

Guidance for Ventilation and Air Filtration Systems



Why is it Important to Ventilate Indoor Spaces?

Shared indoor spaces significantly increase the risk of COVID-19 transmission. Current scientific evidence shows that COVID-19 most often spreads by breathing in air while close to an infected person. When an infected person talks, coughs, shouts, sings, or even just breathes, they breathe out small particles that contain the virus. These particles can be breathed in by other people. Air containing virus particles can linger in indoor spaces for long periods of time, particularly if the spaces are enclosed and poorly ventilated. The risk of COVID-19 transmission also increases significantly when people remove their face coverings (including when eating or drinking), and it increases with every person from a separate household who shares the same indoor area.

It is always safest to avoid gathering with individuals outside one's household. And locating activities outdoors—where wind and sunlight can disperse particles and inactivate the virus—is safer than indoors, particularly if the activity requires the removal of face coverings.

If activities must take place in shared indoor spaces, managing the indoor air won't eliminate the risk of COVID-19 transmission, but it can significantly reduce it, particularly when combined with other safety precautions (like use of face coverings, limits on the number of people in the space, and vigilant social distancing).

As stated by the U.S. Centers for Disease Control and Prevention (CDC) in its [scientific brief on airborne transmission of coronavirus](#), "**ventilation** and **avoidance of crowded indoor spaces** are especially relevant for enclosed spaces, where circumstances can increase the concentration of particles in the air carrying infectious virus."

In general, the more people you have in an indoor environment, the greater the need for increasing the circulation of fresh, outdoor air to dilute airborne particles. Provide fresh air to the areas of your buildings with the highest number of occupants. In areas where you are unable to increase outdoor air, reduce the number of people even further, space people greater than six feet apart, and take other measures to improve ventilation and air filtration.

Who Should Follow This Guidance?

This guidance is intended to assist a wide variety of businesses, offices, schools, restaurants, faith-based organizations, and other non-healthcare industries in identifying general steps to improve ventilation in indoor spaces and reduce the risk of transmission. Healthcare facilities should follow their Infection Prevention and Control Plan and other healthcare-specific requirements.

What Steps Should My Facility Take to Improve Ventilation and Air Filtration?

Take the following steps to improve the quality of indoor air in your facility and reduce the potential for long-range, airborne coronavirus transmission:

1. Require Face Covering Use – Face coverings can help reduce the risk of transmission in an indoor environment by as much as 50%. Face coverings must be worn by almost everyone most of the time when in shared indoor spaces. Good ventilation and air filtration is especially important for indoor facilities like restaurants, where face coverings must be temporarily removed to engage in activities like eating and drinking. Note that face shields have not been shown to protect against aerosols and are not a substitute for face coverings. Face shields may be used in addition to face coverings, but not in lieu of them.

2. Increase Outdoor Air Exchange – Increasing outdoor air circulation is one of the simplest ways to reduce risk of COVID-19 transmission, so long as doing so doesn't pose a greater safety or health risk to anybody using the facility.
 - **Open doors and windows** to increase fresh air circulation when environmental, building, and safety conditions allow. Consider modifications to your facility to make opening doors and windows safe and feasible: like replacing non-opening windows with ones that easily open or installing mesh screens or grates. If your building also has a mechanical ventilation system, be sure to evaluate the impact of open windows/doors in accordance with step #3 below.
 - **Consider using portable fans** to maximize the effectiveness of open windows and doors. However, if doing so, be careful to position fans to point away from occupants and to avoid blowing air from one person to another (which may spread the virus). Instead, position fans near doors and windows and use them to draw or blow air from the inside of the facility to the outside, instead of blowing air inside. Create an airflow plan to maximize the movement of indoor air to the outside.

