# Asphalt is everywhere, but is it bad for our health?

## ASU researcher says pavement's potential impact on our health deserves as much attention as its carbon or energy footprint

By Joanna Allhands, ASU News
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If you piled all of Phoenix's pavement into one spot, it would be enough to cover San Francisco four times over.

Roads, parking lots and other paved surfaces blanket a lot of land — an estimated 40% of Arizona's capital city.

Pavement absorbs heat during the day and releases it slowly at night via the urban heat island effect, increasing the amount of energy that cities consume.

But for Elham Fini, a senior scientist affiliated with the Julie Ann Wrigley Global Futures Laboratory at Arizona State University, pavement's potential impact on our health deserves as much attention as its carbon or energy footprint.

"To make something truly sustainable," she said, "you cannot ignore the human side of it."

### Asphalt fumes can be hard on health

Fini — a faculty member in ASU's School of Sustainable Engineering and the Built Environment — spent years studying why asphalt breaks down so quickly.

That work pointed her toward the volatile organic compounds that escape from bitumen, the black, sticky petroleum byproduct that holds asphalt together.

Two studies in the Journal of Hazardous Materials and Science of the Total Environment shed light on how the compounds that give asphalt its trademark scent change after sunset and form ultrafine particles, which can worsen air quality.

These carbon-based vapors are continuously released but become more noticeable on hot, sunny days. They can cause dizziness and difficulty breathing in the short term.

Long-term exposure also can elevate the risk of lung cancer, a major concern for construction workers who regularly breathe these fumes without a respirator.

## Aging pavement emits toxic vapors

And the impacts could get worse as pavement ages.

Research from Fini and others shows that asphalt begins releasing different, more toxic strains of VOC as bitumen breaks down in sunlight and heat.

These toxic, often odorless VOCs are small enough to work their way into arteries and organs.

Tests and a modeling analysis also suggest that they can cause significant neurological damage in humans, particularly among women and the elderly.

“Heat is worsening the situation,” Fini said. “It’s exacerbating the emissions from asphalt.”

More study is needed to understand what level of asphalt-emitted VOC exposure is unsafe.

But what we know so far should raise alarm bells for hot, car-centric cities such as Phoenix.

## Goal: Safer asphalt, healthier workers

Fini is working with Dr. Bruce Johnson via a partnership with Mayo Clinic to better understand how asphalt emissions impact respiratory health.

She hopes that their studies will lead to stronger protections for construction workers and surrounding communities, as well as less toxic, lower-emitting asphalt formulations.

Fini has a head start on the latter.

She has teamed up with Peter Lammers, chief scientist at the Arizona Center for Algae Technology and Innovation, to begin growing a strain of algae that could reduce VOC emissions using wastewater from a Phoenix treatment plant.

“It’s a great setup,” said Lammers, a research professor in the School of Sustainable Engineering and the Built Environment, “because we use water that’s far too high in nitrogen and phosphorus to be released anywhere. And instead, we reuse it to grow more algae.”

Fini then bakes that algae at high temperatures without much oxygen into a binder that can be easily mixed into asphalt.

## Algae can capture the worst VOCs

A study in the journal Clean Technologies and Environmental Policy found that while algae-infused asphalt doesn’t significantly reduce total VOC emissions, it can effectively keep the most toxic compounds from escaping.

In fact, tests showed that it reduced the toxicity of asphalt emissions by roughly 100-fold.

Algae can slow how quickly pavement breaks down — which could lower construction and maintenance costs and make its inclusion in asphalt even more attractive for cities and paving companies.

Fini is exploring other binder options, including a product made from the leftover branches of forest-thinning projects, and working with Phoenix to pave a section of road with algae-infused asphalt.

Because VOCs from pavement are often left out of air quality assessments, these real-world tests are critical to evaluate pavement performance and its long-term environmental impact.

“We have 4 million miles of roads in America,” Fini said. “We should make those 4 million miles do more for us than just get from A to B.”

