

Six Tips for More Effective Ventilation Management

As we continue to adapt to our pandemic mode - managing your building's ventilation rates¹ has never been more important. Authorities recommend “increased ventilation” and “installation of high efficiency air filters”. This guidance is good, but it is not specific enough. *How much* ventilation is needed? What is your air borne particle count and what is the target?

Unlike operating a car where we rely on our speedometer and road signs to advise us of speed limits and changing conditions, in the world of building ventilation there are typically little or no metrics to guide you. Unfortunately, the standard practice is to set one ventilation rate, and keep it there constantly, despite significantly changing needs and conditions.

Here are six tips to help you manage outside air quantities (ventilation rates) in your building:

1. **Stop the guesswork - use a data driven approach.** First, we need to know our current ‘speed’. In other words, what is our current ventilation rate? Too little ventilation and you compromise health. Too much ventilation and you waste energy (and may compromise comfort and damage your coils). Improvements in sensor platforms provide a cost effective means for quantifying outside air delivery and determining if indoor pollutants (including particles and volatile chemicals) are being effectively *filtered* and diluted.
2. **Measure what’s important.** Limits for key ventilation performance indicators have been established by public authorities (so you can know your ‘speed’ and ‘road conditions’). Today’s multiparameter sensor devices and platforms help you cost effectively compare thresholds with actual readings of these levels in the building. In addition to relative humidity, key parameters include:
 - a. Carbon Dioxide (CO2). CO2 measurements show the amount of exhaled air that has built up in the room without enough fresh air to flush it out. The guidance says as CO2 levels increase (i.e. more people & more aerosols), ventilation rates should also increase (and vice-versa). CDC recommends CO2 levels should not exceed 800 parts-per-million (ppm). However, CO2 measurements alone do not take into account the possible need to dilute other indoor pollutants.
 - b. Key indoor pollutants. Certain pollutants, such as carbon monoxide (CO) and radon are typically required measurements for code compliance and / or property transfer. Other contaminants include respirable particles, formaldehyde, volatile organic compounds (VOC), and mold / bacteria.
3. **Collect real-time data.** Looking at data *over time* will provide significantly better input for optimal ventilation. Data from a single point in time (spot testing) may be helpful, however, occupancy conditions within any given space usually fluctuates throughout the day, the week, or longer period (e.g. hybrid work or learning schedules). Indoor pollutant levels, especially particles and chemicals may also vary due to the dynamic aspect of occupied spaces. Over time the data will also inform filtration use (both at the air handling unit level and for room devices) and help ensure your HVAC systems remain tuned and perform properly. Rule-of-thumb for sampling locations: every 3,500 sq.ft. Consider representative locations.
4. **Adjust ventilation rates to account for both IAQ and Energy Efficiency.**

Assistance may be needed from your HVAC provider.

 - a) Manual / static adjustment – if necessary, increase or decrease ventilation based trended CO2 levels. After adjustments keep an eye on the measured parameters. Be sure key indoor air pollutants (e.g. particles, VOCs) have not increased if you reset to lower ventilation rates.
 - b) Dynamic adjustment. Communicate sensor points (e.g. via BACnet and /or API’s) to the HVAC or automation system so ventilation rates will automatically adjust based on the actual, and real-time demand for ventilation in the space (similar to a car’s cruise control that automatically adjusts for speed).

5. Communicate healthy air data to instill maximum confidence.

Once ventilation rates have been adjusted based on sensor feedback, be proactive in communicating your good results to occupants. This will cast your management in a good light, while assuring occupants of compliance with public authorities with ventilation and indoor air quality standards. Most sensing platforms provide graphics and visualizations that are simple and easy to understand. Performance reports can be easily created. Promote your results! Brag about your sustainability initiative! Incorporate ventilation management into your NYS HERO ACT reporting (or other state reporting as appropriate).

6. Sensor Calibration. Yes, this has been the "Achilles' heel" of real-time monitoring. Sensors drift and lose accuracy over time. How sensors are calibrated and maintained must be included as part of the life cycle costs of any environmental sensor platform.

What are the rough costs for multi-parameter sensor platform?

This depends on a number of variables.

Assuming monitor density of 3,500 square feet², single location device cost (no display screen), installation, dashboard, analysis & reporting support, and annual calibration - the cost per year is estimated **at \$0.16 / SF** (*less utility incentives for demand-controlled ventilation*).

Not included in the above cost is HVAC integration and extended warranty). Note: monitoring in every space is not necessary if a chosen space is representative of another, e.g. X number of classrooms per wing or X percent of private offices.

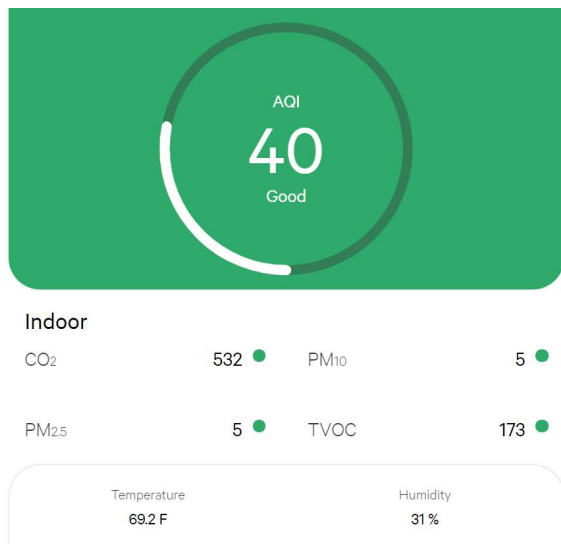
Business case for monitoring – realize a significant ROI at just 1% improvement in absenteeism:

- Per student (middle school): **\$242.96³** :1% improvement = \$2.42 / SF (Protect state aid)
- Salary: **\$300⁴** :1% improvement = \$3.00 / SF

Other benefits: improved cognition and productivity, reputation as a healthy building, reduced energy costs (over-ventilating). ESG alignment with energy conservation and supporting healthy environments.

Example of how data can be communicated to occupants

Your indoor Air Quality Index – real-time reporting can be displayed on an IAQ monitor or any screen with a WIFI connection.



¹The rate of introduction of outside air to an interior space within a building

²The International Well Building Institute; requirement for IAQ monitoring

³Google search for median cost / student / square foot middle school

⁴Jones, Lang, Lasalle Commentary."3/30/300 Rule" <https://www.us.jll.com/en/trends-and-insights/workplace/a-surprising-way-to-cut-real-estate-costs>