ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

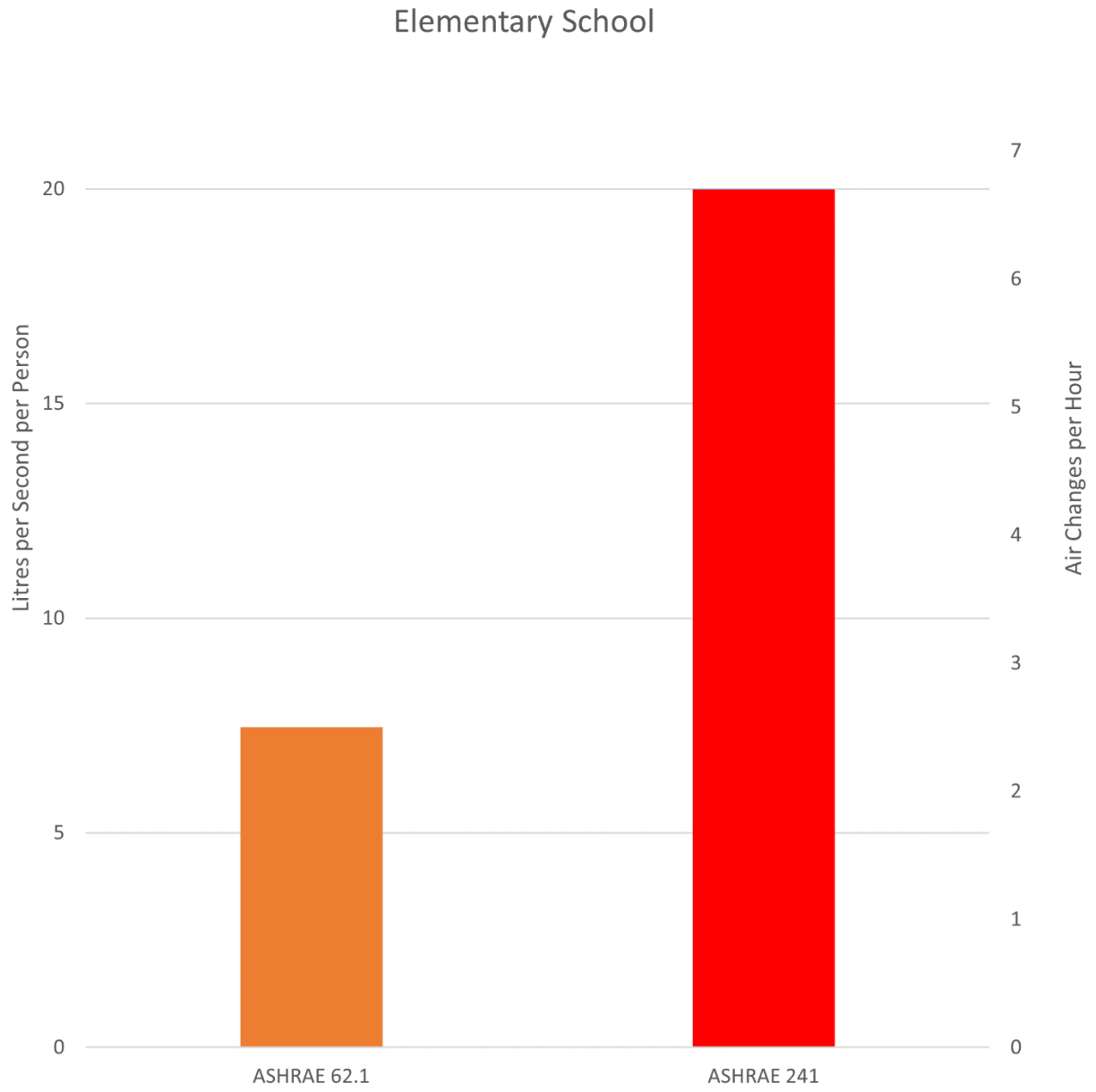
Implementing ASHRAE 241 in Schools

OSPE Indoor Air Quality Advisory Group
Joseph Fox, P.Eng., M.A.Sc, Chair

August 25, 2023

ASHRAE 241 – Control of Infectious Aerosols

- Current IAQ standards (ASHRAE 62.1) are not designed for airborne disease mitigation.
  - Comfort, off-gassing of materials
  - Primarily uses outdoor air - ventilation
  - Particulate matter, requires filtration, but not used
- ASHRAE 241 was developed to control infectious aerosols.
  - Use any method to provide equivalent clean air
  - 20 liters/second/person in classrooms
- Clean airflow rates in ASHRAE 241 are 2-10 x higher than ASHRAE 62.1



ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

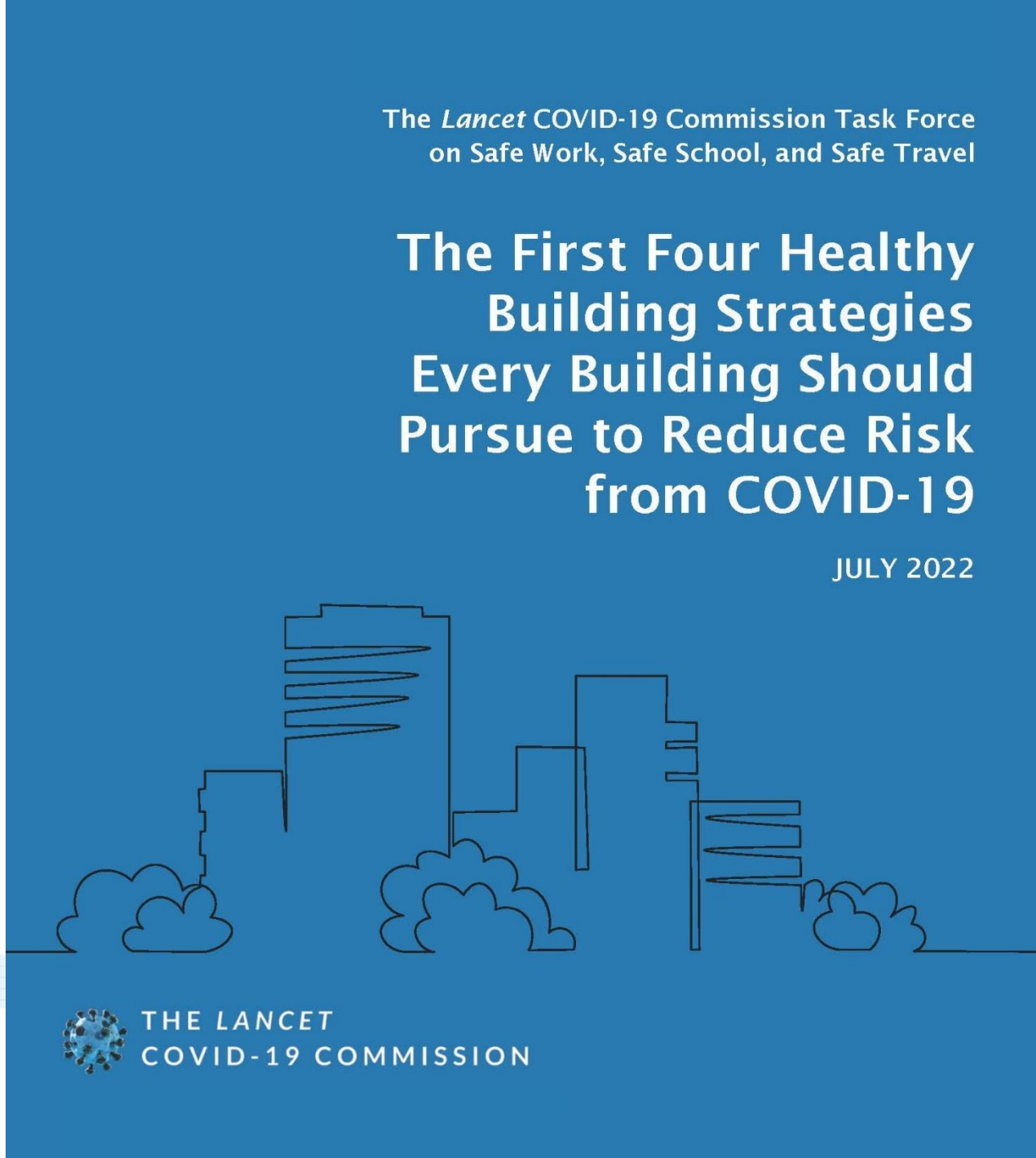
Tools to Improve IAQ

- Ventilation: Supply outdoor air
- Filtration: Remove particles by passing them through a filter
- UV: Disinfect pathogens in the air. Can be effective, but the most effective methods to use UV – upper room UV and far-UV are currently not allowed in Canada
- Alternative air cleaners (ionization, photocatalytic oxidation, hydrogen peroxide, hydroxyl generators)
    - Not regulated. Not necessarily safe or effective. Avoid and disable.

