

Assessing Cost Effective Options for Improving Air Quality in Existing Structures

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Executive Summary:

This Covid-19 pandemic has been a catalyst for an evolving understanding of viral particle spread. Although it was initially managed as droplet spread, dissemination through aerosol clouds is becoming more widely identified as a significant factor in the spread and improvement of indoor air quality of most existing buildings is required to mitigate the problem of air borne diseases. <https://drwayneevans.ca/covid-transmission/>

Current heating and ventilation practices focus more on energy efficiency than air quality. For existing buildings, retrofitting to improve air quality is a matter of urgency given the time of year and the onset of winter with its attendant increase of indoor activities – particularly schools, long term care homes, and office towers. An expedited response to address the risks posed requires a deliberate collaboration of building owners and operators, engineers, maintenance staff, medical professionals, regulators and building inspectors. ,

A primary current engineering issue concerns how to develop a standardized assessment process and guidelines for the practical management and retrofitting of existing buildings to help inform government supported programs to support the mitigation impact of the indoor spread of Covid-19 over the winter of 2021. Engineering is just one part of what needs to be a long-term, coordinated team approach to tackle this challenge.

Background:

Epidemiologic evidence has identified the nature and associations in Covid-19 Spread. To date, advice from the medical community has emphasized management of droplet exposure. This view is now shifting to consider airborne spread and thus indoor air quality.

<https://drwayneevans.ca/covid-transmission/>

Can we Achieve Covid-19 Free Indoor Air Quality?

- We understand how to deal with containment and clean rooms for GMP laboratory work, surgery and highly specialized manufacturing. Such environments are managed by ventilation and filtration to eliminate hazards, such as aerosol clouds of Covid-19 particles. What lessons can we learn from the design and operation of these highly engineered purpose-built environments, that can be applied in a practical and cost-effective way to existing structures?
- It appears that there has been limited opportunity and thus work done to consider cost-effective HVAC adjustments focussed on Covid-19 particle removal. The current building standards and municipal codes for HVAC address a different set of objectives (energy Efficiency being paramount) rather than aerosol particle removal.

What changes are needed?

Mechanical engineering and human factors topics can be considered:

1. Scale of the problem: air quality measurement inside our buildings?
 - a. How can we collect and measure Covid-19 particle concentrations in various indoor settings?
 - b. How do Covid-19 particle concentrations vary with human occupancy and activities?
2. What variables can we control? Dilution and Filtration +/- other?
3. Should we increase air circulation through buildings to dilute particulates?
 - a. What factors favor containment ?
 - b. What factors favor dilution ?
4. Do some structures facilitate Covid-19 aerosol spread more than others?
5. Do structures with windows that open to allow external ventilation offer advantages for particulate dissemination?

Medical topics to explore:

1. What Covid -19 particle concentration leads to infection? What are the ratios of concentration to airflow circulation/population of buildings that reach high-risk thresholds?
2. What Covid-19 particle concentration is tolerable? Optimal bio testing regimens?
3. Can we do better to address/ reduce aerosol spread?
 - a. Innovations in PPE for aerosol - <https://drwayneevans.ca/ppe/>
 - b. Fast track novel & effective PPE deployment
4. How can we augment public health messaging regarding indoor hazard reduction?
5. Create Covid-19 treatment cocktails and eventually deploy effective vaccines.

Team Solutions

A multidisciplinary approach to look at this problem of indoor air quality may be the best way to initiate exploring the topic of mitigating indoor aerosol spread of Covid-19 in the months ahead. However, this investigation must be expedited to enable the swift implementation of improvements given the explicit health risks to our children, colleagues, families, employees, and ourselves.

The above is intended to stimulate coordinated innovation in a setting of very tight time-lines. Accordingly, investigation to prioritize and identify feasible, actionable steps we can take now is needed.

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