COVID-19 Guidance for Ventilation Hygiene
2nd Review October 2020

For the further benefit of our members and all building managers, we are issuing this second guidance to provide a better understanding of the role of ventilation systems in the current Covid 19 pandemic. The guidance concentrates on the airborne transmission route only as it relates heavily to ventilation systems. This has recently taken more prominence as more Associations worldwide acknowledge the importance of utilizing the standards of air conditioning to improve conditions within buildings.

This guidance is supplementary to all government guidelines in relation to social distancing, hand washing, essential travel and staying at home, etc.

The scope is limited to commercial and public buildings such as offices, factories, schools and hotels where normal social transmission is possible. Hospitals and healthcare facilities are excluded due to the higher risk of contact with Covid-19 and the specialised work procedures required

Disclaimer:
This NAAD document is based on best available information on Covid-19, which is limited or non-existing. SARS-CoV-1 information has been used for best practice recommendations, along with recent updated information, NAADUK will not accept liability for any direct, indirect, incidental damages or any other damages that may relate to the use of the information presented in this document. The document is for guidance only and all buildings and ventilation systems operate in a bespoke manner specific to the building. Building owners must ensure they complete their own in-house risk assessment before implementing any Covid-19 control procedures, including a technical and microbiological risk assessment on the HVAC Systems.

1.0 Background

1.1 We have reviewed a number of reports, including RHEVA 3rd August 2020, Refcom in March 2020 and various WHO releases. In the RHEVA document it is stated: There is currently no evidence of human infection with SARS-CoV-2 caused by infectious aerosols distributed through the ventilation system air ducts. The risk is rated as “very low." However, this assumes, incorrectly that all systems are clean and unfortunately in over 60% of anecdotal evidence, this is not true.

The document further states "Viruses attached to small particles will not deposit easily in ventilation ducts and will normally be carried out by the airflow .xlv. Therefore, no changes are needed to normal duct cleaning and maintenance procedures. Much more important is to increase the outside air supply and to avoid recirculation of air according to the recommendations above." Source quoted for this advice is WHO, COVID-19 technical guidance: Guidance for schools, workplaces & institutions.

1.2 For balance to the above advice it must be noted that on the 25th August 2020 the WHO document COVID-19 management in hotels and other entities of the accommodation sector interim guidance states:-

"Ventilation and air conditioning. Ventilation is an important factor in preventing spread of the virus that causes COVID-19. Below are steps that can improve indoor ventilation. These steps (12) should be considered in consultation with a heating, ventilation and air conditioning (HVAC) professional."

"If HVAC systems are used, they should be regularly inspected, maintained, and cleaned. Rigorous standards for installation and maintenance of ventilation systems are essential to ensure that they are effective and safe. Attention should be given, as in normal circumstances, to monitoring the condition of filters and, if possible, increasing the central air filtration as high as possible without significantly diminishing design airflow".

Drawing conclusions about the role HVAC systems might play in spreading COVID-19 is difficult. Only a few published studies look at that issue, and experts admit there has been too little research into the role of HVAC systems in the spread of the novel coronavirus. The WHO Transmission of SARS-CoV-2: implications for infection prevention precautions
Scientific brief on the 9 July 2020 reports "Urgent high-quality research is needed to elucidate the relative importance of different transmission routes; the role of airborne transmission in the absence of aerosol generating procedures; the dose of virus required for transmission to occur; the settings and risk factors for superspreading events; and the extent of asymptomatic and pre-symptomatic transmission." In the same brief document it also states "The role and extent of airborne transmission outside of health care facilities, and in particular in close settings with poor ventilation, also requires further study."

The NPR report in an article written on the 15th August 2020 “In one study, which is available online as a pre-print and has not undergone scientific review, researchers in Oregon collected samples from various places inside a hospital's HVAC system and found genetic material from SARS-CoV-2, the virus that causes COVID-19. This demonstrates that it may be possible for the virus to be transmitted through HVAC systems.” – source Can Air Conditioners Spread COVID-19 (link https://www.npr.org/sections/goatsandsoda/2020/08/15/897147164/can-air-conditioners-spread-covid-19?t=1600423209362).

