

Episode 56FGc June 18, 2023. **PM2.5 is 25 times the size of a COVID 19 particle.** Stop burning wood so that expensive air purification indoors will be less needed.

1)HEPA or MERV filters. Can HEPA or MERV filters in HVAC systems work to control PM2.5?

How well do HVAC systems filter out PM2.5?

1a)Type of Filter.

The effectiveness of HVAC systems in filtering out PM2.5 depends on the type of filter used. Standard air filters are not very effective at filtering out PM2.5, but **high-efficiency particulate air (HEPA) filters can remove up to 99% of these particles.**

Here is a table showing the effectiveness of different types of filters in removing PM2.5:

Filter Type	Efficiency (%)
Standard air filter	10-20
MERV 13 filter	50-70
MERV 16 filter	70-90
HEPA filter	99

1b)Size of particulates.

It is important to note that the efficiency of a filter can also be affected by the size of the particles being filtered. **PM2.5 particles are very small, so even a HEPA filter may not be able to remove all of them.** Clean your HVAC system regularly.

This will help to remove dust and other particles that can build up over time.

Keep your home well-ventilated by using an air purifier.

How well do HVAC systems filter out wood smoke?

1c)Types of MERV filters.

HVAC systems can be effective at filtering out wood smoke, but the effectiveness depends on the type of filter used.

Higher MERV (minimum efficiency reporting value) filters are more effective at filtering out smaller particles, such as those found in wood smoke. **MERV 13 filters are recommended for most homes, but MERV 16 or higher filters may be necessary during times of high wildfire smoke.**

1d)Maintenance of HVAC system and filters.

Here are some tips for using your HVAC system to filter out wood smoke:

Replace your filter regularly. Smoke can quickly clog a filter, so it is important to replace it at least every month during wildfire season.

Run your fan on the "circulate" setting. This will help to circulate the air in your home and bring the smoke particles into contact with the filter.

1e)Choosing HEPA filter over a MERV filter. If you are concerned about the quality of the air in your home, you may want to consider installing a HEPA filter in your HVAC system.

2) Use Portable Air Purifiers. You can also take steps to reduce the amount of PM2.5 in your home by using an air purifier, and planting trees around your home

By taking these steps, you can help to improve the air quality in your home and reduce your exposure to PM2.5.

Here are some additional tips for improving indoor air quality:

2a)Change your air purifier air filters regularly. The frequency of filter changes will depend on the type of filter you use and the level of air pollution in your area.

2b)Recognize you may need an air purifier in addition to a HVAC system with HEPA filter.

Consider using a portable air purifier. A portable air purifier can be a good option for homes with central HVAC systems that are not up to the task of filtering out smoke.

3) Home insulation from wood smoke.

Here are some additional tips for protecting your health during wildfire smoke:

Seal up any cracks or gaps around windows and doors to prevent outside air from coming in.

Stay indoors as much as possible. If you must go outside, wear a mask that can filter out small particles.

Close your windows and doors. This will help to keep smoke from entering your home.

Moisten the air in your home. This will help to prevent smoke particles from drying out and becoming more difficult to breathe. You can do this by running a humidifier or taking a hot shower.

Turn on your central HVAC system or a portable air purifier. This will help to filter out smoke particles from the air.

4) When home insulation from PM2.5 is not enough.

Take breaks from the smoke. If you start to feel sick, go outside for some fresh air or take a break in another room of your home. If you have any health concerns, be sure to talk to your doctor.

5) Recognize and act on medical conditions caused by wood smoke.

If you have respiratory problems, it is important to take extra precautions to protect yourself from wildfire smoke. You may want to consider staying indoors and using an air purifier. You should also see your doctor if you experience any symptoms of respiratory distress, such as coughing, wheezing, or shortness of breath.

6) Masks. Based on particulate size, how well do N95 masks filter out wood smoke (PM2.5)?

N95 masks are designed to filter out 95% of airborne particles that are 0.3 microns or larger. Wood smoke particles can range in size from 0.1 to 10 microns, so N95 masks can be effective at filtering out some of the smaller particles in wood smoke. However, they may not be as effective at filtering out larger particles.

