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An Expert Advice Sheet

Mitigate the risk of COVID-19 spread through ventilation. Working safely during Coronavirus (COVID-19)

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As experts in safety, we're committed to update you with latest and relevant advice for COVID-19 to keep you and your team safe. The HSE has updated its advice on keeping workplaces safe during the pandemic by identifying poorly ventilated areas using CO2 monitors. This ventilation update and expert advice has been written in line with The World Health Organisation (WHO) and government recommendations and guidelines.

Why ventilation is important

When people breathe out, small particles (aerosols) and droplets are released in exhaled breath. Evidence shows that in some cases these aerosols can be carried more than 2m in the air and could cause infection if inhaled[1]. If a person carries a virus, they will transmit aerosols of the virus into the air which can build up. This is most likely to happen in enclosed spaces that have poor ventilation and from activities that require people to breathe out more small particles, for example singing, loud talking or high intensity exercise[2]. Residual virus can remain in the air after an infected person has left the room and therefore increase the risk of COVID-19 spreading. Adequate ventilation can reduce how much virus is in the air and help reduce the risk of aerosol transmission from breathing in the virus.

Employers are legally required to make sure there is an adequate supply of fresh air in enclosed areas of the workplace. With Brits spending over 90% of their time indoors[3], studies have shown that having good ventilation can also improve health, help with better concentration, improve quality of sleep and reduce our exposure to a wider range of air pollutants leading to fewer absences.

Especially during the autumn / winter months when cooler weather sets in and people resort to spending more time indoors, spaces become more crowded, with less ventilation, which attracts the likes of pathogens, making viruses more transmissible.

Ventilation to reduce the risk of Covid-19 spread

Improving ventilation and ensuring there is always a source of air flow can help remove any virus particles that may be contained in an enclosed space. The HSE suggest employers use carbon dioxide (CO2) monitors to help identify poor ventilation so that it can be improved and the risk of spreading COVID-19 reduced. For more information on how to use a CO2 monitor and advice on the suitability of CO2 monitoring in different types of spaces, **visit the HSE website.**

Ventilation Explained

Ventilation is the flow of air through a space. Letting fresh air in circulates the particles within an enclosed space and removes the indoor air.

There are two main ways of increasing ventilation into a space. Natural ventilation, from opening doors and windows and controlled (mechanical) ventilation in the form of systems such as powered fans.

Natural vs Mechanical Ventilation

Natural ventilation relies on letting in fresh outdoor air into indoor spaces and removes indoor air without the use of any fans. When opening doors, be aware not to prop open any fire doors.

If there are a lack of openings, ventilation will be less effective in that area and mechanical ventilation may be required.

Pros

- It's an instant source of ventilation
- It's free
- Fresh air has mental and health benefits

Cons

- Can be unpleasant if cold or wet weather conditions
- Not all spaces have windows or air vents to open
- Opening doors or windows can cause other nuisances such as noise or smell

Mechanical ventilation moves air in and out of a space using fans or systems. Ensure settings are enabled to maximise fresh air and minimise air recirculation as this can increase the risk of transmission. Recirculating air does not draw in a supply of fresh air and will only move air around, which could include COVID-19 particles if someone infected has been in that area.

Pros

- Alternative solution if natural fresh air is limited or not available
- Provides more consistent ventilation
- Can be more effectively controlled, depending on the size of the space or number of occupants within a space

Cons

- Air conditioning and other recirculation units can mask poor ventilation
- Includes installation, running, maintenance and servicing costs
- Can become a complex system depending on the size of the room or building

Identifying and managing poorly ventilated spaces

To mitigate the risk, ventilation should be considered within your risk assessment by identifying poorly ventilated spaces that are usually occupied.

1. Look for areas where people are present for an extended time with no mechanical or natural ventilation

- Check to see if a mechanical ventilation system has an air supply, if not, it is likely to be recirculating air and therefore have poor ventilation
- Identify areas that feel stuffy or smell bad
- Consider using a CO2 monitor to identify poor ventilation

2. Identify higher risk areas where you may need to improve air flow, i.e. the risk of aerosol transmission is greater when:

- areas are occupied by several people at one time or for long periods of time
- the area is a small, enclosed space
- people are partaking in activities that make you breathe deeper such as physical exercise or shouting
- spaces include large machinery, equipment or structural features as this can prevent air flow
- desk or ceiling fans are in use

3. Prioritise the improvement of poorly ventilated areas by considering:

- how these spaces are used and limit overcrowding
- airing rooms frequently by opening windows and doors between use
- working outside where and when practical
- the installation of a mechanical ventilation system upon advice from a ventilation engineer
- checking mechanical systems to ensure they are working to maximise fresh air
- performance checks for mechanical systems from a qualified engineer
- other ways to reduce airborne viruses in a space, for example a high-efficiency particulate air (HEPA) filter or ultraviolet air purifier

Using carbon dioxide (CO2) monitors

Measuring ventilation within a space can be difficult to accurately measure ventilation, but in some spaces, it is possible to use carbon dioxide (CO2) monitors to estimate the effectiveness of the ventilation.

