Similarities and differences between REHVA's & ASHRAE's guidance

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AIVC WEBINAR NOVEMBER 20TH, 2020

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Objectives of this presentation

- Point out differences between REHVA and ASHRAE recommendations
- Discuss research/standards needed to move forward and provide answers
- Explain reasons behind those differences
- Not try to find out "who is right and who wrong?"

Focus on non-residential buildings

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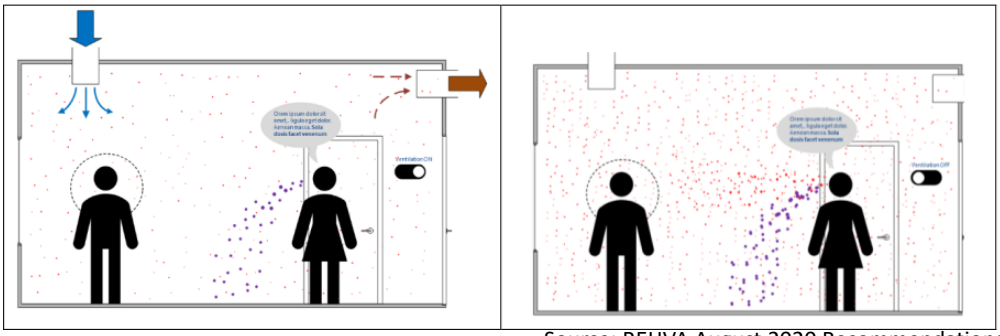
Similarities: agree on the risk of airborne transmission

An infected person leads to aerosol exposure in the breathing zone of another person.

When the room is ventilated with a mixing ventilation system, **the amount of virus-laden particles in the breathing zone is lower** than when the ventilation system is off.



Source: REHVA August 2020 Recommendations

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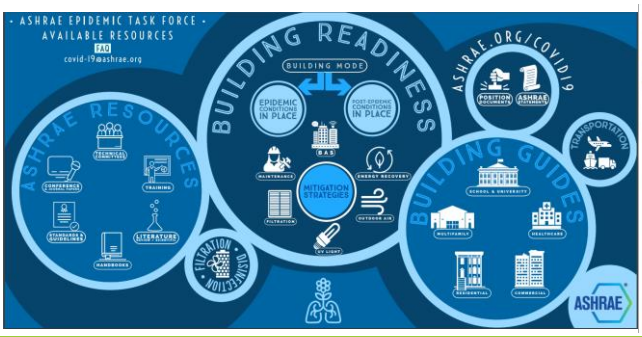
Different scope

REHVA guidance covers commercial and public buildings (no residential buildings)

ASHRAE has various guidance documents adapted to different kinds of buildings (inc. healthcare and transportation)



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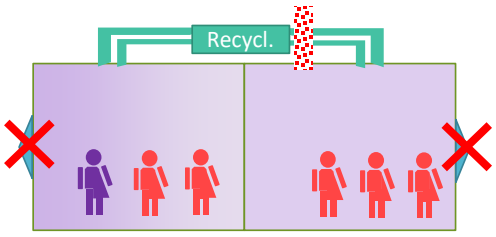
What we do not want is:



Infected person

No/little air renewal

Recycl. Recycling between zones with only large particle filters

of infected aerosols

=> People breathing air with high concentration of infected aerosols all over the building

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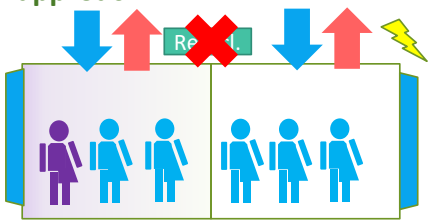
But what do we prefer?

REHVA approach



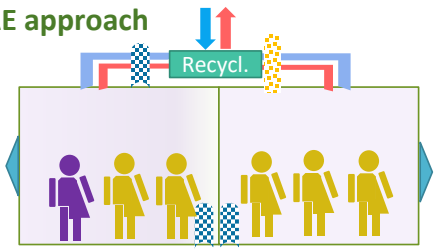
Higher air renewal

No recirculation

More energy use

People subject to thermal stress (but not to infected aerosols)

ASHRAE approach



Recycl. Recycling with MERV 13 / ePM1 50% filters, maximum flowrate

Standard air-renewal

Air cleaner/disinfection (UVGI)

People subject to a low concentration of infected aerosols

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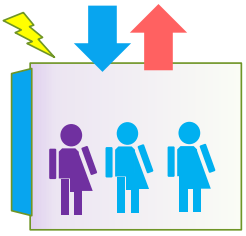
How much ventilation flowrate have to be increased?

REHVA approach

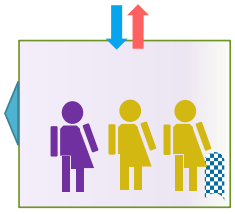


REHVA recommends to supply as much outdoor air as reasonably possible and **use openable windows** much more than normal **even if this causes thermal discomfort** (for buildings without mechanical ventilation).

