

PROSOCO Follow-up Notes on IIBEC Interface Journal article:
Building Science Helps Defeat Coronavirus
by
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1. Coronavirus aerosol floats in the air and spreads throughout a space, and it is the main problem. It can be solved with fresh-air ventilation and without masks and social distancing. Table divider shields adequately address the short-range droplets and make masks and social distancing unnecessary.

The article explains that increasing the fresh air component of a building's mechanical ventilation program prevents transmission of coronavirus aerosol.

It is the aerosol that is the primary infection source.

The recent Centers for Disease Control post, un-post, re-post recognizes the aerosol but wrongly emphasizes the short-range droplets. (More on that below.)

Infectious disease and HVAC experts know fresh outdoor air is the key, but they have not emphasized it, because of the high energy costs associated with it. Building envelope energy retrofits (that would have benefitted building owners prior to the pandemic and that will benefit them afterward) provide the energy savings and controlled air flows to facilitate the virus dilution and removal provided by increased HVAC fresh-air ventilation.

I wrote the article in early September. I have since learned more about the aerosol (floats in the air and goes everywhere) and the droplets (land within 5 feet).

The Lancet medical journal article linked below is referenced by REHVA, the Federation of European Heating, Ventilation and Air Conditioning Associations for this quote:

"There is no evidence to support the concept that most respiratory infections are associated with primarily large droplet transmission. In fact, small particle aerosols are the rule, rather than the exception, contrary to current guidelines."

[https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30323-4/fulltext](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30323-4/fulltext)
[www.rehva.eu/fileadmin/user_upload/REHVA Literature COVID-19 guidance document ver2 20200402.pdf](http://www.rehva.eu/fileadmin/user_upload/REHVA_Literature_COVID-19_guidance_document_ver2_20200402.pdf)

The University of Colorado professor NPR's Science Friday featured on August 28 echoed this in a Time Magazine article:

<https://time.com/5883081/covid-19-transmitted-aerosols/>

This means most of the problem can be addressed with the outdoor air HVAC ventilation I explain with many reference sources in my paper. The article is a roadmap

for negotiating with County and State health agencies for relaxation of requirements on a case-by-case basis.

For the short-range droplets, wear a mask into a restaurant, sit at a table with plastic shields such as are for sale on Amazon, remove the mask, and no social distancing is necessary. This is the approach to take with public health officials.



2. Passive House 100% Fresh Air Ventilation.

Although 100% fresh air ventilation is often attributed to Passive House, my networking with Passive House experts has led me to conclude that the standard Passive House recommendation is essentially equivalent to the ASHRAE recommendation: approximately 17 cubic feet per person per minute which calculates to 3 HVAC Air Changes Per Hour which corresponds to a 16% HVAC fresh air portion.

However, there does appear to be strong support for the position that where high levels of HVAC fresh air are sought, it is most cost-effective to utilize them if the building envelope has a high level of airtightness – which Passive House clearly delivers. See section 3 below “Need for airtightness to facilitate HVAC operation.”

It is true that 100% fresh air would no doubt be the most effective at dilution and removal of aerosol (and perhaps would be effective as to the short-range droplets – given that 16% fresh air in the context of a droplet-aerosol mixture has the same impact as vaccinating half the building occupants). However, 100% fresh air corresponds to 21 Air Changes Per Hour. The Centers for Disease Control requires only 12ACH for infectious disease control rooms in newly-constructed hospitals, and that requirement was previously 6ACH. It is still 6ACH for such rooms added within facilities constructed prior to 2001. www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm

6ACH is the number being recommended by the University of Colorado program which has developed an online calculator for determining the percent probability of infection based on the number of Air Changes per Hour selected and choices from various variables. <https://time.com/5883081/covid-19-transmitted-aerosols/>
<https://www.nationalgeographic.com/science/2020/08/how-to-measure-risk-airborne-coronavirus-your-office-classroom-bus-ride-cvd/>
<https://docs.google.com/spreadsheets/u/0/d/16K1OQkLD4BjgBdO8ePj6ytf-RpPMIJ6aXFg3PrIQBbQ/htmlview#gid=519189277>
<http://cires1.colorado.edu/jimenez/>
<https://twitter.com/ShellyMBoulder/status/1289993688039399424>

6ACH corresponds to 30CFM and 29% fresh air. This is based on HVAC Outdoor Air Ventilation Standard – Ventilation Calculations

https://www.buildingsone.com/cat_series_overview/technical-services/

3. Need for airtightness to facilitate HVAC operation.

The airtightness also assures the building air flows are as intended by the HVAC designers, and that horizontal flow from the walls or windows is avoided. It was horizontal flow that led to the restaurant outbreak

https://wwwnc.cdc.gov/eid/article/26/7/20-0764_article that was the focus of Dr. Li's ASHRAE presentation in July of 2020. (See main article) Horizontal and vertical flow between floors of a high-rise apartment building in Hong Kong led to 321 infected residents. https://en.wikipedia.org/wiki/Amoy_Gardens#SARS_outbreak
<https://www.nejm.org/doi/full/10.1056/nejmoa032867>

Airtightness and ventilation work together to provide energy efficiency and healthy air. In tight buildings, the ventilation system and not unintentional air leakage, provides virtually all of the building's fresh air. The more airtight the building envelope and the HVAC ducts, the more precisely the ventilation system can provide the correct amount of fresh air. Ventilation works more effectively in airtight buildings than in leaky buildings. Airtight buildings save energy compared to conventional buildings. Source: US Department of Energy <https://svach.lbl.gov/benefits-superior-airtightness/>

David Boyer, President of PROSOCO, Inc., BS Architecture, points out that using envelope air leakage for virus control not a good idea, because it is highly variable and seasonal, air in central spaces of the building will to be stagnant and not impacted by the dilution and removal that proper HVAC air flow provides, exterior wind moves interior virus-laden air to clean-air spaces, and the leaking walls and window installations leads to horizontal flow that moves virus-laden air from infected occupants to non-infected ones.

4. Advanced Coronavirus Control

In a follow-up email, Professor Li indicated that the vertical flow will have to be ">1-2" meters per second to remove the short-range droplets during normal breathing, and in a subsequent email that "1-2" meters per second would be too drafty for occupant acceptance. High Volume Low Speed (HVLS) overhead fans generate at 3-5 miles per hour breeze with a perceived cooling effect on occupants of up to approximately 10°F. www.bigassfans.com/faq/what-are-hvls-fans/ 2 meters per second corresponds to 4.47387 miles per hour and apparently is acceptable to occupants.

The Air Movement and Control Association states: "People tend to prefer wind speeds in the range of 3 mph (264 fpm) to around 5 mph (440 fpm) for cooling in the summer time. Wind speeds above 5 mph tend to cause disarrangement of hair and loose clothing, difficulty in use of umbrellas and activities such as reading newspapers etc."

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https://www.amca.org/assets/researcharticle/04p_RAYnsley_paper.pdf