As well as aerosols, people also exhale carbon dioxide when they breathe out. Although CO2 levels are not a direct measure of possible exposure to COVID-19, checking carbon dioxide levels can help you measure a build-up within an enclosed space. By identify poorly ventilated areas, measures can then be put in place to improve ventilation and reduce the risk of transmission.

How to use carbon dioxide (CO2) monitors.

- **When positioning CO2 monitors indoors** make sure they're positioned at head height, away from people, and kept away from air supply openings such as windows and doors.
- **For the most reliable readings, take measurements for CO2 when the space is occupied,** with the number of people who would usually occupy that space, for at least an hour.

Using CO2 measurements

CO2 measurements should be used as a broad guide to ventilation within a space rather than treating them as safe thresholds. The amount of CO2 in the air is measured in parts per million (ppm).

- CO2 values consistently below 800ppm, is likely to indicate that an indoor space is well ventilated.
- CO2 concentration constantly exceeding 1500ppm indicates that a room is likely to be poorly ventilated and may pose a greater risk for COVID-19.
- CO2 readings consistently higher than 150ppm, indicate that action needs to be taken to improve ventilation in this area.
- CO2 monitors can be used to identify spaces where ventilation is poor, but less effective at showing good ventilation.

Deciding if a space is suitable for CO2 monitors

CO2 monitors will only be effective in certain workspaces when:

- **the same number of people use a smaller area (up to 50 square meters)** for over an hour, such as small offices and meeting rooms
- **a consistent number of people use a mid-sized area (50-320 square meters)** for over an hour, such as classrooms, restaurants, and bars
- **a consistent number of people use a larger area (over 320 square meters)** for a long period of time such as indoor concerts and airports. Multiple monitors may be required for more meaningful measurements.

CO2 measurements are likely to be less reliable in areas that:

- **rely on air cleaning units.** These may remove contaminants from the air, such as COVID-19, but not CO2
- **have a low footfall,** such as fitting rooms and toilets
- **you can't be sure the air is fully mixed** – such as large warehouses or production halls with high ceilings.
- **have a constant change of overall number of people over a short amount of time in small and larger spaces,** such as small retail premises or shopping centres
- **produce CO2 as part of a work process** as this may give a false reading

Where CO2 monitors cannot be used, poorly ventilated spaces must still be identified, and adequate ventilation provided.

What can you do in addition to Ventilation?

Although ventilation is important it doesn't reduce droplet transmission, from people being in close contact or contact transmission, from touching infected surfaces.

You should also make sure you're working safely by

- keeping your workplace clean
- socially distancing by 2m where possible
- ensuring workers are frequently washing their hands and wiping down surfaces
- identifying other control measures through a risk assessment
- talking to your workers and
  - letting them know why ventilation is important
  - ensure they're aware of any measures put in place
  - explain how they can play their part in reducing the spread of COVID-19

Sources and Useful Information

1 NERVTAG/EMG Role of aerosol transmission in COVID-19, 22 July 2020
https://www.gov.uk/government/publications/nervtagemg-role-of-aerosol-transmission-incovid-19-22-july-2020

2 HSE ventilation https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/index.htm

3 https://road.cc/content/news/217728-brits-spend-92-all-their-time-indoors

4 J Sundell, H Levin, W W Nazaroff, W S Cain, W J Fisk, D T Grimsrud, F Gyntelberg, Y Li, A K Persily, A C Pickering, J M Samet, J D Spengler, S T Taylor, C J Weschler (2011) Ventilation rates and health: multidisciplinary review of the scientific literature, Indoor Air Jun;21(3):191-204. doi: 10.1111/j.1600-0668.2010.00703.x. 8. M J Mendell , E A Eliseeva, M M Davies, M Spears, A Lobscheid, W J Fisk, M G Apte (2013) Association of classroom ventilation with reduced illness absence: a prospective study in California elementary schools, Indoor Air Dec;23(6):515-28. doi: 10.1111/ina.12042. Epub 2013 Apr 22. 9. P. Strøm-Tejsen D. Zukowska P. Wargocki D. P. Wyon (2015) The effects of bedroom air quality on sleep and next-day performance, Indoor air 26: 679-686 https://doi.org/10.1111/ina.12254 10. W.J. Fisk (2018) How home ventilation rates affect health: A literature review, Indoor air 28: 473-487

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