CO₂ monitoring briefing note

A presentation from Roger Curtis of Historic Scotland to the forum led to a discussion about CO₂ monitoring, comfort, Covid-19 and air flow in buildings.

Roger kindly put us in touch with a colleague who has used and tested CO₂ monitors in historic buildings. She provided some advice on monitoring which has been supplemented with some additional research by the SBP CIC and is summarised below.

**Why monitor CO₂?**
Everyone already knows about the dangerous effects of Carbon Monoxide (CO), but people are increasingly recognising that higher concentrations of Carbon dioxide (CO₂) in a room can make people sleepy and make rooms feel stuffy. This is particularly an issue in spaces which are designed to have a low number of occupants, but which sometimes have a large number for a longer time e.g. gallery events, long meetings or wedding ceremonies. It is also an issue for rooms which do not have good ventilation, either mechanical or easily opened windows.

**Covid-19**
There is some evidence that the CO₂ levels in a building correlates with the spread of airborne infection and so CO₂ monitoring has become more important in the last year because it provide a relatively simple proxy for fresh air, so organisations are using CO₂ monitoring to manage their Covid-19 risk.


**What are safe levels of CO₂ in rooms?**

<table>
<thead>
<tr>
<th>CO₂</th>
<th>Description</th>
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<tbody>
<tr>
<td>250-400ppm</td>
<td>Normal background concentration in outdoor ambient air</td>
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<tr>
<td>400-1,000ppm</td>
<td>Concentrations typical of occupied indoor spaces with good air exchange</td>
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<tr>
<td>1,000-2,000ppm</td>
<td>Complaints of drowsiness and poor air.</td>
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<tr>
<td>2,000-5,000ppm</td>
<td>Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.</td>
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<tr>
<td>5,000</td>
<td>Workplace exposure limit (as 8-hour TWA) in most jurisdictions.</td>
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<td>&gt;40,000 ppm</td>
<td>Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, even death.</td>
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Source: Kane Air Quality Monitor Suppliers [https://www.kane.co.uk/product-selector/indoor-air-quality](https://www.kane.co.uk/product-selector/indoor-air-quality)

**Options for monitoring CO₂**
First – check if your existing systems already has C)2 monitoring – do you have a Building Management System (BMS) with air quality monitoring, do you have a Tinytag system? They may well already have CO₂ monitoring capabilities, or potential to add on without adding additional systems.
CO2 monitors start from simple portable options without data logging to complex integrated systems. Historic Scotland have tested some with the intention of producing guidance, though the pandemic delayed the project, so the information below are interim and forum members are advised to do their own research as other equipment is available.

If you are thinking of investing in new monitoring, ensure you consider the other areas you want to monitor – carbon monoxide, temperature and humidity, VOCs, PM10 particles, pollen etc. when choosing a new system.

Another thing to consider if whether you want a monitor with data logging capability and / or a live display.

Look for monitors with NDIR CO2 sensors
More information: https://www.dwyer-inst.com/articles/?Action=View&ArticleID=83

Monitors currently being tested by Historic Scotland

Tinytag TGE-0010 (>2,000ppm)

Tinytag TGE-0011 (>5,000ppm)

Tinytag are made by Gemini Data Loggers, a Sussex based supplier

Aranet4
Domestic CO2, humidity, temp and pressure monitor
https://aranet4.com/?gclid=Cj0KCQjwzYGGBhCTARIsAHdMTQwUTPNEA9LQsHvSon50Qw69A1LcsmE9UQwDcKE8get1Ei1jMIRrb4aAkdBEALw_wcB

Extech CO-100 Desktop air quality monitor
http://www.extech.com/categories/air-quality-meters/carbon-dioxide

Therm CO2 monitor
https://www.amazon.co.uk/Therm-Mode-Detector-Temperature-Calibration/dp/B08R9T5F3N

Airthings View Plus Domestic smart phone linked air quality monitor
https://www.airthings.com/en-gb/view-plus
Available for pre-order (new model with display screen

Fluke C02-100
Currently out of stock most places