Manish Butte, PhD, an associated professor in the department of microbiology, immunology, and molecular genetics at the University of California, Los Angles told Health that when an AC vent is turned on, air flow can push tiny infectious droplets through the air and onto people. “The air flow direction is what matters,” he said, adding that air conditioning can help these droplets spread farther.”- https://www.newsmax.com/health/health-news/air-conditioning/2020/05/21/id/968428/

CIBSE have also written a response entitled CORONAVIRUS, SARS-COV-2, COVID-19 AND HVAC SYSTEMS. “Droplets will generally fall out of the airstream within a short distance (depending on airflow speed and direction), hence the guidance to remain 2m apart. However, these may evaporate, reducing in size and mass and travel further in air streams, contaminating surfaces and increasing the risk of airborne transmission.

While airborne transmission is not thought to be a primary route of transmission, there is an emerging and growing body of evidence that the SARS-CoV-2 can also be spread through the air, particularly in poorly ventilated indoor spaces, and that ventilation provision in buildings should be reviewed in the light of this. For an explanation of airborne transmission, see the series of tweets by Prof. Lynsey Marr.” (https://www.cibse.org/coronavirus-(covid-19)/coronavirus-covid-19-and-hvac-systems).

In an article written by Mckinskey “HVAC systems can potentially spread a virus across rooms when high-speed air flows pass and infected person to others, something that has been shown with Severe Acute Respitatory Syndrome in 2004.”

A report from the European Centre for Disease Prevention and Control has concluded that HVACs filter out large droplets containing the coronavirus, although the air flow could blow the droplets over a larger distance than they would travel in a still setting. The report also says such systems could spread Covid-19 aerosols if air is recirculated. But, it adds: “There is currently no evidence of human infection with Sars-CoV-2 caused by infectious aerosols distributed through the ventilation system ducts of HVACs.”

On the 13th September 2020 CBC News reported that a team of Engineers headed up by professor Carey Simson at the University of Saskatchewa have received a grant to research the effects of small particles of the novel coronavirus and possible transmission through HVAC systems. Professor Simson has stated "It's enough of a concern that our systems, our HVAC systems, should consider the possible transmission through the ventilation, heating and cooling systems," They're looking specifically at ventilation and air-to-air energy exchangers, and whether they would bring in some of the contaminants that were sent out of the building back into it with government funding.

1.3 In the interest in providing best practice guidance, we have reviewed and discussed the technical content of the publications and supplemented appropriate content with additional information to illustrate the effects of mechanical ventilation on Indoor Air Quality and the risk of exposure to Covid-19 and other airborne organisms.

1.4 Whilst some studies are unequivocal in their advice that ductwork does not transmit the coronavirus, NAADUK adopt the view that whilst there is a potential risk a sensible approach is to continue cleaning and maintenance at the recommended or greater frequency to ensure the HVAC system is fully functioning. To NAADUK’s knowledge no tested studies have ruled out transmission and combined with calls for more research from bodies such as the WHO and potential second waves occurring in Europe as colder weather forces people inside a sensible pragmatic approach is called for.

2.0 Covid-19

2.1 Because Covid-19 or Cov2 information is so limited, information from Sars1 is used for guidance. This assumes the virus can stay active for up to 3 hours in indoor air and can stay active for 2-3 days on room surfaces at common room temperatures. Airborne viruses have caused infection in the past and Sars1 and is likely to be similar to Covid-19, but as of yet, not documented.

2.2 The recent report of swabs taken by exhaust vents in a room occupied by infected patients, implies that a 1-2 meter distance might not be enough to prevent the transmission of the virus. Toilet extract grilles have tested positive for Covid-19.

2.3 **Increasing ventilation** (outside air) is proven to be beneficial in the removal of infectious virus and particles and reducing the risk of transmission.

2.4 To minimise the risk of airborne transmission, use the ALARA principle (as low as reasonably achievable). We will advise on recommended practice further on.

2.5 Advice from gov.uk on covid-19 working safely during coronavirus (COVID-19) updated on the 18th September 2020 recommends under 5.3 Hygiene: handwashing, sanitation facilities and toilets point 8 keeping facilities well ventilated, for example by fixing doors open when appropriate.

3.0 Ventilation Systems

3.1 Ventilation systems are installed to provide clean, conditioned air to the building occupants.

3.2 A clean ventilation system is an essential part of a healthy building.

3.3 Airborne containments can be minimised and removed from the building by effective filtration and regular cleaning and maintenance of the ventilation systems. **There is detailed guidance on this throughout the document.**

4.0 General guidance on building services operations to improve ventilation hygiene

4.1 Ventilate space with outdoor air if possible.

4.2 Switch ventilation to operational speed at least 2 hours before the building usage time and switch to lower speed 2 hours after the building usage time. This will clean the air before use and after use by utilizing higher air change rates.

