## Draft

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### FAQs – Ventilation - Definitions

**What is HVAC?**

"HVAC" stands for Heating, Ventilation and Air-Conditioning. The three tend to work together through shared ducting in a building, so are called 'the HVAC system.'

**What is a building enclosure? (Also referred to as the building envelope.)**

The building enclosure is what separates the indoors from the outdoors including exterior walls, windows, doors, the lowest level floor and the roof. During the winter, the enclosure keeps the heat in and the cold out.

**What is ventilation?**

Ventilation is the process of maintaining clean and uncontaminated indoor air by adding or removing the fresh or recirculated air in a building. Indoor contaminants include particulates such as smoke, bacteria and viruses, gases, vapors, and mists.

**What is infiltration?**

Infiltration is air that unintentionally leaks into or out of a building enclosure. On windy days there is more infiltration due to differences in wind pressure. On cold days there is more infiltration because of the large temperature difference between indoors and outdoors.

**What is natural ventilation?**

Natural ventilation is the air that moves in or out of a building through intentional openings such as operable window and doors.

**What is mechanical ventilation?**

Mechanical ventilation uses fans or blowers to force air into or out of a building.

**What is exhaust air?**

Air that is forced by a fan or blower out of a building.

**What is supply air?**

Air that is forced by a fan or blower into a building.

**What is local ventilation?**

Local ventilation exhausts air from a point close to unwanted odor, moisture, heat or other contaminants including particulates, gases, vapors and/or mists. Common examples of local ventilation include bathroom exhaust fans and kitchen range hoods. Local ventilation is the preferred method for

removing contaminants; however in the case of viruses, people – who move around -- are the source of the contaminant so local ventilation is not an option.

**What is dilution ventilation?**

Dilution ventilation uses supply and exhaust air to flush out the building to reduce the contaminant to a safe level.

**What is recirculated air?**

Air recirculation mixes existing air within the building. Recirculated air can serve to dilute a contaminant from a local area of high concentration to a lower concentration throughout the building. Systems that recirculate air can also be used to clean the air using filters and other technologies.

**What is fresh air?**

Fresh air is outdoor air that is brought into a building.

**What is ACH?**

Air Changes per Hour (ACH) is a term used to measure airflow: how often the air volume of the building is replaced with new air, or the how much air is recirculated by the HVAC system within a given air volume in a building. One ACH of fresh air replaces the building's entire volume of air with new outdoor air in one hour. 12 ACH replaces indoor air with outdoor air 12 times in one hour. One ACH of recirculated air is a building's worth of air moved by an HVAC system in one hour.

**What is CFM?**

Cubic Feet per Minute (CFM) is another rate of air exchange used to express airflow.

**What is the Ventilation Code?**

The Ventilation Code is part of the standardized Building Code that defines the requirements for ventilation systems, including rates of change for fresh air and recirculated air. Ventilation rates in healthcare facilities are expressed as ACH in the code, and rates in all other building types are expressed as CFM in the code.

**What is filtration?**

Filtration -- by air filters, UVGC (ultraviolet germicidal irradiation) and electronic air filter – uses various methods, other than fresh air, to remove contaminants from buildings.

**What is ASHRAE?**

The American Society of Heating Refrigeration and Airconditioning Engineers (ASHRAE) is a resource for research and "best practices" for improving ventilation system performance.

**What is MERV?**

Minimum Efficiency Reporting Value (MERV) is a rating system for filters ranging from MERV 1 to MERV 20. The higher the MERV rating the better the filter is at capturing small particles of various sizes. ASHRAE guidelines suggest using MERV 13 filters in existing systems if possible. Higher-rated MERV

filters are difficult to retrofit in existing HVAC system because of physical size constraints, because they take additional fan energy to push the air through the filter which can be impractical in older systems.

**As a contaminant how does coronavirus compare to other contaminants?**

Coronavirus is characterized as follows:

- Potentially severe in its effects
- Highly contagious
- Associated with a significant percentage of infectious, although asymptomatic, individuals
- Transmitted person-to-person
- Initiating respiratory infection through inhalation and contact with the eyes, nose, and mouth
- Having an unknown infectious dose range

**What is the particle size of the coronavirus that causes COVID-19?**

- SARS-CoV-2, the virus that causes COVID-19 is very small at about 0.12 microns. For comparison, a human hair has a diameter of 50 microns, 400 times larger than the virus. At 0.12 microns the coronavirus is sufficiently small to remain suspended in the air and is difficult to remove.

**What is ionization?**

Ionization technology adds positively or negatively charged ions to the air. The ions cause particles to attract each other, creating larger particles that drop out of the air by gravity or are now large enough to be captured by an air filter. Although ionization technology has been around for many years, there is little data on its effectiveness so ASHRAE considers it to be "an emerging technology." If used, ionization-treated air should be used to supplement not replace outside air and should be used with other measures such as filters, masks and physical-distancing to reduce the risk of COVID-19.

