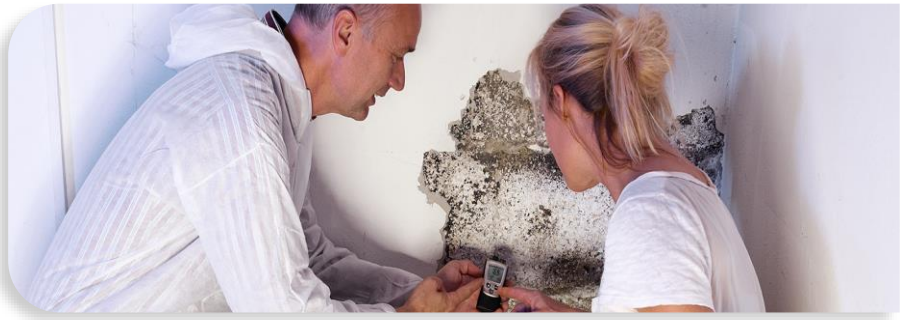
PROTECTING HEALTH | MITIGATING LOSS

Indoor Air Quality Considerations as part of a COVID-19 Management Strategy



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EHS Assess Pty Ltd

Returning to the outside world…..

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As per the **World Health Organisation (WHO)** decisions regarding the reopening of offices, schools, public buildings etc. should be guided by a risk-based approach, to maximise the well-being and health benefit of people, the wider community and help prevent outbreaks of *COVID-19* in the community.

A **layered approach** is required to **reduce exposures** to *SARS-CoV-2*, the virus that causes *COVID-19*. This approach includes using multiple mitigation strategies, including improvements to building ventilation, to reduce the spread of disease and lower the risk of exposure.

While **social distancing** is an effective measure against the spread of coronavirus and its variants, as social distancing measures are being relaxed and areas reopen to the public, good ventilation remains a very powerful tool to limit the risk of coronavirus spreading amongst occupants.

Airborne Transmission

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- **Airborne transmission**, via small particles (**droplets or aerosols**) from an infected person, is a known transmission route for *COVID-19*.

- Smaller airborne particles can travel much further than the recommended 1.5-2m distancing from another person, and so social distancing alone is not totally effective in protecting against breathing in these virus particles.

- Good **ventilation** can **reduce** the transmission risk via the airborne route in an indoor environment by diluting the concentration of airborne particles with a supply of **fresh** or **clean air**. 6-8 air changes an hour (ACH) should be a target.

- Although screens, distance and face coverings can help by controlling larger particles which are expelled from the wearers mouth and nose, the transmission risk still remains from smaller airborne particles, which is why ventilation is also important.

