

# STRATEGIES TO PROTECT AIR QUALITY DURING WILDFIRES

## CONSIDERATIONS FOR DO-IT-YOURSELF FILTRATION

### Introduction

Wildfires are a growing threat throughout the world. In the U.S., the number of acres affected by wildfires has increased over the last 30 years. Even in communities far downwind, smoke from wildfires has been directly linked to poor air quality that can lead to significant health effects and costs to society. Additionally, there is an increasing number of homes within the wildland urban interface (WUI) (nearly 50 million homes currently) that have the potential to be near wildfires and even more residents downwind who may be affected by poor air quality due to wildfire smoke.

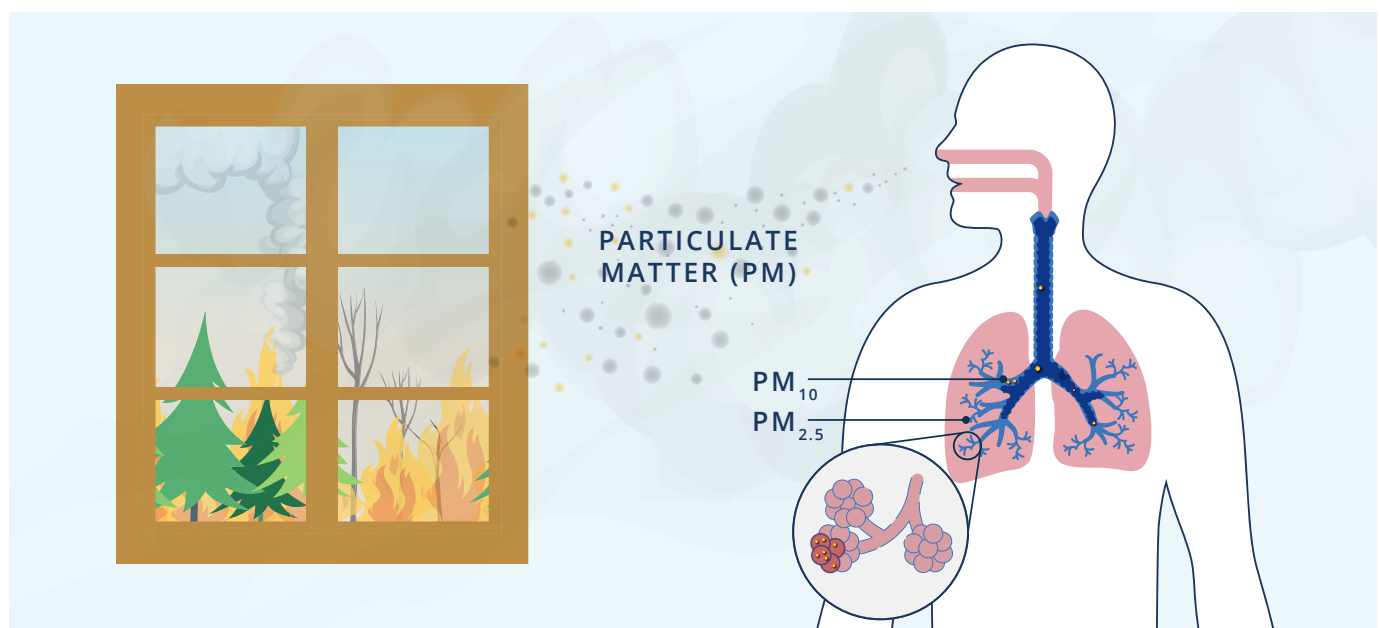
Wildfires are a major source of air pollutants such as fine and ultrafine particulate matter (PM) and volatile organic chemicals (VOCs). Estimates show that wildfires have accounted for up to 25% of PM<sub>2.5</sub> (particulate matter with a diameter of 2.5 micron or less) in recent years across the U.S., and up to 50% in some Western regions.

