A Guide on Compliance with the Requirement on Air Change / Air Purifiers in Seating Areas of Dine-in Catering Premises under Cap. 599F

Introduction

1. The World Health Organization ("WHO") declared on 30 January 2020 that the outbreak of a novel coronavirus infection[1] constituted a Public Health Emergency of International Concern, and characterised COVID-19 as a pandemic on 11 March 2020.

2. The HKSAR Government launched the Preparedness and Response Plan for Novel Infectious Disease of Public Health Significance on 4 January 2020. Among the anti-epidemic measures, social distancing is key to delaying the spread of COVID-19. The Prevention and Control of Disease (Requirements and Directions) (Business and Premises) Regulation (Cap. 599F) was enacted on 28 March 2020, and the Secretary for Food and Health's directions in relation to Catering Business ("SFH's directions") have been in place since 28 March 2020.

3. A voluntary declaration scheme was launched on 16 October 2020 for inviting catering business operators[2] to declare on-line, in respect of the seating areas of their dine-in catering premises, (1) whether they have attained air change per hour (fresh air) ("ACH") at 6 or above; or (2) whether they have installed air purifiers that meet the specified specifications[3] as an alternative, on or before 31 December 2020. It has subsequently been extended until 17 March 2021, after which it has been replaced by the mandatory registration scheme below.

4. Under the mandatory registration scheme launched on 18 March 2021, catering business operators as defined in section 3 of Cap. 599F[4] are required to register on-

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1 The virus and the disease it causes were respectively named by WHO as severe acute respiratory syndrome coronavirus 2 ("SARS-CoV-2") and COVID-19 on 11 February 2020.

2 It covered holders of general restaurant, light refreshment restaurant, marine restaurant and factory canteen licences issued by the Food and Environmental Hygiene Department ("FEHD").

3 It covered (1) Ultraviolet-C ("UV-C") cum High-Efficiency Particulate Arrestance Filter ("HEPA") device; or (2) UV-C device.

4 It covered holders of general restaurant, light refreshment restaurant, marine restaurant and factory canteen licences issued by FEHD and non-licensed operators of catering premises (those in a clubhouse holding a certificate of compliance issued by the Home Affairs Department ("HAD"), school canteens, workplace canteens etc.).

line[5], in respect of the seating areas of their dine-in catering premises, (1) whether they have attained ACH at 6 or above; or (2) whether they have installed air purifiers that meet the specified specifications[6], on or before 30 April 2021; and to download a notice within 2 days after the registration for display at the entrance of their dine-in catering premises[7]. The requirement is set out in the SFH's directions gazetted on 17 March 2021 (see **Annex A** for an extract on the requirement).

5. Against the above background on the Government's decision made, a Working Group was established on 16 March 2021 to advise the Government on the smooth implementation of the requirement (see **Annex B** for the terms of reference and the composition).

6. The Working Group has held two meetings (18 March 2021 and 30 March 2021), including formulating its work plan and engagement plan, and held a press briefing on 31 March 2021 to make public how to use engineering control means for enhancing ventilation, apart from announcing the release of a list of air purifiers that met the specified specifications.

7. The purpose of this Guide released today (11 April 2021) is to provide general information and guidance on how the requirement could be fulfilled, leading to the registration formalities and transparency measures that follow. It should be read by catering business operators and registered specialist contractors (ventilation works category) ("RSC(V)").

Background, Theoretical Basis and Legislative Framework

8. Please see **Annex C** for the Government's position as presented to the Working Group, including the rationale behind its decision made in October 2020. To set the scene for this Guide, the Working Group has reviewed various research articles on the theoretical and scientific basis provided, and recorded that the concept of increasing ACH, either in lieu of or as augmentation to, the existing provision in the catering premises, is a practical means taken worldwide to tackle the imminent issue

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5 The link of the on-line platform is https://www.fehd.gov.hk/english/licensing/CateringPremisesAir.html. A certificate issued by a RSC(V) in prescribed format is required to be uploaded and the submission is required to be signed by the catering business operator concerned.

