

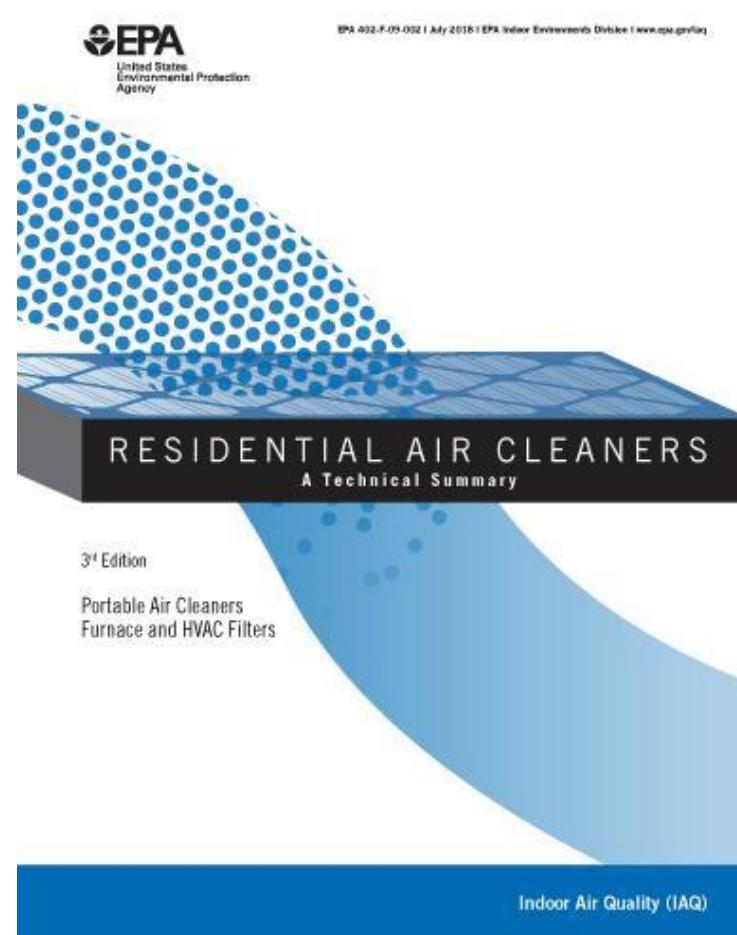
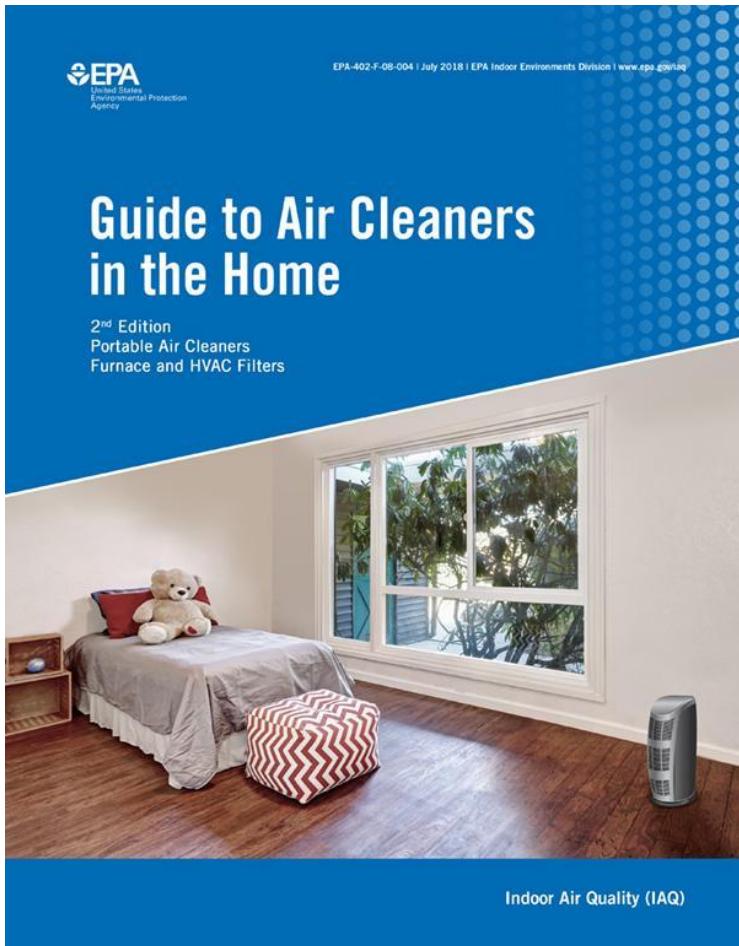
HEPA, MERV AND DO-IT-YOURSELF AIR CLEANERS

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TRIBAL HEALTHY HOMES NETWORK
Clean Air. Safe Homes. Healthy Lives.

