University and College Union

Covid-19: Ventilation at work

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1. Why is good ventilation important?

Indoor air quality has a huge impact on our immediate and long-term health and can also affect our productivity and performance. Good ventilation systems will ensure an effective and sufficient supply of fresh or purified air into an enclosed space. They broadly fall into two categories, natural ventilation and mechanical ventilation.

Once it became widely accepted that Covid-19 is spread through very small aerosols released in exhaled breath, which could travel beyond 2 metres, good ventilation in enclosed spaces became an important control measure to mitigate against transmission.

For instance, when someone with Covid-19 breathes, speaks, or coughs, viral particles are released and smaller aerosols can remain suspended in the air for some time. If people breathe in these particles they may become infected with Covid-19. If people spend long periods of time in a poorly ventilated space, the concentration of virus in the air will build and create a significant transmission risk to occupants.

2. What does good ventilation look like?

Recommendations from experts in the field of ventilation have improved our understanding of what constitutes a good level of ventilation and how this can help to mitigate against Covid-19 transmission.

- UCU Reps should look to agree a ventilation rate of 12-17 litres per second per person (l/p/s) with employers to mitigate against Covid-19 transmission in indoor spaces[i]
- Where CO_2 monitors are being used as a proxy measure we would expect CO_2 levels to be maintained at or below 800ppm.[ii]

2.1 Key points to note

- If a room cannot be ventilated it shouldn't be used
- All recirculation of air must stop
- Personal desk fans and ceiling or pedestal fans should be shut down in areas where more than one person works

- Each room should identify who is using it and how, how many people, what the activity is and for how long
- Building Design Occupancy can be requested
- There should be a break between usage to ventilate a room
- Room occupancy limits should be clear and should be reduced to improve ventilation rates (which will also enable social distancing)
- Fewer people in a space means more fresh air per person.
- Air cleaning and filtration units are not a substitute for ventilation but can reduce airborne transmission of aerosols. Most suitable types are high-efficiency filters and ultra violet-based devices

2.2 Mechanical ventilation

- To establish if the mechanical ventilation is good enough, ask for information about:
    - **Air changes per hour** (ACH) which should be a minimum of 6 ACH but ideally you should be looking for 10-12 ACH. Any room not achieving 6 ACH should not be used.
    - **Filter efficiency** – HEPA – high efficiency particulate air (filter) H14 filters at least 99.995% of any airborne particles with a size of 0.3 microns. H13 can remove 99.95%.[iii] In the US MERV17 filters are being recommended which filter at least 99.97%.
    - Percentage of **fresh air** – which should be set to 100%
- When establishing a fresh-air supply rate, consider the floor area per person, the processes and equipment involved and whether the work is strenuous. There are online calculators available that look at air changes per hour (ACH) and litres per second per person (l/s/p). To establish this you need to know the airflow rate and the dimensions of the space being used. CFM measures the volume of air, in cubic feet, for each minute it moves.

$$ACH = \frac{CFM \times 60\,min/hr}{W \times L \times H}$$

2.3 CO_2 monitors

- A proxy measure of air quality in a room can be done by using a CO_2 monitor. The numbers are not exact and they don't tell you actual risk from the virus. CO_2 increases when there are more people in a space and decreases when ventilation is increased. The value tells you about ventilation and occupancy.
- For most rooms you can use a CO_2 monitor for a short period to check the ventilation in an occupied space.
- They are not suitable in spaces where occupancy varies over short periods but are more suitable for enclosed spaces with occupancy of about an hour minimum.
- CO_2 monitors are not suitable for use in areas that rely on air cleaning units because these remove virus from the air but do not remove CO_2.
- Monitors should be checked regularly and placed away from windows.

- Monitors can be used to help manage ventilation and thermal comfort in a space with natural ventilation/ windows.
- Readings should be recorded as well as the number of occupants and the type of ventilation being used in the space.
- CO_2 should be 800ppm or less as a proxy measure to ensure good ventilation.
- Always look for an NDIR sensor and a monitor that also measures temperature and humidity.
- A monitor that logs data that can be downloaded would be useful.
- Locate the monitor in the part of the room that people occupy.
- Don't locate the monitor near windows or doors.
- Those using CO_2 monitors should know what actions they need to take if CO_2 levels are rising steadily and if they are consistently above 800ppm (some minor fluctuation in readings can occur but should settle quickly). Note a steadily rising CO_2 level suggests a poorly ventilated space even if reading is below 800ppm.