3. Upgrade Existing Mechanical Ventilation System - If your facility has an existing Heating, Ventilation, and Air Conditioning (HVAC) system, have it evaluated by an experienced HVAC professional to make sure it is functioning properly and to consider feasible and appropriate upgrades. Upgrades may increase circulation of outside air and also remove presence of aerosols through filtration. Consider upgrading the efficiency of your system's mechanical filter to the highest efficiency compatible with the air handling system and currently installed filter rack; ideally, filter efficiency should be MERV 13 or greater. Be sure to regularly inspect air handling systems and filters to ensure they are properly operating, and filters are appropriately installed, serviced and within service life. Consider adopting these additional ventilation and air filtration protocols as appropriate to your system:
 - Increase the percentage of outdoor air through the HVAC system, readjusting or overriding recirculation ("economizer") dampers.
 - Try to keep the humidity between 40% and 60%.
 - Run air handling systems for longer hours, including before and after the space is occupied.
 - Seal edges of the filter to limit bypass.

What Steps Should My Facility Take to Improve Ventilation and Air Filtration? (Continued)

- Disable demand-control ventilation (DCV) controls that reduce air supply based on temperature or occupancy, and maintain systems that increase fresh air supply.
- Increase total airflow supply to occupied spaces, if possible.
- Ensure ongoing, routine maintenance of the HVAC system in all areas, but especially smaller rooms with exhaust fans, such as restrooms, laundry rooms, and kitchens.
- Monitor the effectiveness of the system by measuring ventilation directly, when possible. Building owners/operators can review specific components such as air flow rates (outdoor air vs. recirculated air) and the pressure differences between higher risk areas (e.g., bathrooms and dining areas) and other areas.

For further detail, see the October 5, 2020 [Guidance for Re-Opening Buildings](#) by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).

4. Install Portable Air Cleaners – A variety of portable air cleaners, commonly called HEPA filters, can be purchased and used in indoor spaces to increase the removal of small airborne particles. Consider using these filters where there is no or poor outdoor ventilation, no HVAC system, or when upgrades to the HVAC system are not feasible. These come with a range of sizes, features and prices. It is recommended to purchase units which are [certified for ozone emissions and electrical safety](#) by the California Air Resources Board (CARB), and to [avoid ozone-producing air cleaners](#). Also ensure the unit is appropriately sized for the room it is used in, using methods such as the [Clean Air Delivery Rate \(CADR\)](#).
5. Additional Considerations
 - Locate indoor activities in large rooms that have high ceilings, creating more space for exhaled particles to disperse. Control the number of people entering the room.
 - Set ceiling fans to pull air upward, rather than pushing it downward toward room occupants.
 - Consider, where appropriate, installing appropriately designed and deployed ultraviolet germicidal irradiation (UVGI) to deactivate airborne virus particles.
 - Note that ventilation and air filtration measures also apply to enclosed tents set up for events or businesses. Open tent sides as much as possible to increase outdoor air exchange, and note that tents with two or more closed sides qualify as indoor spaces under the County’s Health Officer Order.

Consult an HVAC Professional

The information in this guidance is for general audiences who may have questions about air quality in buildings and mitigation measures to reduce risk of airborne coronavirus transmission. Many buildings have complex HVAC systems, and it is important to work with an HVAC professional to evaluate your building’s ventilation, filtration, and air cleaning system and consider the upgrades and improvements that are appropriate to your system and space.

Additional Resources:

United States Centers for Disease Control:

[Employer Information for Office Buildings](#)

[Operating schools during COVID-19: CDC's Considerations](#)

[Wildfire Smoke and COVID-19: Frequently Asked Questions and Resources for Air Resource Advisors and Other Environmental Health Professionals](#)

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

[ASHRAE Resources Available to Address COVID-19 Concerns](#)

[Guidance for Building Operations During the COVID-19 Pandemic](#)

[ASHRAE Reopening Schools and Universities C19 Guidance](#)

[ASHRAE Epidemic Task Force: Building Readiness](#)

United States Environmental Protection Agency:

[Ventilation and Coronavirus \(COVID-19\)](#)

[Indoor Air in Homes and Coronavirus \(COVID-19\)](#)

[Science and Technical Resources related to Indoor Air and Coronavirus \(COVID-19\)](#)

[Guide to Air Cleaners in the Home](#)

World Health Organization:

[Q&A: Ventilation and air conditioning in public spaces and buildings and COVID-19](#)