



Introduction

Understanding how indoor ventilation affects the spread of COVID-19 can help people in Canada make safe choices. The virus that causes COVID-19 spreads from a person that is infected through the air, by respiratory droplets and aerosols. An infected person releases the virus when they breathe, talk, sing, shout, cough, or sneeze. Risk of COVID-19 spread is highest when people from different households gather in enclosed spaces and are in close contact.

In combination with other public health measures, good indoor ventilation can decrease the concentration of aerosols that may be suspended in the air and help reduce the spread of COVID-19. Employers can protect their workers and visitors by implementing [multiple control measures](#) in a layered approach, including:

- Providing properly ventilated workspaces.
- Minimizing the number of persons in a space at the same time.
- Preventing people who are sick, even with mild symptoms, from entering the workplace.
- Requiring occupants to maintain the greatest physical distance possible (at least 2 metres).
- Requiring occupants to wear well-constructed, well-fitting masks.
- Requiring occupants to practice good hand hygiene and respiratory etiquette.
- Moving gatherings to outdoor or large, properly ventilated spaces instead, if possible.

This tip sheet gives information and advice on indoor ventilation and how it relates to COVID-19. It also provides guidance to building owners and occupiers, workers, and visitors on ways to reduce the spread of infectious diseases which spread through the air, including COVID-19.

While this guidance is applicable to most indoor spaces, many factors must be considered before implementing any of these suggestions such as current local public health measures, [occupancy level](#), size of the space and the [types of activities](#) occurring in the space.

What is Ventilation?

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines ventilation as "the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within a space."

Ventilation can be natural or mechanical.

Natural ventilation includes allowing air into and out of a space by opening exterior windows and doors.

Mechanical ventilation is most often provided by Heating, Ventilation and Air Conditioning (HVAC) systems. These systems have motor-driven fans or blowers that condition and circulate air throughout a space through ducts. HVAC systems must comply with local building codes and be appropriately designed according to the size and type of building. They require regular inspections and maintenance such as filter and parts replacement. A properly functioning HVAC system will evenly distribute filtered air to all areas of a building at a comfortable temperature and humidity, while preventing areas of stale air from forming. Modern industrial HVAC systems are designed to provide ventilation (i.e., introduce outside air into buildings) according to published standards.

Note that re-circulation of stale air within a space when using pedestal fans or ceiling fans is generally not recommended as a protective measure for COVID-19 when the fans may be blowing the air from one person to another.

How Ventilation Impacts the Spread of Viruses

- Ventilation dilutes the concentration of contaminants (including viruses) in the air by allowing clean outside air into a space and removing potentially contaminated air.
- The accumulation of COVID-19 viruses in a space depends on:
 - Ventilation rate
 - Humidity
 - Air mixing patterns



- Room size
- Number of infected occupants and the amount of virus they are releasing (viral shedding)
- The type of activity (e.g., singing, speaking loudly, exercising, etc.)
- Even in a properly ventilated space, COVID-19 can spread between people in close contact, particularly if [public health measures for individuals](#) are not followed.
- Large indoor gatherings or heavy exertion activities can cause viruses to accumulate in the air faster than ventilation can dilute them. This effect is more pronounced in small spaces with less air volume.

Maintenance, Equipment and Other Air Quality Considerations

- Ensure that ventilation systems are properly rated and configured for the layout of the space, type of activity, and maximum occupancy.
- Keep HVAC systems maintained according to manufacturer's recommendations, including using appropriate filters.
- Make sure that maintenance workers are properly trained and protected (e.g., personal protective equipment (PPE)) when performing HVAC system maintenance (e.g., used filters might be contaminated with the virus).
- Avoid directing the airflow from person to person. Adjust air supply vents and fans, if necessary.
- If outside air is of low quality (e.g., contains allergens, smoke from wildfires, or heavy smog), it may be necessary to minimize the outside air intake into a building or pre-filter the air as it enters the building.
- Inspect all drains regularly to make sure that all air sources from sanitary sewer systems are not leaking into interior spaces.
- Install lids on all toilet seats and keep the lids closed, particularly during flushing.

Improving Ventilation

Improving ventilation is one layer of protection for the occupants of a space. HVAC systems are complex; consult with an HVAC professional before making any changes.

- Upgrade HVAC system filters to the highest rated Minimum Efficiency Reporting Values (MERV) or High Efficiency Particulate Air (HEPA) filters compatible with your ventilation system(s).
- Run ventilation systems continuously at low speed. Alternatively, run systems for 2 hours at maximum airflow before and after the space is occupied.
- Improve ventilation effectiveness (e.g., optimizing air flow patterns). This improvement can reduce contaminants more efficiently without needing to increase the number of air changes per hour.
- Most ventilation systems recirculate some air. Adjusting the system to maximize outdoor air intake will provide more air dilution in a space.
- Some systems are designed to adjust ventilation according to occupation level such as demand-control ventilation (DCV) or variable air volume (VAV). Bypass or temporarily reprogram these systems to provide continuous ventilation.
- Open windows and doors to allow outside air in, as weather permits and if it does not pose a safety risk to the occupants. Doing so, even for a few minutes at a time throughout the day, [is recommended](#) and can improve ventilation.
- Continuously run local exhaust fans in washrooms and kitchens.