4.3 At nights and weekends, do not switch ventilation off, but run systems at lower speed.

4.4 Open windows for regular airing (even mechanically ventilated buildings).

4.5 Keep toilet ventilation 24/7 in operation.

4.6 Avoid open windows in mechanically ventilated toilets to assure the right direction of ventilation. This must be reviewed by the user.

4.7 Instruct building occupants to flush toilets with the lid closed.

4.8 Switch all air handling units with recirculation to 100% outdoor air with the recirculation damper closed and ensure the fresh air and exhaust air dampers are open. See diagrams further on.

4.9 Inspect heat recovery equipment to be sure that leakages are under control.

4.10 Switch fan coils either off completely or operate so that fans are continuously on.

4.11 Do not change heating, cooling and humidification setpoints.

4.12 Visually inspect all ductwork systems at the grilles and diffusers. Blocked grilles and grille dampers reduce ventilation and increase risk of Covid-19 transmission. This is mainly applicable to extract and return air grilles, especially toilet extracts. See diagrams further on.

4.13 Do not plan duct cleaning for this period unless planned or necessary. The system should be cleaned if following an inspection.

- **4.13.1** The airflow is restricted due to soiling of grilles and grille dampers
- **4.13.2** Risk of foreign matter falling from extract/return air grilles into room.
- **4.13.3** The system does not meet statutory hygiene requirements.

4.14 Replace Air Handling Unit, Fan Coil Unit and all other filters as usual in accordance with manufacturers recommendations.

4.15 Regular filter replacement and maintenance works shall be performed with common protective measures including respirator protection

5.0 HVAC System operation to improve ventilation hygiene.

By maximising the ventilation in the building, the risk of transmission of Covid-19 will be reduced significantly. Maximising ventilation and ventilation hygiene is achieved by:

5.1 Only using outdoor or fresh air to ventilate the building.

5.2 Operating HVAC plant to obtain maximum air change rates.

5.3 Ensure system is balanced to achieve uniform air distribution and reduce dead spots.

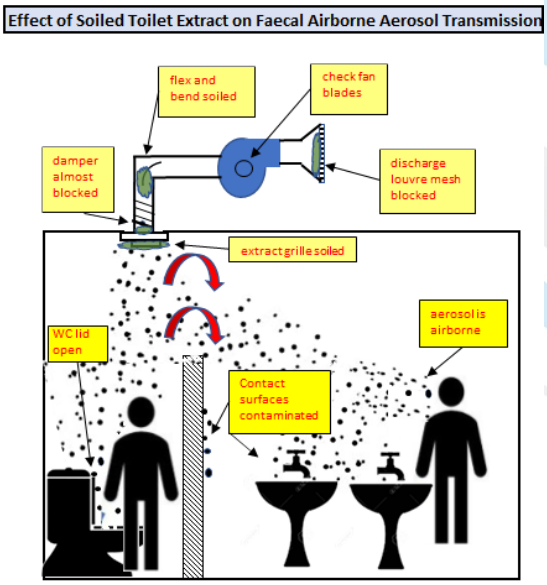
5.4 Ensure extract and return air grilles are clear of restrictions or blockages caused by foreign matter lodged on them. In the case of Covid-19, **toilet extract grille cleaning** is critical due to suspected faecal aerosol transmission routes.

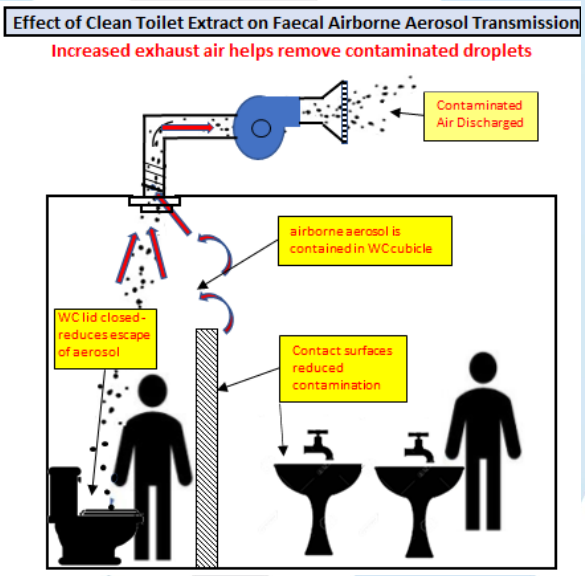
5.5 Change filters as per manufacturers guidelines as soiled filters will reduce airflow.