What School Boards Can Do

- Commission equipment and ensure it is running properly
- Increase the amount of outdoor air supplied to the space
  - Increase the percentage of outdoor air
  - Increase the total airflow to the space
- Upgrade filters to MERV-13
- Supplement with HEPA filters to achieve target rates
- Monitor air quality, especially CO_2

ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS



Transparency & Disclosure

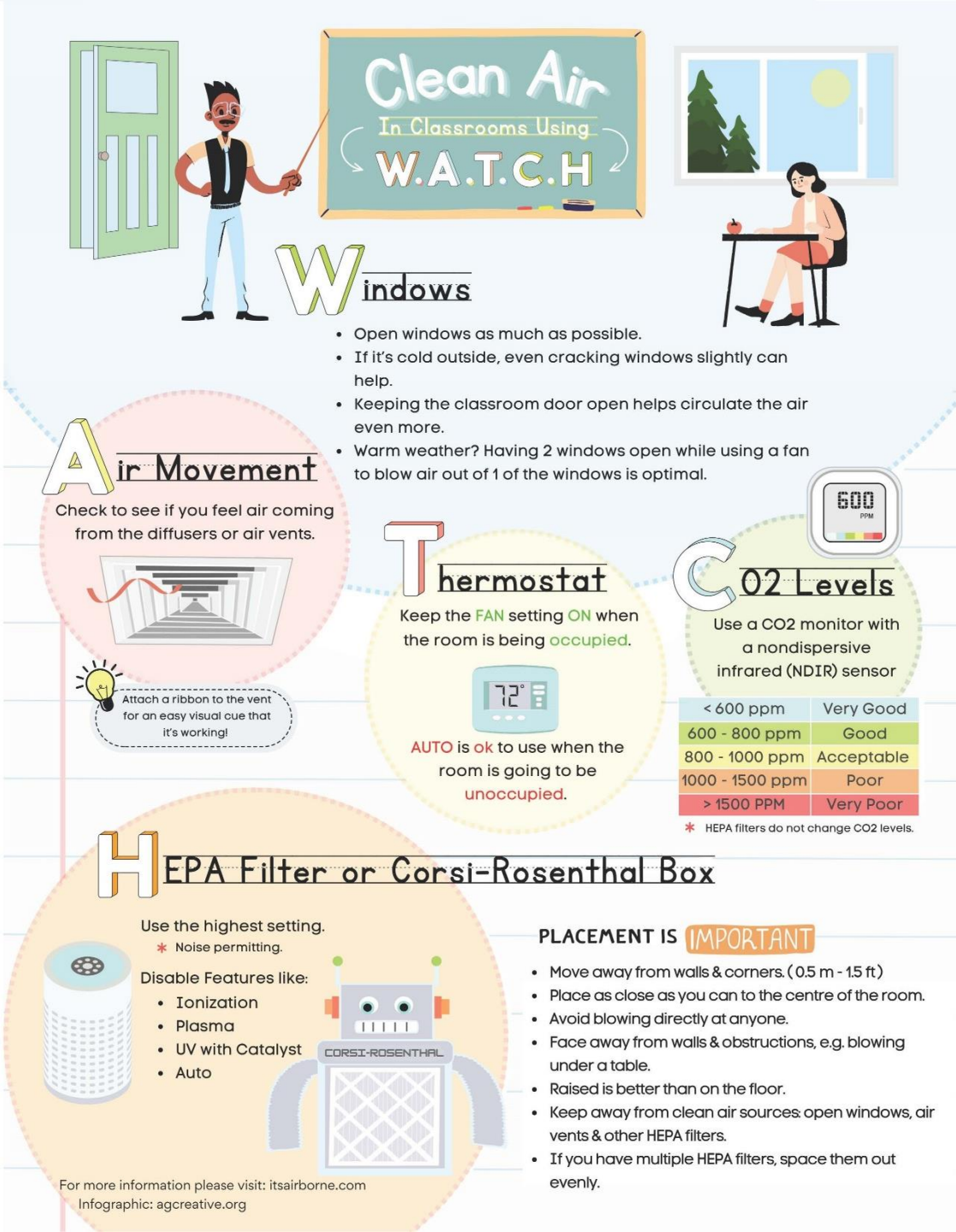
- CO_2 Monitoring
  - Assessing Risk of Airborne Diseases
  - Measuring outdoor airflow per person
- Building Readiness Plan
  - What measures are in place
  - How much clean air is provided per space
  - Need disclosure about commissioning: have the issues been found and fixed

