

# WHAT'S IN THE AIR INDOORS?

Particulate matter is a mixture of very small solids and liquid droplets that float in the air. Some particles come from a specific source (such as a burning candle), while others form as a result of complicated chemical reactions.

Most Americans spend about

**90%**  
of their time indoors.<sup>1</sup>



While much is known about the health effects of exposure to particulate matter outdoors, the effects of indoor exposure are less well-understood. However, indoor exposure to particulate matter is gaining attention as a potential source of adverse health effects.

The National Academies of Sciences, Engineering, and Medicine recently convened a workshop to examine the issues.

## WHAT ARE SOME SOURCES OF PARTICULATE MATTER INDOORS?



outdoor sources that enter indoors through heating, ventilation, and air conditioning systems; open doors and windows; and leakage through walls and roofs<sup>1</sup>



airborne allergens and bacteria in outdoor air and that come from people and their pets and plants indoors<sup>2</sup>



emissions from food as it's cooking<sup>3</sup>



candles, incense, wood burning<sup>3</sup>



cleaning activities like dusting, vacuuming, and ironing<sup>3</sup>



cigarettes, e-cigarettes, and other smoking materials<sup>4</sup>



desktop laser printers and 3-D printers<sup>1</sup>



gas and electric ranges and stoves<sup>1</sup>



mold that grows on indoor surfaces<sup>2</sup>



chemical reactions between elements in the air and materials inside of buildings<sup>5</sup>

## HOW BIG IS PARTICULATE MATTER, AND WHY IS THE SIZE A CONSIDERATION?



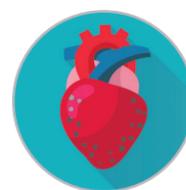
**PARTICULATE MATTER IS TYPICALLY CLASSIFIED INTO THREE SIZE CATEGORIES:**

- Coarse particles are 2.5 to 10 micrometers in diameter (a strand of human hair is 60-120 micrometers wide<sup>6</sup>).
- Fine particles are 2.5 micrometers in diameter or smaller.
- Ultrafine particles are 100 nanometers (0.1 micrometers) or smaller.

**Fine and ultrafine particles may be small enough to pass through the throat and nose and enter deeper into the body.<sup>7</sup>**

## WHAT ARE THE POTENTIAL HEALTH EFFECTS?

A body of epidemiologic research has shown associations between short-term and long-term exposures to particulate matter and a broad array of respiratory and cardiovascular effects.<sup>8</sup> Results from scientific studies are converging to indicate that exposures both to fine and ultrafine particles may produce such adverse effects.<sup>8</sup> The size and shape of inhaled particles influence where and how much mass will be deposited in various regions of the respiratory system.<sup>9</sup>



## WHAT ARE SOME WAYS OF ALTERING THE LEVELS OF PARTICULATE MATTER INDOORS?

**The source of indoor particulate matter may be affected by:**

- limiting indoor smoking<sup>3,10</sup>
- using a correctly installed range hood when cooking<sup>3,10</sup>
- avoiding burning candles and incense<sup>3</sup>
- performing regular surface cleaning<sup>10</sup>

**Ventilation** may reduce the levels of particulate matter generated indoors, but it increases the amount of outdoor-generated particulate matter that comes inside.<sup>10</sup>

**Filtration** may lower the concentrations of particulate matter in indoor air.<sup>3,10</sup>

**To download the free workshop summary, visit [nationalacademies.org/IndoorPM](http://nationalacademies.org/IndoorPM).**

1. Brent Stephens, Illinois Institute of Technology  
2. Sergey Grinshpun, University of Cincinnati College of Medicine  
3. Brett Singer, Lawrence Berkeley National Laboratory  
4. Barbara Turpin, UNC Gillings School of Global Public Health  
5. Charles Weschler, Rutgers University  
6. William Hallmann, Rutgers University

7. Mark Weiskopf, Harvard T.H. Chan School of Public Health  
8. National Research Council (NRC). 2010. *Review of the Department of Defense Enhanced Particulate Matter Surveillance Program Report*  
9. NRC. 2004. *Research Priorities for Airborne Particulate Matter: IV. Continuing Research Progress*  
10. William Fisk, Lawrence Berkeley National Laboratory

**DISCLAIMER:** This infographic summarizes information presented at a workshop. Statements and opinions are those of individual participants; are not necessarily endorsed by the National Academies of Sciences, Engineering, and Medicine; and should not be construed as reflecting any group consensus.

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