Here are some tips for wearing an N95 mask:

Make sure the mask fits snugly against your face.

Pinch the nosepiece to create a tight seal.

Adjust the straps until the mask is comfortable and does not move around.

Breathe in, slowly, and deeply, through your nose.

If you have any difficulty breathing, remove the mask immediately.

If you are experiencing any of the following symptoms, you should seek medical attention:

Cough

Wheezing

Shortness of breath

Chest pain

Fatigue

Headache

Nausea and vomiting

It is important to note that N95 masks are not a substitute for medical care. If you have any concerns about your health, you should consult with a doctor.

2500 nanometers/125 nanometers = PM2.5 is 20 to 25 times larger than COVID.

7) New York Times

June 17, 2023.

United States

<https://www.nytimes.com/2023/06/17/health/covid-ventilation-air-quality.html>

The New War on Bad Air

Excerpts edited by RAWSEP for brevity and clarity, and relationship to Residents Against Wood Smoke Emission Particulates.

Minimum standards.

A classroom in Pelham, N.Y., as smoke from Canadian wildfires descended last week.

In the United States today, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, or ASHRAE, sets widely used indoor air quality standards and specifies minimum ventilation rates. In practice, these rates typically govern how buildings are designed, rather than how they are operated day to day, and many structures deliver less fresh air than they were designed to provide, experts said.

The standards define acceptable indoor air quality as air that does not have “harmful” levels of “known contaminants,” and with which at least 80 percent of occupants are satisfied. But infectious disease is not a focus.

“It says nothing about, ‘Does this level of air quality protect you from risk of infection when flu is going around, or when there’s a novel epidemic disease, like Covid?’”. That is finally changing. ASHRAE is developing a new standard focused on reducing the transmission of airborne pathogens that applies both to new buildings and existing ones. It covers not only the rate of air exchange but also the use of filters and air cleaners, which can be highly effective ways to remove particles from the air. (Updated [ventilation guidelines](#) from the Centers for Disease Control and Prevention cover filters and air cleaners, too.) Although the focus is on infectious disease, many of these same strategies should provide protection from wildfire smoke or (residential wood smoke) that may seep into (public) buildings (and residential homes). But the new recommendations are unlikely to make a big difference unless they are incentivized or enforced in some way. There is little government regulation of indoor air quality, (as there is little government regulation of residentially generated wood smoke which infiltrates the homes of near neighbors from their neighbors’ residential wood burning). Some government entity “needs to take some responsibility”. We have an opening to wage a new war on bad air, experts said, one that will be aided by tools and technologies that were not available to 19th-century sanitary reformers, (such as PM2.5 monitors which are now low cost and available to place in the many hyper-localized areas near where residential wood smoke is generated by residential wood burning). But the key insight, and the animating spirit, is unchanged. “Our buildings,” said Dr. Allen, of Harvard, “should be seen as a public health tool.” (The yards of near neighbors of residential wood burners should also be seen as a public health tool. PM2.5, particulate matter of 2.5 micrometer size, is the perfect size to infiltrate the human lung, setting off a cascade of human health problems and early deaths. Wood smoke is 90% PM2.5. \$249 PurpleAir PM2.5 monitors hung from the eaves of houses of near neighbors of residential wood burners, purchased at cost now by near neighbors of residential wood burners, many of whom are Residents Against Wood Smoke Emission Particulates (RAWSEPresidents,) already provide data on PM2.5 air pollution levels above “safe” limits on U S AirNow maps of Smoke and Fire, alongside \$100,000 official Environmental Protection Agency PM2.5 monitors, correlated to official government monitor data with a simple mathematical formula. PurpleAir PM2.5 monitors also provide data on the PurpleAir map, a color guide from green to purple correlated to levels of safety on Maps of Smoke and Fire. That residential PurpleAir data is collected and available to the general public and government authorities 24 hours a day seven days a week, allowing download of data from hours overnight and on weekends when many wood burners burn, thinking they may escape detection, knowing what they do is polluting the air of near neighbors. This data from evening and weekends, as well as at other times, can provide evidence downloadable during normal government hours, that would allow government health departments to close down polluting residential wood burning violating E P A limits, without having to enter homes of wood burning residents, and without having to check certification of wood stoves. The Office of the Inspector General (O I G), watchdog of the E P A, stated in a February 2023 report that certification of residential wood stoves was flawed, allowing continued sale of highly polluting wood stoves, because of the lobbying of the wood stove industry for loopholes allowing continued polluting residential wood burning.