*This research was done in collaboration with colleagues from the following institutions: Emory University; Dalian University of Technology, China; Mayo Clinic Arizona; Oregon State University; University of Chicago; University of Lille, France; University of Littoral Côte d?Opale, France; University of Miami; University of Missouri; University of Utah.*

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*This story originally appeared on ASU News.*

## Main image

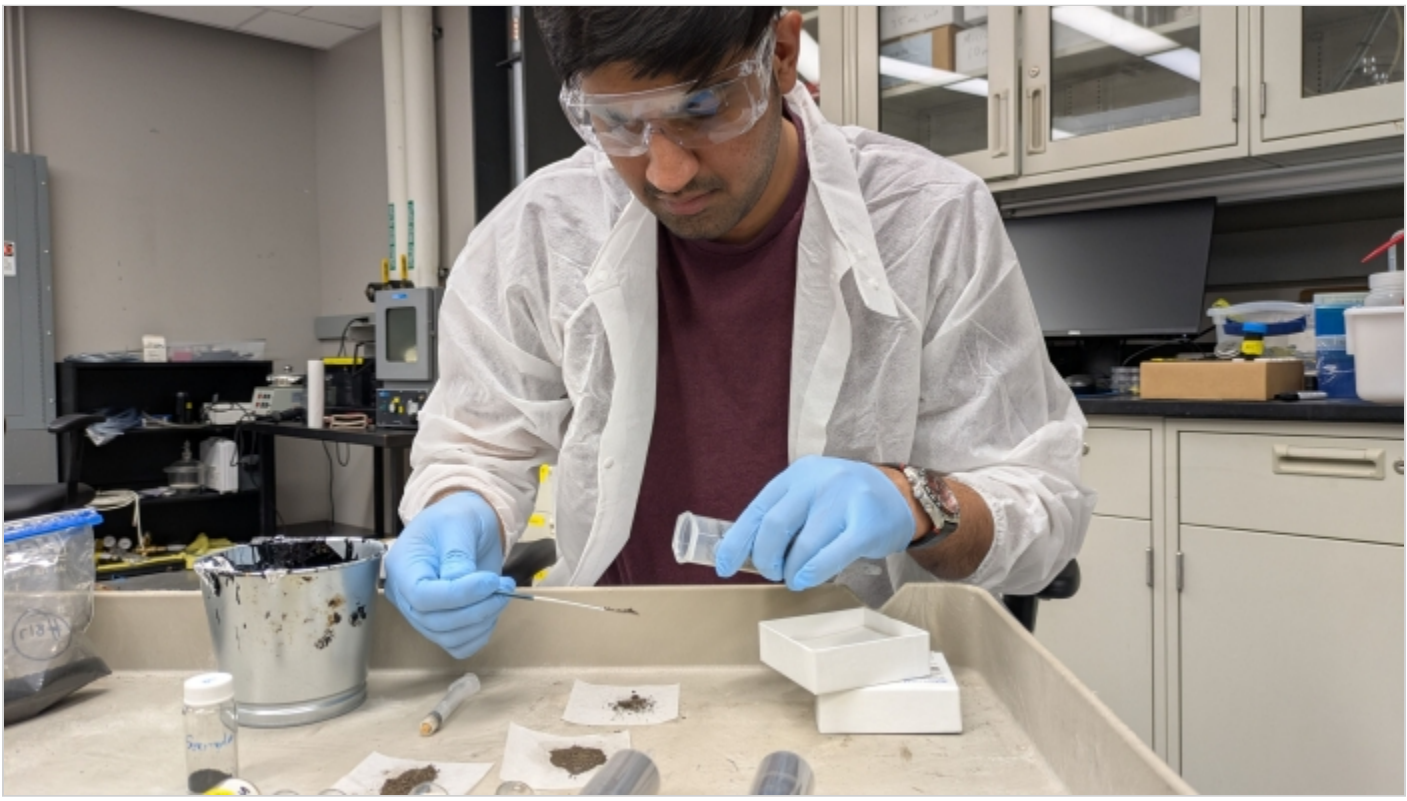


Asphalt covers McAllister Avenue on Arizona State University's Tempe campus. Photo by Joanna Allhands/ASU

## Text image(s)




Associate Professor Elham Fini from ASU's School of Sustainable Engineering and the Built Environment studies how materials like asphalt impact human health. Photo by Erika Gronek/ASU



Suliman Rashid, a graduate teaching associate in the School of Sustainability, moves samples of an asphalt binder made from leftover forest-thinning material. Photo by Joanna Allhands/ASU