Reference Guides



Do we need air cleaners?

- The most economical and effective way to address indoor air pollution is usually *to reduce or eliminate avoidable sources of pollutants* and then to exhaust to the outdoors the unavoidable particles, gases, and excessive water vapor that come from normal indoor activities such as cooking, cleaning, and showering



And what can be the problem with the outside air?



And what could be the problem with *inside* air?

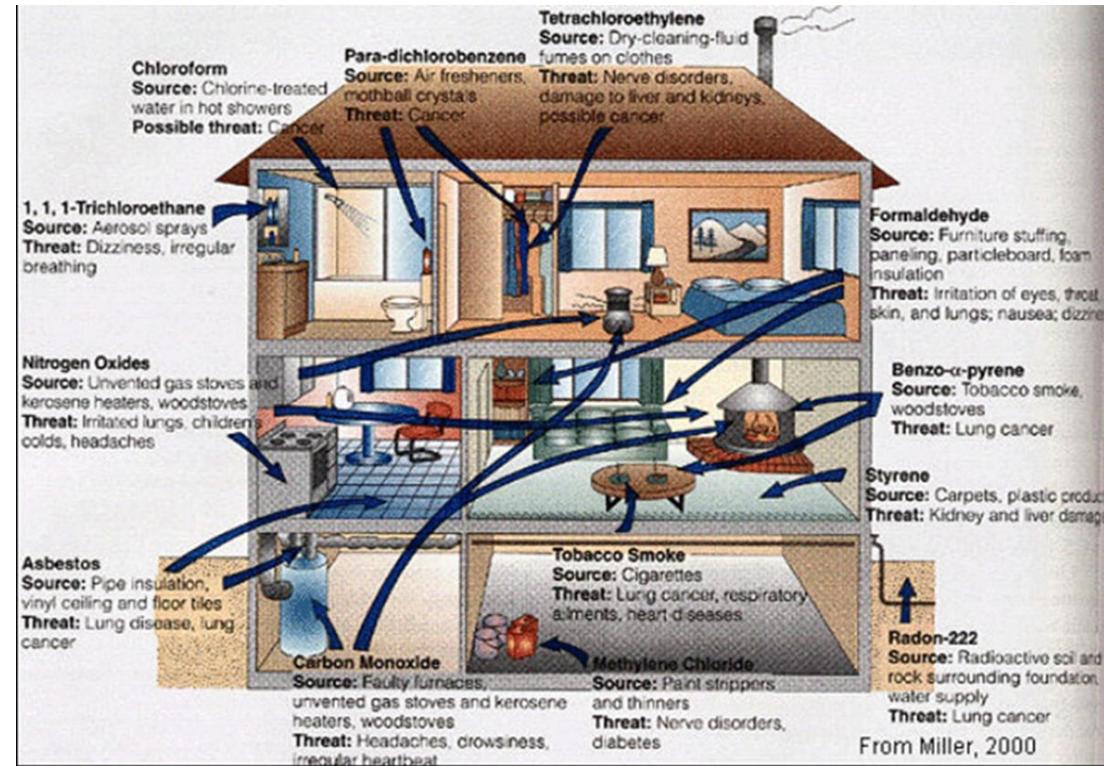
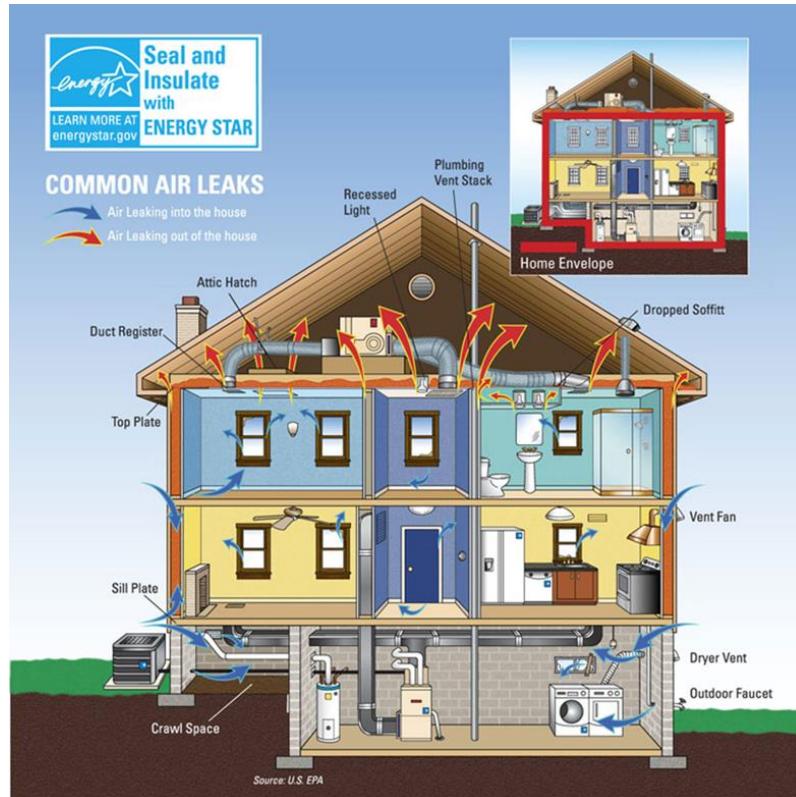