2.4 Windows and ventilation

- The higher the wind speed the greater the ventilation
- On hot still summer days it is hard to get enough airflow and much wider openings are needed to ventilate. Determine which ones to use to get the best flow. Maybe leaving doors open to increase airflow, but don't do this if there is a risk of virus circulating from one room to another.
- When it is cold, open higher windows to limit cold drafts.
- Having trickle vents open or the window on the vent catch can also often be enough in very cold or very windy weather
- Be aware of air pollution from outside, some places are too polluted, noisy or unsafe. This should be identified in ventilation risk assessments.
- Whilst regular airing may help improve air quality, some spaces will need mechanical ventilation or air cleaners to enable safe indoor air.

3. Legislative framework

An employer has legal duties under various Health and Safety Regulations and the consequences of not complying can lead to prosecution or enforcement orders by HSE or LA health and safety inspectors.

Health and Safety at Work Act (1974) — Employers have a legal duty under the Health, Safety at Work Act to ensure the mental and physical health of all workers and everyone else affected by their work activities. They do this by assessing and controlling the risks using a hierarchical control approach. They also have an overall duty to provide and maintain a working environment that is safe and without risk to health.

The Management of Health and Safety at Work Regulations (1999) requires employers to assess and control the occupational risks to health and safety using a

hierarchical approach: eliminations, substitution, engineering controls, administrative controls and PPE. PPE is the last step because it is an individual control. Employers must consider collective controls first.

The Control of Substances Hazardous to Health Regulations (2002) (COSHH) requires employers to assess and prevent or control exposure of employees to substances hazardous to health using control measures, including ventilation.

The Workplace (Health, Safety and Welfare) Regulations (1992) requires that mechanical ventilation systems used for providing general ventilation are maintained, in an efficient state, in efficient working order and in good repair. Employers have also to ensure effective ventilation for any enclosed workplaces by providing sufficient quantity of fresh or purified air. Also toilets have to be well ventilated.

Safety reps and Safety Committee Regulations (1977) — If you have a safety rep then they are entitled to be informed on the control measures used including ventilation through. Even if there are no safety reps then employers have to make this information available to employees.

4. Ventilation risk assessments

4.1 Employers' duties

Employers are required to undertake risk assessments of indoor workspaces to ensure that they provide effective and sufficient levels of ventilation.

THE HSE and HSENI have both provided detailed guidance for employers in how they can undertake a risk assessment of ventilation across their workplace. Employers who fail to undertake a suitable and sufficient risk assessment are not meeting their duties under health and safety legislation to provide a safe working environment for all.

4.2 What is a suitable and sufficient risk assessment?

The HSE say the following:

'The law states that a risk assessment must be 'suitable and sufficient', ie it should show that:

- *a proper check was made*
- *you asked who might be affected*
- *you dealt with all the obvious significant risks, taking into account the number of people who could be involved*
- *the precautions are reasonable, and the remaining risk is low*

- *you involved your workers or their representatives in the process*

The level of detail in a risk assessment should be proportionate to the risk and appropriate to the nature of the work. Insignificant risks can usually be ignored, as can risks arising from routine activities associated with life in general, unless the work activity compounds or significantly alters those risks.

Your risk assessment should only include what you could reasonably be expected to know - you are not expected to anticipate unforeseeable risks.'
(**https://www.hse.gov.uk/managing/delivering/do/profiling/the-law.htm**)

4.3 Ventilation strategy and risk assessments

SAGE recommend the following:

'Ventilation should be integral to the COVID-19 risk mitigation strategy for all multi-occupant public buildings and workplaces. This should include identification of how a space is ventilated and articulation of the strategy that is adopted to ensure the ventilation is adequate.' (**Role of Ventilation in Controlling SARS-CoV-2 Transmission SAGE-EMG**)

The HSE say that employers must:

- Identify poorly ventilated areas
- Assess the risk from breathing in virus in enclosed areas
- Control the risk - Decide on the steps to take to improve ventilation
- Also take account of public health regulations and guidance

Employers will need to know how each space is used, for how many people and for how long. For each space that is to be used they should know the ventilation system that is in place and how to maximise ventilation into a space to mitigate against the airborne transmission risks.

