The application of mechanical ventilation and air cooling equipment and how it relates to COVID-19

Indoor Air Quality (IAQ)

Indoor Air Quality has become a popular topic over the past years as more and more countries shift their focus towards the health and well-being of building occupants in their daily life. Most people in the industrialised world spend up to 90% of their time indoors. The exposure to air contaminants, from dust to spores, bacteria, viruses and chemical compounds has direct influence on people's immune systems and can cause a variety of conditions, from allergies to cancer or – an epidemic disease like COVID-19.

Maintaining a healthy indoor air quality thus becomes a general, basic – yet extremely important – necessity. While this is true at all times, it's imperative in times of a wider health crisis to avoid not only the direct spread of a virus, but to support peoples immune systems to withstand more serious impacts by an aggressive disease and thus reducing pressure on a healthcare system.

Temperature and Humidity

HVAC systems are typically designed to control temperature and humidity, which can in turn influence transmissibility of infectious agents. Although HVAC systems can be designed to control relative humidity (RH), there are practical challenges and potential negative effects of maintaining certain RH set points in all climate zones. However, while the weight of evidence at this time (Derby et al. 2016), including recent evidence using metagenomic analysis (Taylor and Tasi 2018), suggests that controlling RH reduces transmission of certain airborne infectious organisms, including some strains of influenza, this position document encourages designers to give careful consideration to temperature and RH. In addition, immunobiologists have correlated mid-range humidity levels with improved mammalian immunity against respiratory infections (Taylor and Tasi 2018).

Mousavi et al. (2019) report that the scientific literature generally reflects the most **unfavourable** survival for microorganisms when the RH is between 40% and 60% (Evidence Level B). Introduction of water vapour to the indoor environment to achieve the mid-range humidity levels associated with decreased infections requires proper selection, operation, and maintenance of humidification equipment.

Other recent studies (Taylor and Tasi 2018) identified RH as a significant driver of patient infections. These studies showed that RH below 40% is associated with three factors that increase infections. First, as discussed previously, infectious aerosols emitted from a primary host shrink rapidly to become droplet nuclei, and these dormant yet infectious pathogens remain suspended in the air and are capable of traveling great distances. **When they encounter a hydrated secondary host, they rehydrate and are able to propagate the infection**.

Second, many viruses and bacteria are anhydrous resistant (Goffau et al. 2009; Stone et al. 2016) and actually have increased viability in low-RH conditions. And finally, immunobiologists have now clarified the mechanisms through which ambient RH below 40% impairs mucus membrane barriers and other steps in immune system protection (Kudo et al. 2019). (Evidence Level B) This position document does not make a definitive recommendation on indoor temperature and humidity set points for the purpose of controlling infectious aerosol transmission. Practitioners may use the information herein to make building design and operation decisions on a case-by-case basis

Mobile Evaporative Coolers

Mobile evaporative coolers can be beneficial by replacing stagnant air with cooled fresh air whereby reducing heat stress on building occupants. Both of the factors are beneficial as explained below by respected industry regulators and advisors.

Eurovent, Gen – 1105 refers

GEN – 1105.00. In this GENeral Document, Eurovent presents general and basic recommendations on the operation of ventilation systems during the coronavirus pandemic. The following document also provides additional sources of information on COVID-19.

Recommendations
There is no doubt that the concentration of the smaller airborne droplets, which may contain viruses including viruses other than SARS-CoV-2 [COVID-19] should be kept as low as possible. This can be effectively achieved by correctly operating mechanical ventilation systems.

Precautions
With this background, the general Eurovent recommendation is to maintain and operate ventilation systems properly in accordance with instructions and applicable hygiene standards. As a precaution for the pandemic risk period, the following measures may be useful:

1. Increase ventilation rates and increase the percentage of outdoor air in the system

2. Extend the operation time of the ventilation system

3. Check that the ventilation units are properly set up and they are serviced correctly in accordance with the manufacturer's instructions

4. Consider maintaining the indoor relative humidity above 30% (where possible)"

Eurovent, COVID-19: Regular and correct maintenance of ventilation systems, Brussels, Eurovent, 2020

ASHRAE Position Document on Infectious Aerosols refers:
"On the recommendation of the ASHRAE Epidemic Task Force, ASHRAE leadership has approved the following two statements regarding transmission of SARS-CoV-2 and the operation of HVAC systems during the COVID-19 pandemic.

Transmission of SARS-CoV-2 [COVID-19] through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures.

Ventilation and filtration provided by heating, ventilating, and air-conditioning systems can reduce the airborne concentration of SARS-CoV-2 [COVID-19] and thus the risk of transmission through the air. Unconditioned spaces can cause thermal stress to people that may be directly life threatening and that may also lower resistance to infection. In general, disabling of heating, ventilating, and air-conditioning systems is not a recommended measure to reduce the transmission of the virus."

ASHRAE, ASHRAE Position Document on Infectious Aerosols, Atlanta, ASHRAE, 2020

Mobile portable evaporative coolers provide cooled fresh air solutions

Nature's own way of cooling….

Evaporative cooling is nature's answer to efficient climate control. It is the same cooling principle that our body uses when moisture (sweat) evaporates and cools the skin. Requiring low energy input, evaporative cooling is ideally suited for applications where reducing high temperatures and saving energy consumption is required.

Mobile evaporative coolers, use water to cool air naturally. This cooling process takes place over the evaporative media, No chemicals are used in this modern method of adiabatic cooling. The system just needs water and air. It's as simple as that.

Within a mobile evaporative cooler, water is pumped with the help of a submerged water pump over the evaporative media from the water tank. When ambient external air is pulled through the evaporative cooling media with the use of a fan mounted inside the unit, the interaction between water and air causes the water to evaporate and heat to be removed from the air. The result is filtered fresh cooled air being distributed into the workspace at floor level, from the front of the evaporative cooler.

Positive over pressure of a building with a mobile evaporative cooler can assist to expel stale air within the workspace, not only cooling the workspace, but replenishing, the workspace with fresh air.

Placing a mobile evaporative cooler at an open doorway or window of a building, the mobile evaporative cooler blow's cooled air directly into the building, over pressurising the building and forcing the stale air out of open windows or doors.