Particle Sizes

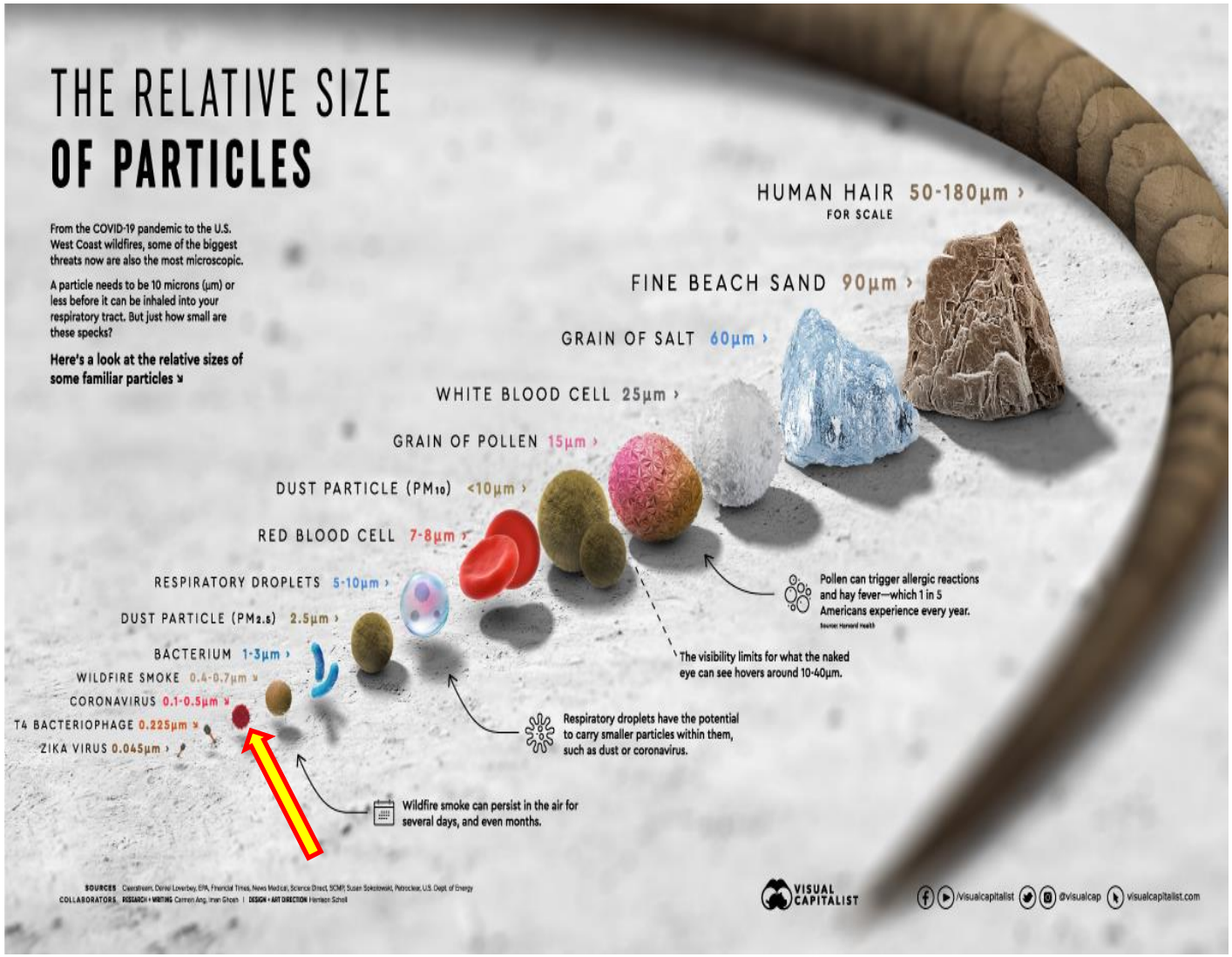

Image: Visual Capitalist

Larger particles (PM_{10}) may only remain airborne for minutes/hours, where as smaller particles ($PM_{2.5}$) may remain airborne for days in the right conditions