**References**

*Industrial Ventilation, A Manual of Recommended Practice, 24th Edition, ACGIH (American Conference of Governmental Industrial Hygienists)*

*ASHRAE (American Society of Heating, Refrigeration, Air-conditioning Engineers), 2020 ASHRAE Handbook, HVAC Systems and Equipment*

*International Mechanical Code, International Code Council, Inc.*

*ANSI/ASHRAE/ASHE Standard 170-2017, Ventilation of Health Care Facilities*

**FAQs – Residential**

**Why is outdoors safer than indoors?**

The amount of fresh air exchanged indoors is small compared to the outdoors. Contaminants in the air outdoors are quickly diluted, which protects humans from harm.

Example: Take a home with 9-foot ceilings and 1000 sq. ft. of living space. If you exposed that space to a light breeze (5 mph), you'd get ventilation of 820 ACH (air changes per hour). Yet the ventilation code requires a minimum of just 0.35 ACH for homes. So that 5 mph breeze you feel outside provides more than 2300 times more ventilation than a code-compliant home. Even if you increased the home ventilation from 0.35 to what the code requires in an operating room – 4 ACH – the breeze would provide over 200 times more ventilation.

**What is the best way to make my home safer from COVID-19?**

The best way is to prevent COVID-19 from entering your home is to minimize the number of people entering your home and to restrict the network of people you and members of your household come into contact with.

**What can I do to improve ventilation in my home?**

Opening windows allows the largest amount of fresh air into your home and dilutes any contaminants, but when you allow hot or cold outdoors air in, you do compromise your comfort and HVAC efficiency. During these times, we must strike a balance between the benefits of open windows and our comfort and energy use.

**Do I need to worry about ventilation in my home if no one at home has COVID-19?**

Because individuals can be contagious and have no symptoms the coronavirus is a difficult contaminant to manage. Improving ventilation in your home will reduce risk.

**What are other effective ventilation measures, besides opening windows?**

- If you have an all-air HVAC system, call your service contractor to see if you can upgrade your filters to higher efficiency filters (MERV-13, or electronic filters)
- Consult with your service contractor to increase the amount of fresh air that is supplied to the home by the HVAC system.
- Add portable air cleaners in rooms where you spend the most time. (Avoid brands that generate ozone -- O3 – which is a common pollutant and makes matters worse for indoor safety.)

**What are long-term changes I can make at home to improve ventilation?**

Adding an Energy Recovery Ventilator (ERV) provides fresh air while incorporating a heat exchanger to recover energy from the exhaust air-stream. ERVs increase the amount of outside air brought into the house without compromising comfort or increasing energy use.

**FAQs – Commercial Buildings**

**How can I reduce the risk of COVID-19 in my commercial building(s)?**

The key is to dilute the concentration of any coronavirus particles by exchanging of "contaminated" indoor air with fresh air. Open windows and doors on opposite sides of rooms for the most effective air exchange.

**What if there are only windows on one wall?**

Use a box fan, pulling outdoors air in, to increase the exchange rate.

**What if we can't open windows or doors? What else can be done? instead of or in addition to opening windows and doors?**

Many buildings use a ducted HVAC system to heat, air-condition and circulate air. Generally, these systems introduce a percentage of fresh air while recirculating most of the air. These steps, in order of priority, can improve the efficiency of these systems:

1. Confirm that system is well-serviced and is introducing fresh air.
2. Because HVAC systems vary in terms of how much fresh air they can supply to a building ask your mechanical service contractor to evaluate the limits of your system and increase the percentage of outside air, if possible. Operating the system so it supplies fresh air to the building when it is occupied and when it is not will help.
3. Increase the efficiency of filters at air-handling units. MERV-13 is a good target efficiency since many existing systems can accommodate MERV-13 filters with little or no downside impact on the HVAC system's ability to function effectively.
4. Add air cleaning technology (UV or Ionization) at the air-handling unit. A mechanical service contractor can determine what technology can be accommodated for individual circumstances.

**What other ventilation measures can be done to reduce the risk of COVID-19 in commercial buildings?**

Stand-alone portable air cleaning equipment is available from multiple manufacturers. This equipment does not introduce fresh air into the building. Instead it uses various methods such as high-efficiency filters, UV light, ionization, or all three, to reduce indoor air contaminants. The equipment draws in room air, cleans it to some extent, and delivers it back to the room. As individual cleaning units would need to be placed close to contagious individuals to be effective, this approach is probably the least effective ventilation method in commercial buildings.

**What about when it gets cold out?**

Cold outdoor temperatures make open windows less attractive from the comfort standpoint. Each building manager will need to strike a balance between open windows and occupant comfort, though the more people accommodate by wearing warmer clothing, the more fresh air can be brought in to reduce the risk of virus contamination. Of course introducing more cold air means increasing heating costs.