Tessa Williams
CULT PERFUMES
The World's Most Exclusive Perfumes



Scent Fill Brand Refills Fit These Warmers And More

What is outside, comes inside! (And we know what we can have inside.....)



Do we need air cleaners?

So let's talk dust, otherwise known as particles.....

Dust consists of some combination of shed bits of human skin, animal fur, decomposing insects, food debris, lint and organic fibers from clothes, bedding and other fabrics, tracked-in soil, soot, particulate matter from smoking and cooking, and, disturbingly, lead, arsenic and even DDT!

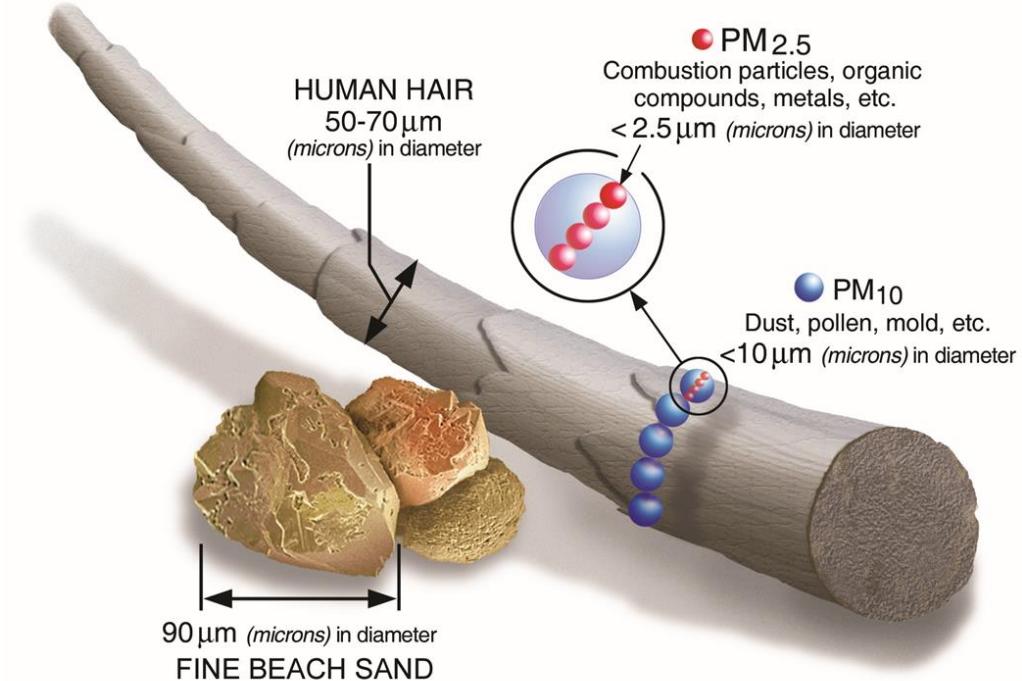
Particle size.....

Particle size is critical:

10 – 100 microns (μ) most either settle on the floor or are filtered out by the nose and the trachea

PM₁₀ – Particle Matter $<10 \mu$ inhaled into lungs

PM_{2.5} - These are the optimal size for reaching the alveoli in the lungs



Particle Size is critical...