6 It covered (1) HEPA cum UV-C device; or (2) HEPA device; or (3) UV-C device (see section 19 below).

7 In addition, the list of licensed catering premises meeting ACH of 6 or above, and/or those installed with air purifier(s) meeting the specified specifications, will be published on FEHD webpage for public inspection.

at hand as articulated by the Government.

Theoretical and Scientific Basis

9. While discussion of short range air-borne transmission of SARS-COV-2 is still evolving, the Working Group could appreciate the theoretical and scientific basis behind the Government's decision on using ACH at 6 or above in October 2020, on which the current exercise is also premised. There are several key risk factors of COVID-19 in dine-in catering premises, including long mask-off time and oral conversation at short distance. Given recent studies, one could not rule out the possibility that SARS-CoV-2 can be transmitted by a short range air-borne route in poorly ventilated and crowded indoor spaces, and good air ventilation or air changes can dilute virus-laden particles at close-range of infected persons.

10. Increasing indoor air changes to reduce infection risk is promoted by WHO, the Centers for Disease Control and Prevention of the United States ("US CDC") as well as many other international professional organisations (public health, engineering, building etc.), while the accumulation of evidence on short range airborne transmission of SARS-COV-2 is still on-going. Their suggestions also highlight that when the air dilution option is not possible, the air filtration or germicide option may be pursued as the alternative. In summary, augmentation of fresh air provision through air change or infection control by air filtration or germicide option would help reduce the risk of short range airborne transmission of SARS-COV-2.

11. As the ventilating system of existing dine-in catering premises generally meets ACH at 3.8 to 4.9[8] or above, the system could be adjusted, upgraded or improved to make up the difference, if any, or by installing air purifiers with filtration or germicide function of a level that is effective in reducing the risk of SARS-COV-2 transmission. These measures are recognised and recommended by international/national engineering and health organisations, including (a) the American Society of Heating, Refrigerating and Air-Conditioning Engineers ("ASHRAE"); (b) the Chartered Institution of Building Services Engineers ("CIBSE"); and (c) US CDC.

Legislative Framework

12. It should be borne in mind that –

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[8] This is the baseline as per Cap. 132. An assumed footprint of 1.5 square meters for each person and an assumed storey height (ranging from 3 metres to 2.3 metres) are adopted.

(i) the policy intent behind Cap. 132 is municipal services, and the concept is sufficient fresh air;

(ii) the policy intent behind Cap. 599F is infection control, and the concept is clean air with virus-load minimised; and

(iii) one is required to comply with all laws of Hong Kong (in this context, both Cap. 132 and Cap. 599F inclusive). Given the threshold of the ventilating requirement under Cap. 599F is higher than that under Cap. 132, it is incumbent on one to attain the higher threshold as well.

Calculation of ACH

13. The ACH is to be calculated according to the instructions set out on the FEHD's webpage based on the plans for food business licence or the plans for certification of compliance for the clubhouse (or on the basis of site measurement, in the absence of such plans):-

(i) floor area of seating space;
(ii) height of seating area measured from floor to ceiling (may opt for actual storey height or assumed storey height at 3 metres); and
(iii) capacity of outside fresh air supplied to the seating area by the ventilating system.

14. In general, ACH of the seating area of the premises can be calculated as below:-

Air Change per Hour (Fresh Air) = A ÷ (B × C)

A : capacity of outside fresh air supplied to the seating area by the ventilating system (cubic metres/hour)
B : size of footprint of the seating area (square metres)
C : height from floor to ceiling of the seating area (metres)

15. For open ceiling including baffle / egg crate / perforated types[9] etc., structural soffit is to be taken as the ceiling. Catering business operators may opt for actual ceiling height / highest point of ceiling (coved type) / structural soffit height (open type) or assumed storey height at 3 metres (see working examples for illustration purposes at **Annex D**), whichever is the smaller, in the calculation of ACH.

[9] with free area ratio at more than 70%

16. An air change calculator is also available at the online platform on the FEHD's webpage for making preliminary calculation on the air change rate of the ventilating system of the premises.

17. Natural ventilation is affected by many factors including layout, compartment, depth of interior area, prevailing wind speed and direction, etc. and/or when the openings are curtailed by air curtain etc. Outdoor dining area is outside the scope of this exercise. The ventilating requirement is applicable to all indoor dining area of dine-in catering premises.

