

A Strategic Research Initiative on Wildfires and Public Health

Introduction

Raging wildfires pose significant economic, ecological and human health and safety threats. Wildfires have grown exponentially in the Western United States with millions of acres destroyed on an annual basis. Increasing arid climates, extreme temperatures and neglected forest management are leading to more extreme wildfire events.

During wildfires, smoke laden with pollutants enters the atmosphere. These pollutants include carbon monoxide, carbon dioxide, organic compounds, nitrogen oxides, particulate matter (PM) and others, and their presence in the air means that people will be breathing hazardous smoke. Smoke plumes can travel long distances and present for widespread human exposure for extended periods of time. One of the pollutants of concern is particulate matter (PM). Very small particles from the smoke can be inhaled into the human respiratory system and penetrate deep into the lungs. This exposure can lead to a myriad of health concerns including eye and throat irritation, coughing and shortness of breath and asthma attacks. Longer term exposure can lead to cardiovascular disease and even premature death. Children, the elderly, and those with pre-existing conditions like chronic obstructive pulmonary disease are especially vulnerable.

People are taking steps to remove the smoke from their homes, schools, and workplaces. While some can afford commercially available air cleaners, many are using Do-It-Yourself (DIY) air cleaners built with a box fan and a common furnace filter (Figure 2). DIY air cleaners have been shown to filter out small particles from wood smoke when they are used appropriately. Some state agencies have begun recommending DIY air cleaners during smoke events as DIYs offer an affordable and accessible alternative to commercial air cleaners, which frequently sell out during smoke events. However, concerns exist regarding DIY air cleaner fire safety since consumers are retrofitting electric box fans not intended or evaluated for this purpose by the manufacturer.

Study Objective

The first phase of our research is to evaluate the potential fire risks of operating a DIY air cleaner comprised of a box fan and an air filter (Figure 2). This will include monitoring the differences in operating temperatures caused by retrofitting furnace filters to electric box fans and simulating various failure modes. The next phase of our research will be directed toward characterizing the smoke aerosol and its toxicity and learning how filtration can reduce human health risks.

Study Plan Overview

A range of commonly available box fans in the U.S. will be obtained for study. Temperatures of the fan motor (if not covered), motor casing, and the fan guard, as well as other physical or electrical hazards observed will be recorded as the fan goes through five different conditions:

- Fan operating normally without any filters attached;
- Fan operating with a clean filter attached;

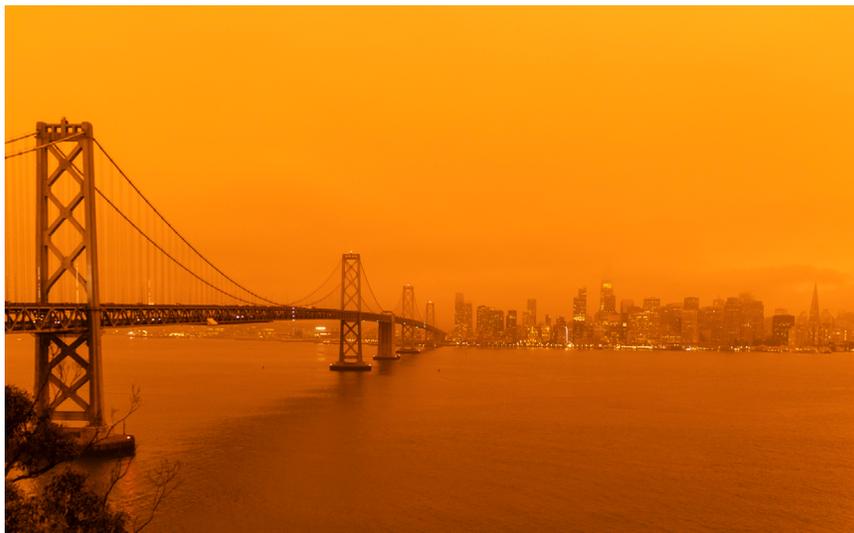


Figure 1: The sky across San Francisco darkened on Sept. 9, 2020, and stayed orange during day as smoke from many wildfires across the state created a massive smoke cloud changing the sunlight to a perpetual orange glow. (iStock)

- Fan operating with a wood smoke-loaded filter, wood smoke representing smoke from biomass burning such as wildfires;
- Fan operating with a dust-loaded filter, loaded with typical household dust without wood smoke; and
- Worst case with a fan completely obstructed on one side.

Study Outcomes

- Identify unintended safety issues of DIY air cleaners;
- Develop an operational protocol for DIY air cleaners that also considers potential unintended safety hazards; and
- Aid local and government agencies if/ how the use of DIY air cleaners should be recommended and used.

Research Partners

- The Office of Research and Development at U.S. Environmental Protection Agency
- UL Fire Safety Research Institute
- UL, LLC
- California Air Resources Board
- Lawrence Berkeley National laboratory
- Puget Sound Clean Air Agency



Figure 2: DIY air cleaner (U.S. EPA)