GWS Specialist Cleaning Services LTD
Accredited Members of NAADUK

COVID-19 Guidance

Return to Work

Maximise your Ventilation System Performance

1.0 Introduction

In addition to our previous Covid-19 Guidance publication, there is a requirement for building owners and managers to maximise the ventilation in the workplace to reduce the transmission of Covid-19.

For the benefit of our members and all building managers, we are issuing this specific guidance to provide a better understanding of the role of both the requirements and benefits of maintaining ventilation systems in a clean condition.

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 relevant to all types of commercial and public buildings such as offices, factories, schools and hotels where normal social transmission is possible. Hospitals and healthcare facilities in particular will benefit from the service due to the higher risk of contact with Covid-19 and the specialised work procedures required

Disclaimer:

This NAADUK 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. 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.

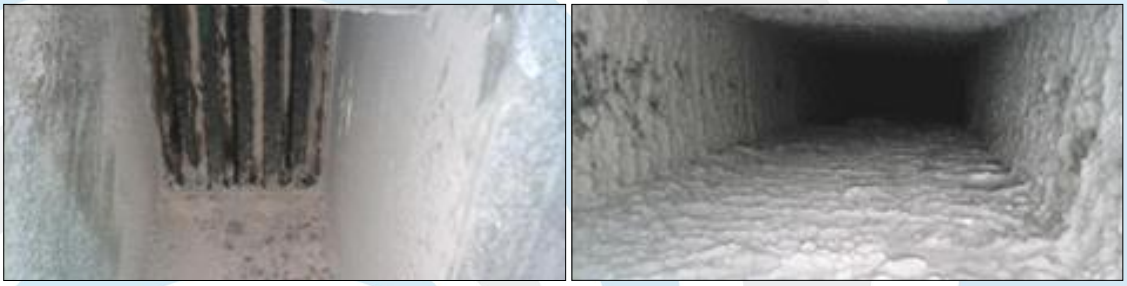
2.0 Background

2.1 There is worldwide consensus that increasing ventilation rates is proven to be one of the most effective measures that can be taken in reducing Covid-19 transmission in buildings.

2.2 NAADUK have reviewed many products being promoted to provide cleaner air and increase ventilation and have concluded that currently **cleaning a ventilation system is the most cost effective and proven method of allowing a ventilation system operate to its maximum potential.**

2.3 NAADUK acknowledge the excellent world leading standards set by BSI and CIBSE and many associations like ourselves hang on to their shirt tails and utilise many of their standards in our own publications.

2.4 However, in relation to COVID-19, we feel the industry in general has overlooked the importance of ventilation hygiene and duct cleaning services. Ductwork in the UK is not sparkling clean (see pictures below) and in some cases it is heavily contaminated and an ideal breeding ground for bacteria to multiply.



2.5 Extract ductwork components such as egg crate grilles, dampers and flexible ducts can be totally blocked, causing air to swirl inside the buildings, generate dead spots with stagnant air and increase the spread of virus such as Covid-19. The photos below are from a hospital.

2.6 We must not assume all ductwork is clean (like in Tom Cruise movies!!). In fact the opposite is often the case and the photos above are normal in many buildings.

2.7 COVID-19 is a pandemic with huge consequences, and the next wave of the pandemic could hit harder. It makes sense to comply with the law as a minimum. In 1992 and revised in 2013 Health & safety stated that all internal parts of mechanical air conditioning systems must be clean. Guidance document BS EN 15780/11 sets out the recommended inspection and cleaning recommendations.

2.8 In addition, employers and building owners should risk assess the ventilation systems in their building for ventilation rates and hygiene condition. There is a legal responsibility for employers to provide a **safe place of work** for employees under national health and safety legislation.

2.9 It is the ideal time to ensure that ventilation systems within the buildings are hygienically cleaned and maintained this way before returning to work and in the future.

2.10 It makes good financial sense that whilst the buildings are unoccupied it would be easier and cheaper to gain access to comply with current legal requirements.