Droplet Suspension

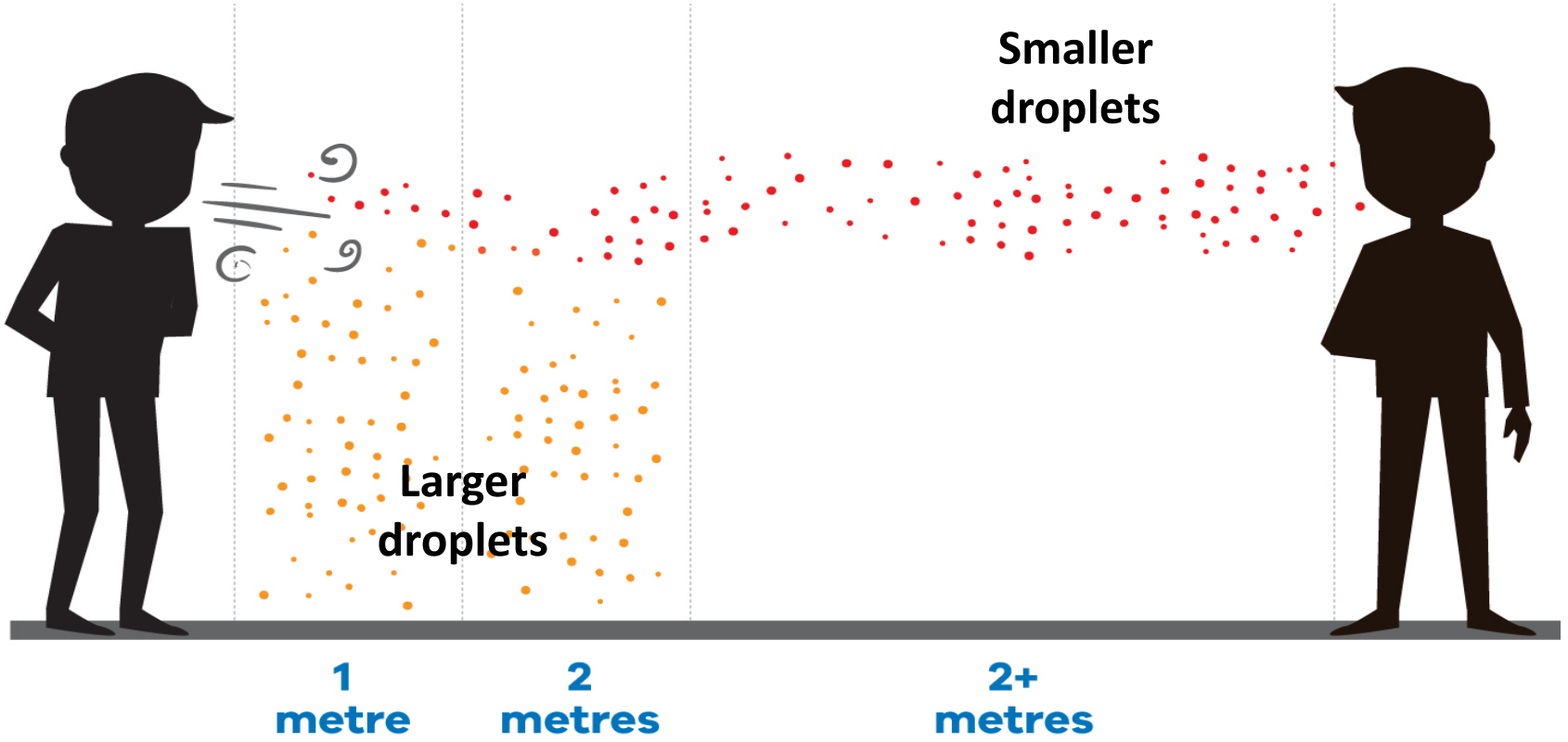

Image: State of Victoria, Australia, Victorian Health and Human Services Building Authority, November 2020.

Ventilation

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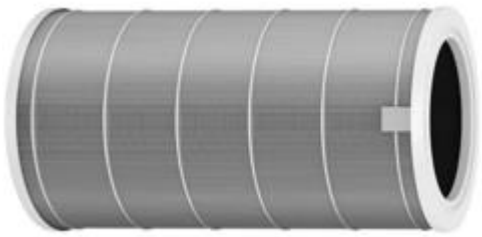
- The principle aim of good ventilation is to control the risk of airborne transmission when in the same indoor space as an infected person. To do this, ensure adequate ventilation and increase total airflow supply to occupied spaces.

  What type of ventilation? Many exist each has its pros and cons.



Ventilation

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- **Clean, natural ventilation** (i.e. opening windows) should be used inside buildings where possible, **without re-circulating** the air. This is simple and cost effective but can present thermal comfort issues during the colder/hotter seasons.