CO_2 (ppm) Elementary	Outdoor Airflow/Person (lps/person)	Extra Clean Airflow Required (lps/person)
600	20	0
800	10	10
1000	7	13
1200	5	15
1500	4	16
2000	2.5	17.5

CO_2 (ppm) High School	Outdoor Airflow/Person (lps/person)	Extra Clean Airflow Required (lps/person)
650	20	0
800	12	8
1000	8	12
1200	6	14
1500	4	16
2000	3	17

What Can Individuals Do?

- WATCH
- Windows – Open as much as possible, comfort permitting
- Air Movement – check airflow from diffusers
- Thermostat – fan should be ON when the space is occupied
- CO_2 – continually monitor CO_2 levels
- HEPA Filters – run as high as comfortable, noise permitting



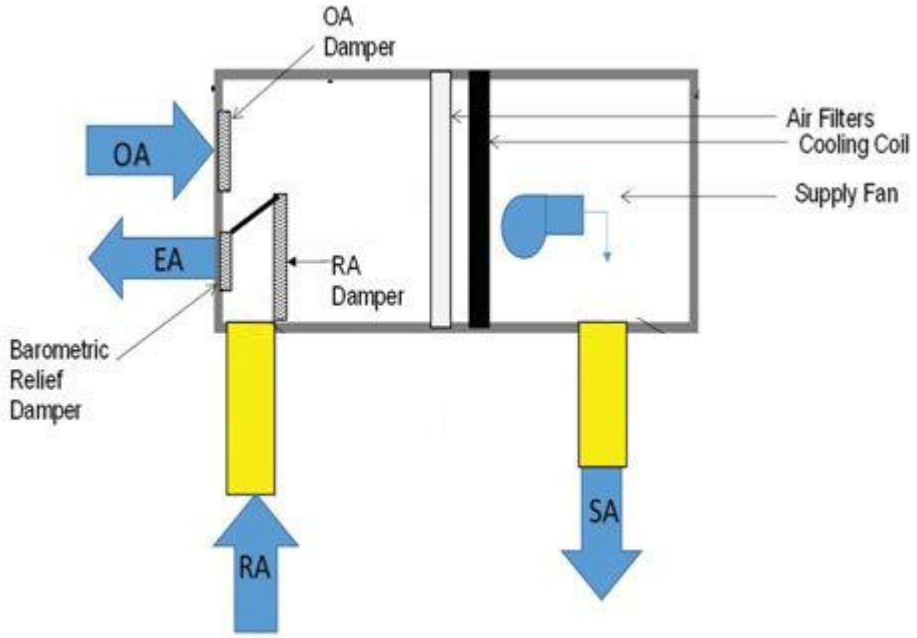
ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

Summary of Tools

	HVAC/Building Wide	In-Room
Ventilation	➢ Increase outdoor airflow	➢ Thermostat Fan setting On ➢ Windows
Filtration	➢ Upgrade to MERV-13	➢ HEPA filter or CR Box
Verification & Transparency	➢ Commission HVAC systems ➢ Building Readiness Plan	➢ Monitor CO_2 ➢ Check airflow

Example 1

- Classroom with 25 people: 20 liters/second/person x 25 = 500 liters/second
- Roof top unit supplying 500 liters/second, 30% outdoor air
  - 150 liters/second of outdoor air
  - 350 liters/second of recirculated air
- 150/25=6 lps/person of outdoor air – Approximately 1100 ppm CO_2
- Upgrade to MERV-13 filters (77% effective)
  - 350 * 0.77 = 270 liters/second
- Total = 150 + 270 = 420 liters/second
- Find a HEPA filter that supplies 500-420 = 80 liters/second of clean air