2.11 All newly proposed ventilation system air cleaning and sterilizing products require a substantial initial investment, increase power consumption and increase operating costs. They will require expensive annual replacement parts (hepa filters and lamps) and are not **proven to be fully effective against Covid-19**. Compared to the tried, tested and hugely beneficial service of duct cleaning, they will probably end up being an unnecessary waste of money.

3.0 Relationship between Ventilation, Quanta (Infectious Dose) Generation Rate, Duration of Exposure and Breathing Rate

(Graphs from BSI S0789_EMG_Role_of_Ventilation_in_Controlling_SARS-CoV-2_Transmission)

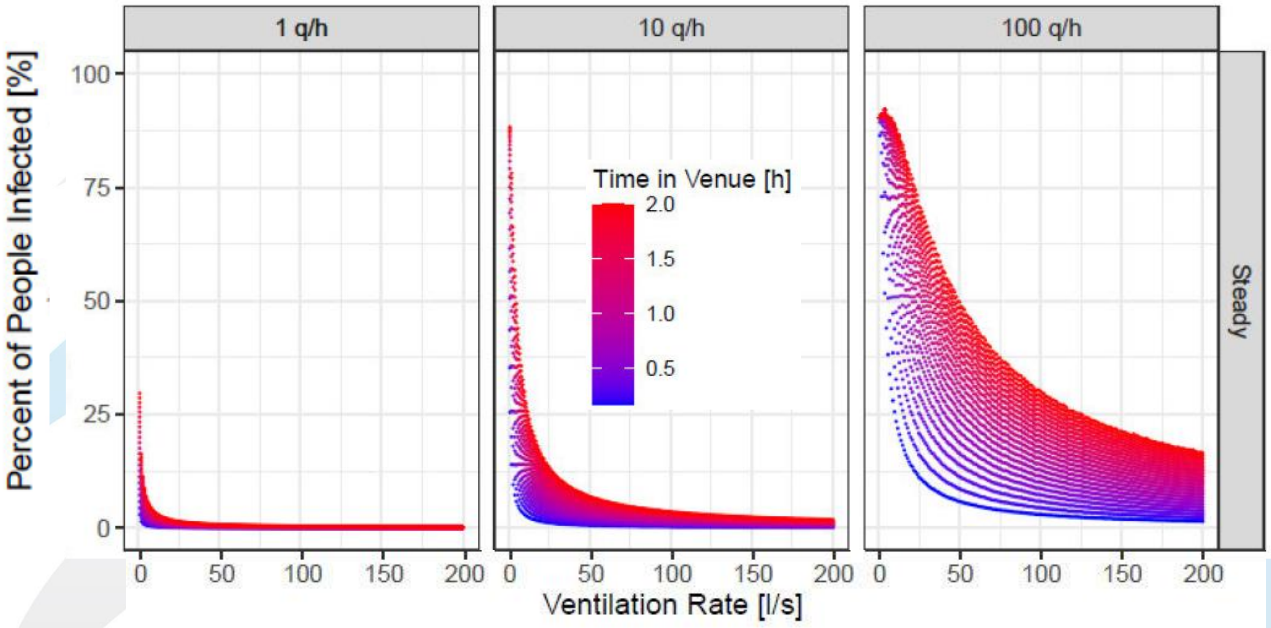
3.1 In simple terms, one quanta as the infection dose required to transmit Covid-19.

