

Air Handling in the Era of Corona Virus: Roles Ventilation Can Play in the Control of COVID-19 Transmission in Non-Medical-Care Facilities

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Here are a few simple thoughts and ideas about using ventilation to help protect people at work, school and home during the COVID 19 pandemic. These ideas and approaches don't deal with all of the complex issues involved but they do offer some ideas and tips for consideration.

Avoid and control airborne viral particles. Sneezes, coughs and even talking¹ can generate small particles that they can carry the virus and transmit the disease to others. These particles are emitted into the air in front of the person, usually straight out or down from the face (if the person doesn't cough or sneeze into a sleeve). But then what happens to the particles in the air?

The particles come in a range of sizes. Some of the particles are "big" (as air contaminants go) and will settle out of the air on nearby surfaces: floors, tables, clothing, chairs, food, and so forth, potentially contaminating them. Smaller ones tend to move with the air in which they are floating.² If inhaled, the larger airborne particles tend to be caught in the upper regions of the pulmonary system, e.g., in the throat, nose and upper areas of the lungs. The smaller particles can reach the lower reaches of the lung.

Unfortunately, we don't know all the details of Covid-contaminated particles. There are still questions like: What is the illness transmitting capacity to other people of airborne corona virus particles? What sizes and concentrations can cause illness? What about a space where several people are contagious or sneezing often? How do these conditions and events effect airborne concentrations and disease transmission? Without complete answers, it is best to choose to be on the side of safety to protect people's health.

Enhance the dilution and dispersion of smaller airborne particles. Smaller particles tend to disperse and dilute as they float with the air, which

is naturally mixing itself at all times. We don't normally notice the air mixing because we often can't feel it, but it is turbulent, moving and mixing itself, helping to disperse and dilute air contaminants.³ We can help the air move, dilute and disperse air contaminants at greater rates if we optimize the ventilation in the space for these purposes. See below.

Tip 1. Social distancing and more. We can help protect ourselves from these particles by practicing physical distancing (six feet or more), moving away from a person who is coughing or sneezing, wearing gloves and masks, washing our hands and clothing, providing regular surface cleaning, and so forth.

Why physical distancing? The idea is that the larger particles released during a sneeze or cough will hopefully settle out and the smaller particles will disperse and/or be diluted by the time the contaminated air reaches our breathing zones.

Tip 2. Being upwind. Being upwind of a potential source of viral contaminant is even better because the contaminated air will move away from us. For example, if you're outside, notice how the wind is blowing. Then stand or sit upwind from others, if possible. Inside, look for the locations of the air supply registers and the return air grilles in the ceiling or walls. Try to sit upwind of others in the space, where that is possible and helpful.

Tip 3. Enhancing air circulation and dilution. We want to maximize the dilution and dispersion of the smaller particles. To meet current standards and codes, most modern offices and classrooms have heating, ventilating and air conditioning (HVAC) system controls that keep the fan running all the time, or that can be set to a "Fan On" or "Circulate" setting. This provides constant air movement through the occupied spaces, increasing local dilution of high concentrations of airborne particles (e.g., those found in the space where the sneezes, coughing and talking occurred). It also removes them at the air filter when the filter is adequate to collect these small particles.

Home furnace fans are not normally on all the time but can often be set to “On” or “Circulate.” When that is done and the air supply and return grilles are open, a furnace can circulate the air in a house in about 5-20 minutes. This can reduce high concentrations of airborne viral particles in a potentially contaminated room or space.

Tip 4. Provide Outside Fresh Air. We can increase the dilution rate if we set the HVAC system to bring outside air into the airflow, or if we can simply open windows and doors. The fresh air exchange will provide greater general dilution of air contaminants throughout the space served by the system. A typical classroom, for example, moves the air through the classroom about four times every hour when the system is running. If half of that is fresh air, it can reduce the concentrations of air contaminants in half in about 15 minutes. Check into it for your spaces.

Tip 5. Use High Efficiency Filters. Many airborne particles of concern can be captured or removed at the HVAC or furnace filter if it is equipped with a filter with a good filtration rating.

According to ASHRAE, a good choice in this era is a filter with a MERV 13 or higher rating, which is fine enough to remove most bacteria, micron-sized particles, pollen, mold spores, etc. Less efficient filters can help, too. Be sure you know what size and filter capacity the HVAC system or furnace can operate with. Some older home furnaces can't handle these more efficient filters because they are too big to fit in the filter housing, or they require too much static pressure to move the air through the filter. You may need to contact your HVAC/furnace supplier or installation people and ask about proper filter sizing, use and capacities.

Portable room air HEPA filter units can also help filter the air, e.g., in bedrooms, offices, classrooms, or other locations where there may be high concentrations of air contaminants.

When replacing a dirty filter, it's better to assume that the filter has viable viral particles. Follow instructions for filter replacement carefully, wear

gloves, respirators, masks, etc., and place dirty filters in plastic bags.

Tip 6. Wear Masks. Wear a mask when going to places like the office or store, even if you don't think you're sick, or you follow the social distancing rules. The mask can help protect others and can also keep your hands from touching your face and can actually filter or block some larger airborne sneeze and cough particles if you're next to or passing a person who happens to sneeze or cough near you. Try not to touch the mask when you're wearing it. Wash it after use, if reusable.

Tip 7. Use ventilation for safe use of disinfectants. During the pandemic, we do more cleaning, sanitizing, and disinfecting than normal. Some products contain potentially hazardous chemicals. To reduce chemicals getting into the air avoid unnecessary spraying, spray into a cloth and then wipe surfaces, or spray outside. Be sure to provide good ventilation, especially for more toxic products. And wearing your mask during spraying might help you avoid inhaling large spray particles.

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1. Interestingly, we know that small micron sized particles can be emitted even during talking, especially when speaking loudly.

2. You might have seen references to PM-10 and PM 2.5 particles that EPA and other environmentalist use when talking about air pollution. “PM-10” stands for “particulate matter 10 micrometers and less” in size. These are respirable particles that can reach the lower regions of the lungs.

3. Most people can't feel air movement on their hands indoors when the air velocity is below about 100 feet per minute (fpm) or below about 50 fpm on necks and ankles. Typical natural air mixing velocities are 25-35 fpm, moving in random directions, and we can't normally feel that. But we can see the mixing, say, when a match is lit or a candle is blown out and a little smoke is generated.

What happens to the smoke? It disperses and dilutes into the air due to the air mixing that naturally occurs. How much is a “foot per minute?” For comparison, 1 mph = 88 feet per minute. When walking leisurely, we walk at about 2 miles per hour. That is about 180 feet per minute. So when we walk around in calm weather we can usually feel the air movement on our hands.

Sources and Additional Resources:

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