Assurity Consulting

Independent workplace compliance

White Paper

Breathing space – managing indoor air quality

February 2022

Breathing space – managing indoor air quality

Not since the days of Sick Building Syndrome has indoor air quality (IAQ) had such scrutiny, or so many commentators and solutions. Where recirculation rates and degree days were the order of the day, they have more recently been replaced with ventilation rates and carbon dioxide measurements.

But what is the reality for a well-managed workplace environment when it comes to air quality and where should you be focussed?

1. Air quality – The big picture

Poor air quality, both indoor and ambient (outdoor), is a significant health issue with the World Health Organisation (WHO) identifying "Air pollution kills an estimated seven million people worldwide every year."

In breaking this figure down, they further reported that:

"Worldwide ambient air pollution accounts for:

- 29% of all deaths and disease from lung cancer;
- 17% of all deaths and disease from acute lower respiratory infection;
- 24% of all deaths from stroke;
- 25% of all deaths and disease from ischaemic heart disease;
- 43% of all deaths and disease from chronic obstructive pulmonary disease.

WHO data shows that almost all of the global population (99%) breathe air that exceeds WHO guideline limits containing high levels of pollutants, with low - and middle-income countries suffering from the highest exposures."

Many countries do have in place a mixture of air quality controls, relating both to environmental, as well as health issues. For example, the UK first had a Clean Air Act in 1956 and a since then, traffic, large combustion plants and emissions amongst others have been targeted.

In terms of pollutants, those identified of most public health concern includes, particulate matter (PM), ozone (O3), nitrogen dioxide (NO2) and sulphur dioxide (SO2).

2. What affects indoor air quality?

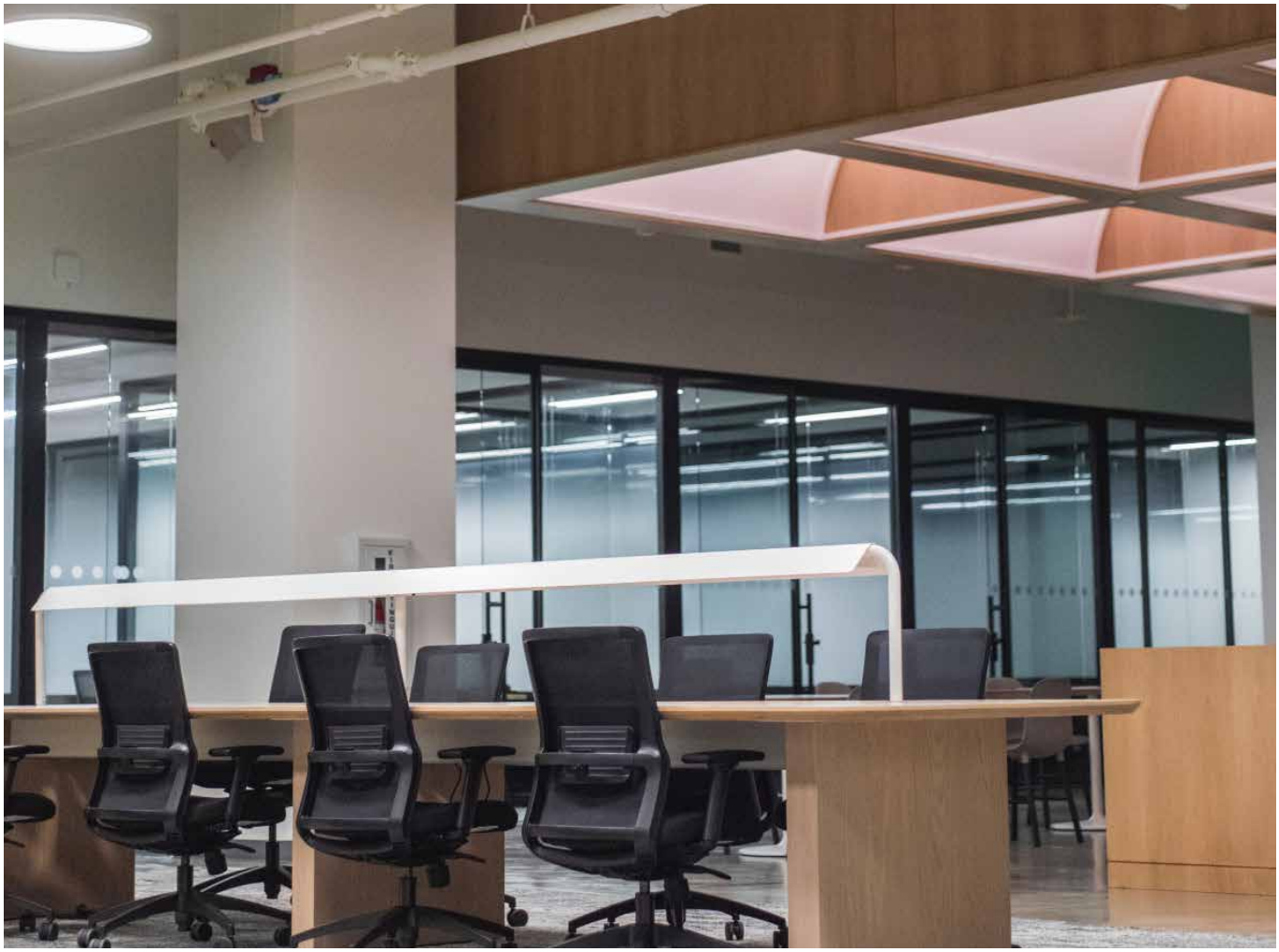
As with ambient air, three main constituents/pollutants need to be considered over that of the typical gaseous make-up of the air itself in workplaces. These are:

- **Biological** - General bacteria, Legionella, fungi, moulds, pollen, other allergens, etc.
- **Gaseous** - Carbon monoxide, Carbon dioxide, Oxides of nitrogen, Volatile organic compounds (VOC), other compounds and chemicals
- **Dusts** - Particle matter – PM2.5, PM10, carbon, crystalline, paper and wood dust, etc.

While the composition of many of these pollutants will depend on the external environment and so what is drawn in from outside, occupation rates, processes/activities/equipment, furnishings and paints, etc., humidity, poor maintenance and even poor space planning can have an adverse effect on IAQ.

Internal fixtures, fitting and equipment, and processes can also adversely affect IAQ through the release of for example chemicals and dusts into the local environment. These can include wood dust and other debris from workshops and construction, VOC from paints, glues and other chemicals, microbiological contaminants potentially from poorly maintained humidifiers and historically ozone released from photocopiers.

Various dusts, gases and micro-organisms occurring in the workplace can also act as asthmagens triggering reactions in certain people.



3. IAQ and legislation

Indoor air quality is covered by a range of health and safety legislation including the general provisions and requirements of The Health and Safety at Work etc. Act 1974.

- The Control of Substances Hazardous to Health Regulations 2002 places a duty on employers to protect employees and others from the hazards of substances used at work, which could include, gases, dusts and microorganisms. Such substances and their management should be dictated by risk assessment, exposure control, health surveillance and incident planning, as required.
- The Workplace Health safety and Welfare Regulations 1992 - Regulation 6(1), requires that "effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air."
- EH40 – Workplace Exposure Limits, contains a list of workplace exposure limits (WELs) to be used with the Control of Substances Hazardous to Health Regulations 2002. Some substances, such as asbestos and lead are regulated separately to these requirements.
- Various HSE and other standards, guidance and best practise also provide further information on IAQ, including HSE L24 the Approved Code of Practice and guidance to the Workplace Health safety and Welfare Regulations 1992 state in paragraphs 47 to 49:
    - Enclosed workplaces should be sufficiently well ventilated so that stale air, and air which is hot or humid because of the processes or equipment in the workplace, is replaced at a reasonable rate.
    - The air, which is introduced should, as far as possible, be free of any impurity which is likely to be offensive or cause ill health. Air which is taken from the outside can normally be considered 'fresh'. However, air inlets for ventilation systems should not be sited where they may draw in contaminated air (for example close to a flue, an exhaust ventilation system outlet, or an area in which vehicles manoeuvre). Where necessary, the inlet air should be filtered to remove particulates.
    - In many cases, windows or other openings will provide sufficient ventilation in some or all parts of the workplace. Where necessary, mechanical ventilation systems should be provided for parts or all of the workplace.