5.6 Inspect AHU coils for foreign matter as they can considerably reduce airflow.

DID YOU KNOW?

On a recirculating system with an average velocity of 5m/s, 50 metres of supply duct and 50 metres of return duct, it would take approximately **25-30 seconds to re-introduce virus back into the room**.





6.0 Filtration and Covid-19

6.1 Most general ventilation systems contain panel and bag filters that will not remove micro-organisms and virus including Covid-19.

6.2 Some virus have been known to penetrate HEPA filters.

6.3 However, filter maintenance should be carried out as part of the normal operation of the system as filters stop large particles, contaminants, pollen, insects, etc entering the building.

6.4 Seek advice from your Filter Supplier on the correct usage of filter media, in accordance with EN 1822-1:2019 High efficiency air filters (EPA, HEPA and ULPA). Classification, performance testing, marking

7.0 Fan Coil Unit operation to manage Covid-19 transmission.

7.1 Fan coil units represent a reasonable concern for the transmission of Covid-19 due to way they function within an occupied space.

7.2 Fan coil units are generally installed above the ceilings of an area and recirculate the air locally within the space. In large open plan offices, there may be large quantities of fan coil units installed. These units generally contain coarse filters which do not filter small particles and may load with particles containing micro-organisms.

7.3 Consideration should be given to the following operation procedures:

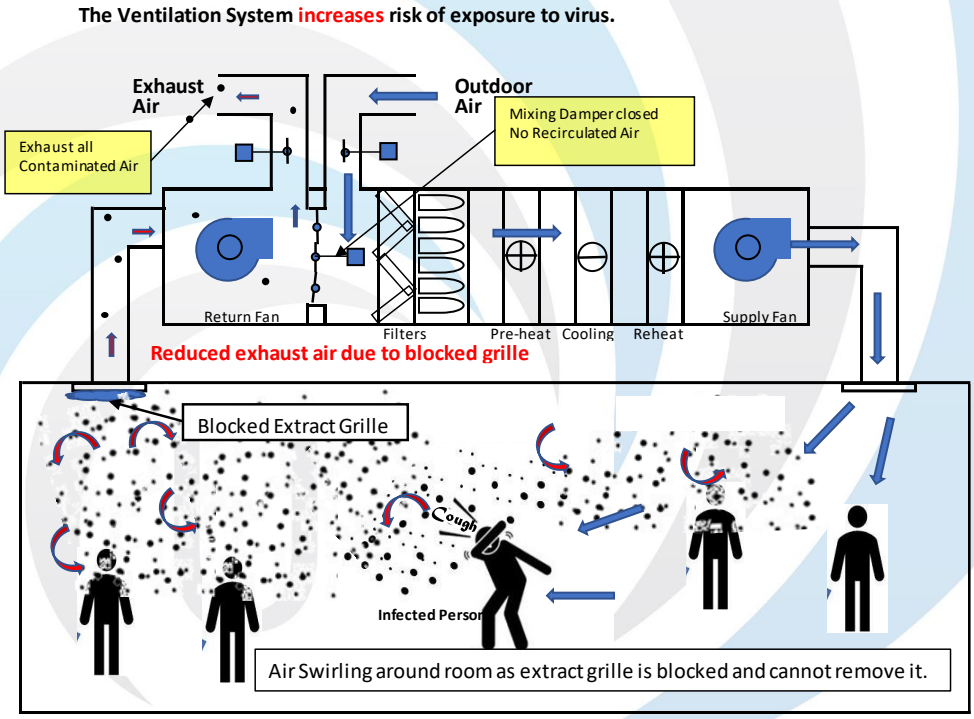
7.3.1 If there is no significant cooling load, turn off the fan coil units altogether to avoid re-introduction of virus particles into the area.

7.3.2 Kill any micro-organisms or virus lodged on the filter by heating up the fan coil unit to 60 0C for one hour or 40 0C throughout the day.

7.3.3 If the fan coil unit cannot be switched off, run the fan continuously. Virus can lodge on the filters and a resuspension boost can occur on start-up when the fan is started.