8a)RAWSEP View: On June 8, 2023, grade school children were sent home early in New Jersey because the wood smoke from wild fires still affected the young children by giving them headaches, in schools where “hospital grade” HVAC had already been installed. Wood Smoke (PM2.5) particles are 2.5 micron size, making them approximately 20 to 25 times the size of COVID particles which are 0.1 micron size. The most effective MERV filter, MERV 16 is 95% effective against 0.3 micron particles, which are about one ninth as large as PM2.5 and three times larger than COVID particles. HEPA (hospital grade) filters are 99.9% effective against 0.3 micron particles. N95 masks are effective in protecting human mouths and noses against COVID and PM2.5. N95 masks do not protect human eyes against PM2.5, and long term exposure to PM2.5 can lead to cataracts of the eye. $2500/125 = PM2.5$ is approximately 20 times larger than COVID.

8b)how much better is a HEPA filter than a MERV 16 filter? A HEPA filter is significantly better than a MERV 16 filter. A MERV 16 filter is capable of capturing 95% of particles in the entire test range (0.3-10.0 microns), while a HEPA filter

captures 99.97% of particles with a size of 0.3 microns. This means that a HEPA filter is able to remove even the smallest and most harmful particles from the air, such as mold spores, bacteria, and viruses.

MERV 16

95%

HEPA

99.97%

9c)The essay below sings the praises of MERV filters in public schools as a tool for fighting wood smoke pollution from wildfires. However, MERV filters are less effective than the more expensive HEPA filters. The essayist absurdly implies that particles from heated food themselves may be as harmful as wood smoke particles from wildfires. This may be a tactic for confusing the general public taken from the tactics of the cigarette lobby and the wood stove lobby, elevating the unreal harm from heated food to the real harm from wildfire wood smoke particulates. How can an essayist write about pollution from natural gas stoves, from heated food itself, and from the wood burning of wildfires (which produce 450 times the particulates as natural gas heating) and ignore a gigantic, but admittedly hyper-localized problem that can be easily solved by just regulating the pollution from residential wood burning and using readings from PM2.5 monitors to stop neighborhood polluting indoor residential wood burning? Stopping indoor residential wood burning requires individual wood burners to take responsibility for their actions, and the analogy of Mothers Against Drunk Driving (M A D D) with Residents Against Wood Smoke Emission Particulates seems more and more apt the more indoor residential wood burning is ignored. Drunk driving was an obvious problem, but other safety regulations affecting manufacture of cars happened decades before the danger of drunk driving was tackled by M A D D, and government regulation slowly and in stops and starts followed a truly grassroots movement, based on reactions of mothers to the deaths of their children caused by drunk drivers. Ralph Nader wrote “Unsafe at any speed” in the mid-1960s which got a reaction that led to the car industry manufacturing safer cars afterward. M A D D only forced the government to take action on drunk driving in the 1980s. Outdoor air quality matters as much as indoor air quality because wood smoke can infiltrate into the near neighbor’s home if it reaches the near neighbor’s yard. Also, the quiet enjoyment of a home with a yard involves being able to exit the home and enter the yard, such as when snow shoveling and or gardening, without fear of the effects of wood burning air pollution, especially when working hard or exercising outside. The particles in wildfires are the same particles in indoor residential wood burning emissions that affect near neighbors. It must be difficult to tiptoe around the elephant in the room, indoor residential wood burning, when endeavoring to talk exclusively about wildfire wood burning. The Ambient Air Quality Standards (AAQS) will affect indoor air quality because outdoor air infiltrates its way into indoor air. The difficulty is that the choice we make to use a natural gas stove, smoke cigarettes, and make other personal decisions in our own homes do not impact our near neighbors on the scale of deliberately emitting wood smoke from a smokestack made for the purpose of emitting pollution into our neighborhood, when indoor residential wood burning. The author foolishly, or deliberately diverts attention from the relative lack of particulate emissions from natural gas burning, by foolishly going on about the particulates generated by heated food itself, which is not a particular health risk. That seems like a diversion from the fact that natural gas emits 450 times less particulates than wood burning. On June 8, 2023, grade school children were sent home early in New Jersey because the wood smoke from wild fires still affected the young children by giving them headaches, in schools where “hospital grade” HVAC had already been installed. An engineer promoting technology to solve a problem that could be controlled (residential wood burning) by just following the motto as simple as individuals taking personal responsibility for wood burning by just not doing it. “Just stop burning things”. The engineer essayist is like a lobbyist promoting carbon capture rather than just stopping industrial coal burning for energy. This supposedly well-educated engineer essayist wrote “You may still smell smoke when wearing the mask because gas molecules can pass through it, while the much larger and more hazardous particles are blocked.” (RAWSEP’s response to the essayist is: This is wrong. Smaller particulate matter PM2.5, particulates of 2.5 micrometer size, are more harmful to human health than larger particles. PM2.5 is the perfect size to infiltrate the human lung, setting off a cascade of human health problems and early deaths. It is clear this is an engineer writing this essay, not a biochemist or biologist or physician studying human health effects or medicine). The essayist also writes, “But air quality is a problem big enough that we cannot leave it to individual actions” RAWSEP begs to differ. Taking personal responsibility not to take individual actions is the solution to the plague of residential wood burning particulate emissions. Not all solutions can be carrots. Individuals have to be held responsible for actions that harm the health of near neighbors. That is a first step, and with PM2.5 monitors, enforcement of shutting down indoor

