#UKPHC20

PASSIVHAUS VENTILATION IN A TIME OF COVID

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COVID-19 and building ventilation

- Means of transmission within buildings
- Ventilation as a control measure
- Ventilation of schools

- Passivhaus ventilation and COVID-19

COVID-19 – Why is being inside a building a risk?

Means of transmission

- **Droplets**
  - Close contact – droplets >60 µm. These fall to the floor within 1.5 m.
  - Long range - droplets <60 µm. Droplet 50 µm will evaporate in ~ 2 seconds, leaving droplet nuclei. These may stay airborne for long periods. Virus remains active for up to 3 hours in indoor air.
- **Surfaces (fomite)**
  - Contaminated by droplets
- **Faecal-oral**
  - Toilet flushing or dry traps

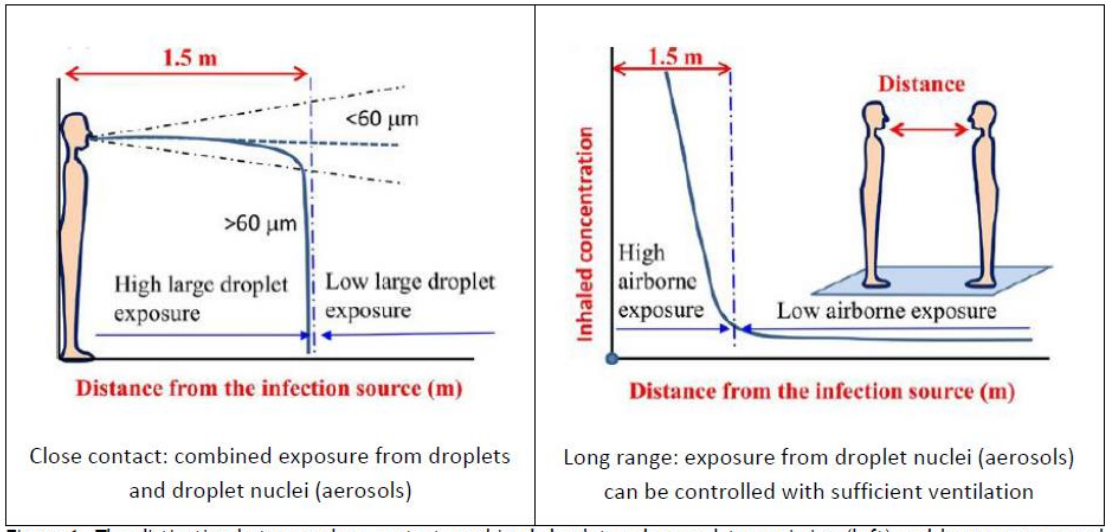
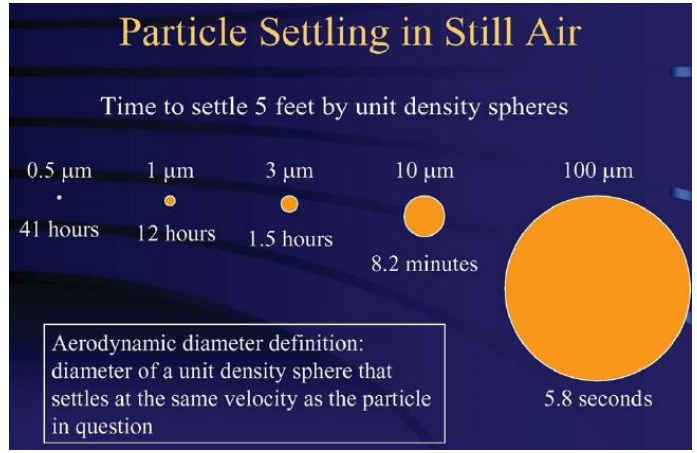


Figure 1. The distinction between close contact combined droplet and aerosol transmission (left) and long-range aerosol transmission (right) which can be controlled with ventilation diluting the virus concentration to a low level. (Figure: courtesy L. Liu, Y. Li, P. V. Nielsen et al.[xii])



Comparative settling times by particle diameter (ASHRAE Position Document on Infectious Aerosols, 14/4/2020.)

COVID-19 – Why is being inside a building a risk?

Rates of production of aerosols

- Breathing : Talking : Vocalising 1 : 5 : 30
- Activity level
  - Exercising - significantly greater production than sitting still (possibly up to 20 times) (SAGE EMG, Role of Ventilation in Controlling SARS-CoV-2)

COVID-19 – Why is being inside a building a risk?