Improvement of ACH

18. A RSC(V) may carry out improvement measures to enhance ACH of dine-in catering premises. Some viable measures to enhance ACH are listed as follows for reference:-
    (i) filter cleaning;
    (ii) commissioning (e.g. damper adjustment, fan belt adjustment, etc.);
    (iii) fresh air fan speed adjustment (e.g. change of fan pulley within limit of motor power, change of frequency invertor set point, etc.);
    (iv) fresh air inlet enlargement;
    (v) liaison with landlord to provide additional fresh air supply (if applicable); and
    (vi) air-conditioning ("A/C") or ventilating system upgrading works.

Alternative Measures

19. If attaining ACH at 6 or above is not possible and carrying out improvement of ACH as suggested in section 18 above is not feasible, air purifiers of the following types that meet the specified specifications are to be installed according to the on-the-ground situation and the manufacturer manual:-
    (i) HEPA cum UV-C device; or
    (ii) HEPA device; or
    (iii) UV-C device.

20. The above three types of air purifiers are recommended by US CDC and ASHRAE to reduce the spread of and lower the risk of exposure to COVID-19.

21. Installation of air purifiers is considered as an alternative means to augment ACH having regard to the following general observations:-
    (i) according to manufacturer's design information, HEPA air purifier can

provide an equivalent clean air ACH of around 2 to 6, derived from its Clean Air Delivery Rate ("CADR") and serving area;

(ii) UV-C device also has serving area based on irradiation coverage as per manufacturer's design. UV-C covered area has an equivalent ACH_{UVC} of 7; and

(iii) air purifier of UV-C or HEPA or UV-C cum HEPA with clean air supply on-the-ground (at around ACH of at least 3.8 to 4.9 as per the baseline under Cap. 132) can achieve the equivalent effect of ACH of around 6 or above, and this would help minimise the risk of indoor short range airborne transmission.

Standards required of Air Purifiers

22. The air purifiers are required to comply with relevant international standards and the Consumer Goods Safety Ordinance (Cap. 456) and the Electrical Products (Safety) Regulation (Cap. 406G) under the Electricity Ordinance (Cap. 406), including but not limited to:-

(i) IEC 60335-1 (Household and similar electrical appliances - Safety - Part 1: General requirements);

(ii) IEC 60335-2-65 (Household and similar electrical appliances – Safety – Part 2-65: Particular requirements for air-cleaning appliances);

(iii) IEC 62233 (Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure); and/or

(iv) other equivalent standards.

23. For electrical work and extension units, one must comply with the safety tips at **Annex E** (Safety Tips for Electrical Work) and **Annex F** (Safety Tips for Extension Units (with poster and leaflet attached)).

24. For the purpose of fulfilling the ventilating requirement, once one goes for installing air purifiers as the alternative, one has to look at the on-the-ground situation (including site condition[10]) and the manufacturer manual (the serving area), with a view to optimising the intended effect of the air purifiers (see working examples for illustration purposes at **Annex D**). The number of air purifiers required in the seating area is to be determined according to the seating layout and zoning and is required to comply with pertaining instructions by the manufacturer on installation and designed coverage. Also, the air purifiers are to be distributed evenly as reasonably as possible with respect to the seating layout. Individual partitioned

[10] for example, if a seating area is segregated into various compartments, then each compartment is to be considered on its own in terms of installation of air purifiers.

zone(s) / room is (are) to be treated on their individual merits and equipped with air purifier(s) as appropriate.

25. After the air purifiers have been installed at the premises, they must be properly switched on, operated, maintained and repaired in accordance with the manufacturer manual when the premises is opened for business.

26. HEPA

26.1 The HEPA should have minimum class of H13. The minimum local efficiency of HEPA in removing small particles of sizes larger than or equal to 0.3 micrometre from air is required to be 99.97% and comply with the European Standard BS EN1822-1:2009 to BS EN 1822-5:2009 (EPA, HEPA and ULPA) or other equivalent international/national standards.