7.3.4 Maximise exhaust ventilation to remove virus particles.

8.0 Effect of soiled extract/return air grilles in ventilation systems.

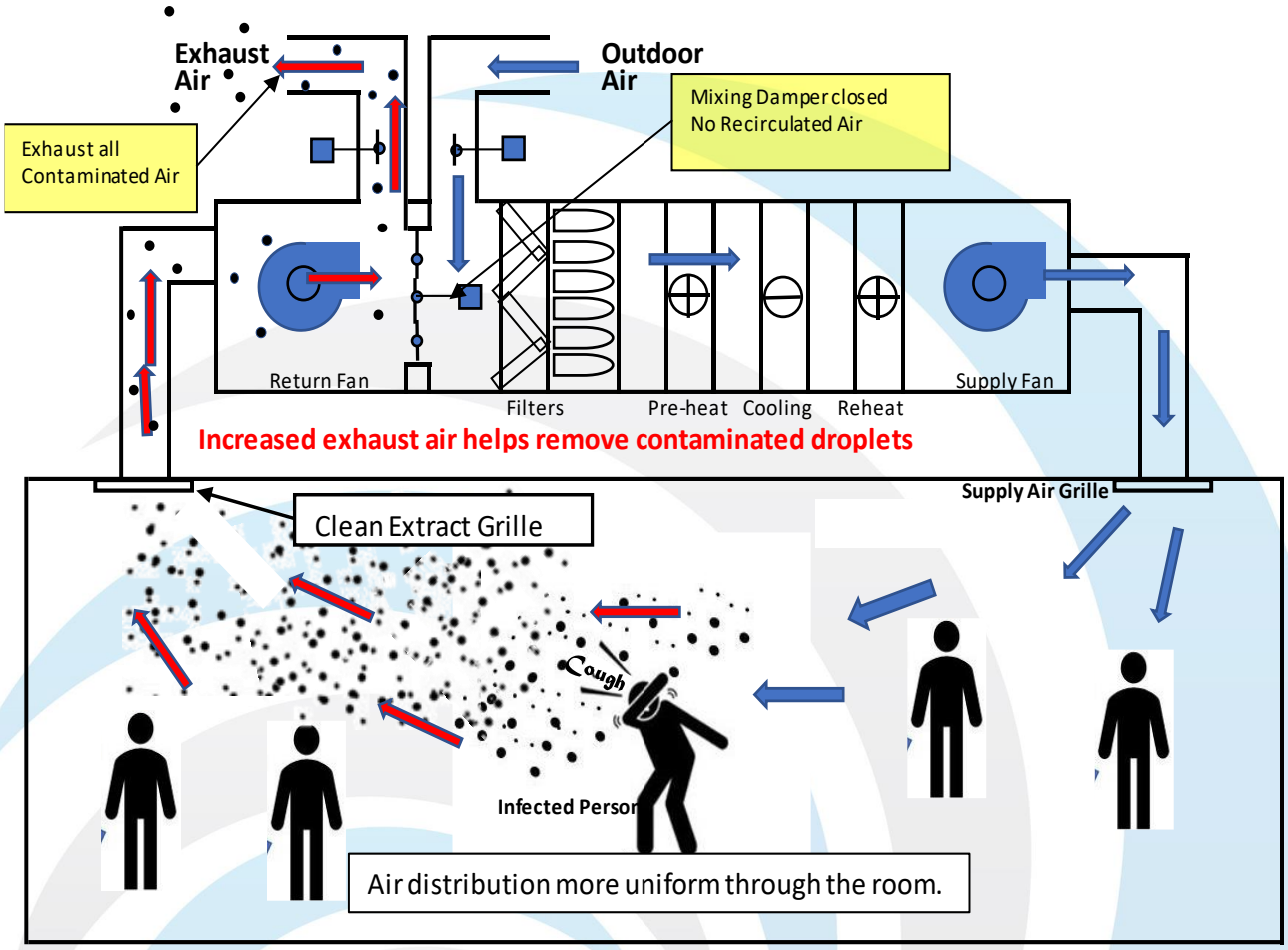


Increased Risk of Infection due to:

- Reduced air change rate
- Reduced or no extraction through the grille.
- Increased number of contaminated droplets in contact with people.
- Increased number of contaminated droplets depositing on surfaces and work stations.
- Longer exposure time of occupants to virus and bacteria.

9.0 Effect of clean extract/return air grilles in ventilation systems.

The Ventilation System decreases risk of exposure to virus.