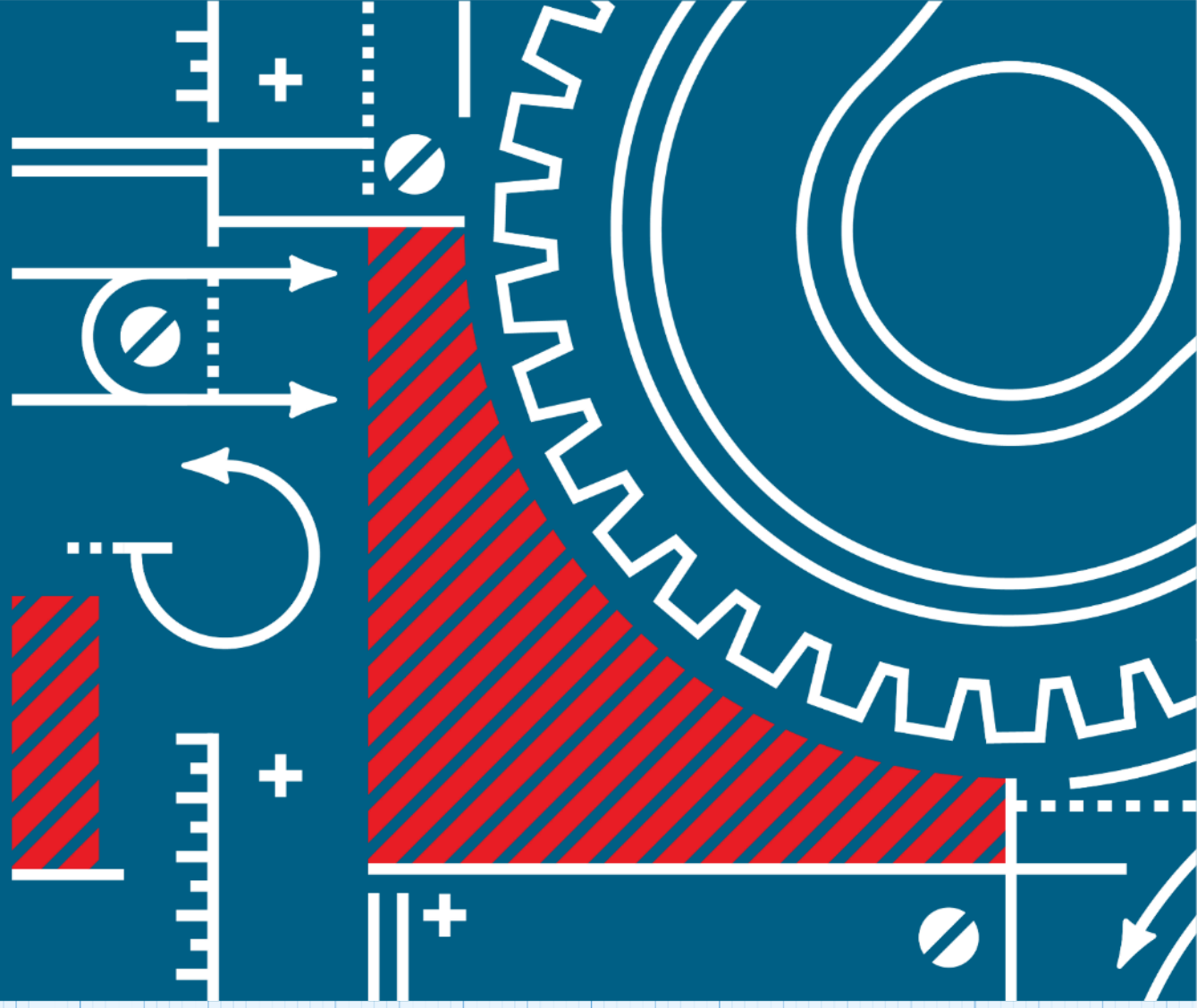
Source: Lorenzo Cremaschi & Pedro Perez Paez (2017) Experimental feasibility study of a new load-based method of testing for light commercial unitary heating, ventilation, and air conditioning (ASHRAE RP-1608), Science and Technology for the Built Environment, 23:7, 1178-1188, DOI: 10.1080/23744731.2016.1274628

Example 2

- Classroom with 20 people: 20 liters/second/person x 20 = 400 liters/second
- No mechanical ventilation. Open window policy
- Monitor CO_2 and find it is 1500 ppm = 4 lps/person x 20 people = 80 lps of outdoor air
- Find HEPA filters to supply 400-80 = 320 liters/second of clean air

Questions.

Joseph Fox, P.Eng., M.A.Sc, OSPE IAQ Advisory Group Chair



ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS