



TCDSB Three School Indoor Air Quality Study

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Project Overview



1. Mother Cabrini – Mechanically Ventilated
 2. St. Jane Francis – Mechanically Ventilated
 3. St. Raphael – No Mechanical Ventilation
- Sensors for CO₂, Temperature, and Relative Humidity installed in representative classrooms and admin areas.
 - Sensors installed on doors and windows.
 - How were the different schools performing with respect to ventilation rates.



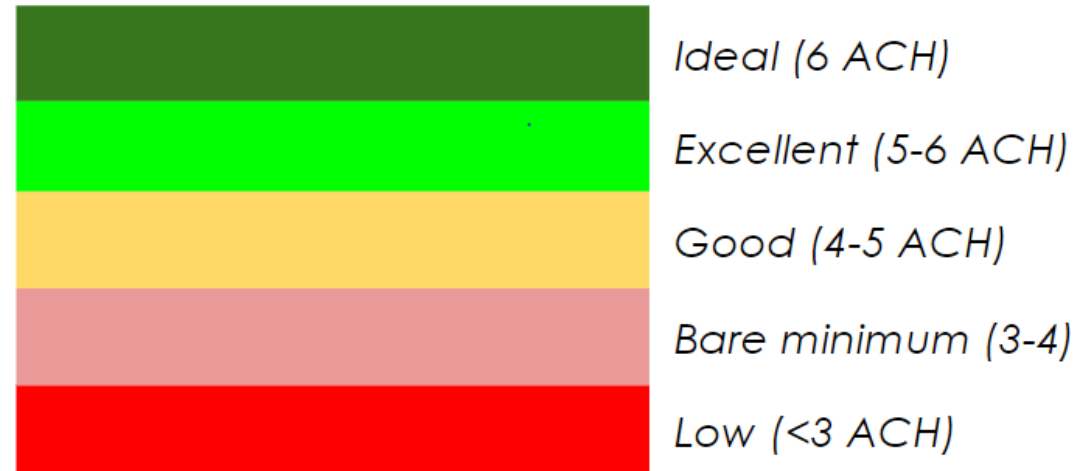
CO2 as an Indicator of Ventilation Rates.



Carbon dioxide is an ideal indicator of ventilation in occupied buildings. Indoor steady state carbon dioxide concentrations rise with occupant load and respiration rates and are reduced based on the amount of outdoor air being introduced.

ASHREA base ventilation recommendation is a steady state CO2 Concentration of 1100 ppm

TARGET IS AT LEAST 5 TOTAL AIR CHANGES PER HOUR



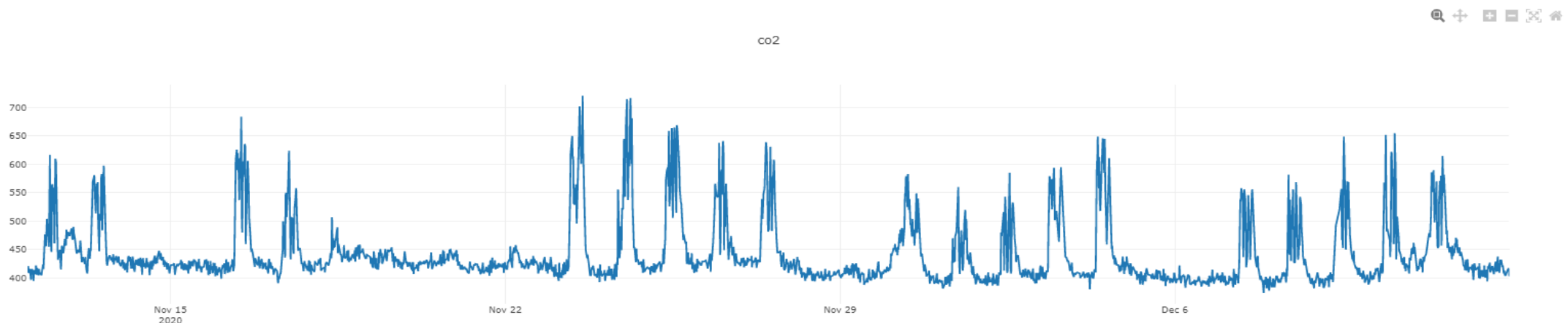
~800 ppm = 4 ACH in 850 sf Class with 20 students and two adult staff

<https://schools.forhealth.org/>

Overview of Findings



- Classrooms at Mother Cabrini and St. Jane Francis generally had adequate ventilation with some minor exceptions / exceedances.
- Classrooms at St. Raphael regularly exceeded both the 800ppm and 1200ppm recommended limits.
- The length of time windows were open did not improve CO2 concentrations in the non-mechanically ventilated buildings.
- There was no planned pattern of window use.



TCDSB Questions



1. Did having windows open in the classrooms lead to improved ventilation?
2. Was there indication that awning style or vertical sliding windows resulted in superior ventilation outcomes?
3. Did the size of the window openings impact ventilation rates based on the number of open windows and carbon dioxide (CO₂) concentrations in the classes?
4. Was the building effectively flushed via the HVAC system or natural ventilation in the vacant period between school days and over the weekend?
5. Were there classroom occupant densities that lead to better controlled CO₂ concentrations?

Recommendations for Mechanically Ventilated Schools



1. Ensure the HVAC systems are properly balanced.
2. Ensure the units are equipped with the highest MERV rating possible (ideally MERV 13).
3. Where humidification systems are installed ensure they are functioning properly.
4. Operate HVAC systems for a minimum of 2.5 hours before and after occupancy to help flush / filter airborne particulate between school days.
5. Address potential problem spots by supplementing with a portable air filtration unit.
6. With proper operation of the ventilation system supplemented where necessary with portable filtration units additional passive window ventilation will not be required.

Recommendations for Non-Mechanically Ventilated Schools



- **Passively ventilated buildings require the same or greater levels of design as mechanically ventilated spaces to function properly.**
- Utilize portable air filters to replace ventilation.
- The four-inch restricted window opening must remain to meet code.
- Operate portable HEPA filters for a minimum of 2.5 hours before and after occupancy.
- Get the most out of window ventilation:
 - ✓ Open top and bottom windows where equipped and when outdoor temperatures allow.
 - ✓ Where equipped open top segments only during cold / hot weather to minimize temperature impacts.
- Monitor CO₂ through a test period to see if these changes show results.



QUESTIONS?