3.2 One Quanta is generated through sedentary conditions with low vocalisation (talking).

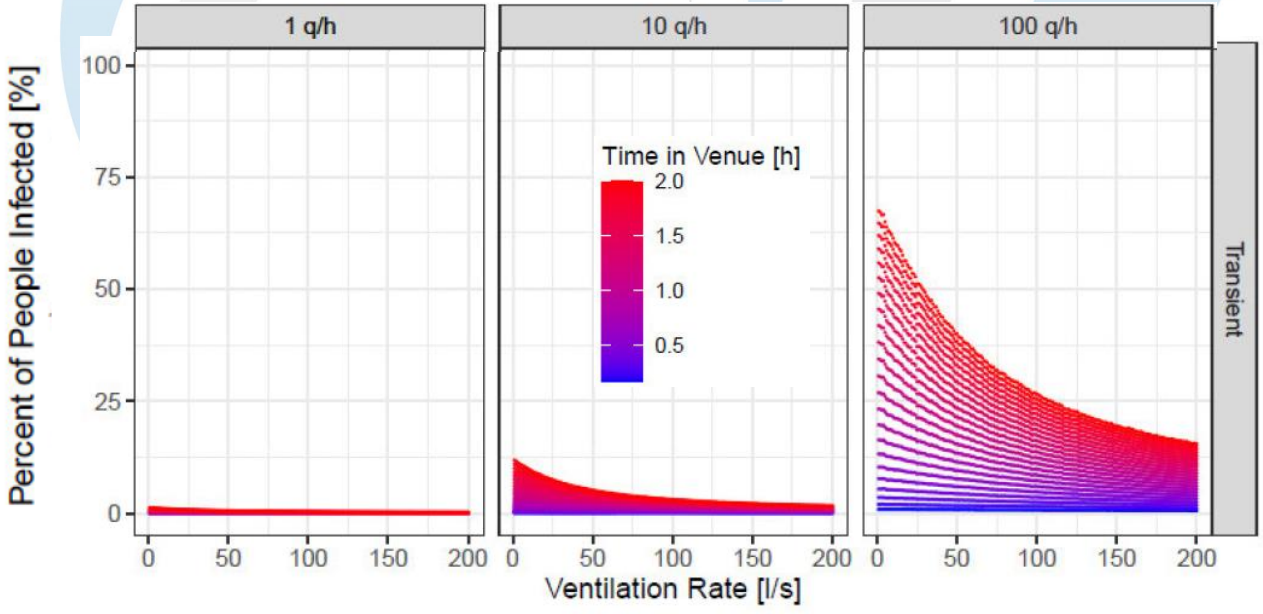
3.3 10 Quanta can be generated through elevated speech (raised voice).

3.4 100 Quanta can be generated through vocalisation during light exercise.

3.5 **Steady Conditions** Steady state conditions are applicable where the infector has been present in a venue for some time before the exposure (e.g. **office environment** or small retail outlets where shop assistants can infect customers).



3.6 **Transient Conditions** Transient conditions are applicable where susceptible and infected people enter a venue at the same time (e.g. a audience at a performance).



3.7 **Interpretation of Graphs.**

3.7.1 Risk of transmission increases with longer duration, lower ventilation rate and activities that may have enhanced aerosol.

3.7.2 In a steady state setting such as an office environment, ventilation rate is critical to reduce the rate of Covid-19 transmission. Observe the sharp fall-off in transmission rate with increased ventilation.

3.8 **CO2 and Ventilation Control.**

(Table from BSI S0789_EMG_Role_of_Ventilation_in_Controlling_SARS-CoV-2_Transmission)

3.8.1 The table below again shows the relationship between ventilation/Co2 and transmission of Covid-19.

3.8.2 The | 1 | 10 | 100 | units shown in the table are units of quanta (infectious dose required for transmission of Covid-19).

3.8.3 The areas coloured are the numbers of new cases at the varying conditions.

Table 3: Averaged likely number of new cases in a worst-case occupancy scenario with ventilation rate/ CO_2, quanta generation rate and time (30 people, 150 m3 room, continuous occupancy, 8 l/min breathing, 0.005 l/s/person CO_2 generation).

		1 hour			2 hours			4 hours			6 hours		
l/s/person	steady CO2	1	10	100	1	10	100	1	10	100	1	10	100
1	5373	0.04	0.38	3.59	0.13	1.23	10.25	0.36	3.38	20.92	0.61	5.58	26.17
3	2058	0.03	0.26	2.51	0.07	0.68	6.13	0.16	1.53	12.24	0.25	2.36	16.79
5	1395	0.02	0.19	1.88	0.05	0.46	4.26	0.10	0.98	8.45	0.15	1.49	11.96
10	897	0.01	0.11	1.13	0.02	0.25	2.38	0.05	0.51	4.73	0.08	0.77	6.88
20	649	0.01	0.06	0.61	0.01	0.13	1.26	0.03	0.26	2.51	0.04	0.39	3.70

Models and practical experience indicate that measurement of CO_2 is a useful indicator to identify poor ventilation in the context of airborne transmission, but may not be necessarily an indicator of sufficient ventilation to fully mitigate transmission.

In a space with more than 20 occupants, a CO_2 concentration routinely greater than 1500ppm (absolute level) is considered to be an appropriate marker to indicate poor ventilation or overcrowding regardless of the size of a space, and is therefore likely to be associated with a higher risk of transmission. Spaces where CO_2 cannot normally be kept under 1500ppm are suggested as the highest priority for mitigation.

Settings where there is likely to be enhanced aerosol generation, for example through singing, loud speech or aerobic activity may pose a substantially higher risk. Ventilation rates should aim to maintain CO_2 below 800ppm and the duration of exposure below 1 hour. Even this may be insufficient to fully mitigate transmission, and other measures may need to be introduced.

Use of CO_2 as an indicator for ventilation effectiveness is more difficult in spaces with lower numbers of occupants (<20) due to the increased influence of individual variations in CO_2 generation rate; any measurements in spaces with lower occupancy should be treated with caution. Measurement of CO_2 cannot account for other mitigation strategies such as filtration, UVC air cleaning or the use of face coverings; these strategies remove the virus from the air but not CO_2.

3.8.4 The table clearly shows that reduced litres per second (l/s) of fresh air per person can lead to an increased risk in transmission of Covid-19. The 6 hour figures are frightening.

4.0 Effects of Contaminated Ventilation Systems

4.1 **Reduced supply airflow and ventilation**.

Heavily contaminated and blocked heating coil

4.2 **Reduced air extraction and thus air cleaning in the building.**

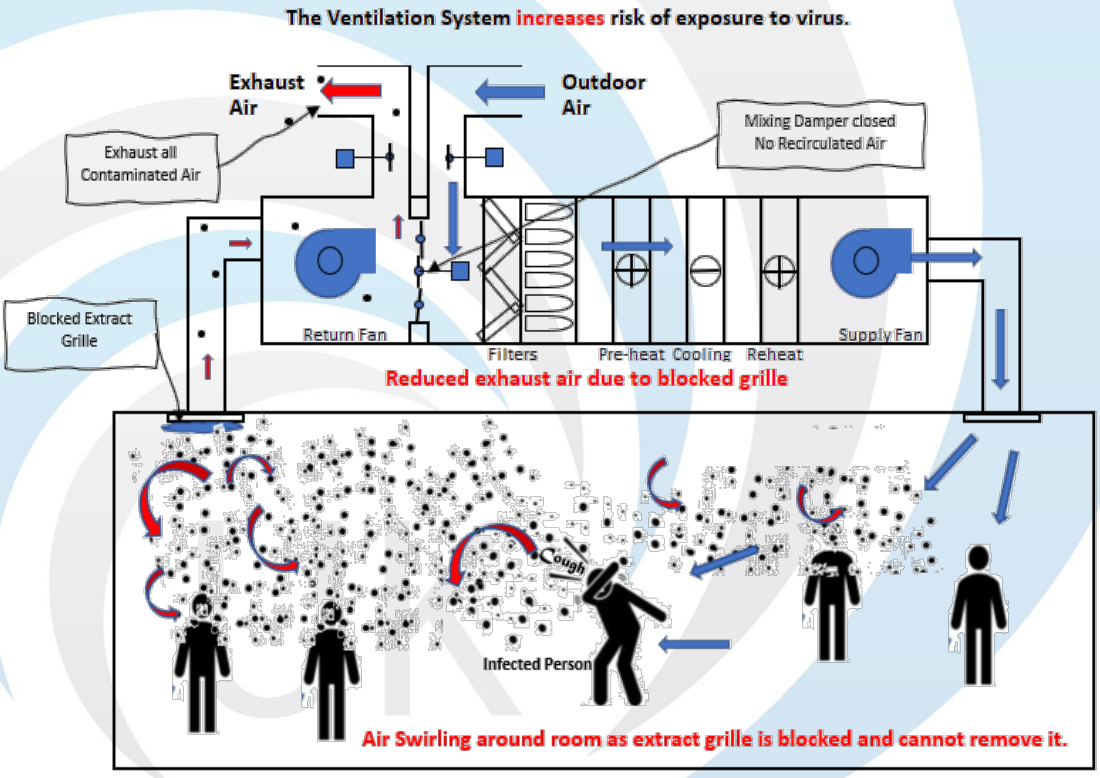
Heavy Contamination on grille and damper.

Heavily regulated damper blocked

4.3 Increased power consumption.

Fans, motors, coils, chillers and boilers will have to work harder on contaminated systems.

4.4 Disruption of intended room airflow patterns.



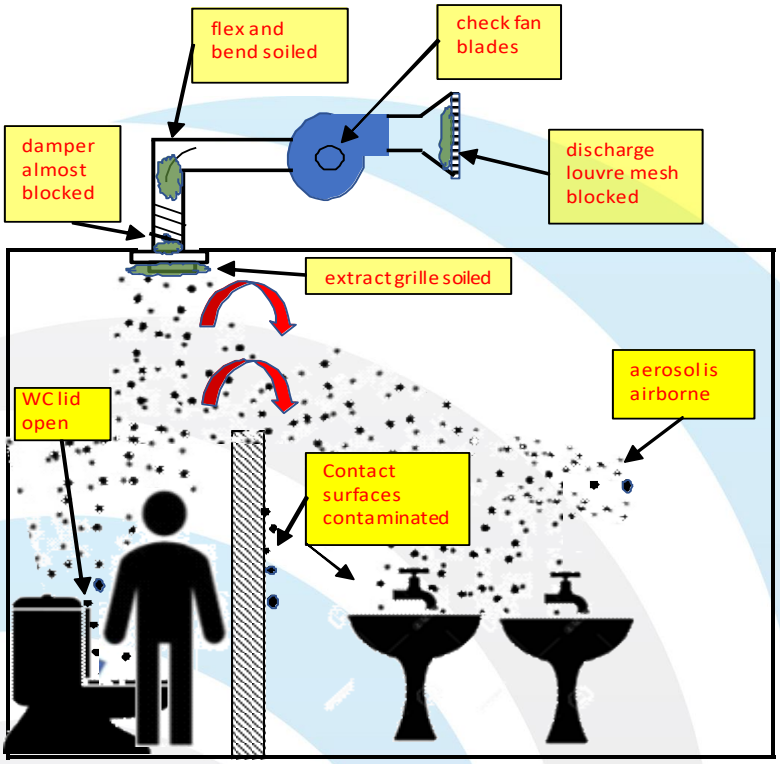
Increased Risk of Infection due to:

- 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.

In addition, there can be stagnant air in dead spots in the room where there is no air movement and this is highly undesirable.

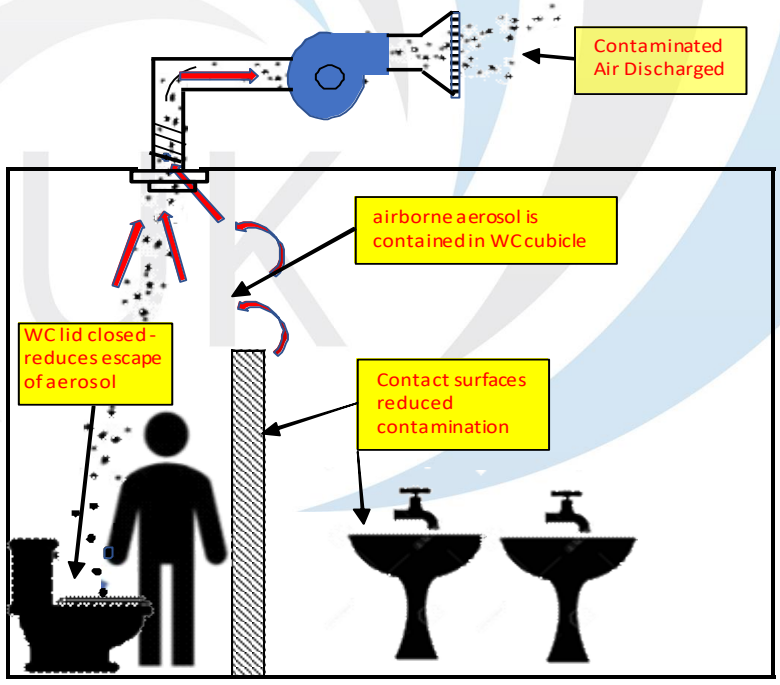
4.5 Faecal Aerosol Transmission reduced

Effect of Soiled Toilet Extract on Faecal Airborne Aerosol Transmission



Effect of Clean Toilet Extract on Faecal Airborne Aerosol Transmission

Increased exhaust air helps remove contaminated droplets



Effects of Contaminated Ventilation Systems.....cont'd

4.6 **Inefficient heat transfer leading to poor comfort conditions and increase in Building Related Illness.**

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

Supply duct before cleaning

Supply duct after cleaning

5.0 Considerations for supplementary Air Cleaning Products

5.1 **Hepa Filters**

5.1.1 Substantial plant modifications will be required.
5.1.2 Possible electrical components, fan and motor upgrades.
5.1.3 AHU incorrect pressure rating and risk of leaks.
5.1.4 Substantial increase in power consumption and operating cost.
5.1.5 Expensive filter replacement costs and associated labour.
5.1.6 Integrity testing of hepa filters.
5.1.7 Not proven to be effective against Covid-19.

5.2 **UV-C** (Ultra-Violet Light) **Installation in Ventilation System**

5.2.1 High capital cost of installation.
5.2.2 AHU and/or duct modifications required.
5.2.3 Increased building power consumption.
5.2.4 Ventilation system velocities must be compatible with UV-C requirements.
5.2.5 Electrical cabling and controls required.
5.2.6 Must be replaced every 10,000 hours approx (2-3 years).
5.2.7 Tube replacement expensive.
5.2.8 Dose rates versus exposure time in HVAC systems not proven.

6.0 Advantages of Ventilation System Cleaning

By maximising the ventilation in the building, the risk of transmission of Covid-19 will be reduced significantly. Advantages of maximising ventilation through ventilation hygiene are:

6.1 Plant will operate at maximum capacity and deliver ventilation rates close to original design.

6.2 Power consumption is kept to a minimum or if desired, there may be capacity on the fan and motor to further increase air flow-rate and ventilation with a simple, inexpensive belt and pulley change.

6.3 Cleaning of extract systems will ensure room air flow patterns are maintained and contaminated air is removed from the transmission zone as quickly as possible. Turbulent airflow patterns or "dead spots" will increase the transmission of Covid-19.

6.4 Faecal Aerosol Transmission reduced as toilet grilles can extract contaminated air from the area at the required extraction rates.

6.5 **Proven engineering solution** to deliver increased ventilation rates and reduce operational costs.

6.6 Cost of cleaning ventilation systems significantly less than air cleaning alternatives and **annual hygiene certification** will be a fraction of the cost of the alternatives.

6.7 Annual Hygiene Certification for Insurance Purposes and Health and Safety File.

6.8 Service is proven visually through photo reporting of the ventilation duct internal surfaces before and after cleaning.

6.9 Staff wellbeing and safety increased to maximum.

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 everyone's efforts, so follow the guidance and safe working practices.

So please keep yourselves safe and once again, thank you for all of your efforts.

Peter Reid – FIC - MPR

President of NAADUK