A SURVEY OF KNOWLEDGE GAPS IN SWEDEN DURING THE CORONA PANDEMIC

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PRESENTATION OF SURVEY AT UMEÅ UNIVERSITY

How do property owners, companies, and authorities view measures that need to be taken on the built indoor environment and buildings' energy systems due to the Corona pandemic?

- Energi & Miljö, No 3-4, March-April 2020
- Slutrapport, P.nr. 50889-1, Energimyndigheten
- Energi & Miljö, No 10, October, 2020
- REHVA Journal, October 2020

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Hypothesis: The knowledge (or lack of knowledge) may affect building operational decisions made and not made during the ongoing corona pandemic. To prepare for future similar pandemics, it is useful to understand how these organizations have responded or not to the Corona pandemic

EFFECTS ON THE BUILT ENVIRONMENT

- The use of the built environment has suddenly changed.
  - With fewer people - the more airflow than needed
  - With more people - insufficient air flows
- In some cases, the operating organization may have changed the operation of the building's ventilation, heating, and comfort cooling systems. Actions can be based on:
  - Thermal comfort and air quality
  - Spread of viruses
  - Costs and save energy

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NEED FOR THE INVESTIGATION

- The resulting situation caused by the Corona pandemic was unforeseen, but there was a preparedness to varying extents in society
- Regarding the operation and maintenance of buildings, there is professional knowledge to make wise decisions, but there is also a need to produce more knowledge.
- In light of the Corona pandemic, there is a lack of an overview of the knowledge that exists about the operation and maintenance of buildings' technical systems, how the knowledge is available, as well as the knowledge that is missing

Project: Energy-related consequences in buildings caused by the Corona pandemic

The purpose of the project: Initial compilation and overview of the state of knowledge regarding what the Corona pandemic can mean for the built indoor environment and buildings' energy systems

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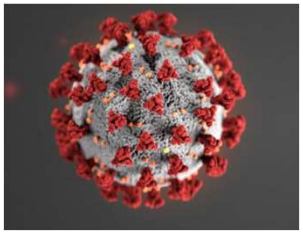
Investigation of the state of the knowledge in Sweden during the initial stage of the corona pandemic



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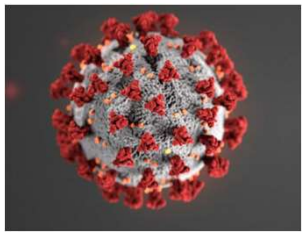
PART 1

LITERATURE STUDIES



RECOMMENDATIONS FOR THE OPERATION OF BUILDINGS (SOME INTERNATIONAL EXAMPLES)

- **Chinese guidelines for the operation of buildings**, February 2, Expert Group on Air-conditioning (Heating) System for Fighting against Novel Coronavirus Pneumonia, China Association of Refrigeration
- **ASHRAE** Position Document on Infectious Aerosols, April 14, 2020, https://www.ashrae.org/file%20library/about/position%20documents/pd_infectiousaerosols_2020.pdf
- **REHVA COVID-19** guidance, April 3, 2020, https://www.rehva.eu/activities/covid-19-guidance
- **SCANVAC,** Request for measures against airborne transmission of infectious diseases, April 21, 2020, https://www.scanvac.eu/scanvac-petition.html
- .. Other journal publications….

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GUIDELINES FOR THE OPERATION OF BUILDINGS

Chinese guidelines for the operation of buildings, February 2, 2020, Expert Group on Air-conditioning (Heating) System for Fighting against Novel Coronavirus Pneumonia, China Association of Refrigeration

Basic principles for preventing the safe use of different types of air treatment systems

Five-step strategy to quickly, and as far as possible, prevent the spread of covid-19 in buildings early:

- Discovered
- Reporting
- Isolation
- Diagnosis
- Treatment

Liquid-repellent face masks are recommended to reduce the risk of spreading infectious agents between different individuals caused by droplet infection.


COVID-19-VIRUSET I KINA

Thomas Olofson är professor i energieffektivisering vid Tillämpad Fysik och Elektronik vid Umeå universitet. Här skriver han om de rekommendationer för säker drift i byggnader som används i Kina för att stoppa spridningen av covid-19. De är inte i alla delar direkt tillämpbara i Sverige, men de kan vara ett underlag för nationella rekommendationer.