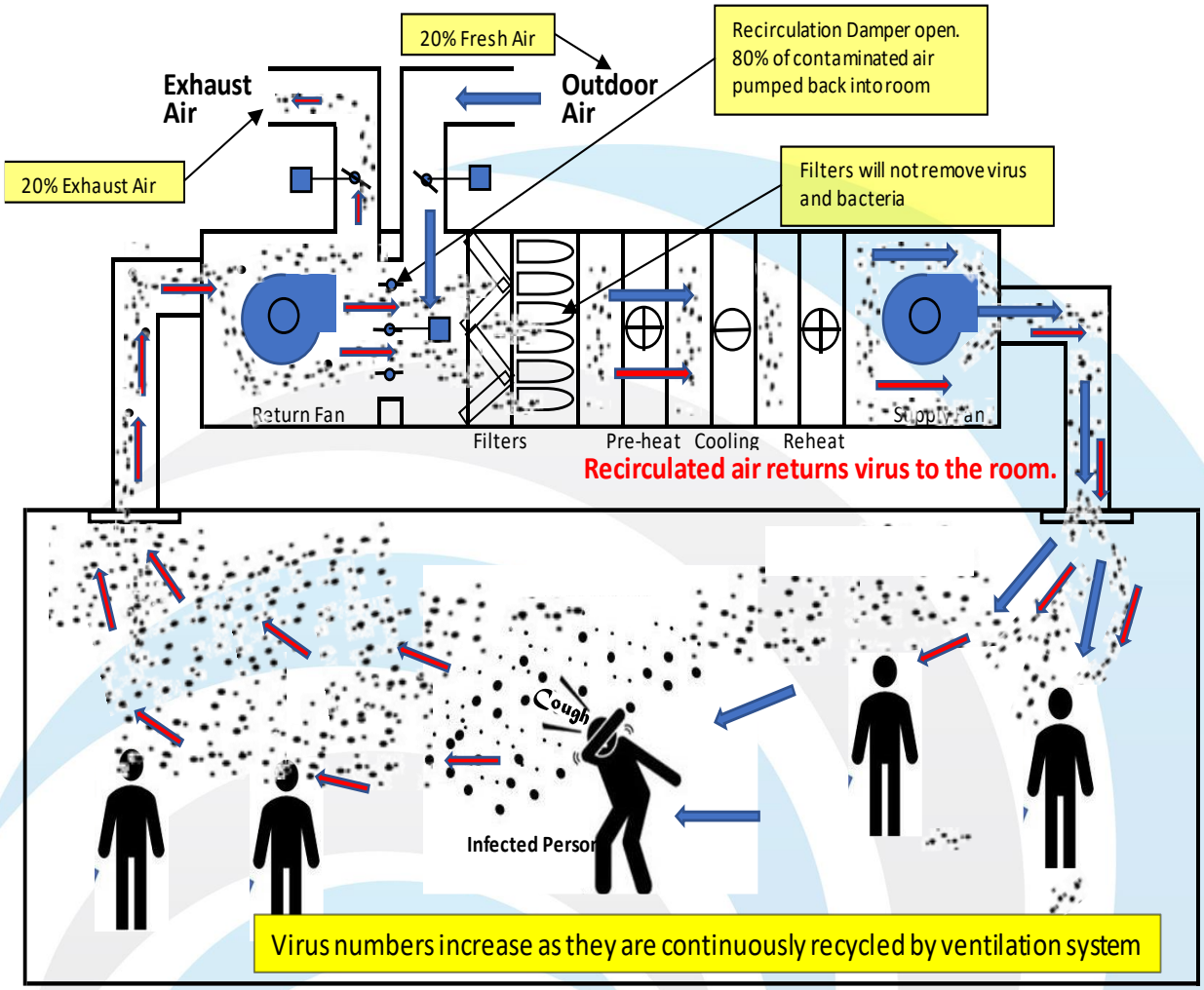


Reduced Risk of Infection due to:

- Air distribution more uniform and extract grille is removing contaminated air.
- Air flow rates as per system design.
- Contaminated droplets taken away from occupants by airflow.
- Reduced number of contaminated droplets depositing on surfaces and work stations.
- Minimum exposure time of occupants to virus and bacteria.

10.0 Effect of 100% Recirculation in a Building

The Ventilation System increases risk of exposure to virus.