Agreement on:

- The DCV system shall be overruled
- Rooms shall be flushed before and after occupancy

ASHRAE approach



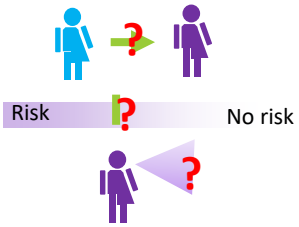
ASHRAE warns against causing a thermal stress and lowering resistance to infections and estimates that **other methods should be considered first** when the energy/comfort/IAQ conditions warrant.

Ventilation may be increased above minimum required by standards if deemed necessary

What do we need to agree on that?

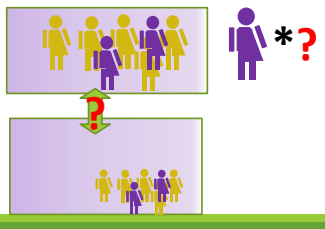
Is **thermal stress** an issue:

- Does it enhance the risk to develop the COVID?
- Does it increase the risk to develop a severe form of COVID?



Multiple information to determine the **needed ventilation flowrate**

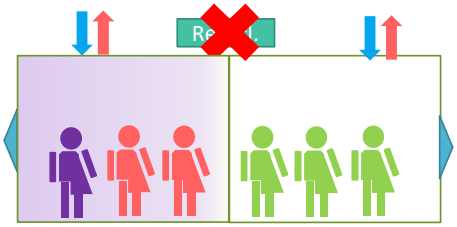
- From what concentration/time the exposure to infected aerosols becomes risky?
- What is the emission of infected aerosols per sick-person?
- What is the foreseen percentage of sick-persons in a room?
- Shall only the number of persons be taken into account to estimate the required flowrate or also the volume?
  - How is the air mixed, is the concentration homogeneous or not?



Can air-cleaning replace part of outdoor air in COVID context?

Regarding recirculation

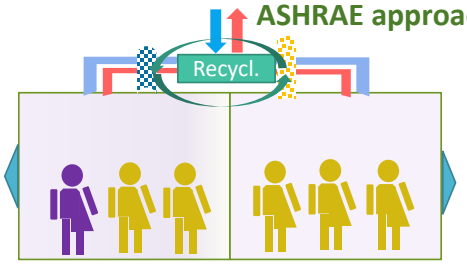
REHVA approach



REHVA recommends to close recirculation dampers even if they have air filters.

For a given flowrate the impact of switching off the recirculation is increasing the concentration in the room of the infected person but no spreading in other spaces.

ASHRAE approach



ASHRAE recommends

- **upgrading recirculation filters to MERV 13**
- **A maximum flow** through the filter to remove as many infected aerosols as possible.

In general, ASHRAE believes that dilution, filtration and disinfection all act together and that in many circumstances filtration can be superior to increased ventilation.

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What do we need to agree on that?

Previous information on emission, risky concentration, etc.

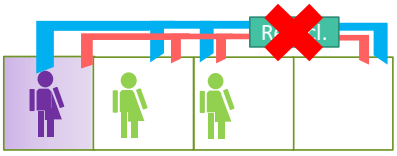
For how long does the virus survive in a ventilation system?

Probably the recirculation recommendation shall be different according to:

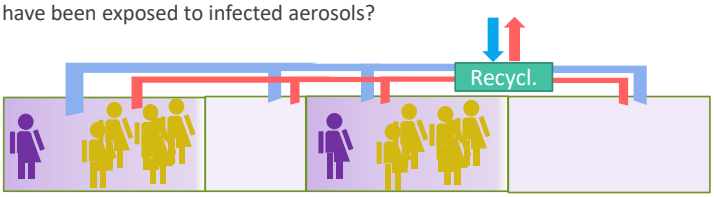
- The building occupation (all room with the same density or not)
- The occupants: high-risk individuals or not.
- The number of persons that may be infected

⇒ **Interpretation of guidance by competent professionals is important**

Is there a need to track people that may have been exposed to infected aerosols?



Hotel/Healthcare rooms



School

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Regarding the efficiency of filters to inactivate the virus

REHVA approach:
HEPA or ePM1 80 % filters

- Catch almost 100% of the infected aerosols
- High resistance, may be incompatible with existing systems and with higher flowrates

ASHRAE approach:
MERV 13 filters

- Low resistance:
  - Compatible with most existing systems
  - Allow to pass large flowrate through
- Won't catch 100% of the infected aerosols

If recirculation cannot be avoided: installation of HEPA filters or at least ePM1 80% filter

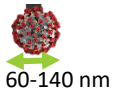
UVGI "may be used"

ASHRAE estimates that MERV 13 filters are sufficient to catch infected aerosols, and estimates that high air-change rates through moderately high-efficiency filters do help.

Ultraviolet Germicidal Irradiation (UVGI) technologies are recommended

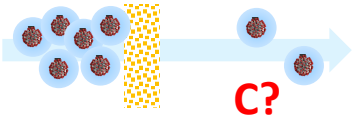
What do we need to agree on that?

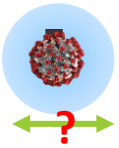
The virus has a diameter between 60-140 nm which is not catchable by a MERV13 filter but it is not about catching "naked" viruses but about catching the aerosols that contain infectious viruses.



