Adjusting HVAC to Maximize Both Safety and Energy Savings during the COVID-19 Pandemic

patrick richardson, BSEE, PEM
Energy Analyst
Physical Plant
Appalachian State University

Big Energy Changes for COVID-19

Guidance for Building Operations During the COVID-19 Pandemic By Lawrence J. Schoen, P.E.

… few actions related to HVAC systems are suggested, in case some spread of the virus can be affected:

- Increase outdoor air ventilation (use caution in highly polluted areas); with a lower population in the building, this increases the effective dilution ventilation per person.
  - Disable demand-controlled ventilation (DCV).
  - Further open minimum outdoor air dampers, as high as 100%, thus eliminating recirculation (in the mild weather season, this need not affect thermal comfort or humidity, but clearly becomes more difficult in extreme weather).
- Improve central air filtration to the MERV-13 or the highest compatible with the filter rack, and seal edges of the filter to limit bypass.
- Keep systems running longer hours, if possible 24/7, to enhance the two actions above.

Lots of Information… What to do?

- Safety is ***absolutely*** our Top Priority
- We have been recommended to put HVAC Systems at 100% OA and 24/7 Occupation
  - … but it increased power by 50% in one of our buildings that had sectional occupancy
- Is this always needed? Do we need maximum dilution…
  - with multiple occupants in close proximity? ***YES***
  - with few or isolated occupants? ***NO***

How is SARS-COV-2 (COVID-19) Transmitted?

- Primary transmission is near field (sneeze/cough) and physical contact, rarely airborne. From the CDC[1]:

  "Most often, spread of respiratory viruses from person-to-person happens among close contacts (within 6 feet). CDC recommends everyday preventive actions to prevent the spread of respiratory viruses, such as avoiding people who are sick, avoiding touching your eyes or nose, and covering your cough or sneeze with a tissue."

- COVID-19 isn't a typical lab contaminant like VOC's, etc.
  - Rarely airborne, and if so, has a short lifetime
  - NEJM stated on March 17[2]

    "Based on what we know about other respiratory viruses, we don't think that SARS-CoV-2 gets aerosolized in everyday settings," Morris said. "Rather, aerosolization, if it happens at all for SARS-CoV-2, is likely to happen in health care settings," according to recent studies[3].

Covid 19: 24/7 Airflow?

- SARS-CoV-2 Aerosol **lifetime is 3 hours** per NEJM's March 17 discussion "Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1"[4]

- Conclusion?

*Don't run outside air in an **empty** building at high flow all night or weekend on 100% OA*

The airborne virus will be dead in 3 hours

Cheaper and more effective to put up hand sanitizer

Covid 19: 24/7 Airflow? (continued)

- Since COVID-19 doesn't live long, why do need to do plenty of fresh air for meeting areas and/or nearby people?

- Per NIH's March 20 "Features, Evaluation and Treatment Coronavirus (COVID-19)" 5

  "As with other respiratory pathogens, including flu and rhinovirus, the transmission is believed to occur through respiratory droplets from coughing and sneezing. ***Aerosol transmission is also possible in case of protracted exposure to elevated aerosol concentrations in closed spaces.***

  Analysis of data related to the spread of SARS-CoV-2 in China seems to indicate that close contact between individuals is necessary. The spread, in fact, is primarily limited to family members, healthcare professionals, and other close contacts. "

HVAC Recommendations for SARS-COV-2 (COVID-19)

- Normal Air Filters Aren't Going to Help
  - Virus is very small (around 0.3 μm)
  - MERV 16 and below are ineffective
  - Must use HEPA filters (99.97% of 0.3 μm particles)[1]
- Dilution airflow is important ONLY in areas where multiple people are present and near each other
  - If people are near each other- group offices, cubes, meetings, maximum outdoor air for dilution is important
  - If there are separate offices with few people, no special air flow requirements
  - If a building is unoccupied, HVAC is not required

FINAL RECOMMENDATIONS

- Use maximum OA in buildings for dilution where people must be in close contact *when occupied (cube-type offices, etc.)*
- Use normal occupied conditions in buildings with dispersed occupants
- Use normal unoccupied procedures
- If you have 100% OA, HEPA, and/or full building UV treatment in a building:
  - RECOMMEND that these spaces be used for any absolutely necessary face-to-face meetings
  - Insure occupants follow WHO contact guidelines

End of presentation

The following slides include

- Acronyms/definitions
- References/Links
- Selected WHO information from yesterday's Situation Report

Acronyms/Definitions

- WHO: World Health Organization
  https://www.who.int/
- NEJM: New England Journal of Medicine
  https://www.nejm.org/
- CDC: Center for Disease Control
  https://www.cdc.gov/
- MERV: Minimum Efficiency Reporting Value
- HEPA: High-Efficiency Particulate Air
- VOC: Volatile Organic Compound

References

1. Frequently Asked Questions about Personal Protective Equipment
https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirator-use-faq.html

2. New coronavirus may spread as an airborne aerosol, like SARS
https://www.livescience.com/coronavirus-can-spread-as-an-aerosol.html

3 Nosocomial Transmission of Emerging Viruses via Aerosol-Generating Medical Procedures
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6832307/

4. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1
https://www.nejm.org/doi/full/10.1056/NEJMc2004973

5. Features, Evaluation and Treatment Coronavirus (COVID-19)
https://www.ncbi.nlm.nih.gov/books/NBK554776/

6. What is a HEPA filter?
https://www.epa.gov/indoor-air-quality-iaq/what-hepa-filter-1

Other Useful Information

- https://en.wikipedia.org/wiki/HEPA
- https://www.nejm.org/doi/full/10.1056/NEJMc2004973
- https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces
- https://www.livescience.com/coronavirus-can-spread-as-an-aerosol.html
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7045880/
- https://www.nejm.org/doi/full/10.1056/NEJMc2004973

Recommendations from WHO from

Situation report - 65
Coronavirus disease 2019 (COVID-19) 25 March 2020

- https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=2b74edd8_2

"Preventing transmission of COVID-19 between employees"

- Implement remote work practices (tele-working)
- Social distancing measures in the workplace when on-site presence is required (at least 1 metre (3.5 feet)
- Hold fewer in- person meetings
- Restrict the number of visitors entering the workplace
- Limit travel beyond non-essential travel
- Ensure people with symptoms or with family members with symptoms self-quarantine for 14 days
- Check the body temperature of employees daily so that employees with fever don't come to work
- Facilitate access to reliable information for employees to promote understanding of the disease and its
- symptoms and the personal preventative measures (respiratory etiquette, hand washing, self-isolation if
- sick)
- Check and follow the advice from the authorities in the community before holding a meeting or event;
- follow all necessary precautions, protective and self-isolation measures, should a meeting go ahead.

Recommendations from WHO

Situation report - 65

Coronavirus disease 2019 (COVID-19) 25 March 2020, continued

- https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200325-sitrep-65-covid-19.pdf?sfvrsn=2b74edd8_2

Selections from "Maintain a safe and healthy work environment" that are based on physical transmission (airborne, surface, etc.)

- Promote regular and thorough hand washing by employees, contractors and customers, as well as good
- respiratory hygiene.
- Clean workspaces frequently with disinfectant including high risk areas/space (e.g. door handle, reception
- counter, elevators, disinfection of working stations of COVID-19 cases)
- Provide alcohol-based gel or washing hands stations
- Ensure good ventilation
- Develop a food delivery system that reduces contacts with food deliverers and avoid employee lines