- If **heating, ventilation and air conditioning** (HVAC) systems are used they should be regularly **inspected, maintained and cleaned**. Rigorous standards for installation, maintenance and filtration are essential to make sure they are effective and safe, refer to ***AS/NZ 3666 Air-Handling and Water Systems of Buildings.***

- Suitable **high efficiency filters or 'HEPA' filters** which remove small airborne particles from the air passing through the filter can be installed on systems.

- Whether it is necessary to run the system all day and night will depend on factors such as **airflows, space volume** and **occupancy levels**.

Ventilation

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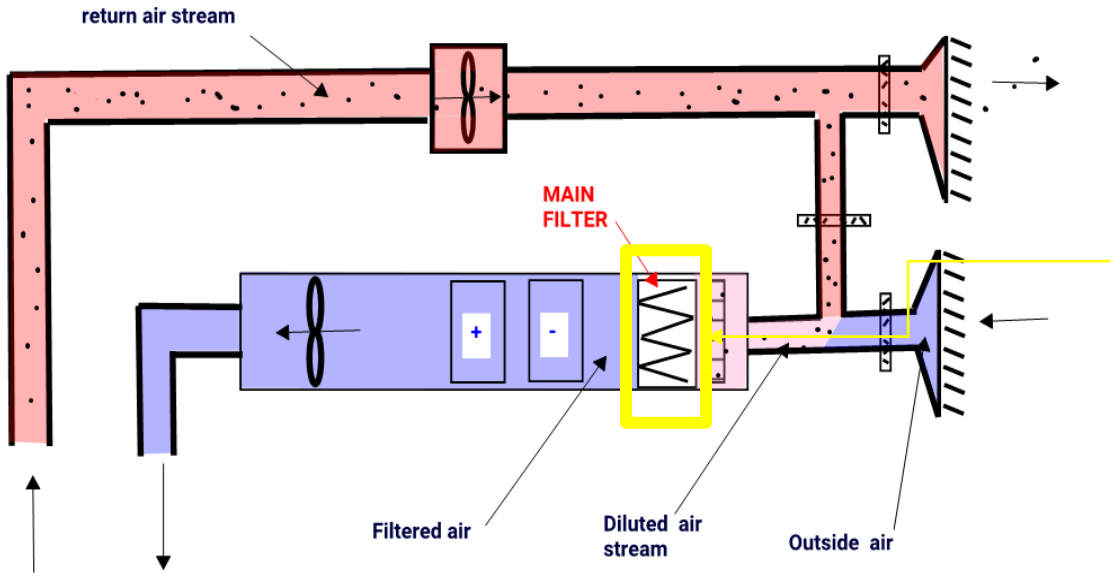
- **Portable air conditioners** often recycle the air without removing or destroying infectious coronavirus particles. If the portable air conditioner is fitted with an air purifier, then they may help to reduce transmission risk from airborne particles.

- There is some evidence that air purifiers can reduce the amount of infectious material in the air in an enclosed space using - **HEPA filters** and **UV sterilisation** systems.