As are their settling rates:

- 100μ / 3 seconds
- 10μ / 5 minutes
- 5μ / 20 minutes
- 1μ / 8½ hours
- $<1 \mu$ / permanently suspended in the air

High concentrations of fine particles are associated with health risks—especially in sensitive populations such as children, the elderly, and those with existing respiratory health problems like asthma and allergies



Air Cleaners

- Intervention studies of air cleaners operating in homes have consistently found statistically significant reductions in indoor exposures to indoor PM_{2.5}, PM₁₀, and/or particle number counts with the use of portable air cleaners, whereas levels of allergens in dust were only sometimes affected



Okay...now that we know WHY we want to use an air filter, WHAT do they all mean?

- HEPA
- MERV
- ESP (Electrostatic Precipitator's)
- Ozone Generators
- Ion Generators
- UVGI – Ultra Violet Germicidal Irradiation
- Carbon Filters

HEPA – *High Efficiency Portable Air Cleaner*

- The basic components of a portable air cleaner include a filter or other air cleaning technology and a fan that propels air through that filter/air cleaner
- Portable air cleaners may also have a panel filter with bonded fine granules of activated carbon, an activated carbon filter encased in a frame, or other sorbent mixtures to remove gases and odorous compounds

HEPA – *High Efficiency Portable Air Cleaner*

- In residential air cleaners, filters described as being HEPA filters are generally equivalent to MERV 16 and offer the highest available particle removal efficiency of fibrous media air filters for a wide range of particle sizes



MERV - Minimum Efficiency Reporting Value

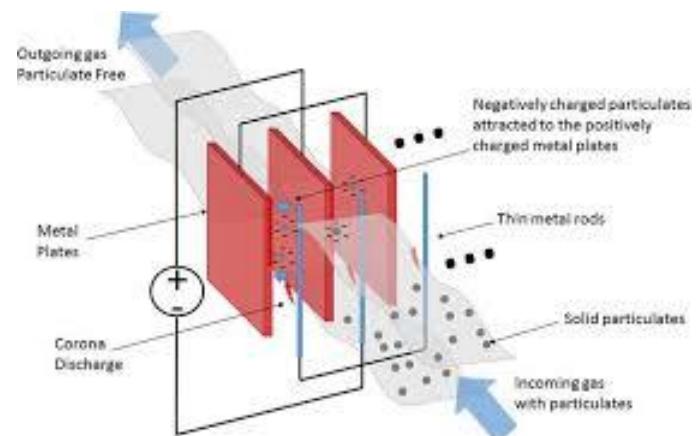
(MERV) ranging from MERV 1 to MERV 16 based on the average removal efficiency across three particle size ranges: 0.3–1 μ , 1–3 μ , and 3–10 μ

EPA recommends that consumers who are concerned about small particles choose furnace filters with at least a MERV 13 rating or as high a MERV rating as the system fan and filter track can accommodate

ESP (Electrostatic Precipitators)

Corona discharge wire charges incoming particles, which collect on oppositely charged plates

- Can have high removal efficiency for a wide range of particle sizes
- Low pressure drop and minimal impacts on HVAC systems
- Low maintenance requirements
- Sometimes ESPs have high ozone and nitrogen oxide generation rates
- Efficiency typically decreases with loading and plates require cleaning
- High electric power draw requirements



Ion Generators

Similar to ESP, ionizers use a high-voltage wire or carbon fiber brush to electrically charge air molecules, which produces negative ions that attach to airborne particles; the charged particles are then collected either on oppositely charged plates in the air cleaner or become attracted to other surfaces in the room and deposited elsewhere

- Typically low power draw requirements
- Quiet
- Low maintenance
- Generates ozone



Ozone Generators

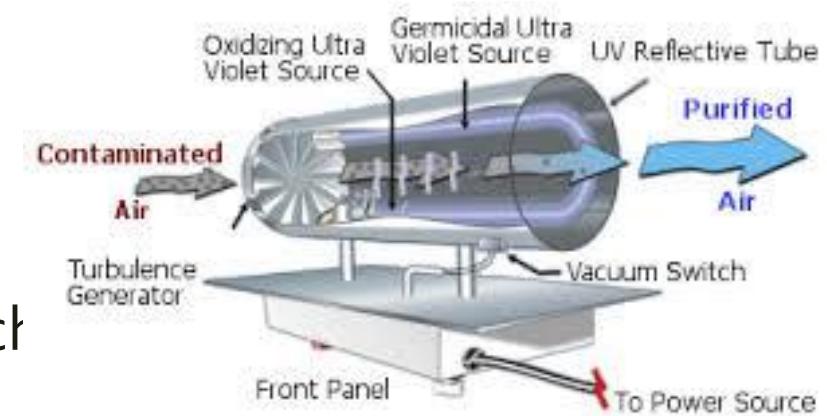
- Intentional generation of ozone using corona discharge, UV, or other method to oxidize odorous compounds and other gases
- Reacts with many indoor gases
- Can be combined with other less harmful technologies such as adsorbent media
- High ozone generation rates
- High amounts of byproduct formation
- Can cause degradation to indoor materials