Means of limiting transmission in buildings

- Faecal / oral – lid down before flushing and all water traps full
- Surfaces – frequent cleaning
- Droplets >60 µm – distancing
- Aerosols <60 µm … ventilation
  - Poor ventilation, <2 l/s/occupant, high concentration of aerosols
  - Good ventilation 10 l/s/occupant, aerosols effectively removed reducing the overall risk (SAGE-EMG, Role of Ventilation in Controlling SARS-CoV-2)

COVID-19 – Ventilation as a control measure

Means of ventilating buildings

- **Nat Vent ~ windows**
  - Largely uncontrolled – requires occupant interaction
  - In winter, significant potential for under-ventilation as occupant thermal comfort is balanced against ventilation rate
- **Mech vent ~ extract or balanced**
  - Potentially fully controlled – rate, duration, etc. and can be automated
  - Supply temperature can be tempered, limiting thermal discomfort

COVID-19 – Ventilation as a control measure

Control of mechanical ventilation

- Constant flow 24/7 or variable, e.g. timed
- Demand control (CO_2, Occupancy, etc.) – care is needed if control is central, as flow rates in individual rooms must be maintained
- Local demand control, i.e. per room.

Guidance is to keep ventilation rate as high as practical without causing discomfort (CIBSE, NHS, REHVA)

Humidification and increased temperature have no practical effect on virus – Impact only at HR > 80% and > 30°C. RH values should not be less than 25~30% (REHVA COVID-19 guidance document, 3/4/20)

COVID-19 – Ventilation as a control measure

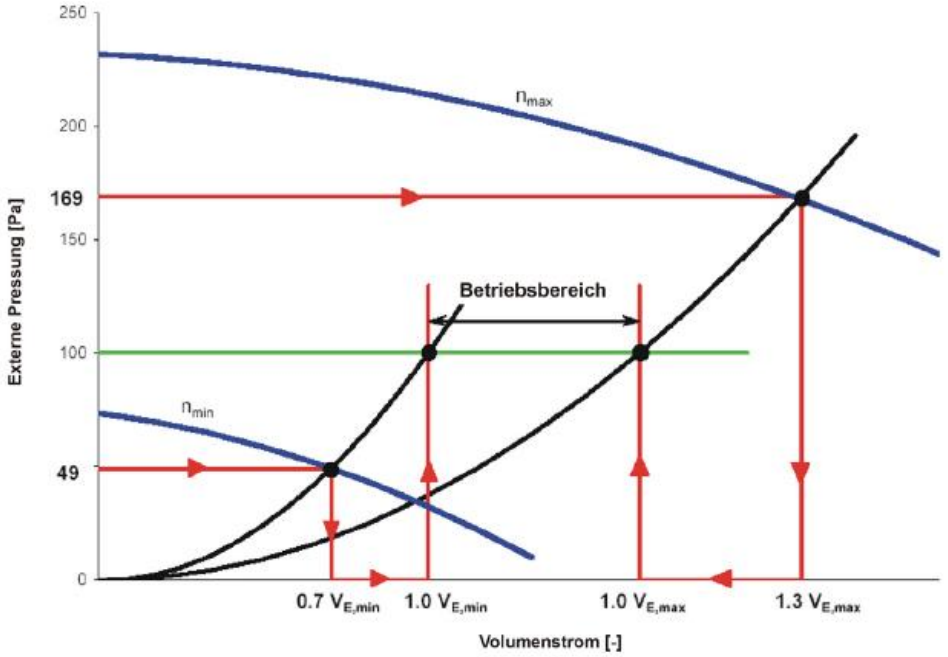
The use of a house for isolation

- **Physical separation**
  - Zoning based on rooms – e.g. Bedroom / en-suite bathroom – balanced ventilation to limit exchange with other spaces. This may not be possible and in larger households NHS guidance on cleaning and use of shared facilities must be followed (NHS – Stay at home guidance, 23rd Oct 2020)
  - Zoning based on ventilation – as above, only practical if living and bathing facilities can be maintained separate to other areas.
  - Activity levels – passive vs exercise

COVID-19 – Ventilation as a control measure

The use of a house for isolation

- Physical separation
- Increase air flow rate
  - Design rate; 30 m^3/h/person. Max rate +30% (39 m^3/h/person)
  - Testing data for MVHR - Scope to increase above upper commissioned flow rate (system capacity)
  - Ventilation rate in each room – should be as high as practical and sourced from outside, not another occupied room



COVID-19 – Ventilation of schools

- 5~8 l/s per occupant in classrooms (BB101)
- Passivhaus designed schools – mechanical ventilation with heat recovery
- Ventilation should be kept running at a lower rate overnight, not stopped
- Ventilation should be run at full speed before and after occupancy to purge rooms

COVID-19 – Ventilation of Passivhaus buildings

- The adoption of MVHRs throughout Passivhaus designed buildings ensures high levels of ventilation control
- The focus upon installed performance results in design air flows being met
- The installation of ventilation systems with spare flow rate capacity allows the maximum air flow rate to be increased if required to further enhance the safety of the internal environment.

A design standard that meets the requirements of these exceptional times

UKpassivhaus conference 2020

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