### WILDFIRE PM<sub>2.5</sub> CONTRIBUTES TO ADVERSE HEALTH EFFECTS SUCH AS:

- Exacerbation of asthma
- Chronic obstructive pulmonary disease
- Circulatory effects such as heart attacks and stroke

### PM FROM WILDFIRES CAN BE OF SPECIAL CONCERN TO THOSE AT RISK INCLUDING:

- People with preexisting health conditions (e.g. heart disease, lung disease, diabetes)
- Pregnant women
- Older adults
- Children
- Certain occupations who are more likely to be exposed to PM such as firefighters and outdoor workers
- People without access to healthy environments
- People without easy access to healthcare



## Available Mitigation Strategies

There are several ways to reduce or avoid exposure to wildfire smoke with varying levels of feasibility.

- Relocate to safe areas, away from the path of the fire and smoke
- Reduce physical activity
- Wear personal protective equipment such as masks selected and worn properly for PM<sub>2.5</sub> filtration (including N95 masks or equivalent)
- Reduce smoke infiltration by:
  - Staying indoors (as long as the space is sufficiently cooled)
  - Closing doors and windows
  - Sealing door and window leaks
  - Running any heating, ventilation, and air conditioning (HVAC) systems in a recirculation mode
- Filter indoor air by:
  - Ensuring a pleated HVAC filter with a Minimum Efficiency Reporting Value (MERV) of 13 is in place (if the system is designed to support it)
  - Using portable air cleaners with HEPA filtration
  - Using do-it-yourself (DIY) air cleaners (i.e., furnace air filter attached to electric box fans)

*Filtration is one of the most effective and feasible controls to improve indoor air quality for many affected by smoke events.*

Applying higher performance filtration on supply ventilation in homes reduced outdoor particles by up to 97%, and portable air cleaners reduced PM exposure indoors by 48% – 78%. But to address feasibility (including cost and supply limitations), some organizations have begun recommending do-it-yourself (DIY) air cleaners during smoke events as an affordable and accessible alternative to commercially available air cleaners. **Preliminary data show DIY air cleaners are effective at removing particles indoors and are comparable to small commercial air cleaners with a clean air delivery rate (CADR) of < 100 ft<sup>3</sup>/min to medium sized commercial air cleaners with CADR of around 200 ft<sup>3</sup>/min.**