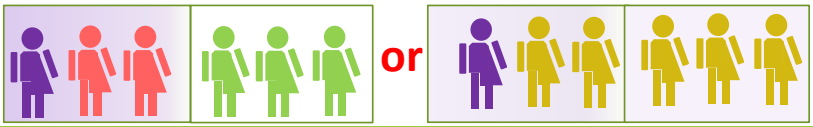
We need measurements of the efficiency of MERV13 filters on infected aerosols

- Measurement for a new filter
- Measurement **after discharge** of the filter



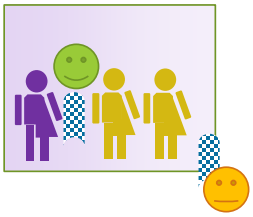


Again in which cases is it better to have a smaller concentration everywhere or to preserve safe-zones?



How should portable air-cleaning devices be used?

REHVA approach



Air- cleaner

HEPA filters

Other filters

REHVA implies it is mostly effective if located in the breathing zone.

REHVA only recommends air cleaners with HEPA filters efficiency and says that UVGI may be installed in return air ducts in systems with recirculation or in rooms provided that they are correctly sized, installed and maintained.

ASHRAE approach

Check CADR* instead of filters performance only

ASHRAE estimates that UVGI upper room systems are more effective than in-duct in terms of CADR (Clean Air Delivery Rate) but are only suitable in some spaces.

*See IEC 63086-1 test method

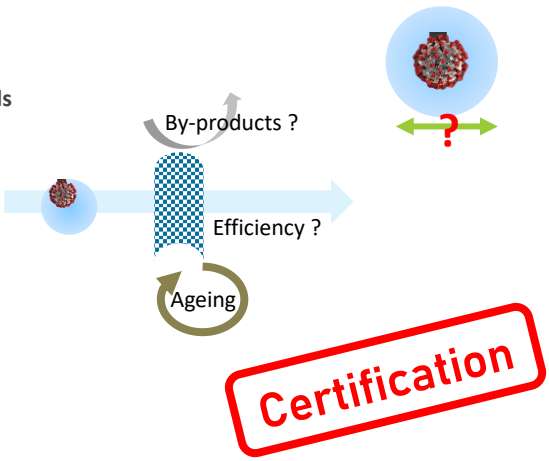
What do we need to agree on that?

Size of infected aerosols

Independent research on

- **Long-term** efficiency of air-cleaners on **infected aerosols**
  - According to their technologies
- **By-products** generated by air-cleaners

Certification of air-cleaners products.



Is CO_2 a good indicator to stress the need to ventilate in the context of COVID?

REHVA

The source of CO_2 and COVID infected aerosols is the same => people
The more CO_2, the more risk of a high concentration of infected aerosols

REHVA recommends 800 ppm CO_2 (absolute value) as a proxy of good ventilation.

ASHRAE

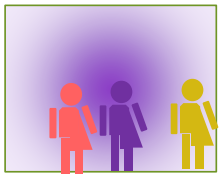
In large volume scarcely occupied, the CO_2 level will remain low, so the ventilation will remain low while there may still be a need for ventilation

No recommendations from ASHRAE

What do we need to agree on that?

How does the infected aerosols naturally mix in the air?

- Could a CO_2 sensor associated to a mixing fan be more relevant?
- In case of social distancing is mixing still relevant?



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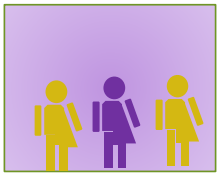
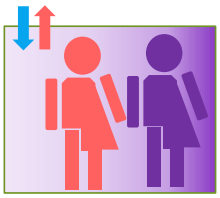


Is it OK to have a small air-renewal in a large volume scarcely occupied in the context of Covid 19?

- If the building is flushed after occupation?

Is the answer the same if there is air-cleaning/recirculation?

Do we need the same flowrate in those 2 configurations?



Possible reasons behind those differences

- Typical ventilation systems in Europe and US are different.
  - Europe relies on outdoor air ventilation and air conditioning that is typically separated from hydronic heating
  - In the US, all-air-systems for air conditioning including heating and cooling and air recirculation with minimal fresh air are commonly used.
- ASHRAE recommendations are more influenced by energy use
- The impact of thermal conditions is considered to be more important for ASHRAE than for REHVA It may be partly due to a better acceptation of adaptative comfort in Europe than in the US.
- Regarding filters, REHVA, recommending HEPA and ePM1 80% filters, has a more "safe-side" approach than ASHRAE who recommends MERV 13 filters but with higher flowrate.
- Recirculation with high efficiency filtration has been the basic approach to healthcare ventilation in ASHRAE Standard 170 for a long time

What do we need now?

Research

- On the virus itself but also on the efficiency of air cleaners

New standards for ventilation systems that make systems "epidemy-ready"

- High capacity/ Demand control ventilation systems in future buildings
  - Full speed in epidemic conditions,
  - According to demand control in normal condition

For each typology of building/occupation

- Define the main objective
  - Limit the risk of virus propagation / limit side-effects (energy use, thermal stress)
- Adapt the recommendation to the objective and the specificities of the building.