26.2 The device is required to be regularly maintained as per the manufacturer's instruction. The HEPA filter shall be replaced regularly according to the recommended interval by the manufacturer, or otherwise under general circumstances not more than 3 to 6 months, in order to maintain the filtration efficiency. Before replacing the filter, 1:49 diluted bleach or other equivalent disinfectant should be sprayed onto the surface of the filter with proper personal protective equipment (i.e. gloves, eye shield and surgical mask). The filter can then be put inside an enclosed plastic bag for disposal.

27. UV-C

27.1 The air purifiers are required to have UV-C with an optimal wavelength of 253.7 nanometers of UV-C spectrum, of which the effective range should be ranging from 100nm to 280nm.

27.2 Design of the UV lamps is required to comply with relevant safety standards, such as those listed by Underwriters Laboratories ("UL") and tested to meet UL Standard 153:2014 - Standard for Portable Electric Luminaires, UL Standard 1598:2018 - Luminaires and UL Standard 1995:2015 - Heating and Cooling Equipment, or other equivalent international/national standards.

27.3 For UV-C lights for air handling units or air duct or inside a housing/container with fan blowing air across the UV-C lights, the UV-C

should be tested in accordance with ASHRAE 185.1-2015 Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms. Unless the UV-C device is completely encased, it is also required to comply with IEC 62471 (Photobiological safety of lamps and lamp systems).

27.4 To prevent eye and skin injuries, sources of UV-C must either be shielded or encased inside the disinfection device or mounted at a location to avoid direct exposure to eye and skin.

27.5 For encased UV-C device, automatic interlock function is required to be provided to switch off the UV-C light when the device casing is opened.

27.6 Regarding installation of wall-mount, pendant and corner mount upper-air UV-C device, the following points are to be followed:-

(i) the construction and placement are to be done by trained personnel to prevent excessive UV energy from striking the occupants below;
(ii) the wall and ceiling UV-reflectivity are to be taken into consideration;
(iii) the fixture is to be mounted in such a way that the UV energy is distributed parallel to the plane of the ceiling and no excessive UV energy will affect the occupants below; and
(iv) the minimum mounting height of UV-C device and the minimum ceiling height requirement is to be decided having regard to Chapter 62 of 2019 ASHRAE Handbook – HVAC Applications[11], or according to manufacturer's installation instruction.

27.7 The sources of UV-C must be conspicuously labelled with a warning attached to the housing of the sources. The warning sign should state:-

WARNING
DO NOT EXPOSE EYES AND SKIN TO ULTRA-VIOLET LIGHT RAYS
WHICH ARE HARMFUL TO UNPROTECTED EYES AND SKIN
警告
切勿讓眼睛及皮膚暴露於紫外光之下，可引致損害

[11] According to the 2019 ASHRAE Handbook – HVAC Applications (SI): Chapter 62, Ultraviolet air and surface treatment, for wall-mounted fixtures, the fixture mounted height and minimum ceiling height should be 2.1 metre and 2.44 metre respectively; while for ceiling-mounted fixtures, the fixture mounted height and minimum ceiling height should be 2.4 metre and 2.89 metre respectively.

27.8 The device shall be regularly maintained as per the manufacturer's instruction.

27.9 All UV-C light must be switched off before any maintenance works of the device could be conducted. Maintenance should only be carried out by trained workers.

27.10 For shielded UV-C device or upper-room UV-C device, the **UV-C light must be SWITCHED OFF**, before any nearby maintenance work is to take place, to minimise potential risk of exposure of the workers to the UV-C light.

Building Safety Aspects

28. Air purifiers to be installed should not reduce the width of exit routes for the premises. For devices suspended from ceiling or installed at high level, vertical clearance of not less than 2 metres measured from the floor should be maintained.

29. Enhancing the ACH of the dine-in catering premises as mentioned in section 18 above may involve the carrying out of building works. Under the Minor Works Control System ("MWCS"), certain small-scale building works are designated as minor works, which may be carried out under the simplified requirements as an alternative to obtaining approval and consent under the Buildings Ordinance (Cap. 123). Reference may be made to Schedule 1 to the Building (Minor Works) Regulation ("B(MW)R") and Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers ("PNAP") APP-147. Common minor works items[12] related to A/C and mechanical ventilating system upgrading works are as follows:-

(i) erection/alteration of metal ventilation ducts or associated supporting frames inside a building, on grade, on a roof of a building, or projecting from an external wall or a fence wall;

(ii) erection/alteration of supporting frames for suspending an A/C plant or a mechanical ventilation plant inside a building;

(iii) erection/alteration of supporting structures or frames for an A/C unit on grade, on a roof of a building, or projecting from an external wall;

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[12] Details of the minor works items and the associated requirements are stipulated in the B(MW)R and the Technical Guidelines on MWCS. These documents are available at Buildings Department website www.bd.gov.hk.

