

Carbon Dioxide and Performance

Because carbon dioxide (CO₂) in exhaled air is about 100 times greater than atmospheric air (4%v/v compared to 0.04%v/v respectively) it has been used as a tracer gas to determine whether a building is occupied and the efficiency of ventilation for over 150 years. On the basis that CO₂ concentrations are high it is assumed that other airborne contaminants that are deleterious to health are also high and that these other compounds/ microbes are the causative agents.

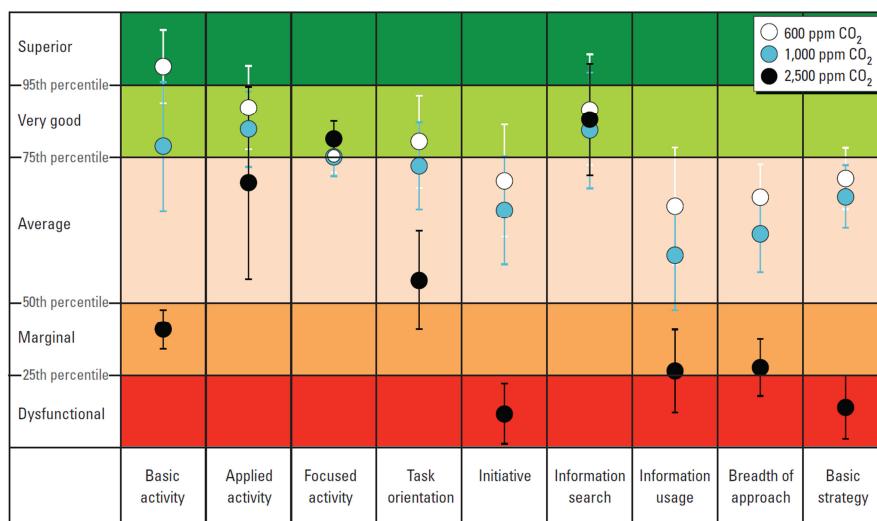
There have been a number of studies that have illustrated a link between poor IAQ and reduced occupant performance but initial evidence suggests that poor IAQ adversely influences the performance and attendance of occupants, primarily through health effects from indoor pollutants. The implication being that not only does good ventilation reduce health risks it also improves occupant performance.

However, CO₂ can also have direct impacts on health with HSE exposure limits set at 5% CO₂ for 8 hours due to the ability for high CO₂ to cause nausea, dizziness and unconsciousness – as well as being toxic at concentrations above 20%.

Now recent research is demonstrating that CO₂ is a direct causative agent in reducing performance and CO₂ levels above 0.25% (2500ppm) can have a significant impact on concentration and performance ability.

Using a controlled environment chamber, participants underwent a series of specially developed task and initiative based computer tests. Ventilation within the chamber remained constant and CO₂ levels were varied by injecting pure CO₂ into the chamber and maintaining constant CO₂ levels throughout the duration of the tests. The results demonstrate that a CO₂ concentration of 0.25% significantly reduced the participants' performance ability in all tasks apart from focused activity and information search (7 out of 9 task types)¹.

We've all felt sleepy in crowded meeting and lecture rooms and this effect is a direct consequence of increased CO₂ in the internal air. Thus improving ventilation reduces CO₂ and increases occupant performance, be that office staff or pupils. Improved performance have associated cost benefits, with one study suggesting that improved ventilation is equivalent to €300 per person per year.



¹ Image from Satish *et al.*

References

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