



COVID-19 GUIDANCE

Ventilation, HVAC systems and COVID-19 risks

COVID-19 is thought to spread mainly through close contact from [person to person](#), primarily through respiratory droplets (larger particles) produced when a person coughs, sneezes, talks and sings. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own eyes, nose or mouth. In addition to close contact with infected people and contaminated surfaces, there is the possibility that the spread of COVID-19 [may also occur through airborne particles in indoor environments](#) (particularly in those with poor ventilation).

An important approach to lowering the concentrations of indoor air contaminants including any viruses that may be in the air is to increase ventilation by increasing the amount of outdoor air coming indoors. Ensuring proper ventilation with outside air can help reduce the concentration of airborne contaminants, including viruses. However, by itself, increasing ventilation is not enough to protect people from COVID-19. When used along with other best practices recommended by CDC and others, increasing ventilation can be part of a plan to protect people indoors. Managing a building's Heating Ventilation And Cooling system and other methods of increasing ventilation indoors can play a role as part of a plan to minimize COVID-19 transmission risk. However, it should not be relied on as the only plan - it should be recognized that other infection control practices are likely to play larger roles in [COVID-19 prevention](#). The most effective ways to reduce the risk of COVID-19 transmission are to:

1. Stay home if you are sick. Most people with COVID-19 have mild illness and can recover at home without medical care. Follow CDC's [what to do if you are sick](#) to prevent giving the virus to others.
2. Cover your face and nose with a face covering when in public and around others - even if you do not think you are sick.
3. Practice social/physical distancing: limit close contact with others by remaining at least 6 ft or more away at all times. Avoid physical interactions (shaking hands, hugs, etc.) and sharing items with others (e.g., pens, computers, tools).
4. Wash your hands often with soap and water or use alcohol-based hand rub with at least 60% alcohol often, especially after touching common, high-touch surfaces (e.g., door handles, elevator buttons).
5. Routinely clean and disinfect frequently touched surfaces.

What is known about COVID-19 risk in indoor environments?

Emerging scientific evidence suggests that SARS-CoV-2, the virus that causes COVID-19, may be spread via smaller airborne particles, which remain airborne for longer times and travel further distances than respiratory droplets. This means there is a possibility that the spread of COVID-19 may also occur via airborne particles in indoor environments, in some circumstances beyond the 6 foot social distancing

recommendations. Ensuring proper ventilation with outside air can help reduce the concentration of airborne contaminants, including viruses, indoors. In general, the greater the number of people in an indoor environment, the greater the need for ventilation with outdoor air. In other words, the ventilation rate should be based on the number of people that occupy an indoor space (and a few other factors). Special consideration should be given to increase indoor ventilation when occupancy is high, in areas with high-traffic flow and after occupants leave an area.

In addition to the information provided in this CDPHE Guidance, readers are encouraged to review the following resources related to COVID-19 and indoor air:

- <https://www.epa.gov/coronavirus/ventilation-and-coronavirus-covid-19>
- <https://www.epa.gov/coronavirus/air-cleaners-hvac-filters-and-coronavirus-covid-19>

Natural ventilation

Even with an open window or door, natural ventilation can be limited if inside and outside temperatures are similar and there is little wind. Below are strategies to increase natural ventilation indoors.

- Do not open windows and doors if doing so poses a safety or health risk to children or other family members, such as:
 - Risk of falling.
 - Bringing in unfiltered air that may contain pollen, dust, or air pollutants like particulate matter or ozone into the indoor space. These contaminants may cause respiratory irritation to sensitive subpopulations.
 - If the outdoor air quality in your area is particularly poor, opening windows and doors may not be recommended, as the benefit gained for COVID-19 risk reduction could be outweighed by the added risks from exposure to poor quality air. For example, if there are nearby wildfires that are adversely impacting air quality in the region or your building/facility is located near an area with exceedingly high traffic-related air pollution, outdoor air could contain levels of pollutants like particulate matter and ozone that can cause acute and long-term cardiopulmonary risks, particularly for individuals with pre-existing conditions like asthma or cardiovascular disease. To check air quality advisories for your area, check out [CDPHE's Air Pollution Control Division Air Quality Advisories](#) webpage.
- Opening doors and windows may affect the temperature and humidity of the indoor space, which could impact occupants' perceived comfort.
- Ventilation can be further increased through cross-ventilation, by opening windows (or doors) at opposite sides of a home (but preferably not directly opposite of each other), and keeping internal doors open.
- Opening the highest and lowest windows in a home at the same time (especially on different floors) can also help to increase ventilation.
- For double-hung windows (the most common type), opening the top sash of one window and the bottom sash of another also encourages ventilation. Even when using a single window, partially opening both the top and bottom sash can help improve ventilation.

- Local bathroom or kitchen fans that exhaust air outdoors and remove contaminants directly from the room where the fan is located also increase the outdoor air ventilation rate and can be turned on in areas that are occupied to increase ventilation.
- For more information on increasing ventilation in homes visit [EPAs Indoor Air in Homes](#).