(iv) erection/alteration of fire dampers in a ventilating system; and
(v) alteration of external walls, windows or window walls such as for formation or enlargement of duct or fresh air inlet.

30. Where erection or alteration of a fire damper in a ventilating system of an existing building is involved, the RSC(V) who installs the fire dampers should inspect and certify that the fire dampers are in a safe and efficient working order pursuant to Clause E8.3 of the Code of Practice for Fire Safety in Buildings in 2011. If the fire dampers are installed by the registered general building contractor ("RGBC") / registered minor works contractor ("RMWC"), a RSC(V) should be engaged to inspect the fire dampers and certify that these are in a safe and efficient working order. The RGBC/RMWC in submitting the certification on fire dampers should include an inspection certificate on fire dampers by RSC(V). PNAP APP-13 is relevant.

Fire Safety aspects

31. For improvement measures as mentioned in section 18 above, please be reminded that the ventilating system shall comply with the following fire safety requirements:-
(i) for holders of general restaurant, light refreshment restaurant and factory canteen licences, one must comply with fire safety requirements for ventilating system for scheduled premises at **Annex G**;
(ii) for non-licensed operators of catering premises (those in a clubhouse holding a certificate of compliance from HAD, school canteens, workplace canteens etc., one must comply with the Building (Ventilating Systems) Regulations (Cap. 123J); and
(iii) for both item (i) and (ii) above, one must comply with fire safety requirements for mechanical ventilating system as stipulated in the Fire Services Department Circular Letter No. 4/96 Part XI which can be found at http://www.hkfsd.gov.hk/eng/source/circular/e04_1996.pdf.

32. Regarding the provision of UV-C installed in air handling unit or air-duct which could be connected to the ventilating system of the premises operating dine-in catering business, the following fire safety points should be observed:-
(i) all parts of material of the system/equipment as installed in air stream of the ventilating system should be non-combustible;
(ii) any PVC cables or cable glands as located inside the air stream should be enclosed in metallic conduits or enclosures; and
(iii) the UV-C equipment including the accessories should conform to UL

1995:2015 - Heating and cooling equipment or equivalent national/international standards. Documents such as catalogue as well as i) test reports issued by the accredited local, Mainland or overseas testing laboratories OR ii) information about the product certification bodies, for example UL online certifications directory with specification of brand name and model of the equipment could be relevant.

Registration Procedure and Transparency Measures

33. The catering business operators specified in section 4 and footnote 4 are required to register through the online platform on FEHD's webpage that they have met the requirement of having attained the threshold of ACH at 6 or above; or, as an alternative, having installed air purifiers meeting the specified specifications and according to the on-the-ground situation and manufacturer's manual in the seating areas of the dine-in catering premises.

34. Catering business operators which have submitted certificates in respect of ACH and/or air purifiers through the FEHD's webpage on "Voluntary Declaration Scheme on Air Changes in Licensed Catering Premises" can already be handled under FEHD's system. Other catering business operators specified in section 4 and footnote 4 must register on the FEHD's designated webpage https://www.fehd.gov.hk/english/licensing/guide_general_reference/Registration_air-changes_purification.html on or before 30 April 2021, with certificate(s) in specified form filled in and signed by a RSC(V) and the signature(s) of the catering business operator(s). The certificate, which can be downloaded via the above webpage, includes the following information:-

(i) the ACH, and whether the ACH is 6 or above;

(ii) if the ACH is not 6 or above, whether having installed air purifiers and provided the following information about the air purifiers:-

(1) type;

(2) brand;

(3) model;

(4) quantity; and

(5) location.

In providing the information on location, the use of an indicative plan showing where the air purifiers are placed would be useful.