SÅ GÖR MAN I KINA

Rekommendationer för säker drift av byggnader

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ASHRAE STATEMENT ON INFECTION WITH SARS-COV-2

- Airborne transmission of SARS-CoV-2 is so likely that airborne exposure to the virus should be controlled. Changed controls and monitoring, including operation of heating, ventilation, and air conditioning systems, can reduce airborne exposure
- Ventilation and filtration with heating, ventilation, and air conditioning systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of airborne transmission. Unventilated spaces can cause thermal stress to some people which can be directly life-threatening and which can also lower the resistance to infection. In general, turning off heating, ventilation, and air conditioning systems is not a recommended measure to reduce the transmission of the virus.

SUMMARY OF REHVA'S MEASURES FOR OPERATING BUILDINGS

1. Ensure ventilation of spaces with outside air
2. Normal ventilation for at least 2 hours before the building is used and continued reduced ventilation 2 hours after the building is used
3. In the evenings and weekends, the ventilation is not turned off, but the systems are kept running with a lower flow
4. Regular ventilation with windows (even in mechanically ventilated buildings)
5. Keep the toilet ventilation operating 24 hours a day
6. Avoid open windows in toilets to ensure the correct direction of ventilation
7. Instruct about flushing toilets with the lid closed
8. Return air system must be adjusted to 100% outdoor air
9. Check the heat recovery system to make sure there is no leakage
10. Ensure that fan coils are either used or that the fans are on continuously
11. Do not change the heating, cooling, and any humidification setpoints
12. Avoid cleaning ducts during this period
13. Replace outdoor air and exhaust air filters, according to the maintenance plan
14. Regular filter changes and maintenance work must be carried out with prescribed protective measures, including respiratory protection

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HIERARCHICAL INFECTION CONTROL PYRAMID

Figure 1. Hierarchical infection control pyramid, adopted from REHVA (2020), with four levels, for reducing the relative risk of airborne infection, where the top level is most effective and the bottom least effective.

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REHVA Journal
October 2020, pp 69-71

SCANVAC: REQUEST FOR MEASURES AGAINST AIRBORNE TRANSMISSION OF INFECTIOUS DISEASES

- Airborne transmission of infectious diseases through virus-laden microdroplets should be recognized as a valid transmission in spaces where people reside (buildings and transport)
- The measures presented in the REHVA COVID-19 Guidance should be applied immediately to reduce the risks of infection related to the current pandemic
- Research funders and industry should invest in developing practical technological solutions that protect against airborne transmission of infectious diseases in indoor environments, buildings, and means of transport
- Building codes, standards, and guidelines should be revised and updated to improve preparedness for future epidemics

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THE PRECAUTIONARY PRINCIPLE

Experimental and epidemiological data suggest that transmission of SARS-CoV-2 can occur at a distance of several meters and that the nature of the ventilation affects the risk of infection.

There is uncertainty about transfer between rooms with ventilation air.

The present investigation is based on the precautionary principle, which advocates that with a lack of evidence to the contrary, the scenario cannot be rejected either.

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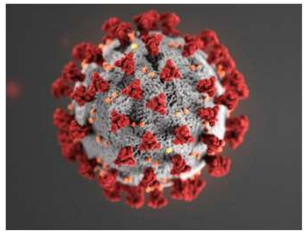
PART 2

INTERVIEWS



PARTICIPANTS IN THE SURVEY

Working group

Thomas Olofsson, Åke Fransson, Gireesh Nair

Applied physics and electronics

Umeå University

Reference group

Lars Ekberg, Chalmers

Dennis Johansson, Lund University of Technology

Mathias Cehlin, University of Gävle

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Participating authorities, organizations, trade associations, and companies

Table 1. *List of organizations and number of interviewees.*

Swedish Authorities	*6*	
Industry Associations	*3*	
Consultancy Companies	*Design and Construction: 2*	*Distributors: 2*
Real Estate Companies	*Private Enterprises: 5*	*Public Enterprises: 3*

OFFENTLIGA MYNDIGHETER	BRANSCHFÖRENINGAR	TEKNISKA FÖRETAG	FASTIGHETSFÖRVALTARE
Boverket	Svensk Ventilation	**Teknikkonsulter**	**Privata förvaltare**
Arbetsmiljöverket	Energi- och Miljötekniska Föreningen	Tyréns AB, Umeå	Lerstenen AB
Beställargruppen lokaler	The Finnish Association of HVAC Societies	WSP AB, Umeå	Rikshem AB
Folkhälsomyndigheten		**Leverantörer**	Diös AB
Vårdhygien, Region Västerbotten		Camfil AB	Balticgruppen AB
Ergonomi och Aerosolteknologi, LTH		Rise	Riksbyggen
			Offentliga förvaltare
			Akademiska Hus AB
			Umeå kommun
			Region Västerbotten

