



THE *BREATHE* PROJECT WORKSHOP GUIDE

Do-It-Yourself (DIY) Air Cleaners: Building Resilience to Emerging Airborne Threats and Heat Events

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BREATHE
Building Resilience to Emerging
Airborne Threats and Heat Events



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Acknowledgements

Land Acknowledgement

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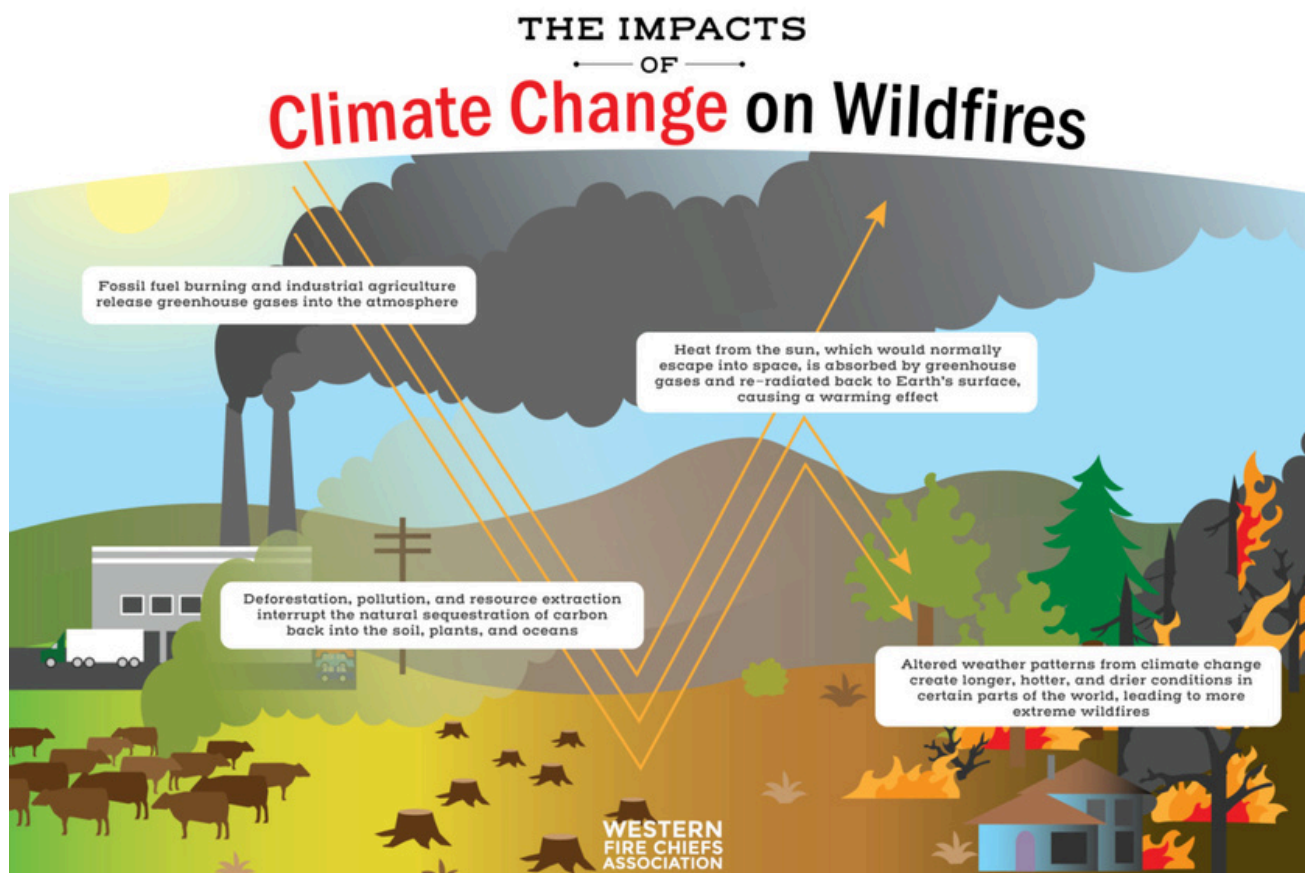
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Background

Climate Change and Wildfires

Since 2005, the number of forest fires in British Columbia (BC) has significantly increased, primarily due to climate change and land use practices that make the landscape more prone to wildfires. The number of wildfires burnt in an average year in BC has surpassed record levels, and our worst wildfire seasons have occurred in the past five years.