Additional Considerations for Improving Indoor Air Quality

Consult an HVAC professional about upgrades designed to improve indoor air quality.

- Consider installing ventilation system upgrades such as ultraviolet germicidal irradiation (UVGI), heat or energy recovery ventilation (HRV or ERV), or an air economizer. These upgrades should only be installed by HVAC

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professionals and the technology must be approved by Health Canada.

- Maintain indoor air humidity between 30-50%. Having indoor humidity in this range can decrease the time respiratory aerosols (which may contain viruses) remain suspended in the air. Improper humidity levels could lead to:
 - the drying of mucous membranes of occupants (making them susceptible to infection), and
 - increase the length of time that viruses remain viable on surfaces and in the air.
- The use of a portable air cleaners with HEPA filters can be considered in areas with poor ventilation, or where natural or mechanical ventilation is not feasible. Using portable air cleaners has not specifically been proven to be effective against the virus that causes COVID-19 and they require ongoing maintenance for effective operation. As such, they should not be used alone or as a replacement for adequate ventilation and other [public health measures](#) such as physical distancing. Always follow manufacturer's set up and maintenance recommendations when using a portable air cleaner.
- Circulating air within a space may help spread viruses and other contaminants. Carefully evaluate all air circulating fans. Ensure that fans are positioned to blow inside air to the exterior and avoid placing fans that blow air from person to person.

Protect Yourself and Others

- For general COVID-19 prevention practices, both employers and workers can refer to [Protect Yourself and Others from COVID-19](#).
- Avoid poorly ventilated spaces. Possible indicators of poor ventilation include:
 - Blocked or missing ventilation ducts
 - Dust or smoke in the air
 - Stuffy, humid air
 - Lingering odours
- If you are concerned about the air quality in a space, ask your employer:
 - Has the system been inspected and maintained regularly?
 - Have filters been replaced as needed?
 - Do the filters have the highest possible MERV ratings for this system?
 - Has the system been set to the maximum air changes per hour?

All answers should be 'yes' if systems are properly inspected, maintained and adjusted.

- Trust your senses: if you smell, taste or see the air quality deteriorating in your surroundings seek fresh air and inform building management about your observations.
- Educate yourself about building ventilation using trusted sources of information (i.e., Health Canada, Public Health Agency of Canada (PHAC), National Collaborating Centre for Environmental Health (NCCEH), Centers for Disease Control and Prevention (CDC), ASHRAE).
- Monitor air conditions in your workplace. If you notice that air circulation stops or it gets unusually hot, cold or humid, leave the space, if possible, and notify your manager. If working in a space where air quality or ventilation is a concern and cannot be improved, consider the use of portable air filtration devices with HEPA filters. Follow the manufacturer's advice regarding use and placement to maximize air filtration.
- Consider using [carbon dioxide \(CO2\) monitors](#) as a tool to track the air quality of an indoor space. High CO2 levels may indicate poor indoor air ventilation, and may require a response (e.g., opening a window, reducing the number of people in the space, relocating the activity outdoors or to a better ventilated space). CO2 levels alone do not reflect risk of transmission, other factors should also be considered.
- For work tasks of a hazardous nature, follow your existing job-specific PPE requirements, such as respiratory protection or other PPE.

Resources

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- [Indoor Ventilation During COVID-19 video](#), CCOHS
- [Roadmap to improve and ensure good indoor ventilation in the context of COVID-19](#), WHO
- [Ventilation in Buildings](#), CDC
- [Ventilation and the indoor environment](#), Health Canada
- [Heating, Ventilation and Air Conditioning \(HVAC\) Systems in Buildings and COVID-19](#), Public Health Ontario
- [COVID-19: Guidance on indoor ventilation during the pandemic](#), PHAC
- [COVID-19: Improving indoor ventilation](#), PHAC

If you or someone you know is in crisis, please contact your local hospital, call 911 immediately, or contact a [Crisis Centre in your area](#).



It is important that mental health resources and support are provided to all workers, including access to an employee assistance program, if available.

For further information on COVID-19, refer to the [Public Health Agency of Canada](#).

Note that this guidance is just some of the adjustments organizations can make during a pandemic. Adapt this list by adding your own good practices and policies to meet your organization's specific needs.

Disclaimer: As public and occupational health and safety information is changing rapidly, local public health authorities should be consulted for specific, regional guidance. This information is not intended to replace medical advice or legislated health and safety obligations. Although every effort is made to ensure the accuracy, currency and completeness of the information, CCOHS does not guarantee, warrant, represent or undertake that the information provided is correct, accurate or current. CCOHS is not liable for any loss, claim, or demand arising directly or indirectly from any use or reliance upon the information.