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Energi & Miljö, Nr 10, Oktober, 2020

RULES, LAWS, AND GUIDES

- Several international regulations have been revised to deal with the Corona situation.
- It was established in several cases during the interviews that REHVA's revised advice is highly trusted by industry organizations and has made an impression.
- Interviewed persons at the authorities and a supplier believe that it is too early to assess whether there is a need to revise the regulations.
- However, other voices highlight arguments for revisions. Future revisions of regulations may aim to increase the flexibility of the systems, adapt the operation in hospital buildings, and provide conditions for zoning.
- It may therefore be valuable in that context to initiate a process to review how we in Sweden, during current pandemic times, should relate to international organizations' revision initiatives.

Actions/initiatives initiated by property owners

The property owners have mainly not made any changes in terms of the buildings' operation

- Not reduced ventilation in the buildings
- Face mask requirements for maintenance personnel when changing filters

Notes

Most of those interviewed say that the tenants had no concerns related to the ventilation system due to COVID-19.

The risk of virus infection due to filter replacement had been discussed internally in a company

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PROPERTY MANAGEMENT

- From the interviews, it is established that the users of premises and housing generally express relatively little concern about the transmission of viruses.
- It is established that residential tenants express concern during apartment visits in connection with HVAC and filter changes and such cases, are not carried out. It may be worth investigating whether and in what way it affects the indoor environment negatively in the event of a longer pandemic.
- It is noted that the administrators generally did not change air flows due to COVID-19.
- However, some systems (e.g. VAV systems) automatically reduced the air flow when the density of people decreases, which may be worth investigating further.
- For care facilities, it is noted that flows and pressure differences have been adjusted in some cases to reduce the spread of viruses based on previously prepared guidelines. The extent of these changes and consequences are not investigated.

TECHNICAL SYSTEMS IN THE BUILDINGS

- There is evidence that UV radiation can be used to inactivate certain viruses and bacteria.
- It is considered to be an advanced technology used in healthcare, but currently there is a lack of evidence as to how effectively SARS-CoV-19 is eliminated.
- Effective filtering of viruses requires so-called HEPA filters. They can be used in air cleaners, but to be effective high air flows are required and the entire air volume is converted.

KNOWLEDGE GAP

- The completed mapping shows various needs to increase knowledge in several areas and it includes both general competence and expert competence.
- The areas of knowledge span the entire ventilation technology area, from the selection of technical components to construction, maintenance, and use of technology.
- In many of the interviews, the interdisciplinary nature of the issues is particularly emphasized, as a perspective is important to take into account when strategies are to be formulated for knowledge enhancement.
- It is considered reasonable that the industry and the authorities make joint coordinated efforts.

ILLUSTRATION OF HOW THE SPREAD OF INFECTION IN THE INDOOR ENVIRONMENT CAN BE DESCRIBED AS INTERDISCIPLINARY

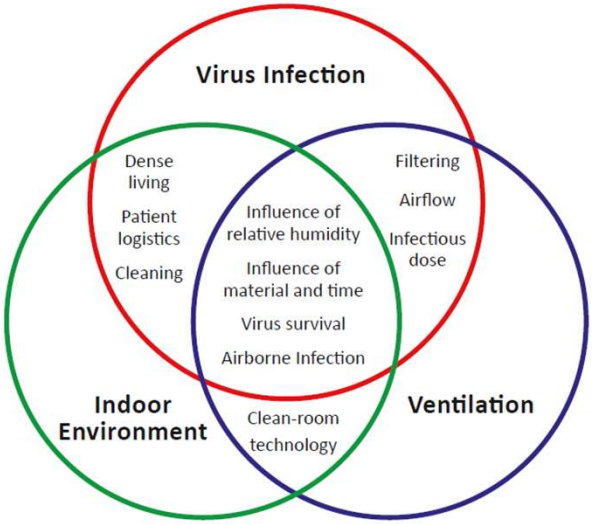

Figure 2. Illustration of interdisciplinary approach on addressing the spread of infection in the indoor environment as emerged from the interviews.