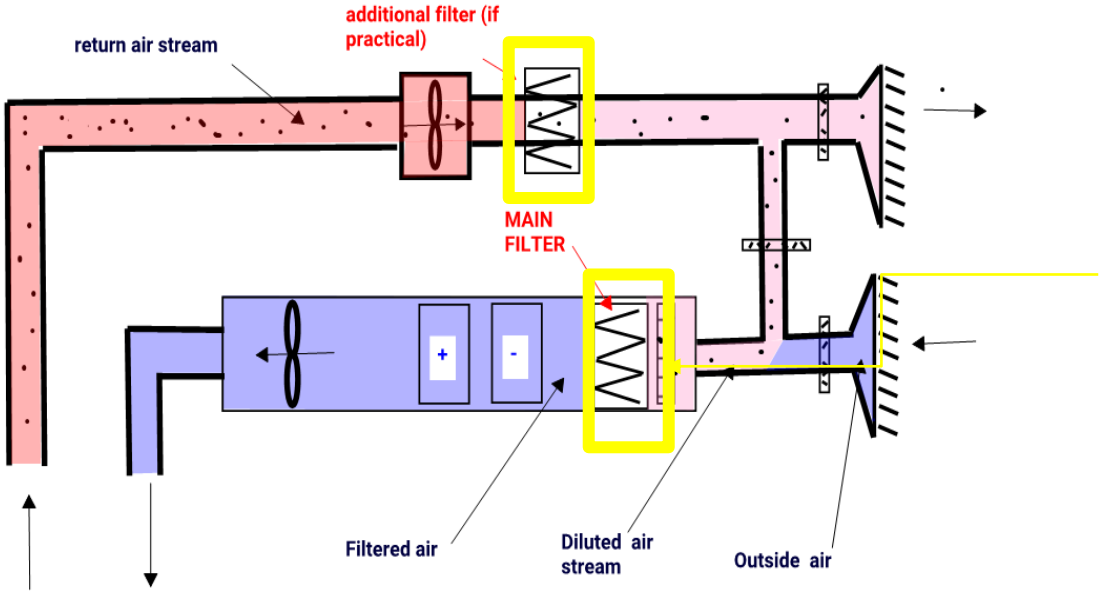
- **Recirculating air** in a room is a risk if the air is from a place where there are people who may be infected with *COVID-19.* There is no avoiding the need for fresh or clean air supply into a room or indoor space from either a mechanical system providing fresh/cleaned air, which offers more control, or via natural means.

- **Recirculating air conditioners** alone will not prevent the airborne spread of Coronavirus particles.

Ventilation



Traditional HVAC system – air filter on the incoming air



Upgrade option may be to include a filter on the return air

Image: State of Victoria, Australia, Victorian Health and Human Services Building Authority, November 2020.

Filters

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- However, not all filters are the same. Most regular filters on building HVAC systems are not capable of filtering out the particles sizes of concern.

Methodology		ISO16890 Minimum Filtration efficiency % of PM	
EN779.2012	ASHRAE 52.2	0.3 – 1.0 µm $ISOePM_1$	0.3 – 2.5 µm $ISOePM_{2.5}$
G1	MERV 1-2	Nil	Nil
G2	MERV 3-4	Nil	Nil
G3	MERV 5	Nil	Nil
G4	MERV 6-7	Nil	Nil
M5	MERV 8A-9A	>20%	>30%
M6	MERV 10A-12A	>40%	>50%
F7	MERV 13A	>50%	>60%
F8	MERV 14A	>60%	>75%
F9	MERV 15A-16A	>80%	>90%

- Knowing what is best for you requires an **occupational hygienist** to undertake a **risk assessment** of your system with input from the HVAC contractor/engineer.

Image: State of Victoria, Australia, Victorian Health and Human Services Building Authority, November 2020.

Ventilation Risk Assessment

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A competent **Occupational Hygienist** can undertake a ventilation risk assessment and review to assess the effectiveness of ventilation as a control strategy to reduce *COVID-19* transmission. As per the BOHS in the UK, this should include and consider:

- **Volume of the Room**
- **Number of area users**
- **Social distancing:** How often do people need to worker closer that 2m in this space?
- **Area Natural Ventilation:** What type of window ventilation have you got?
- **Vents:** Have you got wall vents and trickle vents you can use?
- **Mechanical Ventilation**
  - No mechanical ventilation.
  - HVAC or similar on recirculation.
  - Toilet or change room exhaust fans.
  - HVAC or similar on full fresh air.
  - HVAC on recirculation with HEPA or other suitable virus arresting technology.

Using a risk assessment calculator, the Occupational Hygienist can determine whether the ventilation is likely to have **no effect, some effect,** or a **strong effect** on reducing the risk of coronavirus transmission.

Stale Air

- **Stale air** areas may exist where there is very little airflow and the air remains still and unaffected by ventilation.
- They can be found in various locations where there are obstructions or physical barriers to free airflow. This may include privacy screens or large items of work equipment.
- It very much depends on the ventilation in place and how the building is used.
- The use of some simple tools such as **CO_2 monitors** can sometimes help you see what is normally invisible.