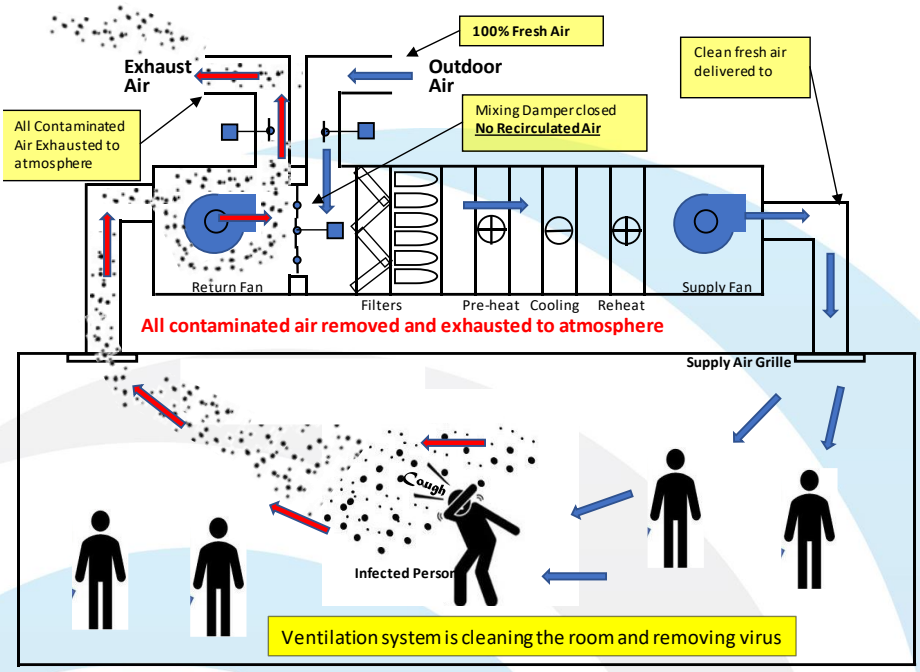


Increased Risk of Infection due to:

- Ventilation system is **increasing risk of infection** in the room.
- 80% Air containing virus re-introduced to the room.
- Filters will not remove virus and bacteria.
- Increased number of contaminated droplets in contact with people.
- Increased number of contaminated droplets depositing on surfaces and work stations.
- Contact with infected person **not necessary** to be exposed to virus or surface contamination.
- Longer exposure time of occupants to virus and bacteria.

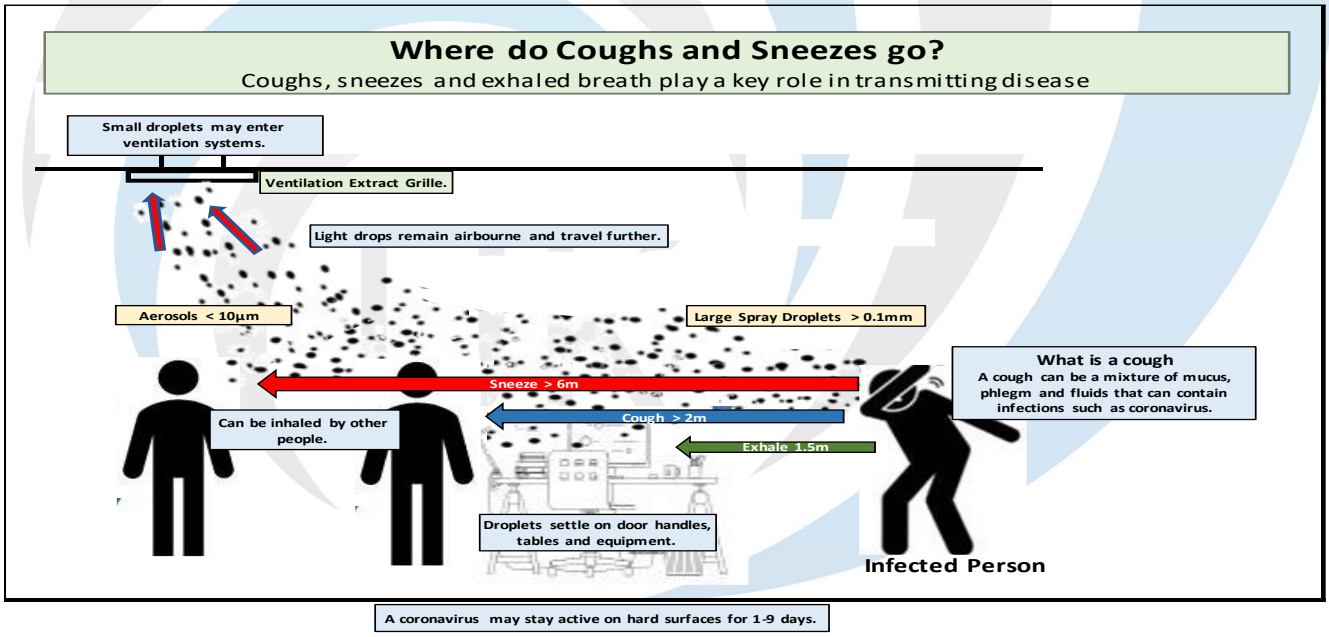
11.0 Effect of 100% Fresh Air in a Building.

