REHVA
Federation of European Heating, Ventilation and Air Conditioning Associations

# Safe operation of buildings and HVAC systems during the COVID-19 pandemic (v1 autumn 2020)

## Module 1

The first module of the course aims at familiarising the participants with the scientific concepts of SARS-COV-2 transmission, risk mitigation and the key role of air quality, air distribution solutions and adequate ventilation in infection control.

1.1 Boost your IQ on IAQ & COVID-19

1.1 provides a general overview of the fundamentals and definitions of Indoor Air Quality (IAQ) and Indoor environmental Quality (IEQ), along with its relevance to the COVID-19 pandemic, highlighting some real-life examples.

1.2 COVID-19 in the light of IAQ concepts

1.2 goes deeper in the nature of the virus and its physics, such as the relation between the size of the droplet and its behaviour in space.

1.3 COVID-19 transmission routes, airborne transmission and infection control pyramid

1.3 explains the different transmission routes of the virus, providing a further analysis on the airborne route and virus kinetics in indoor environments, underlining the important role of adequate ventilation.

1.3.1 Fecal-Oral Transmission

1.3.1 sheds light on the less known faecal-oral route of the virus and its unique characteristics, providing some evidence from anecdotic cases and practical recommendations to minimise transmission risk.

1.4 The role of HVAC systems during COVID-19

1.4 analyses evidence of the significant role of source control of the virus, illustrating the impact of HVAC systems on reducing the risk of aerosol infection.

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## Module 2

This module goes deeper on the role of HVAC systems' operation and maintenance to reduce the risk of airborne transmission, providing also specific guidelines and hands-on exercise on estimating the infection risk for different spaces.

2.1 How to restart buildings after lockdown - system maintenance tasks

This course goes through the key considerations that engineers should take into account in order to plan and assess a safe re-occupation of a building after lockdown period.

2.2.1 How to mitigate infection risk with HVAC and other technical building systems

This course goes briefly through the main points of REHVA guidance document, providing a summary of recommendations and practical measures that have to be followed, regarding the operation of HVAC systems. (Given that REHVA guidance is subject to frequent updates, please always consult the latest version at REHVA website here: https://www.rehva.eu/activities/covid-19-guidance )

2.2.2 Airflow management and its role against COVID-19

This course explains the role of the airflow management in indoor spaces, and how different airflow settings can have an impact on reducing the risk of virus transmission.

2.2.3 Infection probability calculation tool for room ventilation

2.2.3 introduces a Wells-Riley based tool for estimating the infection risk of virus transmission in different types of occupied spaces, taking into account occupancy time, room area, ventilation rates et.al.

2.2.4 Calculation tool for infection management in mechanical ventilated buildings

This course describes a methodology to estimate the infection risk in buildings with mechanical ventilation, giving the opportunity to run different scenarios in multi-room settings, providing the possibility to compare the effectiveness of different ventilation strategies in a building.

## Module 3

Module 3 provides a detailed review of the different components and technologies of the HVAC systems that are crucial on reducing infection risk, such as filtration, heat recovery systems and respective inspection methods, air-cleaning technologies and UV installations.

3.1_Heat_recovery_systems_&_internal_leakage_inspection

This course complements the Appendix 2 of the main guidance document (4th version), explaining how to correctly carry out an inspection of rotary heat exchangers to limit the internal air leakages between supply and exhaust, suggesting AHU configurations, the correct position of rotor purge sector and a method to estimate the internal leakage in terms of exhaust air transfer ratio.

3.2_Air filtration in practice

3.2 summarises the key messages of the Guidebook 11, adapted in the context of the pandemic, highlighting the role of filtration in the effort to reduce the infection risk in mechanical ventilated buildings.

3.3_IAQ monitoring the invisible made visible

This course underlines the important role of Indoor Air Quality monitoring that can enable a more informed decision making on optimising building operation. In the era of the pandemic, IAQ monitoring is crucial for measuring the concentration of the pollutant in indoor spaces.

3.4.1_Introduction to air cleaning tools and technologies

3.4.1 provides an introduction on the air cleaning tools and technologies, focusing on the used terminology and the existing air cleaning methods.

3.4.2_Technologies in-depth_UV-C case study

3.4.2 aims to provide a basic understanding of the fundamentals of UV technology, along with some calculation procedures and guidelines for installations in building environments.

3.4.3_Other common technologies for air cleaning and/or sterilization

This course provides an overview of other cleaning and sterilization technologies, including fumigation, fogging, photocatalytic oxidation etc. that can be combined with other measures to increase the removal of pollutants in indoor spaces.

## Module 4

This module is focusing on the specific characteristics of the different types of buildings and spaces (e.g offices, industrial buildings, school buildings etc.), providing information to better understand their particular dynamics, suggesting also tailor-made strategies for reducing risk of transmission.

4.0_The influence of the characteristics of densely occupied spaces

This course lists the most important factors that contribute to contaminants concentration in indoor spaces, explaining the influence of their characteristics by using an interactive exposure dose calculator.

4.1_Office buildings and the safe use of office space

4.1 focuses on the safe use of office spaces and office buildings in general, underlining some key aspects that have to be considered in order to reduce the risk of virus transmission. It also provides some examples of real cases to better understand the different dynamics of this type of spaces.

4.2_Industrial buildings (production hall, logistic halls & workshops)

This course provides an overview of the most common ventilation settings within industrial buildings and recommends some supplementary measures that can be adopted to protect workers from contracting the virus.

4.3_School_buildings

Complementing the information found in Appendix 4 of the main guidance document, this course provides some basic guidelines on measures to be adopted in school buildings, tailor-made for school principals, teachers, and facility managers.

4.4 Sport facilities

Given the physical activity taking place in such spaces, sport facilities are more likely to facilitate an increased risk of infection, and as such, higher ventilation rates together with additional viral removal measures should be considered.

4.5_Places of Worship

This course explains the high risk that places of worship run on sparking superspreading events, recommending preventive measures on the ventilation but also on the activity type and safe operation of such spaces.

4.6_Elderly homes

Recognising that elderly homes are at the epicentre of the pandemic, this course provides some general advice to be followed in this specific type of building use in order to reduce the risk of viral infection.

4.7_Wellness and swimming pools

This course is focusing on the safe use of wellness and swimming pool facilities, providing specific guidelines for facility managers but also for the users of such spaces.

## Practical Exercises (optional)

- **Exercise 1**
  Determination of the infiltration rate of an auditorium with capacity for 200 seats from the temporal evolution of the concentration metabolic CO2 monitored during the concentration rising phase with a constant emission rate.
- **Exercise 2**
  Determination of the infiltration rate of a room in an office building from the decay of the concentration of metabolic CO2 monitored during the period of absence of the occupants.

## Examination and certification

At the end of each module there is an exam in the form of multiple-choice questions. Trainees will have to answer correctly to the 75% of the questions within 12 minutes in order to pass the exam. They can choose to take each module exam after they complete the relevant material or at the end of the entire course. When all exams have been successfully completed, the trainees will receive their certificate.