What is CO_2

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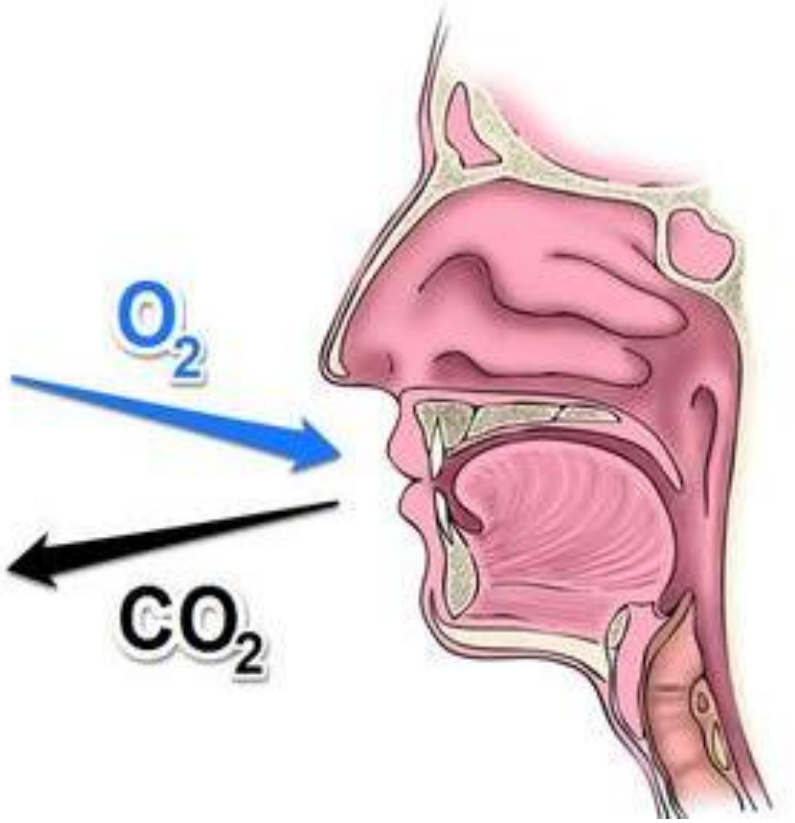
- CO_2 is a **colourless, odourless,** faintly acidic tasting, non-flammable gas.
- CO_2 is the fourth most abundant gas in the earth's atmosphere; therefore, it is present in fresh air generally at concentrations of 350-400ppm (parts per million).
- CO_2 is present in **exhaled air** from our lungs.
- Approximately 4–5% (or 40,000ppm) of the gas we exhale with each breath is CO_2.
- Therefore, where people are present in an indoor space, **measuring CO_2** can tell how much fresh air exchanges are occurring in a room and if adequate ventilation and dilution of the air is occurring to reduce possible *COVID-19* transmission between people.



Carbon Dioxide Monitoring

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- Measuring CO_2 concentrations can assist in determining if there is enough **fresh air** supplied into the room or space to prevent CO_2 building-up as a result of the occupants breathing and talking.

- Air-cleaning devices such as **HEPA or UV**, this may be able to reduce the risk of *COVID-19* transmission, but it does not reduce CO_2 levels.

- In order to use CO_2 as an indicator of how well the space is ventilated, competence is required to establish a suitable **measurement regime** using **the right monitors, in the right locations** at times of typical **occupancy**, and to interpret results and decide on the need for corrective actions.

The Hot New Back-to-School Accessory? An Air Quality Monitor.

Parents are sneaking carbon dioxide monitors into their children's schools to determine whether the buildings are safe.