The Ventilation System decreases risk of exposure to virus.



Reduced Risk of Infection due to:

- Ventilation system is cleaning air in the room.
- Most or all contaminated air being removed from the room.
- 100% Fresh Air being supplied to the room.
- Contaminated droplets taken away from occupants by airflow.
- Reduced number of contaminated droplets depositing on surfaces and work stations.
- Minimum exposure time of occupants to virus and bacteria.



12.0 Effect of Air Change Rate on Contaminant Removal

12.1 The table below shows the effect of air change rate on contamination removal.

12.2 Ventilation and air change rates are critical to ventilation hygiene and to minimise the risk of Covid-19 transmission by aerosol.

12.3 In the below test, by increasing the air change rate from 2 ACH to 4 ACH, the contamination time halved.

Table B.1. Air changes/hour (ACH) and time required for airborne-contaminant removal by efficiency *

ACH § ¶	Time (mins.) required for removal 99% efficiency	Time (mins.) required for removal 99.9% efficiency
2	138	207
4	69	104
6+	46	69
8	35	52
10+	28	41
12+	23	35
15+	18	28
20	14	21
50	6	8

12.4 The photo of the extract grille below shows the part of the grille we don't see from the ground. The face of the grille might be cleaned by contract cleaners but the grille is fully blocked. **This is why professional ventilation system inspections are required.**

A complete clean of extract (and supply) grilles requires that the grille face (or grille is removed and the diffuser, damper, grille box, flex and vertical duct are cleaned. A survey of the grilles is necessary before undertaking this work to establish the difficulty levels in cleaning various grilles installed to the stated level.

13.0 Recommendation to Members

Taking into account the above our recommendations for our members are as follows:-

13.1 Concentrate on the cleaning of extract air systems, particularly toilet extract systems and recirculating air systems in offices and factories.

13.2 Clean supply and extract systems in areas where Covid-19 infections occurred and decontaminate the buildings also if equipped to do so.

13.3 Advise duct cleaning and damper testing whilst buildings are unoccupied so that when staff or guests return (offices, shops and hotels) the buildings are safe and ready for use. This is beneficial to the vent hygiene techs and the client while the buildings are unused.

13.4 Consider obtaining training on HVAC sanitizing and building sanitizing to supplement duct cleaning. There are various systems on the market such as electrostatic fogging, ozone fogging, etc. Proper training and certification is required to protect yourselves and the occupants of the buildings.

13.5 Safety:

13.5.1 Follow government guidelines in relation to social distancing, hand washing, essential travel and staying at home, etc.

13.5.2 Wear PPE at all times when working.

13.5.3 Decontaminate tools after use.

13.5.4 Always allocate where possible, same team same vehicles.

13.5.5 If using pool vehicles, decontaminate after use and also before using a different vehicle.

13.5.6 When not in vehicles always use face masks or improvised protection in general areas before switching to full PPE when working in possible contaminated areas.

13.5.7 Follow NHS guidelines for garbing and de-garbing PPE when working with Covid-19.

13.5.8 Advise clients COVID 19 will not be the last pandemic and clean ducts are just a tiny tool in the box to help fight all future virus pandemics

13.5.9 Get it **DONE NOW** whilst the building is empty, to ensure legal adherence to Health & Safety 1992 Reg Rev2013, "All internal parts of a mechanical air conditioning system must be cleaned"

13.5.10 **STAY SAFE**

Many of our member Companies operatives are working in the same infected areas as NHS and Care Home Staff during this outbreak. We are very proud of their efforts and to keep all safe.
So please stay safe yourselves, and thank you all, once again, for all your efforts.

Peter Reid, FIC
President of NAADUK