Poorly ventilated spaces need to be clearly identified and taken out of operation. If there is an absence of definitive information about ventilation rates, a precautionary approach should be taken.

4.4 Risk assessment considerations for safety reps

- What is your workplace ventilation strategy?
- Who are the competent persons?
- Has a competent person undertaken the ventilation risk assessment?
- Have experts been consulted as required?
- Have UCU safety reps been meaningfully consulted on the risk assessment?
- Have UCU safety reps been provided with sufficient safety related information about ventilation to enable them to perform their statutory functions?

- Have all foreseeable and significant ventilation hazards been captured in the risk assessment?
- Do the control measures identified reduce any risks to the lowest level practicable following a hierarchy of control approach?
- Does the employer have monitoring and assurance processes in place to ensure risks remain low?

4.5 Factors that can increase covid-19 transmission risks indoors (list not exhaustive)

- Lack of mechanical or natural ventilation
- Multi-occupancy usage
- Space used consecutively by different groups
- Long periods of time spent indoors
- Activities that increase amounts of exhaled breath - exercise, singing, shouting, continuous talking
- No social distancing (2 metres plus is most effective)
- Face masks or coverings not worn (lack of source control)
- Inadequate cleaning
- Occupant behaviour (e.g. a person near to a window choosing to close it).

4.6 Factors that can reduce covid-19 transmission risks indoors (list not exhaustive)

- Effective ventilation (mechanical or natural)
- Reduce occupancy levels
- Increase length of time between consecutive usage
- Air/purge spaces before and after usage
- Reduce length of time spent within an enclosed space
- Increase frequency of breaks or length of breaks (leave the space periodically)
- Identify higher risk activities and locate within good ventilated spaces
- Ensure a multi-layered approach to mitigating aerosol transmission risks indoors (e.g. mask wearing, social distancing, asymptomatic testing etc)
- Monitoring and assurance measures (e.g. supervision, technology, inspections, sampling)
- Effective information, instruction and training

5. Joint working to make workplaces safer

Employers may have concerns about their ability to improve workplace ventilation due to various constraints. UCU reps and members therefore have a key role to play in helping employers to overcome these barriers.

5.1 Potential barriers to improving ventilation

- Lack of technical support or internal expertise
- Financial concerns
- Building design or age
- Poor communications
- Operational concerns

5.2 Overcoming barriers

- Bring in technical expertise
- Develop internal expertise – provide training and re-fresher training
- Consult meaningfully with UCU reps and safety reps and draw on their expertise
- Access free online advice and expertise (e.g. CIBSE, BOHS)
- Consider practical and lower cost measures – maintenance, servicing, opening up windows that are painted shut.
- Prioritise improvements to poorly ventilated spaces
- Operational changes to improve ventilation or avoid usage of poorly ventilated spaces (e.g. timetabling, flexible working, blended learning)
- Consult stakeholders and improve two way communications

Actions to improve ventilation indoors will reduce airborne transmission risks, improve health outcomes, reduce disruption to education and work, improve the reputation of the employer, building a culture of confidence and trust, increase productivity.

6. Ventilation checklist (members and reps)

1	UCU safety reps have been consulted on the risk assessment	
2	The employer has provided you with a copy of the risk assessment (if not, ask your safety rep to request copies)	
3	Ask for a list of all indoor spaces you will use and how each area is ventilated	
4	Have all inside areas been separately audited for ventilation? (all rooms, corridors, toilets, congregational areas, canteens etc?)	
5	For each area has the ventilation been identified and assessed?	
6	In each area is the ventilation adequate?	
7	If mechanical ventilation is used is there proof of maintenance by a qualified engineer?	
8	What is the air flow in each area (ideally 12-17 litres per second per person with a minimum of 6 air changes per hour)?	
9	Is the ventilation set for 100% outdoor air to prevent recirculation?	