Fan use

Consider using indoor fans in combination with open doors or windows to further increase ventilation. In addition to specialized window fans, box fans or tower fans can be placed in front of a window. Fans can face toward the window (blowing air out of the window) or away from the window (blowing air into the room).

- If a single fan is used, it should be facing (and blowing air) in the same direction the air is naturally moving. You can determine the direction the air is naturally moving by observing the movement of drapes, holding a light fabric, or dropping paper clippings and noting which direction they move.
- The direction the air is blowing (in or out of the home or building space) from a particular window or door may change at times, especially on windy days. If these changes are frequent, try moving the fan to another location. Also, you may not need to use a fan on windy days.
- To help reduce risks of airborne transmission, direct the airflow of the fan so that it does not blow directly from one person to another.
- Consider limiting or removing access to the area directly in front of any ground-level fans to prevent people from standing directly in front of the air flow discharge.
- Do not use rotating/oscillating fan heads that create “recirculation” and can push air (that may potentially contain virus particles) around in circles. Keep the fans pointing in one direction
- Oscillating fans may be used if there is no other way to avoid blowing air directly from one person to another. Circulate air away from breathing zones or in an upward direction if at all possible to avoid fully recirculating the air.
- Personal cooling fans should not be used in group settings, to reduce the potential spread of any airborne or aerosolized viruses. If personal cooling fans are removed, remain aware of, and take steps to prevent, heat hazards.
- Caution: Use caution when operating fans, particularly when children are present. Position fans so they are out of reach of small children and so they are stable and won’t fall over easily. Consider using a tower or other fan where the blades are concealed or completely shielded.

Use a portable air cleaner or air purifier if you have one

When used properly, air purifiers can help reduce airborne contaminants including viruses in a home or confined space. However, by itself, a portable air cleaner is not enough to protect people from COVID-19. When used along with other best practices recommended by the CDC, operating an air cleaner can be part of a plan to protect yourself and your family.

- Portable air cleaners with HEPA (high-efficiency particulate air) filters are likely the most effective. Other filter types, including ionizers and ozone generators, have not been proven in infection control and can generate harmful byproducts.
- Place the air cleaner in the room you or the most vulnerable people spend the most time. To help reduce risks of airborne transmission, direct the airflow of the air cleaner so that it does not blow directly from one person to another.
- Change filters in portable air cleaners according to manufacturer instructions for use.
- More information on portable air cleaners can be found on the US EPA's webpage: [Air Cleaners and Air Filters in the Home](#).

HVAC systems

Since running your HVAC system filters the air as it is circulated, it can help reduce airborne contaminants, including viruses, indoors. By itself, running your HVAC system is not enough to protect yourself and your family from the virus that causes COVID-19. When used along with other best practices recommended by CDC, operating the HVAC system can be part of a plan to protect yourself and your family.

Residential HVAC systems

- Run the system fan for longer times, or continuously, as HVAC systems filter the air only when the fan is running. Many systems can be set to run the fan even when no heating or cooling is taking place.
- Check to be sure the filter is correctly in place and consider upgrading the filter to a higher efficiency filter or the highest-rated filter that your system fan and filter slot can accommodate. Consult your HVAC manual or an HVAC professional for details.
- Open the outside air intake, if your system has one (this is not common for home systems). Consult your HVAC manual or an HVAC professional for details.
- If your HVAC system has an energy-efficient air-to-air heat exchanger, heat recovery ventilator (HRV), or energy-recovery ventilator (ERV), use it, as they increase ventilation.

HVAC in commercial buildings

The HVAC systems of large buildings typically filter air before it is distributed throughout a building, so consider upgrading HVAC filters as appropriate for your specific building and HVAC system (consult an HVAC professional). The variety and complexity of HVAC systems in large buildings requires professional interpretation of technical guidelines, such as those provided by ASHRAE and CDC. The EPA, ASHRAE and CDC recommend upgrading air filters to the highest efficiency compatible with the HVAC system and checking the filter fit to minimize filter air bypass and leakage.

The following best practices will ensure your system is operating optimally and decreasing the risk of indoor air contaminants and potential viral transmission:

- Ensure that you are maintaining the system so that it is operating optimally.