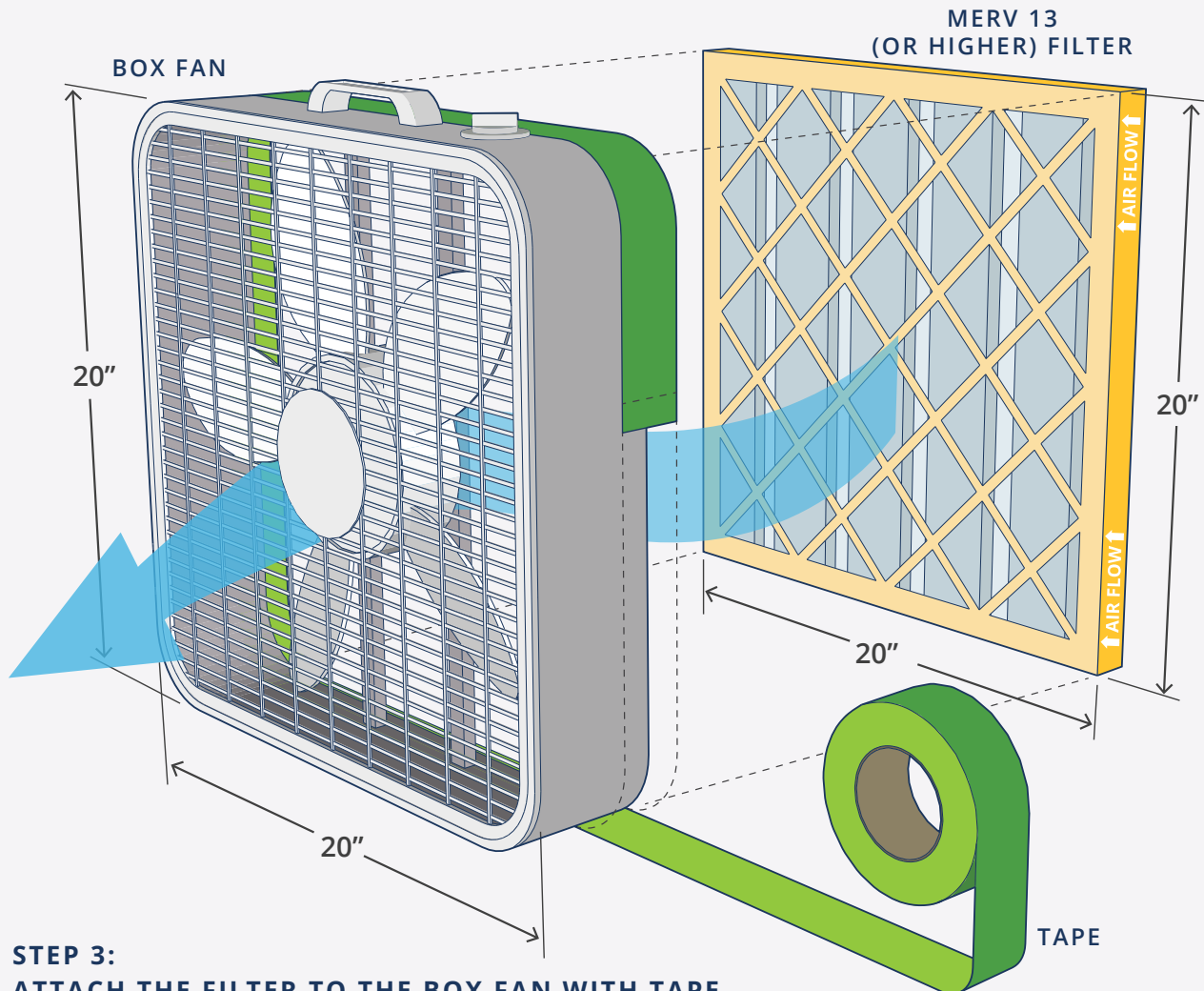
## Setting Up a DIY Air Cleaner

### STEP 1: LOCATE THE FRONT OF THE BOX FAN

Identify which side of the fan is the front (the side that blows the air out) and which side of the fan is the back (the side that sucks that air in). Typically, the fan brand name or logo is located on the front of the fan.

### STEP 2: LOCATE THE FRONT OF THE FILTER

Identify which side of the filter is the front (the side that pulls the air through). There is typically an arrow on the side of the filter that indicates the direction of airflow. Place the front of the filter against the back of the fan.



### STEP 3: ATTACH THE FILTER TO THE BOX FAN WITH TAPE

Once the box fan and filter are correctly positioned (the front of filter is placed squarely against the back of fan), use tape to attach them together on all four sides. Apply enough tape so that the filter is securely attached to the fan and the seam is continuous with no gaps. Clamps, bungee cords, or string may also be used in the absence of tape. Sealants and wet glues are not recommended as they may be an additional source of VOCs in the room and may complicate filter replacement.