The increased number of wildfires in BC jeopardizes the health and well-being of individuals from wildfire smoke. It is the populations closest to wildfires who are exposed to the highest levels of wildfire smoke pollutants. However, wildfire smoke can also travel long distances depending on weather patterns, creating prolonged impacts on air quality that affect populations near and far.



Western Fire Chiefs Association. (Published July 18, 2022 | Edited March 4, 2024).
<https://wfca.com/wildfire-articles/wildfires-and-climate-change/>

Knowing the Basics

i. Making the Link Between Climate Change, Wildfires, and Health Impacts

Burning fossil fuels (oil, gas, and coal) releases greenhouse gases, particularly carbon dioxide (CO₂), into the atmosphere. These emissions trap heat, causing global temperatures to rise. Warmer temperatures and prolonged droughts, driven by climate change, dry out vegetation, making it more vulnerable to wildfires. This has led to more frequent and intense wildfires.

Wildfire smoke can cause respiratory problems, such as coughing, shortness of breath, and worsening asthma or COPD, as well as increase the risk of heart attacks and strokes. Long-term exposure to the toxic particles in smoke can lead to chronic lung diseases, reduced lung function, and even lung cancer. Vulnerable groups, including children, the elderly, and individuals with pre-existing conditions, face greater risks, while the smoke can also contribute to stress, sleep disturbances, and mental health challenges.



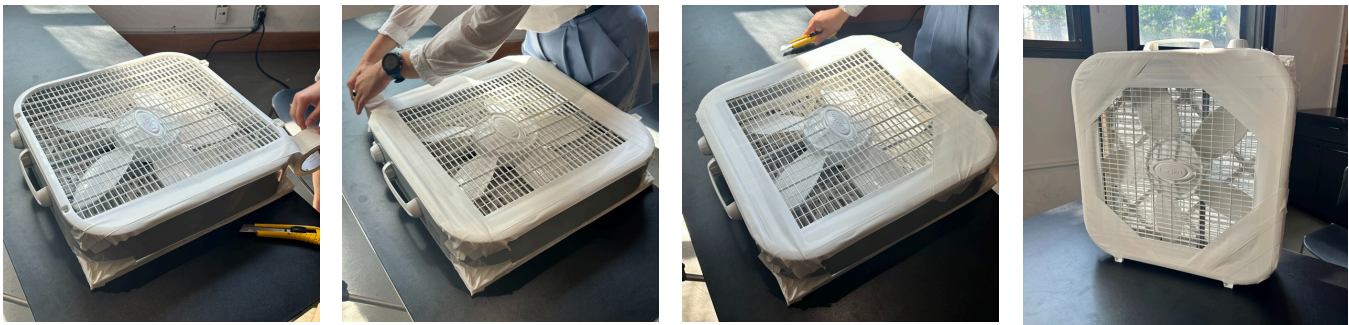
Image Reference: Kulkarni, A., & Nelms, B. (2021, June 21). B.C.'s South Coast could soon see smoky skies, experts warn. CBC News. <https://www.cbc.ca/news/canada/british-columbia/metro-vancouver-wildfire-smoke-1.6109122>

ii. Effectiveness

This project grew out of an evidence assessment conducted by Dr. Angela Eykelbosh of the National Collaborating Centre for Environmental Health (NCCEH). The study compared the performance of different models of DIY air cleaners to ones available commercially, most of which use high-efficiency particulate air (HEPA) filters. Performance was based on clean air delivery rate (CADR), which measures how fast the air cleaners can remove particles in an enclosed room. A higher CADR decreases the time it takes to change the air in a room, referred to as air changes per hour (ACH). Most commercially-available air cleaners filter out particles as small as 0.3 to 1.0 micrometers (Eykelbosh, 2023). This range covers a wide variety of indoor air pollutants, including viruses, wildfire smoke, mold spores, emissions from indoor wood burning, pollen, and sources of outdoor pollution that penetrate indoors (Eykelbosh, 2023). The evidence review suggests that DIY air cleaners performed comparable to or better than some commercial HEPA units, and were also less expensive to build than purchasing a commercial model.

iii. Shroud

To improve the efficiency of DIY air cleaners, it has been found that placing a **shroud** on the front of the fan improves its CADR by approximately 40% (Pistochini and McMurry, 2021). A shroud, made of either cardboard or duct tape, covers the borders of the front of the fan (see page 12 for shroud photos). The shroud increases the efficiency of air going through the filter. Without a shroud, dirty air gets sucked back into the corners of the fan and pushed out the centre without passing through the filter. The shroud helps to ensure that the air coming out of the fan has passed through the filter first.



