

# Metalmark Innovations Reveals Inadequacies in Air Filters for Wildfire Smoke Protection

*Misconceptions About Wildfire Smoke and Air Filtration: What You Need to Know*

CAMBRIDGE, MA, UNITED STATES, January 31, 2025 /EINPresswire.com/ -- As Los Angeles battles

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There are a number of misconceptions about the size and behavior of particles generated by wildfires. This leads to a false sense of security when recommending filters.”

*Sissi Liu, CEO and co-founder of Metalmark Innovations*

recent wildfires, air quality across the region has plummeted to hazardous levels. Per expert recommendations, many have turned to air filters and purifiers to fend against smoke pollution. But what if these solutions are not as protective as suggested? It turns out there are widespread misconceptions about wildfire smoke and its hazards, as well as the effectiveness of air filtration in protecting human health against wildfire smoke, because this has been an understudied and consequently overlooked area of research. A [scientific paper](#) by [Metalmark](#) researchers uncovers critical flaws in current filter technologies and their evaluation for capturing

wildfire smoke particles.

## Understanding Wildfire Smoke and PM2.5

Wildfire smoke consists of fine particulate matter (PM) known as PM2.5, which includes particulates smaller than 2.5 microns in diameter—approximately 1/30 the diameter of a human hair and smaller. While PM2.5 is a key regulatory benchmark, this characterization fails to convey the size of smoke particles. Practically all wildfire smoke particles are much smaller, averaging about 0.1-0.3 microns—roughly 1/350 the diameter of a human hair and smaller. The nuance is critical because smaller particles carrying toxic chemicals can be more harmful, penetrating deep into the lungs and entering the bloodstream.

## Key Misconceptions About Wildfire Smoke

### Misconception #1. Smoke Particles Are Larger Than 1 Micron

Wildfire smoke particles are predominantly submicron in size, forming as ultrafine particles (UFPs,  $\leq 0.1$  microns) during combustion. Over tens of minutes, these particles stabilize around 0.1-0.3 microns. Their stability means that harmful smoke particles from fires in Los Angeles can

affect the air quality of other US regions.

#### Misconception #2. Wildfire Smoke Is Just Like Any Other PM2.5

Unlike urban PM2.5, which often originates from traffic and industrial emissions, wildfire smoke is composed mainly of organic compounds with more diverse and complex compositions. Smoke is even known to spread pathogens, contributing to rising cases of Valley Fever, for example.

Fires in the wildland-urban interface include the combustion of vegetation, building materials, vehicles, electronics, batteries, and more. They introduce additional toxins, such as hydrogen cyanide, hydrogen fluoride, chlorine, various toxic organic compounds (e.g., benzene, toluene, xylenes, formaldehyde), heavy metals (e.g., lead, chromium, cadmium, arsenic), and polycyclic aromatic hydrocarbons. While some compounds, such as formaldehyde, are dispersed in gaseous form, many of these substances hitch a ride on smoke particles.

#### Misconception #3. Smoke Is Harmless If You're Far from the Fires

Smoke's impact extends far beyond the immediate vicinity of the fires. During the 2023 Canadian wildfires, smoke traveled thousands of miles and caused hazardous air quality as far away as New York City and Atlanta. Despite the distance, the particle size and composition remain largely unchanged. Research shows that faraway smoke increases health risks, and indirect deaths are up to 1,000-fold direct wildfire deaths.

#### Misconception #4. Staying Indoors Provides Adequate Protection

Many believe that staying indoors is a sufficient safeguard against wildfire smoke. However, smoke particles infiltrate buildings through gaps, ventilation systems, and even closed windows. Additionally, indoor air quality can degrade due to formaldehyde, ozone, and other chemicals—common byproducts of wildfires that penetrate indoors.

#### Misconception #5. MERV 13 and HEPA Filters Provide Exceptional Protection

While MERV 13 and HEPA filters are lauded for their effectiveness in filtering PM2.5, they have limitations:

- Suboptimal Performance for Submicron Particles: Most HVAC filters, including MERV 13 and



higher grades, are least effective at capturing particles in the 0.1-0.3 micron range—precisely the size of wildfire smoke particles. Furthermore, non-HEPA filters' efficacy is not generally assessed for <0.3 micron particles.

- Efficacy Not Tested for Smoke: Standard ratings for filters do not include tests with particles representative of wildfire smoke, which behaves differently on filter material compared to test particles.

- Short-lived Efficiency: Many HVAC filters on the market are made with electrostatically charged material. They are preferred for their lower cost and pressure, which in turn provides lower HVAC cost and energy use. However, the material can lose effectiveness within minutes or hours of exposure to smoke. Some even rerelease captured particles into the air.

Similarly, many HEPA air purifiers that rely on electrostatically charged filters can quickly lose smoke filtration efficiency.

Metalmark's findings underscore that even filters rated MERV 13 and above may not reliably capture smoke particles. Standard filter test methods may also not be accounting for wildfire smoke conditions.

#### Tips to Combat Wildfire Smoke

- Shut Down Ventilation: Turn off HVAC ventilation (with outdoor air) and seal vents, windows, and doors to minimize smoke infiltration.

- Use High-Quality Air Purifiers: Invest in air purifiers with mechanical HEPA filters and sorbents to remove particles and gases. Base your system selection on the size of the room and the reported clean air delivery rate (CADR) for cigarette smoke for better approximation.

- Choose MERV 13+ Mechanical HVAC Filters If Feasible: Mechanical filters offer improved smoke filtration but typically come with significantly higher pressure and energy use. If your HVAC system can accommodate such increase, they are a viable choice.

- Change Filters Regularly: Replace both air purifier and HVAC filters regularly, especially sorbent filters.

- Monitor Indoor Air Quality: Track air quality and adjust your protective measures accordingly. Events still unfolding in Los Angeles serve as a stark reminder of the hazards posed by wildfire smoke. While current filtration technologies offer some protection, there is a pressing need for improved solutions and testing tailored to the unique properties of wildfire smoke. Policymakers, manufacturers, and researchers must collaborate to address these gaps and ensure public safety.

For more information/resources, visit <https://www.mdpi.com/2073-4433/14/12/1729>

#### About Metalmark

Metalmark is addressing growing global air quality problems as well as climate adaptation and mitigation challenges by developing products that make a difference. First inspired by nanostructures present in the wings of the metalmark butterfly, the company creates sustainable products from the nanoscale up. For more information, visit <https://metalmark.xyz>

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