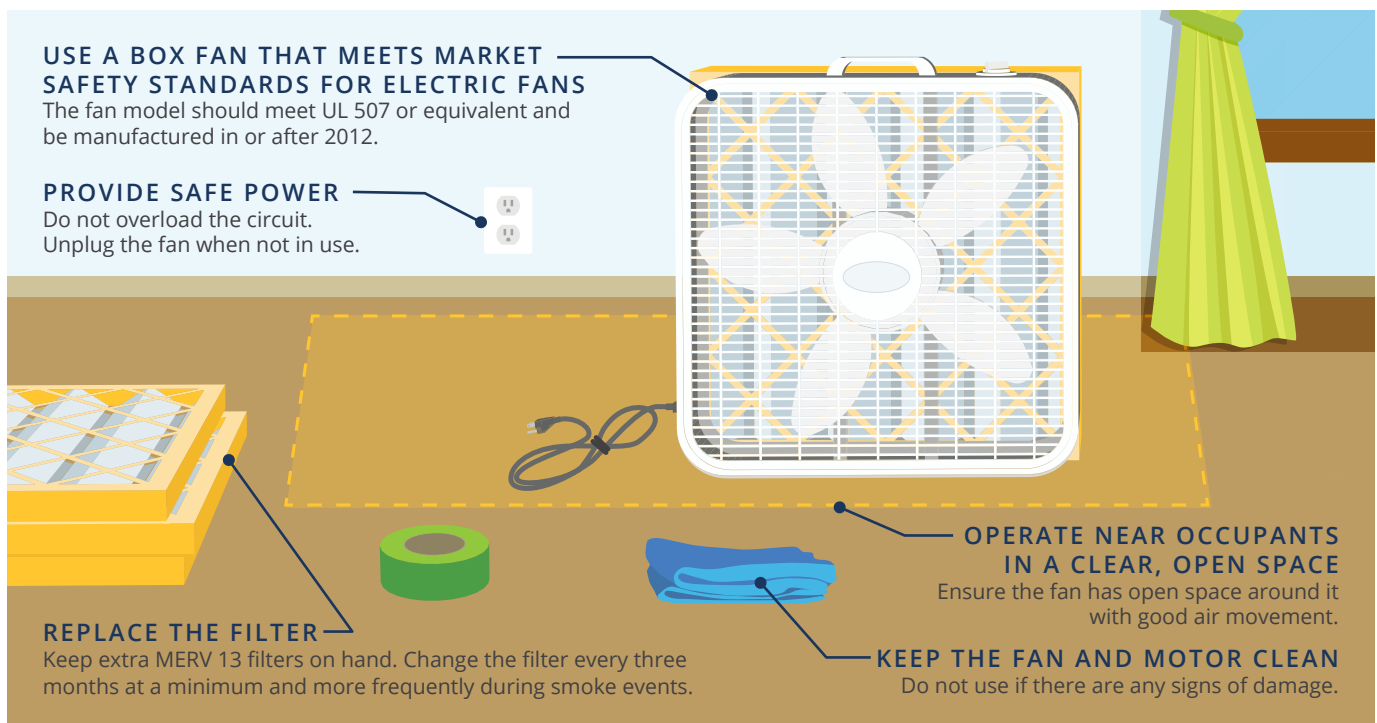
A box fan that is designed without a power cord and/or a switch/dial on the back (air intake side) of the fan is recommended to achieve a better seal between the box fan and filter. The more the DIY air cleaner operates, the cleaner the air within the room will be if the filters are replaced frequently, and the fan is cleaned and well-maintained. A visibly soiled filter should be replaced well before it gets clogged to the point that airflow through the filter is significantly restricted. The filter needs to be replaced more frequently when the fire smoke is intense.

## Benefits and Tradeoffs of DIY Air Cleaners

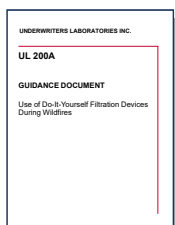
DIY air cleaners are economical, simple to assemble, and require only three parts, which are readily available in retail home improvement stores. One tradeoff of DIY air cleaners is that they may be louder to operate than a typical portable air cleaner, especially at the highest speed setting. In addition, some DIY air cleaners may generate heat, and dirty filters may not look or smell pleasing, even though the filter is still effective at removing PM in air. DIY air cleaners can also require slightly higher power usage compared to commercial air cleaners.

Since these consumer-level box fans were not being used in a manner originally intended by the manufacturers, and safety under these conditions had not been evaluated, Chemical Insights Research Institute of Underwriters Laboratories Inc. (CIRI) with support of the Office of Research and Development at U.S. Environmental Protection Agency conducted a study assessing the potential fire risks (overheating and fire ignition) of these operating DIY air cleaners. The study found that all measured temperatures fell below the maximum allowable thresholds defined by the market safety standard for electric fans, UL 507. Fire ignition was not achieved with any of the filter/fan scenarios tested.

## Safety Considerations for Community Use of DIY Air Cleaner



## ADDITIONAL RESOURCES



### UL 200A: Use of Do-It-Yourself Filtration Devices During Wildfires

*This guidance document, developed by CIRI and an expert scientific volunteer group, presents evidence-based, actionable procedures to help communities construct and safely use DIY air cleaners during wildfires.*



### Handout: DIY Box Fan Air Cleaner Safety Tips

*This handout summarizes important safety tips for DIY box fan air cleaners, including guidance for set-up and best practices related to before, during, and after use. This handout can be shared with community members.*