residential wood burners can be done based on science. This essayist is a lobbyist for the engineering industry who sell HVAC systems, obviously. In the case of one New Jersey school, maybe the hard sell on HVAC systems should have been replaced, instead, by selling the concept of personal responsibility. Wildfire may seem unstoppable, but indoor residential wood burning definitely is stoppable, with regulations and enforcement of regulations, based on readings from low-cost PurpleAir PM2.5 monitors in the yards of near neighbors of indoor residential wood burners. Why not promote an obvious solution, instead of lobbying for more HVAC systems to be installed, possibly on the scale of carbon capture systems at coal fired or biomass (wood) burning plants which are scheduled to receive billions in subsidies from the U S government but are being proven ineffective and expensive over and over again. Why not promote stopping burning things entirely? Thank you, lobbyist for HVAC systems, for stating the obvious: wood smoke pollution is happening. No thanks, for not stating one obvious, low cost way to stop it, PM2.5 monitors used for regulation of residential wood burning, rather than installing expensive systems as afterthoughts, sales of which will line the pockets of HVAC manufacturers. The academic-sounding mention of the history of air pollution is gratuitous, as the professor appears to have learned nothing from history, such as the need for real solutions to real problems, as she notes that wood burning was recognized as polluting as far back as the ancient Romans.

<https://www.nytimes.com/2023/06/07/opinion/wildfire-smoke-air-quality-viruses.html>

10)What Wildfire Smoke, Gas Stoves, and Covid Tell Us About Our Air
June 7, 2023

Edited by RAWSEP for brevity and clarity and relationship to Residents Against Wood Smoke Emission Particulates.

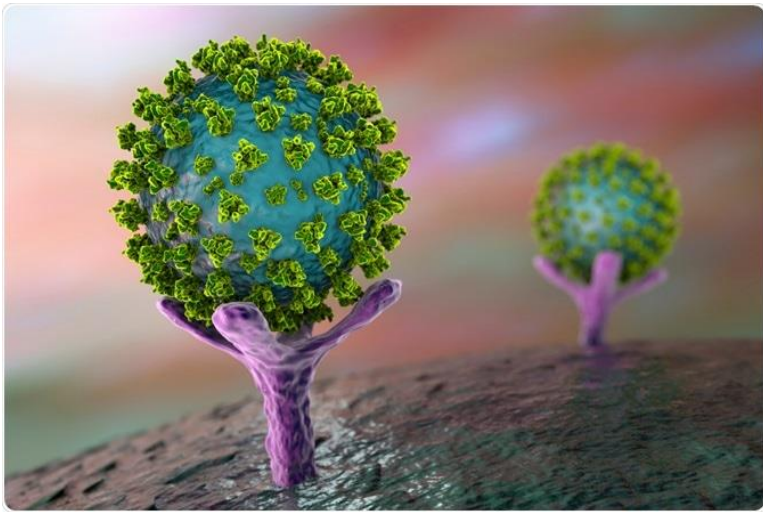
Time-lapse video of smoke from Canadian wildfires obscuring New York City's skyline on June 7, from 5 a.m. to 3 p.m.
Source: EarthCam

