

Application Spotlight

Why Monitor CO₂ Levels in Classrooms?

What do you look for in a school district? Quality of teachers? Reputation? How their sports teams and extra-curricular activities stack up? But, do you ever think about the indoor air quality in the school buildings?

In 2014, the U.S. National Center for Education Statistics (NCES) surveyed a sample of school districts and estimated the average age of the nation's main school buildings at 55 years old. And, nearly half of these buildings have been reported to have problems related to Indoor Air Quality (IAQ).

Studies by The U.S. Environmental Protection Agency (EPA) on human exposure to air pollutants indicated that levels of indoor air of pollutants may be two to five times higher, and occasionally, more than 100 higher, than outdoor levels. These levels of indoor air pollutants are of particular concern because most people spend about 90% of their time indoors.

So, what is IAQ really? The EPA defines Indoor Air Quality (IAQ) as “the air quality within and around buildings as it relates to the health and comfort of building occupants.” Understanding and controlling common indoor pollutants can help reduce your risk of indoor health concerns. Pollutants, however, are not the only concern. Temperature and humidity factor into this as well because thermal comfort conditions are a main contributor to air quality. “Good” IAQ is an important component of a healthy indoor environment and can help schools reach their primary goal of educating children. The health and comfort of students and teachers are among the many factors that contribute to learning and productivity in the classroom, which in turn, affect performance and achievement.

Failure to prevent or minimize IAQ problems can increase long- and short-term health effects for students and staff. Some of these can include, coughing, eye irritation, headaches, allergic reactions, aggravating asthma and/or other respiratory illnesses. Any or all of these can impact student attendance, comfort, and performance, as well as reduce teacher and staff performance.



But how do you know if the air quality is good? The most obvious method to ensure that a room is properly ventilated, which aids in maintaining a high-level of indoor air quality, is to monitor Carbon Dioxide (CO₂) levels within the classroom. Every time you exhale, you release CO₂ into the air. Therefore, the CO₂ level lets you determine if the room is being properly ventilated with fresh outside air; thereby, helping you gauge the quality of the air within that space.

It's important to note that high levels of CO₂ can contribute to poor air quality as well. Studies have found that high levels of CO₂ can impair cognitive ability. This can impact our ability to make decisions, maintain a high quality of work, or learn and communicate effectively. As a result, IAQ has a huge influence on productivity at work, life outcomes in education, and clinical outcomes in hospitals.



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Physiological Responses to Carbon Dioxide (CO₂)

350 - 450 ppm	Normal background concentration in outdoor ambient air
400 - 1,000 ppm	Concentrations typical of occupied indoor spaces with good air exchange
1,000 - 2,000 ppm	Complaints of drowsiness and poor air
2,000 - 5,000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
5,000 ppm	Workplace exposure limit (as 8-hour TWA) in most jurisdictions
>40,000 ppm	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, and even death.

Source: Wisconsin Dept of Health Services, <https://www.dhs.wisconsin.gov/chemical/carbondioxide.htm>

Under normal circumstances, CO₂ sensors, when connected to the Energy Management System (EMS) in a Demand-Controlled Ventilation (DCV) scenario, monitor the CO₂ levels within a space. Based on the respective CO₂ level, which is also a good proxy of the number of occupants in the room, the EMS will determine the amount of fresh outside air to introduce into the space. This method is used to ensure that the space is properly ventilated, while saving energy and reducing operating costs. In general, under this circumstance, the CO₂ levels are maintained $\leq 1,000$ ppm.



During the recent COVID-19 pandemic, however, the Centers for Disease Control and Prevention (CDC) has made several recommendations to help minimize exposure to the SARS-CoV-2 virus particles. One recommendation is to disconnect the DCV system and increase the amount of fresh air necessary to maintain CO₂ levels between 600-800 ppm, while paying attention to the humidity and comfort levels within the space. Maintaining the lower CO₂ level helps to minimize the chance of transmission of the virus if an infected person is inside the space.

If too little outside air is introduced into the building, pollutants can accumulate to levels that can pose health and comfort problems. Unless buildings are constructed to include a mechanical means of ventilation, the amount of outdoor air that can “leak” in and out of the building can be insufficient to provide quality indoor air conditions and can result in higher indoor pollutant levels. Improving and maintaining proper indoor air quality can reduce the number of student visits to the nurse’s office, reduce absenteeism due to illness, and enhance the general health and well-being of all students and staff.

In conclusion, air quality in schools is of particular concern. Proper maintenance of indoor air is more than a “quality” issue. Quality indoor air encompasses safety and stewardship of your investment in students, staff, and facilities. CO₂ level is a good indicator of whether the space is properly ventilated and maintains a high-level of air quality. Quality indoor air provides students and staff the atmosphere needed to perform at their best.

AAS Advantage

Amphenol Advanced Sensors - with its portfolio of industry-leading brands - Thermometrics, NovaSensor, Telaire, Protimeter and Kaye - is a trusted OEM partner providing temperature, pressure, CO₂, humidity, and dust sensors to solution providers in HVAC, automotive, industrial, and healthcare markets.

Telaire has been at the forefront of Carbon Dioxide (CO₂) sensing technology for 30+ years and are the originators of the maintenance free CO₂ infrared sensor. Telaire continues to lead the way in innovation with over 35 technology patents, including ABC Logic™ and warrants single-wavelength sensor calibration for the life of the sensor.

Telaire offers a complete line of CO₂ sensors for a wide range of applications. These can be viewed at www.telaire.com.

References:

<https://www.epa.gov/iaq-schools/take-action-improve-indoor-air-quality-schools>

<https://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools>

<https://www.dhs.wisconsin.gov/chemical/carbondioxide.htm>

<https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html>

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