Ozone generators that are sold as air cleaners intentionally produce ozone
No federal government agency has approved these devices for use in occupied spaces

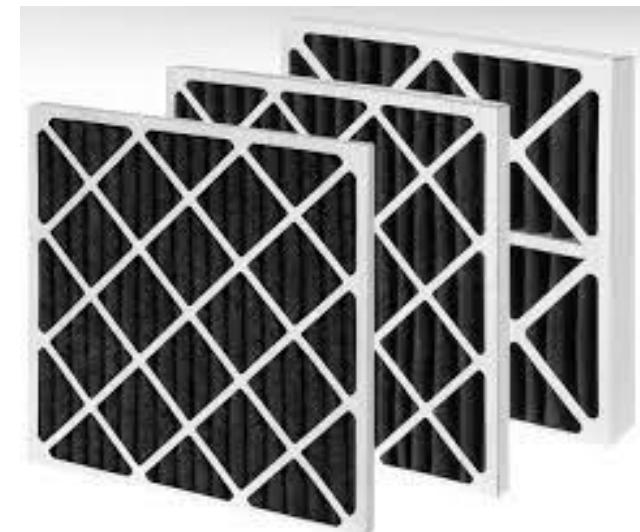
Ultraviolet Germicidal Irradiation (UVGI)

- UV light kills/inactivates airborne microbes
- Can be effective at high intensity with sufficient contact time
- Can be used to inactive microbes on cooling coils and other surfaces
- Uncoated lamps can generate ozone
- Potential for eye injury
- Effectiveness increases with lamp intensity, which is typically low in residential UVGI air cleaners
- High electrical power draw requirements
- Inactivates but does not remove microbes



Carbon Filters

- Adsorbent media Gases Collection
- Gases physically adsorb onto high-surface-area media (typically activated carbon)
- Potential for high removal efficiency for many gaseous pollutants in air cleaners with a sufficient amount of media for the application
- No byproduct formation