Step by step construction of a Tape Shroud on the 1x1 DIY Air Cleaner unit.

iv. Use and Limitations

While DIY air cleaners can help to remove solid or particulate matter, the filter cannot trap gaseous pollutants, such as radon, VOCs, and carbon monoxide. These units are also thought to work well for removing infectious aerosol particulates such as COVID-19, and the flu, but the evidence has not shown whether this removal is large enough or fast enough to reduce the probability of infection.

DIY air cleaners are not long-term solutions. Homes that have conditions that cause long-term indoor air pollutants, like mold growth and wood-burning stoves, can use DIY air cleaners as an immediate response. However, homeowners should make the necessary arrangements to remove the source of home air pollution.

DIY air cleaners are not a cooling solution - if the temperature is 35 degrees or above, the fan will not be enough to lower your core body temperature, and you need to relocate to a cooling centre. If you have to choose between immediately protecting yourself from high heat or air quality, you should always **prioritize the heat**. Extreme heat carries a much greater risk of immediate injury and death compared to smoke.

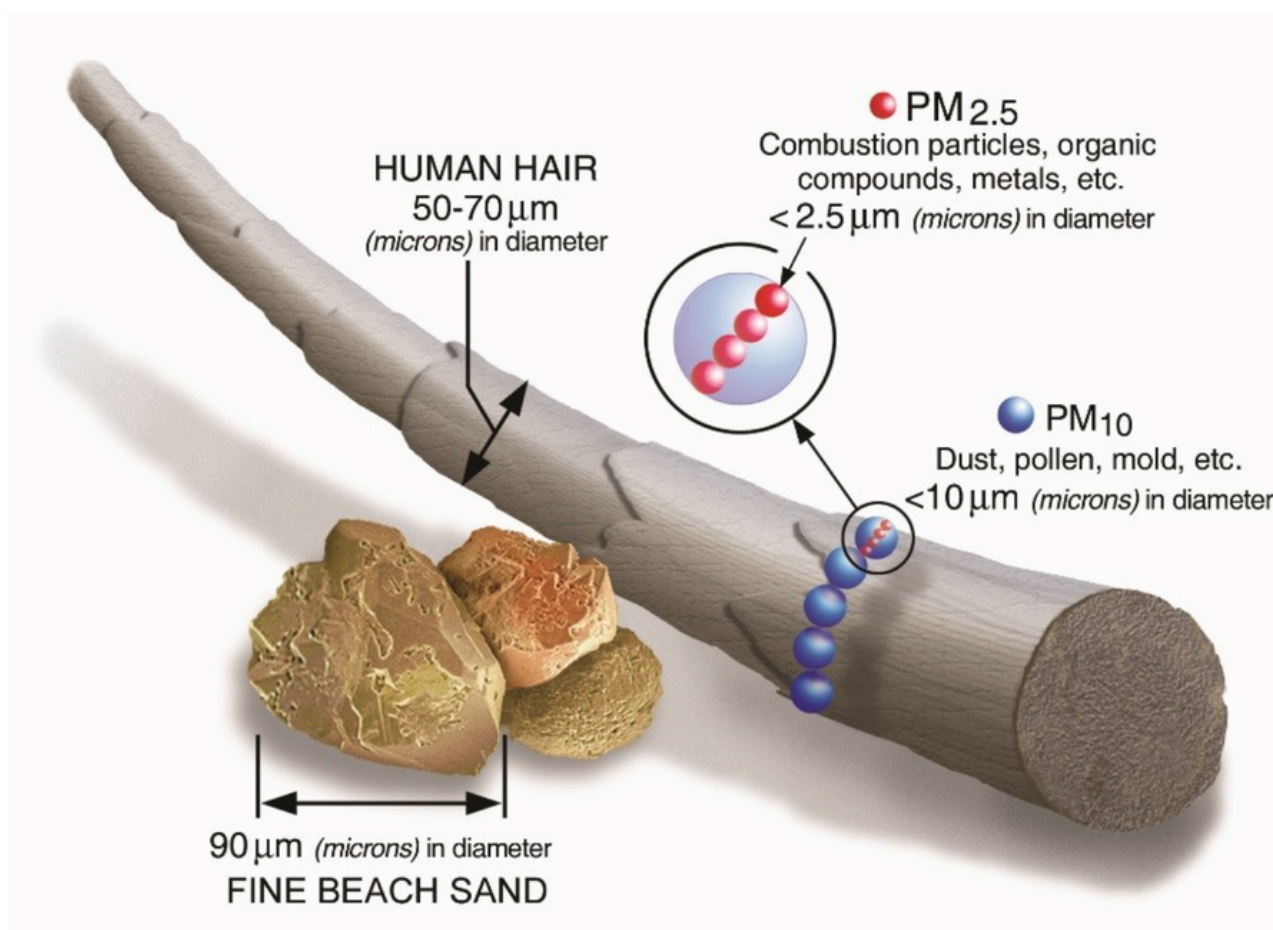


Image Reference: United States Environmental Protection Agency (US EPA). (2023, October). Why Wildfire Smoke is a Health Concern [Overviews and Factsheets]. <https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern>

v. Safely Operating a DIY Air Cleaner

When using a DIY air cleaner, simple precautions should be taken to avoid safety issues.

We strongly recommend instructing participants on the following:

- The air cleaner should be used with at least 4 feet of space away from walls, curtains, or furniture for air to flow through easily.
- To reduce wildfire smoke indoors, windows must be closed to prevent further smoke from entering the room.
- Air cleaners should not be left running unattended.
- The air cleaner should be plugged directly into the wall, not an extension cord.
- Place the air cleaner on a hard surface (i.e. not on a carpet) and stand it upright.
- Replace the air filter on the back when it is visibly dirty (gray or black).
- Do not cover the air cleaner with wet or dry towels, blankets, or other fabrics.

The United States Environment Protection Agency has conducted a rigorous review of DIY air cleaners' fire safety risks and has deemed them safe. **Wildfire Safety Report:** <https://chemicalinsights.org/wp-content/uploads/2022/03/DIY-Box-Fan-Report-2021.pdf>

➡ See the **“Safety and Consideration”** handout available on our website

vi. What Can We Do to Improve the Wildfire Situation?

As individuals, **there are many things we can do** to improve this situation.

First, we can adopt best practices for preventing wildfires, such as:

- Not throwing burning cigarettes or cigars on the ground.
- Not starting a fire when there is a fire watch.
- Clearing the area surrounding our homes of flammable materials, or creating Firewise® site.
- Keeping the roofs on our homes in good repair to prevent sparks from flying in and catching fire.

Second, our real power is not as individuals, but as a collective. Reining in the biggest contributors to the climate crisis requires action at the legislative level. It will only happen if we make our voices heard.

- Consider writing to your elected officials to ask for decisive action in response to the climate crisis.
- Vote for representatives who will prioritize climate change, and who are not sponsored by major polluters.
- Talk about climate change with your friends, family, and neighbors, and take action to address your impact as a community.

Planning

This section encompasses the steps required to plan for a workshop in your community. Whether you're a municipality, neighbourhood group, or high school, you may find similar issues in budgeting, procuring items, storage, or an array of other areas.

i. Unit Costing

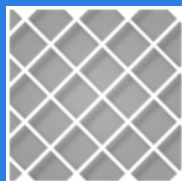
The air cleaner comprises the bulk of the cost of hosting a workshop, at **approximately \$75 per unit**.

Here is the unit cost breakdown, as well as a list of other costs that may arise. Your organization or community partner may provide some items in-kind:

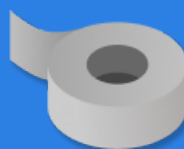
DIY Air Cleaner – Required Materials



20x20" box fan



20x20" MERV 13
filter (MPR 1900)



Duct tape



Scissors or
Box Cutter

Item	Cost Per
Lasko Box Fan	\$50
MERV-13 Filter:	
• Order >12 units in bulk	\$20
• Individually	\$25-30
1/2 Roll Duct Tape	\$5
Total Cost Per Unit (before tax)	~ \$75

Event costs can vary with the following considerations: workshop rental space, snacks and refreshments, storage space rentals, and travel/transportation rentals.

Other costs to consider: first aid kit, gift cards for volunteers, and childcare.

ii. Workshop Space and Preparation

When selecting a workshop space, an average-sized classroom with capacity for 25 participants is sufficient. There should be enough room for 10 to 12 folding tables (two people per table). Furthermore, you want to ensure space for people to move around freely, especially if participants bring wheelchairs or an extra friend for assistance.

The workshop should take no longer than 2 hours to complete, with some people finishing much faster than others depending on their ability. At the end of the workshop, ensure all participant's fans have been plugged in and are working sufficiently.

