

FREQUENTLY ASKED QUESTIONS (FAQs) ON BCA-NEA-MOH GUIDANCE NOTE ON IMPROVING VENTILATION AND INDOOR AIR QUALITY IN BUILDINGS AMID THE COVID-19 SITUATION

Updated Guidance Note: <https://go.gov.sg/bca-nea-moh-guidance-improve-ventilation>

Scope of Guidance Note

Q1. Is it mandatory to comply with the guidelines in the Guidance Note?

No. While the recommendations are not mandatory by law, building owners and facilities managers should take active steps to improve ventilation, as this would reduce the risk of COVID-19 transmission through the dilution and removal of virus aerosols from indoor spaces. Building owners and facilities managers should develop their individual operation plans, taking reference from the Guidance Note and considering the existing building condition, to best meet the needs of their own buildings.

Q2. Do the guidelines apply to non-commercial buildings such as schools and community centres?

The guidelines apply to non-residential premises, including non-commercial buildings, schools and community centres, except for specialised premises such as certain factory production areas, hospitals, polyclinics and laboratories.

Q3. Are there plans to enforce against operators whose premises have high CO₂ readings? Would measures to improve ventilation be mandated under legislation?

The recommended indoor CO₂ limits of 800ppm and 1,100ppm are guidelines under [SS554:2016 Code of Practice for Indoor Air Quality for Air-Conditioned Buildings*](#), which is a voluntary standard and is not currently mandated. Notwithstanding, building owners, facility managers and occupants all have a role to play in maintaining good indoor CO₂ levels and adequate ventilation to reduce indoor transmission of COVID-19.

While high CO₂ levels are an indicator of inadequate ventilation or potential overcrowding, the direct correlation between CO₂ levels and risk of exposure to the COVID-19 virus is not established, as risk can also be affected by other factors such as compliance with safe distancing, proper masks-wearing, and the presence of infected persons. Besides good ventilation, measures such as mask-wearing, safe distancing, cleaning are still needed even if CO₂ levels are within the recommended limits.

[*Note: Under SS554, CO₂ levels of >700 ppm in excess of outdoor level (approx. 1,100ppm), indicate poor ventilation or overcrowding. In COVID-19 situation, it is recommended that CO₂ levels should not exceed an average of 800ppm over the measurement period.]

Ventilation

Q4. As different premises may be configured differently, does BCA/NEA/MOH have specific guidance to premises with CO₂ levels higher than 800ppm to help them bring down the CO₂ levels at their premises? Who can the premises owner/operators reach out for clarification and technical advice on how to improve ventilation at their premises?

The revised Guidance Note provides building owners and facilities managers with updated recommended measures to enhance ventilation and air quality in indoor spaces.

For more detailed assessments, building owners and facilities managers may also engage consultants or professional engineers to provide technical advice and recommendations according to your needs. A list of mechanical professional engineers and their contact details can be found here: <https://go.gov.sg/professional-engineer>. A list of BCA-registered contractors offering air-conditioning, refrigeration and ventilation works can be found here: <https://go.gov.sg/bca-registered-contractors>.

Q5. My premises is enclosed and air-conditioned without mechanical ventilation provision. What should I do to improve ventilation?

It is recommended to install supply or exhaust fans to introduce outdoor air into the enclosed spaces.

Opening operable doors and windows, if it is safe to do so, can also be considered to increase natural ventilation. Air-conditioning systems should be reduced or turned off when doors and windows are opened to minimise energy wastage. If there are existing air exhaust systems, such as toilet exhaust fans, the exhaust fans should be operating at full capacity continuously.

In the event that these options are not possible or feasible, you may consider localised air cleaning as an interim measure. Portable air cleaners with HEPA filters may be used to help remove virus aerosols.

Nevertheless, localised air cleaning will not improve ventilation in the indoor space. Building owners of such spaces should make plans for mechanical ventilation where possible. You may wish to engage consultants or professional engineers to provide technical advice and recommendations according to your needs. A list of mechanical professional engineers and their contact details can be found here: <https://go.gov.sg/professional-engineer>. A list of BCA-registered contractors offering air-conditioning, refrigeration and ventilation works can be found here: <https://go.gov.sg/bca-registered-contractors>.

Q6. How can I determine if my workplace is sufficiently ventilated?

While there is currently no international standard for a minimum ventilation rate that would sufficiently prevent the risk of COVID-19 disease transmission in indoor spaces, [WHO](#) recommends a ventilation rate of at least 10L/s per pax. Ventilation rates can be calculated or measured based on the ventilation systems selected.

Safe distancing measures for building occupants, wearing of masks and regular cleaning of high-touch points are proven key measures that would significantly reduce the risk of COVID-19 transmission. Increasing ventilation further reduces the risk of disease transmission through dilution and removal of infectious agents from an indoor space.

Q7. Does the virus spread via the ACMV system? Will the increased ventilation spread the virus from one zone to the other?

It is commonly accepted that well-controlled ventilation systems incorporating high efficiency filtration of recirculated air will help to reduce the risk of aerosol transmission through air dilution and air cleaning. Directionality of ventilation air should be considered to facilitate air movement from clean-to-less-clean areas. Increased ventilation brings in more outdoor air, and will dilute any contamination, thus reducing the risk of aerosol transmission in an indoor environment. Notwithstanding the importance of increasing ventilation, other key measures to

reduce disease transmission should continue, such as safe distancing, wearing masks properly, and carrying out regular disinfection of high-touch points within the building.

Q8. What should the building owners and facility managers look out for when checking the ACMV systems? Is there a checklist that we can refer to?

Building owners and facility managers should ensure that the ventilation systems are properly installed and operated according to specifications and relevant standards. For example, these systems should be designed in accordance with [SS553:2016 Code of Practice for Air Conditioning and Mechanical Ventilation in Buildings](#)¹ and [SS554:2016 Code of Practice for Indoor Air Quality for Air-Conditioned Buildings](#). A checklist can be found in SS554 Annex G. In addition, additional measures to mitigate COVID-19 risk could be found in the Guidance Note, e.g. ensuring that demand control systems, such as those with CO₂ sensors, are deactivated to avoid automatic reduction of outdoor air supply.

Q9. How often should maintenance of ACMV systems be carried out?

The recommended frequency of maintenance for various ACMV components can be found in [SS553:2016 Code of Practice for Air Conditioning and Mechanical Ventilation in Buildings](#) and [SS554:2016: Code of Practice for Indoor Air Quality for Air-Conditioned Buildings](#). In addition to the recommended maintenance frequency, please also follow the recommendations specified in the latest Guidance Note.

Q10. My premises is located within a building (e.g. shopping mall) with mechanical ventilation system and I have no control over the building's ventilation system. What can I do to improve ventilation within my premises?

Building owners and facilities managers should ensure that the building's ventilation systems are properly maintained and in good working condition to provide adequate ventilation in all spaces, including worker resting areas. As tenants and occupants of the building, you may wish to engage the facilities managers to discuss ventilation issues and ensure that there is adequate ventilation within your premises. Where possible, you may also keep the windows or doors open to improve ventilation within your premises.

[Air Cleaning](#)

Q11. How effective are ultraviolet germicidal irradiation (UVGI) and high-grade filters in dealing with the virus?

The efficacy of UVGI against a range of microbes has been demonstrated by numerous studies, which have found that applying UV-C radiation can inactivate the virus. The effectiveness of this technology depends on many factors in a UVGI system's design and operation, such as its structural design, lamp design, and effective contact time. When using UVGI, care needs to be taken to protect occupants from exposure to UV radiation.

Filters can remove particles of with varying efficiencies. Filters with rating of at least MERV 14, F8, or ePM1 70-80% are necessary to substantially remove fine particles, including most viruses and bacteria. To achieve optimal efficiencies, filters should be properly installed and maintained.

In spaces where there is a high risk of aerosol transmission, upper-room UVGI may be considered for air cleaning if the ceiling heights allow. UVGI systems must be installed by professionals, as viral disinfection efficacy and safety are greatly dependent on the system and how it is installed and maintained. More information on air cleaning is available in [NEA's Technical Advisory on Use of Air-Cleaning Technologies to Mitigate COVID-19 Aerosol Transmission Risk](#).

Q12. Does BCA/NEA/MOH approve or provide specifications for air-cleaning technologies that can be used to reduce airborne contaminants?

The agencies do not approve nor provide specifications for any air-cleaning technologies. Interested building owners and facility managers should seek professional services and consult various vendors for solutions of their interest. Building owners and facility managers are also encouraged to exercise caution and to ensure that product claims and the intended use of the product are supported by efficacy and safety data.

Please refer to NEA's [Technical Advisory on Use of Air-Cleaning Technologies to Mitigate COVID-19 Aerosol Transmission Risk](#) for more information.

Q13. How can I select and size portable air cleaners for my premises?

Portable air cleaners or portable air-filtering devices are often equipped with a high-efficiency particulate air (HEPA) filter. Products with HEPA filters are recommended for use in environments with higher risk of COVID-19 transmission, while products with non-HEPA filters may be used in lower-risk environments.

When choosing a portable air-filtering device, select a unit that is appropriately sized for the space. The minimum smoke Clean Air Delivery Rate (CADR) that a unit should provide for a particular room size can be estimated as follows, according to AHAM AC-1 standard:

$$\text{smoke CADR (cmh)} \geq \text{room size (cubic meter)} \times 5$$

For example, a room with a floor area of 24 m² and a ceiling height of 2.6 m (room volume of 62.4 m³) will need a portable air-filtering device with a minimum smoke CADR of 62.4 x 5 = 312 cmh (i.e. 184 cfm).

Please refer to NEA's [Technical Advisory on Use of Air-Cleaning Technologies to Mitigate COVID-19 Aerosol Transmission Risk](#) for more information.

Energy Consumption

Q14. How will the recommended guidelines affect building energy efficiency/ use? Specifically, what is the impact of increased ventilation on energy?

We anticipate an increase in energy consumption by ACMV systems for occupied spaces, due to the recommendations for increased outdoor air supply and extended operating hours. However, the overall electricity consumption of buildings is expected to drop with the reduced building occupancy during COVID-19 period.

Design Standard

Q15. Is there any additional ventilation requirement that will be introduced in new construction for buildings in future? How should ventilation systems in new buildings

be designed to support Business Continuity Plans while coping with potential pandemic situations?

There is currently no additional ventilation requirement due to COVID-19, other than what is recommended in [SS553:2016: Code of Practice for Air Conditioning and Mechanical Ventilation in Buildings](#) and [SS554:2016 Code of Practice for Indoor Air Quality for Air-Conditioned Buildings](#). Managers are also advised to refer to SS553 Annex D and SS554 Annex K, which contain additional recommendations for operation of ACMV systems amid the pandemic, including maximising outdoor air supply, purging indoor air, and installing efficient filters in ACMV systems to treat recirculated air.

In view of potential pandemic situations similar to COVID-19, it would be ideal for buildings to be designed with resiliency features that provide operational flexibility – normal operation mode vs epidemic mode.

For instance, systems could be designed to allow a wider operational range of outdoor air intake and accommodate high efficiency filters.

Building and Construction Authority

National Environment Agency

Ministry of Health

ⁱ For building/occupancy types not listed in [SS553:2016](#), [ASHRAE 62.1](#) should be used as reference.