Ollscoil Mhá Nuad
Maynooth University

CO2 monitoring Report

Week 20-24 September

Background

The approach to ventilation is aligned with the HSE/HSPC "Guidance on non-healthcare building ventilation during COVID-19", version 23 July 2021. The document concludes that:

There is evidence that COVID-19 outbreaks are more commonly associated with crowded indoor spaces, and that poor ventilation may increase the risk of transmission in such settings by facilitating the spread of droplets over longer distances. The SARS-CoV-2 virus shows similar viability to SARS-CoV-1 (the airborne coronavirus that caused the 2003 SARS epidemic) in aerosol form in experimental laboratory conditions. While it is possible that experimental viability may be maintained in real-world situations, there is currently no conclusive evidence that this is the case. Given that there are still unknowns around SARS-CoV-2, it is worth applying the precautionary principle until further conclusive evidence is available regarding airborne transmission.

The document recommends that mechanical systems be set to REHVA standards, and that in school settings the following measures should apply:

- *Ensure that windows and air vents can be accessed and opened when needed, weather and student comfort permitting.*

- *In classrooms that rely on natural ventilation, consider opening the windows 15 minutes before the classroom is occupied to ventilate the room. Similarly, leave windows open for 15 minutes after the classroom is emptied to ventilate the room.*

- *Consider installing an indoor air quality (IAQ) meter in each classroom that relies on natural ventilation. IAQ meters monitor the level of CO2 in an area, alerting the user to when the level rises above a set parameter, indicating that there is poor ventilation….. The Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA) recommend setting the lower limit to 800ppm of CO2. When this limit is reached, the necessary steps need to be taken to increase classroom ventilation (e.g. opening a window).*
    - *Provide teachers with instructions on how to manage classroom ventilation:*

- *Open windows and air vents as much as possible during school time to facilitate ventilation, weather and student comfort permitting. Opening windows just below the ceiling will reduce the risk of cross-draughts.*
- *Ensure regular airing with windows during break time by opening windows fully*
- *Make sure the ventilation system openings are not blocked by furniture or curtains*
- *Observe IAQ CO2 monitor levels during the school day and respond appropriately when the threshold is reached (800ppm CO2 recommended as threshold)*

Maynooth University Ventilation

At MU we have introduced the following ventilation measures.

Mechanical ventilation:

- All systems services and checked.
- Air mix adjusted to 100% fresh air.
- Duration of on-time extended (to have the rooms ventilated in advance of first use).
- Energy conservation systems disabled
- Systems checked and verified by independent engineers.

Natural ventilation.

- Each room assessed to determine maximum capacity as determined by ventilation.
- Indicators (green dots) on windows to indicate windows which should remain open all day.
- Indicators (green dots) on doors in some cases, to indicate doors which should remain open.
- Campus services staff opening windows and doors each morning.

CO_2 monitoring

In accordance with the guidance for schools, we are using CO_2 as a proxy indicator. CO_2 is not a risk *per se* (except at very high levels), but is an indication that the flow of air is falling below the desirable standard.

A total of 74 teaching rooms have been fitted with CO_2 monitoring devices. These were not fitted in the rooms with mechanical ventilation, as the CO_2 level is already monitored by the ventilation systems in these rooms and older fixed volume systems deliver the required air changes for the room capacity.

The purpose of the monitoring is to identify rooms where the windows have not been kept open, or rooms where additional ventilation interventions are needed.

Our CO2 monitors have been set to 2 threshold levels:

- The lower threshold is 800 parts per million (ppm). This is considered the “orange” level, which is a reminder to check the windows.
- The higher threshold is 1,000ppm. This is the “red” level, at which some action must be taken.

CO_2 levels for week 1 (20-24 September).

During the first week of the semester there were 74 monitors in operation. The system reports the peak levels during every 15 minute block of time, and as there are 9 hours timetabled (Monday-Thursday), the 74 monitors tracked levels for 660 teaching hours per day, or 2,664 time blocks.

On Mondary and Tuesday there were a significant number of occasions when the levels exceeded the 800ppm level, and a very small number of occasions when the levels exceeded the 1,000 ppm threshold.

The occasions when the 1000 ppm level was exceed were investigated by Campus Services staff. In one case the cause was a faulty sensor, and in almost all other cases the windows had been closed. Campus Services staff intervened to open windows, in some cases during lectures.

The campus services team monitored the data to identify rooms where levels were higher, or peaks were more frequent, and took the following corrective actions:

1) JH5 replacement of faulty Sensor which was reading 5,000ppm at all times.
2) School of Education automatic window management system was intervening to close windows. This was switched to a manual mode to avoid this.
3) Arts Classhalls some additional green dots applied to increase the number of windows held open.
4) Arts Classhall F and Education Hall; dots applied to doors, to increase crossflow of air.
5) John Hume Building; some window openings increased to increase airflow.
6) Physics Hall; window openings increased.

In addition, the main building doors held open to increase airflow in corridors and circulation spaces.

Table A: CO2 peak readings in excess of the thresholds during the week of 20 September.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Monitors in use	74	74	74	74	74
Teaching hours	9	9	9	9	8
No. of 15 minute time blocks measured	2,664	2,664	2,664	2,664	2,368
No. of time blocks in which peak exceeded 800ppm	381	296	134	154	45
No. of time blocks in which peak exceeded 1,000ppm	25	23	12	12	2
% of time blocks in which peak exceeded 800 ppm	14.3	11.1	5.0	5.7	1.9
% of time blocks in which peak exceeded 1000 ppm	0.94	0.86	0.45	0.45	0.08

This table shows the data from the 74 new CO2 monitors. CO2 monitors in the main mechanically ventilated spaces is monitored through different systems, and levels in excess of the threshold are very rare.

Conclusion

1. In general the ventilation systems are functioning as expected, and CO_2 levels are remaining below the 800 ppm threshold most of the time, even when rooms are in regular use.

2. The main problem that is arising is that windows in naturally ventilated rooms are being closed, presumably by the students siting near them. The data show that once the windows are opened the CO_2 levels rapidly fall below the threshold.

3. There were a number of interventions made during the first week to increase ventilation, and these have reduced the number of occasions on which the levels exceed the 800ppm threshold to under 2%.

4. These data underline the need for continued vigilance in adherence to the ventilation protocol, and staff should ensure that windows with green dots are open during classes.

5. Campus services will continue to monitor the data and take action if the either the general pattern changes, or if the levels in specific rooms are higher than normal.