10	Is ventilation system turned on 2 hours before occupation?	
11	If there is no mechanical ventilation system is there natural ventilation?	
12	If natural ventilation is used is it creating a healthy work environment?	
13	Have areas not adequately ventilated been taken out of use or alternative methods of ventilation used like portable HEPA air filtration units?	
14	If CO_2 monitors are being used are they set to trigger a response if CO_2 measurements are steadily increasing or consistently above 800ppm?	
15	Are protocols and procedures in place for when ventilation concerns arise?	
16	Are all rooms subject to periods of no occupancy to allow virus to dissipate?	
17	Are rooms cleaned regularly?	
18	Is humidity adequate? (40-70% is recommended by HSE)	
19	If mechanical ventilation is being used or air filters, ask when were they last maintained and when is the next maintenance planned and who is carrying out this maintenance?	
20	Is toilet ventilation in operation 24/7?	
21	Has thermal comfort been considered in risk assessments particularly during colder autumn and winter months?	

7. Further information

HSE — Ventilation and air conditioning during the Coronavirus pandemic
https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/index.htm

SAGE — Ventilation papers 2020-2021
Role of Ventilation in Controlling SARS-CoV-2 transmission — 30 Sept 2020
https://www.gov.uk/government/publications/emg-role-of-ventilation-in-controlling-sars-cov-2-transmission-30-september-2020

Ventilation Actions Summary (updated Dec 2020)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945754/S0973_Ventilation_Actions_Summary_16122020_V2.pdf

Mitigations to reduce transmission of the new variant SARS-CoV-2 virus — 22 December 2020

https://www.gov.uk/government/publications/emgspi-btweg-mitigations-to-reduce-transmission-of-the-new-variant-sars-cov-2-virus-22-december-2020

Application of CO_2 monitoring as an approach to managing ventilation to mitigate SARS-CoV-2 transmission — 27 May 2021
https://www.gov.uk/government/publications/emg-and-spi-b-application-of-co2-monitoring-as-an-approach-to-managing-ventilation-to-mitigate-sars-cov-2-transmission-27-may-2021

Hazards Campaign Resources

Hazards magazine - VENTING | Coronavirus risks are mostly up in the air — Hazards magazine — **https://www.hazards.org/infections/venting.htm**

Hilda Palmer Ventilation Presentation
https://drive.google.com/file/d/1bsPGscEVrSTKkmgEZw0iZW8EWBQWkesa/view?usp=sharing

BK2School Ventilation Webinar — Presenter Monona Rossol is an internationally recognized expert and authority on the subject of purifying indoor air with ventilation and HVAC systems. **https://fb.watch/v/axuqxCQdD/**

CIBSE Covid-19: Ventilation guidance updated (Version 5, published 16 July 2021)
https://www.cibse.org/coronavirus-covid-19/emerging-from-lockdown

Universities Safety and Health Association (USHA) — Ventilation as a control measure in managing the spread of Covid-19
https://usha.org.uk/images/stories/files/guidance-documents/USHA_Ventilation-as-a-Control-Measure-in-Managing-the-Spread-of-COVID-19.pdf

Ventilation calculators and tools

CIBSE Covid-19: Relative Exposure Index Calculator
https://www.cibse.org/emerging-from-lockdown

BOHS non-technical ventilation check tool
https://breathefreely.org.uk/ventilation-tool/

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[i] SAGE recommended an uplift in previous recommended ventilation rates by a factor of 1.5 to 1.7 for the more transmissible (B.1.1.7) Alpha variant as precautionary approach in December 2020.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/

attachment_data/file/948607/s0995-mitigations-to-reduce-transmission-of-the-new-variant.pdf

[ii] SAGE — 800ppm is typically 10-15 l/s/p (page 2)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/928720/S0789_EMG_Role_of_Ventilation_in_Controlling_SARS-CoV-2_Transmission.pdf

[iii] **https://www.cibsejournal.com/technical/understanding-hepa-filters/**