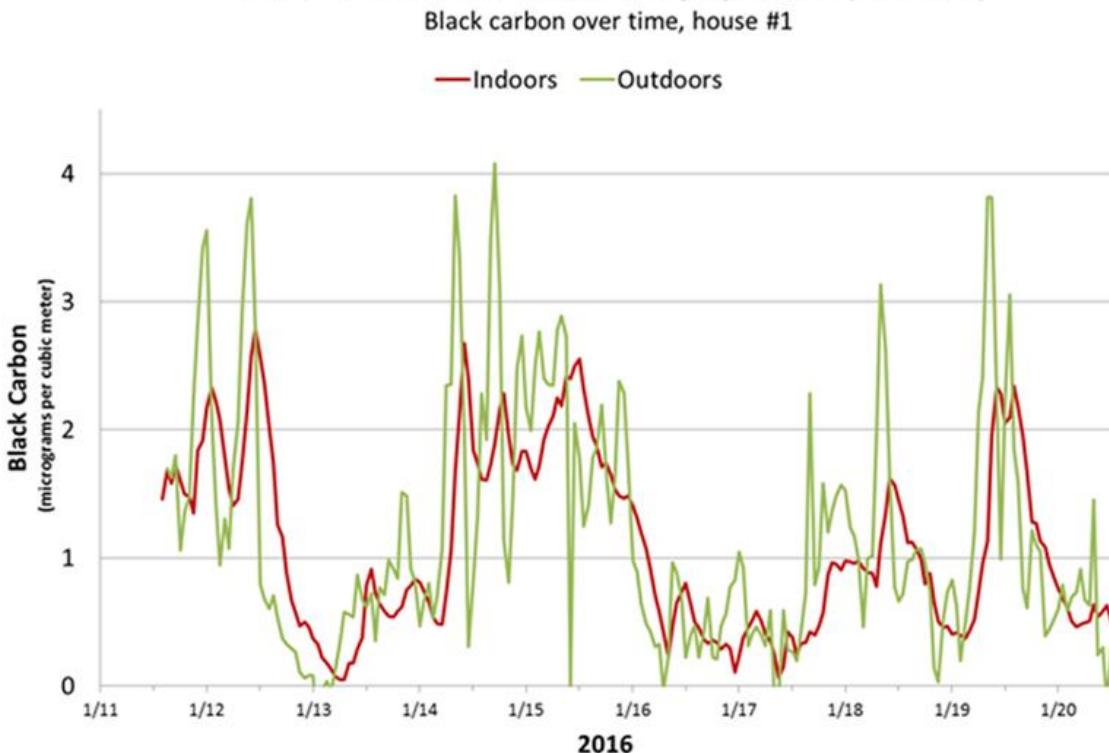
Do-It-Yourself Air Cleaners

<https://www.uofmhealth.org/news/sinus-hepa-0630>

<https://www.youtube.com/watch?v=K9bIWINK8hI>



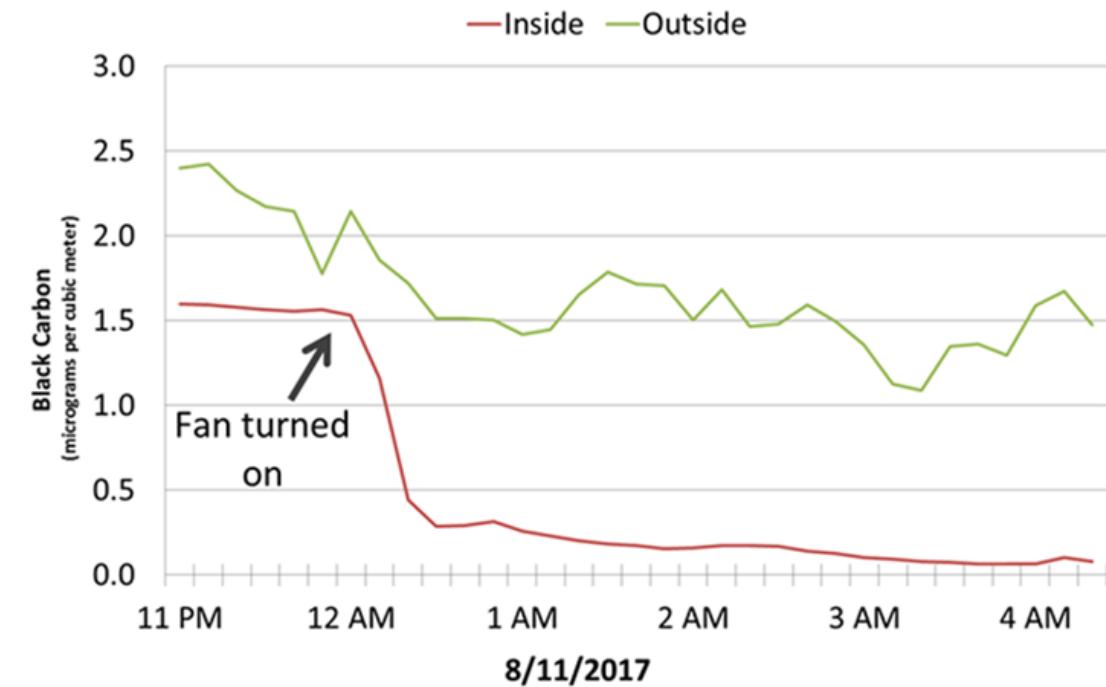
House with no filter/fan equipment (control)



Typical pattern of air pollution – outside vs inside

Example of filter/fan performance

Black carbon during wildfire smoke event, house #4, windows and doors closed



Pollution levels inside a small (12' x 12') room decrease after the filtered fan is turned on



Effect of Filter Fan Type:

A single filter is just as efficient as two filters stacked on top of each other.

Using two filters in a triangle, so that the surface area is doubled, enables the filter fan to reach a 90% reduction nearly twice as fast!

Furthermore, it can reach a lower level of particles over time than either a single filter or two stacked filters

FOR ANY DIY FILTERED FAN –DO NOT LEAVE UNATTENDED OR WHILE ASLEEP



TRIBAL HEALTHY HOMES NETWORK

Building knowledge, skills, and tools because your AIR MATTERS

Thank you!

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