35. If a catering business operator is unable to complete the registration referred to in section 34 above on or before 30 April 2021, it must submit an application to FEHD

for an extension of time for registration. If approved, it must complete the registration within the time limit as specified by FEHD.

36. Within 2 days after the registration has been confirmed by FEHD, the catering business operator must download a notice from a designated position of the FEHD's webpage, and display the notice with the following specifications round-the-clock at the entrance of the catering premises:-

(i) the size of the notice must not be less than 297 x 420 mm (A3 size);

(ii) the letters in the notice must be black in colour, the font type must be Times New Roman, and the font size must not be less than 32; and

(iii) the content of the notice must be displayed in a way that is clearly legible and in a location unobstructed, with the following information included:-

(1) the licence number (if any);

(2) name and address of the business; and

(3) air change per hour (fresh air) and/or air purifier(s) installed (as applicable).

37. List of dine-in catering premises covered by a valid food business licence issued by FEHD meeting the required ACH at 6 or above and/or installing air purifier(s) that meet(s) the specified specifications will be published on the FEHD's webpage for public inspection.

38. For dine-in catering premises not covered by a valid food business licence issued by FEHD, upon confirmation of the registration (registration received in respect of a clubhouse with a certificate of compliance will be processed by HAD), they will receive a notification through short message services.

Registered Specialist Contractor (Ventilation Works Category)

39. The certificate mentioned in section 34 above is required to be filled in and signed by a RSC(V). Information of the registered contractor can be found at https://www.bd.gov.hk/en/resources/online-tools/registers-search/registrationsearch.html.

40. The RSC(V) is to check whether the ACH is 6 or above, based on the information on the plans for food business licence or the plans for certification of compliance for the clubhouse (or on the basis of site measurement, in the absence of such plans).

41. Should the catering business operator decide to opt for the alternative of installing air purifiers, the RSC(V) is to be responsible for calculating the number of air purifiers required and determining the placement of air purifiers in the seating areas, having regard to the on-the-ground situation and the manufacturer manual, and completing the certificate based on information as provided by air purifier manufacturers (the onus and accuracy of the information on air purifiers rest with the air purifier manufacturers concerned).

Work Flow

42. To summarise, a schematic presentation of the work flow is at **Annex H**.

Working Group on the Air Change or Air Purifier Requirement
in Dine-In Restaurants under Cap. 599F
11 April 2021

Bibliography

No.	Title (URL, if available)	Author	Publisher	Date	Discipline
1	First MW Inactivation of Poxviruses by Upper-Room UVC Light in a Simulated Hospital Room Environment	McDevitt JJ, Milton DK, Rudnick SN		2008	Public Health / Building
2	Environmental design: Chartered Institution of Building Services Engineers (CIBSE) Guide A “Restaurants suggested fresh air supply rate: 10L/s per person”		CIBSE	2015	Building
3	ASHRAE Position Document on Filtration and Air cleaning		ASHRAE	2018	Building
4	Aerosol emission and superemission during human speech increase with voice loudness https://www.nature.com/articles/s41598-019-38808-z	Asadi S et. al	Scientific Reports	20 February 2019	Public Health
5	Environmental Control for Tuberculosis: Basic Upper-Room Ultraviolet Germicidal Irradiation Guidelines for Healthcare Settings https://www.cdc.gov/niosh/docs/2009-105/default.html		NIOSH/CDC	March 2019	Public Health
6	Quantity, size distribution, and characteristics of cough-generated aerosol produced by patients with an upper respiratory tract infection https://snucm.elsevierpure.com/en/publications/quantity-size-distribution-and-characteristics-of-cough-generated	Lee J, et. al	Aerosol and Air Quality Research	April 2019	Public health

7	Chapter 62: Ultraviolet air and surface treatment 2019 ASHRAE Handbook – HVAC Applications		ASHRAE	2019	Building
8	The State Administration for Market Regulation, the Standardization Administration of the People's Republic of China (Natural Standards) GB37488-2019 Hygiene indicators and limits for public places https://www.chinesestandard.net/PDF.aspx/GB37488-2019		The State Administration for Market Regulation, the Standardization Administration of the People's Republic of China (Natural Standards)	November 2019	Public Health
9	IES Committee Report: Germicidal Ultraviolet (GUV) – Frequently Asked Questions (IES CR-2-20-V1) https://media.ies.org/docs/standards/IES%20CR-2-20-V1a-20200507.pdf		Illuminating Engineering Society	15 April 2020	Public Health
10	Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant (https://doi.org/10.1101/2020.04.16.20067728)	Prof Yuguo Li et al	MedRxiv	22 April 2020	Public Health/ Building
11	High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington, March 2020 https://www.cdc.gov/mmwr/volumes/69/wr/mm6919e6.htm	Hamner L, et al	MMWR	15 May 2020	Public Health

