure at school and homes may both contribute to the development of asthma.

**Two other publications are worth noting**

**Pilot study of high-performance air filtration for classroom applications<sup>vii</sup>**

Although most of the legislative efforts should focus on ambient PM (particulate matter) reduction policies, the installation of highly effective air filtration devices in schools may be an important mitigation measure to minimize exposure of children to indoor pollutants of outdoor origin, especially at schools located near heavily trafficked freeways, refineries, and other important sources of air toxics.

**Logan Airport Health Study<sup>viii</sup>**

Among children, study results identified respiratory effects indicative of undiagnosed asthma (i.e., probable asthma); children in the high exposure area were estimated to have three to four times the likelihood of this respiratory outcome compared with children in the low exposure area.

**A synopsis of recent scientific findings published in respected journals related to traffic and aircraft pollution and adult's health, specifically *Cardiovascular disease, Breast cancer (see note), Lung cancer, Mortality, and Chronic obstructive pulmonary disease (COPD)***

**Cardiovascular disease and mortality**

**Residential exposure to aircraft noise and hospital admissions for cardiovascular diseases: multi-airport retrospective study<sup>ix</sup>**

Averaged across all airports and using the 90th percentile noise exposure metric, a zip code with 10 dB higher noise exposure had a 3.5% higher cardiovascular hospital admission rate, after controlling for covariates. Despite limitations related to potential misclassification of exposure, the authors found a statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular diseases among older people living near airports.

*Note: FAA's estimates of the noise metric, DNL, varies across Milton by 10 dB or more.*

**Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study<sup>x</sup>**

High levels of aircraft noise were associated with increased risks of stroke, coronary heart disease, and cardiovascular disease for both hospital admissions and mortality in areas near Heathrow airport in London. As well as the possibility of causal associations, alternative explanations such as residual confounding and potential for ecological bias should be considered.

**Airport noise and cardiovascular disease; the link seems real: planners take note<sup>xi</sup>**

These studies provide preliminary evidence that aircraft noise exposure is not just a cause of annoyance, sleep disturbance, and reduced quality of life but may also increase morbidity and mortality from cardiovascular disease. The results imply that the siting of airports and the consequent exposure to aircraft noise may have direct effects on the health of the surrounding population. Planners need to take this into account when expanding airports in heavily populated areas or planning new airports.

**Near-Roadway Air Pollution and Coronary Heart Disease: Burden of Disease and Potential Impact of a Greenhouse Gas Reduction Strategy in Southern California<sup>xii</sup>**

Some of this studies results: In 2008, an estimated 1,300 Coronary Heart Disease (CHD) deaths (6.8% of the total) were attributable to traffic density, 430 deaths (2.4%) to residential proximity to a major road and 690 (3.7%) to elemental carbon (EC). ...These results suggest that a large burden of preventable CHD mortality is attributable to near-roadway air pollution (NRAP) and is likely to increase even with decreasing exposure by 2035 due to vulnerability of an aging population. Greenhouse gas reduction strategies developed to mitigate climate change offer unexploited opportunities for air pollution health co-benefits.

**Changes in Residential Proximity to Road Traffic and the Risk of Death from Coronary Heart Disease<sup>xiii</sup>**

Living close to major roadways was associated with increased risk of coronary mortality, whereas moving away from major roadways was associated with decreased risk.

## Adult Health (continued)

### Breast Cancer

#### **Postmenopausal Breast Cancer Is Associated with Exposure to Traffic-Related Air Pollution in Montreal, Canada: A Case–Control Study<sup>xiv</sup>**

We found evidence of an association between the incidence of postmenopausal breast cancer and exposure to ambient concentrations of NO<sub>2</sub>. Further studies are needed to confirm whether NO<sub>2</sub> or other components of traffic-related pollution are indeed associated with increased risks.

*Note: This is the only recent study showing an association between air pollution and breast cancer. It is a flag of a possible association but should not be interpreted to be a strong finding of risk at this time. Nitrogen dioxide is generally considered a good marker for the primary transportation pollutants though few think it is the main agent. The main agent is more likely particles.*

### Lung Cancer

#### **Urban Air Pollution and Lung Cancer in Stockholm<sup>xv</sup>**

The authors' results indicate that urban air pollution increases lung cancer risk and that vehicle emissions maybe particularly important.

### **Other publications worth noting**

#### **Logan Airport Health Study<sup>xvi</sup>**

Among adult residents, individuals diagnosed with chronic obstructive pulmonary disease (COPD) were statistically significantly more likely to have lived in the high exposure area for three or more years.

#### **A 2009 German environmental study of over a million people who live around airports<sup>xvii</sup>**

Starting at a comparatively low aircraft noise of 40 decibels of continuous noise, the risk of cardiovascular diseases in men and women increases significantly and steadily. Greiser regards the legal limits and noise specifications of levels over 60 decibels, which are still deemed reasonable by airport operators, as “irresponsibly high.” The lives of residents living around airports are particularly in danger when aircrafts fly over their homes at night. In fact, according to Greiser’s data, women are exposed to higher health risks [than men]. Women in areas affected by noise are also more often treated for depression than women living in other areas. Even an increased leukemia and breast cancer risk was seen in women, says Greiser and calls for further investigations. It is conceivable that sleep deprivation and stress caused by aircraft noise could weaken the body's immune system and favor the spread of cancer cells. See also: [http://www.researchgate.net/profile/Eberhard\\_Greiser3](http://www.researchgate.net/profile/Eberhard_Greiser3)

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