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REHVA Journal
October 2020, pp 69-71

SUGGESTIONS FOR FUTURE EFFORTS

- Establish an expert service to support building maintenance professionals to help their decisions to reduce risks for airborne virus infections in the indoor environment
- Facilitate broader interdisciplinary expert competence for developing future HVAC guidelines and regulations
- Initiate interdisciplinary educational efforts on basic and expert competence levels
- Coordinate expert competence for future training initiatives on ventilation, indoor environment, and risks of indoor airborne infection for professionals
- Funding programs for interdisciplinary research and development on ventilation, indoor environment, and airborne virus infection

For future efforts, there are opportunities in that context to both use existing infrastructures for coordination and to initiate new ones.

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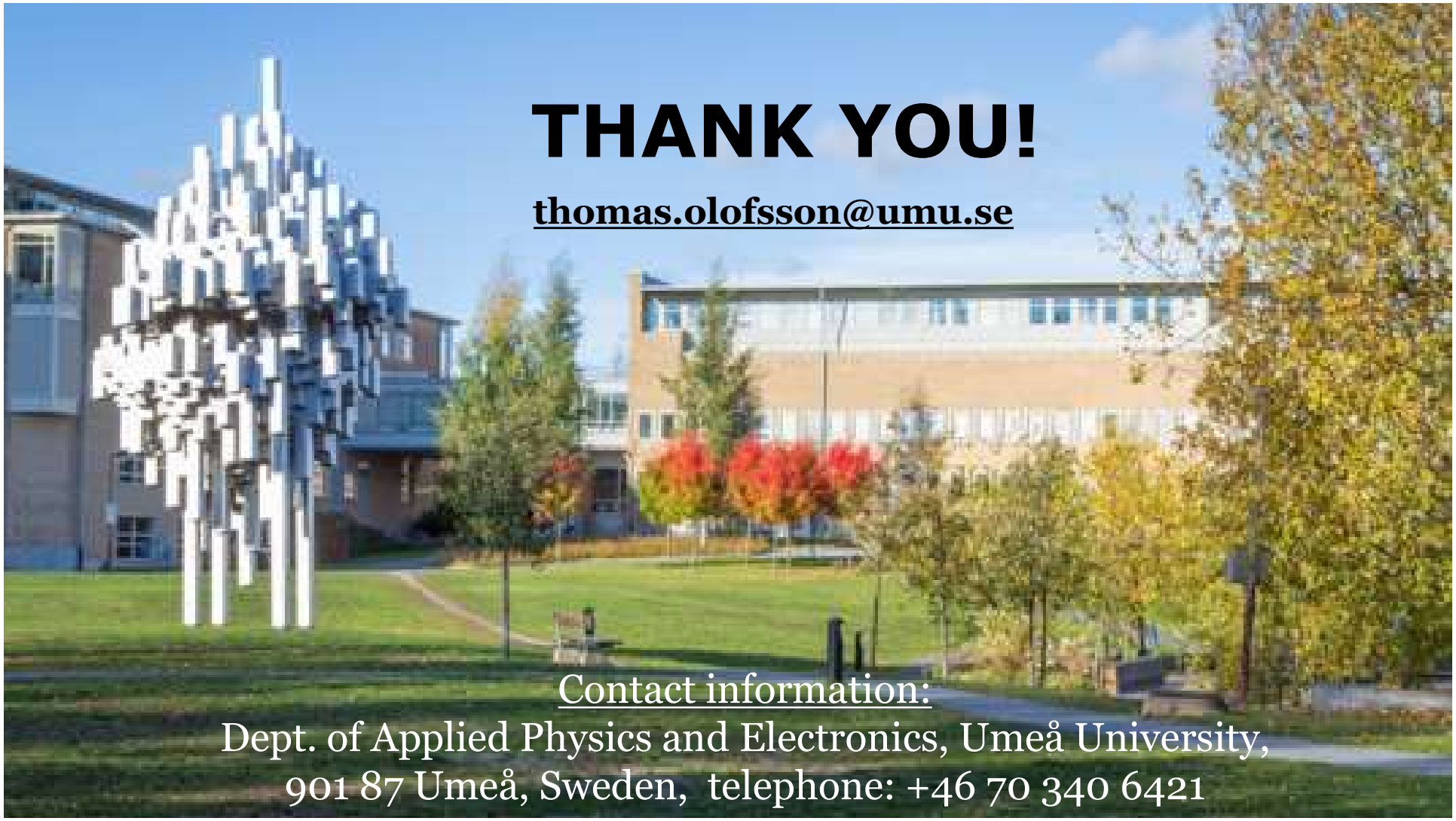
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