Luke Beauregard, 8, holding a CO2 monitor he carries with him to school so that his mother, Lizzie Rothwell, can keep an eye on the school's ventilation. Rachel Wisniewski for The New York Times

New York Times – 10 October 2021

Carbon Dioxide Monitoring

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- CO_2 monitors **are not measuring *COVID-19***, they are indicating how effective the ventilation is, so even when used perfectly, the readings are rough indicators.

- **CO_2 levels will vary** according to what people are doing and other factors. A perfectly healthy person breathes out CO_2, so CO_2 levels can be high and no actual *COVID-19* being spread.

- But if everyone in the space is infected, there could be a high risk, even if the CO_2 reading is low.

Carbon Dioxide Concentrations

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Different type monitoring systems exist – real time **spot measurements** (one off measurements), real time **single sensor** instruments (can data log) or **multi-sensor real time logged data** with online portal, alarm triggers etc.

The type required depends on what is required to be achieved. Input from the supplier and/or an Occupational Hygienist should be sought.

Levels of CO_2 of **800-1000ppm or below** are indicators that the ventilation is working effectively. Above these levels it is an indication that ventilation is not working effectively and needs reassessing. NOTE: Levels above this are not considered hazardous, simply just demonstrates poor ventilation in an area.

When elevated CO_2 are present measures to reduce it include:

- **Increasing fresh** air to the area and removing stale air – by natural or mechanical means as explained previously.

- Reducing room **occupancy.**

Standalone Unit

- Measures CO_2, Temp and RH
- Portable
- Battery and USB powered.
- Easy to use
- Real time CO_2 reading in ppm
- Colour coded for visual reference (traffic light system)
- Auto calibration
- Can datalog if required (trends)
- Cost effective soluton

Datasheet
Publish Date: 20.08.2019

ERS CO_2

ELSYS.se

LoRaWAN Wireless Sensor

Description

ERS CO_2 is a sensor for measuring the indoor environment. It is enclosed in a room sensor box and is designed to be wall mounted. ERS CO_2 is completely wireless and powered by two 3.6V AA lithium batteries. Inside you will find internal sensors for measuring indoor CO_2 levels, temperature, humidity, light, and motion.

Applications

- Indoor environment measuring
- Smart buildings
- Workplace management
- Room occupancy

Product features

- LoRaWAN Certified ™
- CO_2 sensor
- Temperature sensor
- Humidity sensor
- Light sensor
- Motion detection sensor (PIR)
- NFC for configuration
- Configuration over the air

Device Specifications

Mechanical specifications	
Weight	80 g excluding batteries / 120 g including batteries
Dimensions	86 x 86 x 27 mm
Enclosure	Plastic, PC/ABS

Operating conditions	
Temperature	0 to 50 °C
Humidity	0 to 85% RH (non-condensing)

Device Power Supply	
Battery Type	2 x 3.6V AA Lithium Batteries
Expected Battery Life	<10 years (Depending on configurations and environment)

Device Logging Function	
Sampling Interval	Configurable via NFC and downlink configuration
Data Upload Interval	Configurable via NFC and downlink configuration

Multi-sensor/Wireless

- Measures CO_2, temp, humidity, light and motion sensors
- Battery powered, up to 10 years
- Completely wireless
- Real time data logging (trends)
- Log on to an online portal to see logged data
- Cost effective solution

Summary/Takeaway

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- Good ventilation is a proven mitigation strategy to reduce the spread of disease and lower the risk of exposure to *COVID-19* in the built environment. Secondary benefits of this are alert and healthy students and teachers etc.

- A risk-based approach to assessing ventilation is required – engage with experienced and competent professionals to undertake a ventilation risk assessment and review to assess the effectiveness of ventilation prior to implementing solutions.

- Simple changes to existing tools/systems can have a big impact. Not all solutions need to be complex and/or expensive.

- The only way to effectively assess the impact and/or effective of ventilation is to monitor it. Simple cost-effective methods of doing this now exist and are quickly becoming the expectation in the built environment, particularly schools.

Details

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