Here is an example of how to prepare your workshop space:

- Set up folding tables, with two chairs at each
- Place two fans at each table, with a filter on top
- Ensure the following documents are placed on each workstation
 - Instruction manual
 - Safety document
 - Any additional educational materials



iii. Procurement

There are several important factors when it comes to the MERV-13 filter and box fan. When purchasing the MERV-13 filter and box fan, ensure that you are selecting the ones with the correct requirements. Ensure you are purchasing a square (20"x20" inch) box fan that uses at least 75 watts and square (20"x20"x1" inch) MERV-13 filters (MPR 1900). Higher MERV-rated filters can also be sourced, but at substantially greater cost. Bulk buying filters can reduce the cost of a filter by almost half. Refer to pg. 12 for a list of the exact air cleaner specifications and a materials list.

If you are hosting a workshop in the summer, plan to secure the fans early in the season as supplies may run out when wildfire smoke increases. Purchasing a few extra fans and filters ahead of time to use as emergency backups (e.g., in case fans are defective) is recommended.

Before the materials are purchased, it is important to find a space large enough to store them until the workshop. If you work with a community centre or organization, they may be able to provide a storage room to keep the fans and filters until they are needed. It is particularly convenient to ship the materials directly to the location where you will hold your workshop.



Workshop Shopping List

Compulsory Item	Approx. Cost	Link to Example
Box Fan 20x20x3" Min. 75 watts	\$50	https://www.canadiantire.ca/en/pdp/laskosteel-portable-box-floor-fan-3-speedwhite-20-in-0430929p.0430929.html
MERV-13 Air Filter 20x20x1"	\$32 for 1 \$72 for 6 (\$12 per)	Single Filter from Home Depot
	\$225 for 12 (\$18.75 per) <i>*Quickest delivery option in emergency cases</i>	Pack of 6 from Amazon Pack of 12 from ULine
Roll of Duct Tape	\$7	https://www.homedepot.ca/product/scotchmulti-purpose-duct-tape-3920-wh-white-188-in-x-20-yd-48-mm-x-18-2-m/1000104244

Additional Item	Approx. Cost	Link to Example
Scissors or Box Cutter	\$15	https://www.canadiantire.ca/en/pdp/fiskarspowerarc-heavy-duty-stainless-steel-soft-grip-scissors-8-in-black-orange-0572923p.html
Ruler	\$2	https://www.canadiantire.ca/en/pdp/meringue-stainless-steel-ruler-12-inch-30cm-1424149p.html?rq=ruler
Pencil or Pen	\$3	https://www.canadiantire.ca/en/pdp/paper-mate-canadiana-woodcase-pencils-hb-2-24-count-1424181p.html?rq=pencil

 This list is available in a downloadable and printable PDF on our websites.

Useful Handouts for Workshops

i. Facilitating the Workshop Process

You can find all handouts mentioned in this workshop guide on the BC Lung website, including the **Instructions (available for download and printing in 12 languages)**, **Safety & Considerations document**, and a full **shopping list**. Also available are instructional videos as well as a PowerPoint presentation that can be used for information sessions.



www.bclung.ca/diyaircleaners OR www.sfu.ca/fhs/breathe-project.html

Additional wildfire smoke health risk and prevention infographics can be found on the BCCDC website for printing or presentations.

BCCDC Wildfire Smoke Information:

<http://www.bccdc.ca/health-info/prevention-public-health/wildfire-smoke>

ii. Risk Assessment Tools and Information

Being aware of your local PM sensor not only helps to understand one's own individual response to outdoor particulate matter, but it is also a prompt to turn on the DIY air cleaner.

Map of community PM sensors supported by Environment and Climate Change Canada: <https://aqmap.ca/aqmap/#9/49.5902/-122.7557/L38/L40/L41>

iii. Effectiveness

The US Environmental Protection Agency also provides detailed resources and research on air cleaner safety and effectiveness. Additionally, some infographics can be printed for workshops from this site.

Research on DIY Air Cleaners to Reduce Wildfire Smoke from the United States Environmental Protection Agency:

<https://www.epa.gov/air-research/research-diy-air-cleaners-reduce-wildfire-smoke-indoors>

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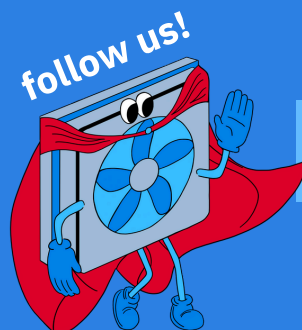
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