



AIR QUALITY

The Smallest of Pollutants Are Linked to Outsize Health Risks

Can steering clear of particles from traffic fumes protect the heart?

By Adam Voiland

Sitting in traffic triples a person's short-term heart-attack risk. Living in a city with heavy air pollution such as Los Angeles is as risky for the heart as being a former smoker. And having a house near a highway ups the risk of hardened arteries by some 60 percent. In each case, tiny "ultrafine" particles in the air may be a key culprit.

While air pollution comes in many forms, scientists are increasingly concerned about its most minute constituents—virus-size particles produced by combustion. These ultrafines, which measure no more than 0.1 micrometer in diameter, are ubiquitous near roadways and are emerging as one of the most dangerous components of air pollution, which kills an estimated 60,000-plus Americans a year. That's more than the number killed annually by automobile accidents.

The tiny particles are worrisome for several reasons. For one, they tend to be rich in potentially toxic organic compounds and other reactive chemicals. Their size, moreover, allows them to travel deep into the lungs, lodge there for long periods, and stress the body in a variety of ways, researchers theorize. They

may even slip into the bloodstream, where they can do further damage. In comparison, so-called fine particulates, which can be up to 25 times wider than ultrafines, are snared more easily by protective hairlike structures in the nose and throat. Not that fine particulates are benign: Last year, a study of older women in the *New England Journal of Medicine* linked a 10-microgram-per-cubic-meter increase in fine particulate pollution—approximately the difference between Pittsburgh and cleaner Anchorage—to a 76 percent increase in the cardiovascular death rate.

BAD AIR

These regions had the highest levels of fine particulate pollution.

CITY	FINE PARTICULATES*
Los Angeles area	22.6
Pittsburgh area	20.8
Bakersfield, Calif.	19.0
Birmingham, Ala., area	18.2
Detroit area	18.2

*A three-year average of concentrations; the federal standard is 15.0 micrograms per cubic meter. Source: American Lung Association, based on 2003–05 EPA data

More recent data seem to confirm researchers' suspicions that smaller particles are even worse. With Environmental Protection Agency funding, a team co-led by Jesus Araujo, an environmental cardiologist at UCLA, zoomed in on the ultrafines and found that mice exposed to those particles developed more atherosclerotic plaque than mice breathing fine particulates only—and did so faster. "Much, much faster," says Araujo. In addition, HDL, or good cholesterol, didn't work as well in ultrafine-exposed animals. Araujo's team will report in the March 14 *Circulation Research*. Other recent experiments have found troubling cardiovascular changes in human volunteers following exposure to ultrafines.

Such findings are bad news for people with heavy exposure to traffic. Diesel vehicles are particularly potent sources of both fine and ultrafine particles, and their fumes, recent studies show, have adverse effects on the heart. European

researchers found, for example, that exercising men who inhaled fresh diesel fumes at levels that can occur near major roads experienced rapid reduction in blood flow to the heart and a one-third drop in a protective protein that prevents dangerous clotting. "The effect was about the same as what we see with secondhand smoke," explains Nicholas Mills, the University of Edinburgh cardiologist who led the research.

At risk. The elderly, young children, and those with pulmonary and cardiovascular problems are most at risk from particulate air pollution. However, particles affect everybody. Recent Taiwanese research shows, for example, that inflammation, oxidative stress, and other cardiovascular warning signs are detectable among urban teens breathing polluted air as well.

While fine particulate matter and certain smog-generating emissions are regulated, ultrafine particles are not. "There's no doubt particulate matter is the elephant in the room," says Dan Costa, the director of the Environmental Protection Agency's air research program. Since 1997, the agency has been cracking down on fine particulates, and their levels have generally been falling nationwide. A new rule, phased in last year, requires trucks

Questions from *The Smallest of Pollutants Are Linked to Outsize Health Risks*

to use cleaner-burning diesel fuel and should help reduce both fines and ultrafines. But it may be a decade, Costa says, before scientists amass enough evidence on ultrafines to justify directly limiting them.

A third to a half of ultrafine exposure comes from driving. "If you have otherwise healthy habits and don't smoke, driving to work is probably the most unhealthy part of your day," says Scott Fruin, an environmental scientist at the University of Southern California. The tiny particles can also slip into homes, especially those near busy roads. Cooking with a poorly ventilated stove can be another source of exposure to ultrafines, he says. Some fireplaces also generate particulates. However, so-called HEPA filters can help clear indoor air of particulates, including ultrafines.

Avoiding exposure. Exercising near traffic increases one's exposure, since heavy breathing draws particles deep into the body. Murray Mittleman, a cardiologist at Harvard University, suggests that people—especially those with heart conditions—try to exercise away from major roadways. Masks probably won't have much of an effect on the tiny ultrafines, says Fruin, but might stop larger particles. (Some U.S. Olympians, in fact, have been advised to wear face masks in heavily polluted Beijing.) Two government websites, www.airnow.gov and www.epa.gov/airtrends, can help people plan outdoor activities.

Still, there's no reason to live in complete fear of particulates; the risk for any individual remains quite small. That tripling of heart attack risk due to traffic exposure, for example, sounds frightening but is similar to the increased short-term risk posed by exercise or even sexual activity, says Robert Brook, a University of Michigan cardiologist. "The absolute risk—meaning the risk you have every single time you are exposed to air pollution, exercise, or have intercourse—is still very, very low," he says. "But when you multiply that by the tens of millions of people being exposed to polluted air all of the time, you end up getting large numbers of people who are affected."

Araujo, for one, isn't taking any chances. He used to bike frequently in heavy traffic. However, after seeing what happened to his mice, he says: "You won't find me stuck behind bus tailpipes anymore." ☺

1. What are some of the reasons for all the concern over these tiny air pollutant particles?
2. What type of jobs could now be re-classified as hazardous?
3. What groups of people are most at risk?
4. When did the EPA begin cracking down on fine particulates?
5. What are some of the ways you can minimize your exposure to fine particulate pollution?



A video on dirty air and health is at www.usnews.com/air