The essayist is an engineering professor and she studies the airborne transmission of viruses. We just lived through a pandemic caused by a tiny virus floating in the air. Now we are experiencing wildfires that send out [gigantic plumes of smoke](#) that can affect millions of people. If [the pandemic was whispering to us about air quality](#), the wildfires are screaming to us about it. Add to that concerns about [gas stoves](#) and longer allergy seasons. Air pollution is bad for us, and we've known that for a long time. The ancient Romans wrote about "heavy heavens" generated by [emissions from wood burning](#) and metal processing. In 1948, [killer smog](#) in Donora, Pa., affected nearly half the town's residents and inspired the Clean Air Act of 1970. National Ambient Air Quality Standards (NAAQS) are designed to protect health, but no such standards exist for indoor air quality for the public, though we spend about [90 percent of our time](#) indoors. [Also, NAAQS standards don't help when unstoppable plumes of wildfire smoke drift through our cities and towns.](#) The particles in [wildfire smoke](#) are about the same size as respiratory particles that carry the coronavirus, so some of the same tools we used during the pandemic also work for wildfire smoke. Indoors, the portable [air filtration unit](#) that some people used to scrub viruses from the air will also remove smoke particles. Run it on high. If you must go outdoors, wear a high-quality, well-fitting mask such as an N95 or a KN95, which are designed to filter out at least 95 percent of particles of all types. For gas stoves one of the greatest concerns is a nitrogen dioxide, [rather than a particulate pollutant](#), but [cooking by itself can generate large amounts of particles in the air](#). A strong kitchen exhaust fan can remove these pollutants. Air pollution, including wildfire smoke, causes coughing, burning eyes, headaches and difficulty breathing in the short term. Long-term exposure to air pollution causes cardiovascular disease, cancer, and asthma. Improvements in ventilation and filtration should happen in schools, and the federal government provided billions of dollars to do so. The Centers for Disease Control and Prevention recommended at least five air changes per hour to reduce the risk of virus transmission. Children spend long hours in classrooms that have insufficient ventilation.

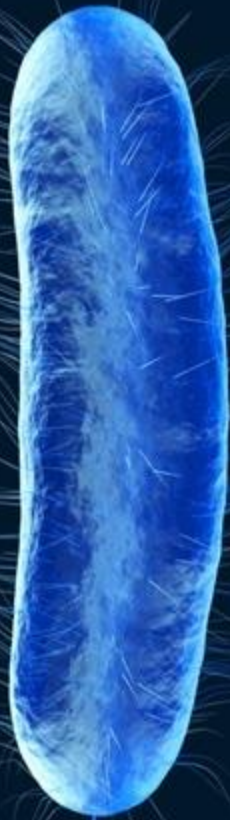
COVID Appendix

11)Masks. The size of particulates compared. COVID size, PM2.5 size, and effectiveness of N95 respirators and masks to block COVID and PM2.5.

N95 respirators made by different companies were found to have [different filtration efficiencies for the most penetrating particle size \(0.1 to 0.3 micron\)](#), but all were at least 95% efficient at that size for NaCl particles. A tenth of a micron is 100 nanometers, the size of a COVID 19 virus.



Giant viruses



Bacterium
(2 μm)



Pithovirus
(1.5 μm)



Mimivirus
(400 nm)



T4 Bacteriophage
(225 nm)



HIV
(120 nm)



Zika
(45 nm)



Parvovirus
(18-28 nm)



Parvovirus
(18-28 nm)