12	Surgical mask partition reduces the risk of non-contact transmission in a golden Syrian hamster model for Coronavirus Disease 2019 (COVID-19) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7314229/	JFW Chan et. al	Clin Infect Dis	30 May 2020	Public Health
13	Guidance for building operations during the COVID-19 Pandemic – "Consider portable room air cleaners with HEPA filters; Consider UVGI (ultraviolet germicidal irradiation)" https://www.ashrae.org/file%20library/technical%20 resources/ashrae%20journal/2020journaldocuments/72-74_ieq_schoen.pdf		American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Journal	May 2020	Building
14	Supplement to Reducing the Risk of COVID-19 Using Engineering Controls – Guidance Document https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Guidance-Documents/SUPPLEMENT-to-Reducing-the-Risk-of-COVID-19-Using-Engineering-Controls-Guidance-Document.pdf		AIHA	Version 1: 11 August 2020	Building
15	Reducing the Risk of COVID-19 Using Engineering Controls – Guidance Document https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Guidance-Documents/Reducing-the-Risk-of-COVID-19-using-Engineering-Controls-Guidance-Document.pdf (Increasing to ACH at 6 or above is an effective engineering control to reduce the relative risk of exposure to COVID-19 by 95%)		AIHA	Version 4: 9 September 2020	Building

16	Latest guidance from CIBSE and Scientific Advisory Group for Emergencies (SAGE) - Role of ventilation in controlling SARS-CoV-2 transmission https://www.cibse.org/coronavirus-covid-19/coronavirus,-sars-cov-2,-covid-19-and-hvac-systems		Scientific Advisory Group for Emergencies	30 September 2020	Building
17	A Critical Review on Ultraviolet Disinfection Systems against COVID-19 Outbreak: Applicability, Validation, and Safety Considerations https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7571309/	M Raeiszadeh et. Al	ACS Photonics	14 October 2020	Public Health
18	CIBSE COVID-19 Ventilation Guidance file:///D:/users/dshwong/Downloads/Covid_19_Ventilation_guidance_v4.pdf		CIBSE	23 October 2020	Building
19	Susceptibility of SARS-CoV-2 to UV irradiation https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7402275/	CS Heilingloh et. Al	Am Journal of Infection Control	October 2020	Public Health
20	Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients https://pubmed.ncbi.nlm.nih.gov/32949774/	Lednicky JA et.al	Int J Infect Dis	November 2020	Public Health

21	Coronavirus (COVID-19): ventilation guidance - November 2020, Guidance to support the mixing of individuals safely in indoor domestic and commercial properties. "8-10 litres of fresh air per person (minimum) would be a better guide to fresh air demand" https://www.gov.scot/publications/coronavirus-covid-19-ventilation-guidance---november-2020/pages/ventilation/		Scottish Government	18 December 2020	Building
22	In-room Air Cleaner Guidance for Reducing COVID19 in Air in your Space/Room. https://www.ashrae.org/file%20library/technical%20resources/covid-19/in-room-air-cleaner-guidance-for-reducing-covid-19-in-air-in-your-space-or-room.pdf		American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	21 January 2021	Building
23	Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic Infection Control Guidance – "Consider the addition of portable solutions (e.g., portable HEPA filtration units) to augment air quality in areas when permanent air-handling systems are not a feasible option." https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html		Centers for Disease Control and Prevention	Updated: 23 February 2021	Public Health

24	Probable airborne transmission of SARS-CoV-2 in a poorly ventilated restaurant https://www.sciencedirect.com/science/article/pii/S0360132321001955	Prof Yuguo Li et al	Building and Environment	March 2021	Public Health/ Building