- Have an HVAC technician perform regular (at least twice per year) maintenance checks, cleaning, and upkeep to ensure the system is running smoothly.
- Ask an HVAC technician to make a basic assessment of airflow directions and system function, and adjust as recommended.
- Replace filters regularly and use the top-rated filters for the system (HEPA or MERV-13 or higher is best if the system can accommodate it and handle the pressure drop it creates).
- Set air exchange rates to the highest settings allowed by the system.
- Disable Demand-Controlled Ventilation (DCV) systems that allow an occupant to modify or adjust the system.
- Maximize the dilution of indoor contaminants by running the system as much as possible while the building is occupied.
 - Consider keeping the ventilation system running 24/7, removing the system from any economizer schedule on nights and weekends. This will ensure that the building is able to purge interior spaces after use.
 - Many buildings have HVAC systems that operate the ventilation system during occupied hours and then off completely at night or other periods when the building is unoccupied. While turning the system off may save energy, maintaining airflow after the space is occupied will help “flush” air through and can clear any contamination of the space that occurred while it was occupied.
 - If HVAC is turned off or airflow rates minimized when the space is unoccupied, it is recommended to turn back on or increase to full capacity and run the system for at least 2 hours before occupancy, and 2 hours after the last cleaning is completed before turning off again.
 - Maintaining air circulation when spaces are not occupied, allows clean air exchange to occur between occupants.
 - If the space will be unoccupied for an extended period of time, turning off the HVAC/ventilation may make sense. Allow the system to flush air through the space for some time after occupants leave (e.g., 24 hours) before shutting it off, and then when restarting the system again before occupancy, allow time for air exchange before the space is reoccupied.
 - Follow manufacturer guidelines for your system- avoiding running systems continuously that are designed to be run intermittently (e.g. bathroom fans).
- Design the system to have unidirectional “clean-to-dirty” airflow, directing contaminants toward exhaust registers and grilles via uniform, non-mixed airflow patterns. Do not recirculate air if possible.
 - In this context, areas that are more likely sources of SARS-CoV-2 emissions are the “dirty” areas, whereas areas with less potential sources of SARS-CoV-2 are the “clean” areas. People who are sick are the source of airborne SARS-CoV-2.
 - “Dirty” areas are places where more people congregate (e.g., a crowded lobby or break room is “dirty” compared to a hallway or open low-density workspaces) or areas where people spend more of their time (e.g., an office space someone sits in for several hours would be “dirty” compared to a hallway where they pass through briefly).

- Set the direction of vents/exhaust and fans to move air from "clean" areas that are less likely sources of potential SARS-CoV-2 towards the "dirty" areas with sources of potential SARS-CoV-2, rather than the other way around. A commercial building's HVAC system likely has this "clean to dirty unidirectional flow" as a built-in feature. It may be modified when people have manually altered vent openings to blow air in different directions, blocked vents or exhausts with furniture, add standing fans, etc.
- Ensure vents and exhausts are not covered or blocked by furniture.
- Promote dilution of indoor air by maximizing intake of outdoor air supply and reducing recirculation of air. Open windows and doors to draw outdoor air in as much as possible. Generally, outdoor air will be "cleaner" than air that's been recirculating inside where people are located.
- If your space and use profile allows, purposefully leaving common areas or rooms empty to allow air exchange to occur between groups of occupants is recommended. For example, an office building should avoid scheduling back-to-back meetings in conference rooms or alternate meetings between two conference rooms, if space allows.
- If COVID-19 cases are identified in the building:
 - Change filters including those in portable units, while the system is turned off (do not have occupants in the space while the system is off). Wear gloves and respiratory protection when changing the filter and dispose of the filter media in a sealed bag.
 - Run the HVAC system at the maximum air exchange rate for which it is designed. It is recommended that the space remains empty of other occupants, if possible, for 24 hours while air exchange occurs.
- Consider consulting with an industrial hygienist with expertise in air/HVAC for an evaluation.

UV light and other disinfection systems

- UV light or other microbial disinfection systems are generally used for infection prevention in hospitals and other areas where there is the expectation of higher levels of airborne infection risk. In most buildings occupied by the general public (e.g., office spaces, retail stores, restaurants, schools), circulating airborne contaminant concentrations are expected to be low. Additionally, most of these systems have not been tested specifically for effectiveness related to SARS-CoV-2 / COVID-19.

Resources

EPA

- [Indoor Air and Coronavirus \(COVID-19\) | Coronavirus \(COVID-19\)](#)
- [Ventilation and Coronavirus \(COVID-19\) | Coronavirus \(COVID-19\)](#)
- [Air Cleaners, HVAC Filters, and Coronavirus \(COVID-19\) | Coronavirus \(COVID-19\)](#)
- <https://www.epa.gov/coronavirus/will-ozone-generator-protect-me-and-my-family-covid-19>
- [Is there HVAC guidance that building and maintenance professionals can follow to help protect from COVID-19?](#)
- [Will an air purifier protect me and my family from COVID-19 in my home?](#)

- https://www.epa.gov/sites/production/files/2018-07/documents/guide_to_air_cleaners_in_the_home_2nd_edition.pdf
- https://www.epa.gov/sites/production/files/2018-07/documents/residential_air_cleaners_-_a_technical_summary_3rd_edition.pdf

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.)

- [COVID-19: Resources Available to Address Concerns](#)
- [ASHRAE Reopening Schools and Universities C19 Guidance](#)
- [ASHRAE Position Document on Infectious Aerosols](#)
- [Guidance for Building Operations During the COVID-19 Pandemic](#)
- [ASHRAE Issues Statements on Relationship Between COVID-19 and HVAC in Buildings](#)

Other

- <https://ww2.arb.ca.gov/our-work/programs/air-cleaners-ozone-products/california-certified-air-cleaning-devices>
- <https://www.cdc.gov/infectioncontrol/guidelines/environmental/background/air.html>
- <https://www.epa.gov/coronavirus/there-hvac-guidance-building-and-maintenance-professionals-can-follow-help-protect-covid>