NRC-RIM
National Resource Center for
Refugees, Immigrants, and Migrants

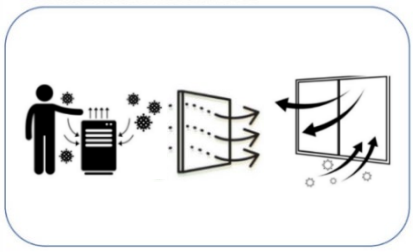
Ventilation as an essential control strategy to avoid contagion

The main mechanism by which we can get COVID-19 is through the air. This occurs when we breathe in air containing aerosol particles or fine droplets that are contaminated with the virus. These particles are small enough to travel great distances and stay in the air for long periods of time. Enclosed spaces with poor ventilation and lack of controls like face protection, hygiene, and physical distance, present a higher risk of transmission.

What considerations should we have when we want to implement better ventilation strategies?

The ventilation of a room is classified as "adequate" when the amount of clean air provided is enough to decrease and dilute the amount of virus particles that may be present. Due to the differences between rooms and structures and varying usage of theses spaces, individual evaluations should be conducted. There is no single answer on how to ventilate, but combining some of the following strategies with others such as the use of respirators or masks and physical distancing can reduce the risk substantially.

ENGINEERING CONTROLS

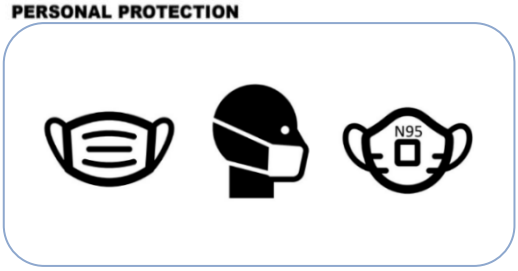


- Opening of windows for natural ventilation.
- Filters with Minimum Efficiency Reporting Values rated 13 (MERV-13) or higher.
- Independent filtration units with high efficiency filters (HEPA).

ADMINISTRATIVE CONTROLS

- Routine cleaning and disinfection of frequent contact surfaces.
- Hand washing and hygiene.
- Physical distance of 6 feet or more.

PERSONAL PROTECTION



- Determine the risk of COVID infection based not just on ventilation but also on individual vaccination status, health, and immunity, and length of exposure and crowd density.
- In higher-risk environments, use high-quality protection like a respirator. In medium-risk environments use a medical mask or respirator. It is recommended that you choose a respirator over a mask for increased protection if one is available.

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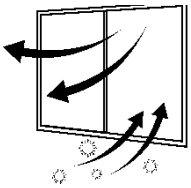
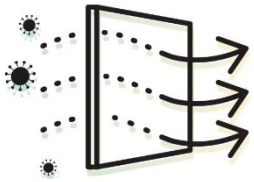
The National Resource Center for Refugees, Immigrants, and Migrants (NRC-RIM) is funded by the U.S. Centers for Disease Control and Prevention to support state and local health departments working with RIM communities. Learn more at nrcrim.umn.edu. Last update: 07/28/2023.

What measures do I have available to improve ventilation?

Each workplace is unique, and control and mitigation strategies must be adapted to the dynamics of each area and population. Here are some strategies you can use to improve indoor ventilation.



NATURAL VENTILATION can be used by opening doors and windows (if this does not pose additional risks). The ventilation can be improved through cross-ventilation by opening doors and windows that are on opposite walls. For pedestal or window fans, the wind should be blowing in the same direction as it is coming through the window.



Installation or improvement FILTERS in the building's heating and cooling systems (HVAC). Filters with Minimum Efficiency Reporting Values (MERV) with a range of 13 or higher can capture 70% of small particles that may contain the infectious virus.

Installation of AIR PURIFIERS that use high-efficiency (HEPA) filters. High-efficiency filters can capture 99% of small particles. It is important that the chosen unit has the adequate filtration capacity for the size of the space that needs to be improve.

ADJUSTMENTS can be made to window air conditioners and heating and cooling systems (HVAC) to increase the constant intake of outside air, the speed at which the air is expelled and its direction.

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Purifier Selection

There are several things that are recommended when choosing a portable air purifier (or standalone unit). The following checklist can help you make an appropriate selection.

- ☐ The portable air purifier is suitable for the size of the room where it will be used (see next section if you need assistance with this criteria).
- ☐ The unit meets at least one of the following criteria (you can find this information in the equipment manual, website or in the manufacturer's specifications placed on the packaging)
  - ☐ It is designated as HEPA
  - ☐ It has a clean air delivery rate (CADR)
  - ☐ The manufacturer indicates that the unit will remove most particles smaller than 1 µm.
- ☐ Avoid selecting units that contain additional processes such as UV or bipolar ionization.
- ☐ Do not use intentionally ozone generating units in occupied spaces.

Estimating the Air Exchange Rate

There are practical and easy ways and tools to estimate if a portable purifier is suitable for a room. The criteria that should be used is the amount of air exchanges per hour (ACH), that is, how many times the purifier can filter all the air in a room in a period of one hour. Ideally the ACH should be greater than 4.5.

To calculate ACH the following information is needed:

- ☐ The area of the room in square feet. This can be obtained directly from the site's blueprints, or by measuring the length and width of the room with a tape measure and then multiply to get the total area.
- ☐ The height of the room, that is, the distance from floor to ceiling. This can be obtained directly from the site's blueprints, or by measuring it with a tape measure.
- ☐ Volume of clean air emitted by the purifier per minute. This information is usually identified as CADR and can be found in the manufacturer's specifications or in the equipment manual.

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- The ACH can be obtain with the following formula:

$$ACH = \frac{CADR\ x\ 60}{(Area)x\ (Height)}$$

Important notes:

- If the calculated ACH does not reach the expected measurement, other models or devices can be explored or more of the same models can be added to add up their ACHs.
- These calculations only show the air flow. They do not measure how well the purifier works in its filtration or purification processes.
- These calculations do not take into consideration other air supply provided by HVAC, ventilators, or windows.

Other ways to disinfect the air and modifications to ventilation systems

There are air and surface disinfection mechanisms that use ultraviolet (UV) radiation. In the past, the UV-C range has been used as a germicide against various microorganisms and viruses like SARS-CoV-2. However, the use of UV-C as a disinfection mechanism has several limitations, mainly due to the health consequences that it can have on people if they are directly exposed. Therefore, the implementation of systems with this radiation must be carefully planned and with due protection for workers and visitors to the spaces in which it is installed. Less risky technologies with this radiation, such as Far UV-C, are being studied and have begun to show favorable results in terms of eliminating the virus while not presenting greater risks to humans. Both technologies are an addition to ventilation systems and should not be considered as a single solution for the air disinfection process.

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