It is for the duty holder to determine the applicability and requirements of the above for their workplace and work activities, and the level of management and controls they need to employ/introduce.

4. Particulate matter and dust

General dust levels in outside air will have an impact on IAQ. Traffic, construction work, urban, sub-urban and rural environments, etc. will all have an influence on the dust and particulate matter in the air.

Similarly, whether your workplace is naturally or mechanically ventilated - and depending on the quality of any installed filters with the latter – it will affect your ability to control the levels of these contaminants.

In COSHH, dust of any kind is defined as a substance hazardous to health, when present at a concentration in air equal to or greater than:

- 10 mg.m-3 8-hour time weighted average of inhalable dust; or
- 4 mg.m-3 8-hour time weighted average of respirable dust.

This means that any dust will be subject to COSHH if people are exposed to dust above these levels.

Specific occupations and places of work can also have a direct effect on types of dust and particulates (e.g. construction, workshops, baking, milling and agriculture). Some dusts within these environments may have been assigned specific workplace exposure limits and in these locations specific testing against EH40/2005 could be required.

The HSE have also, as part of their "Health Priority Plan", targeted occupational lung disease. Further information on this can be found on the HSE website.

Having monitored particulate/dust levels in workplace environments for over 3 decades, indoor air quality in almost every well ventilated, well maintained, well filtered space, is significantly better than outside air in both number and levels of airborne contaminants.

5. Workplace environment microbiological activity

Notwithstanding laboratory and research settings – and of course those we bring in – most micro-organisms affecting workplace environment IAQ will be those brought in through the natural or mechanical ventilation systems. These almost exclusively are non-hazardous in these situations.

There are other situations where microbiological contamination can cause issues in internal environments, examples of which include:

- Water and high moisture levels can increase the potential for mould and fungi to colonise and grow in certain materials which in turn can release spores into the local environment.
- Poorly maintained humidifies (central system or room) can introduce micro-organisms or biological fragments into the atmosphere, which could cause infection or allergic reaction, such as humidifier fever.

Legionella is often erroneously associated with air delivered from mechanical ventilation systems, but it is actually transmitted via water droplets inhaled from for example showers, evaporative cooling systems and spa baths. The risk of Legionella in supply air from forced air ventilation systems is negligible.

The increased use of fresh air, reduced circulation rates and upgraded filter systems over the pandemic has led to the impression of significantly improved IAQ in workplaces over the pandemic. While this may be true for some, having reviewed our datasets for the 100,000s of UKAS accredited air quality test we've carried out in 1,000s of buildings over the past five years, we've found no discernible change in our findings.

Between January 2016 and December 2019, less than 1% of our surveys indicated microbiological air quality to be an issue. Over 2020 and indeed 2021, this figure didn't change. In every instance too, the fault was almost exclusively a failure of maintenance or cleaning, which when rectified resolved the issue. It also indicates that contrary to the rhetoric, air quality in well managed workplaces, was very good or excellent, even before the "enhancements" the pandemic facilitated and has continues to be so! The suggestion that this was not the case therefore does professional workplace managers a great disservice.

6. The role of Carbon dioxide

Carbon dioxide (CO2) is a naturally occurring gas atmospheric gas and a product of respiration. It has been used as a marker for ventilation in indoor spaces for some time, with prevailing CO2 levels an outcome of the relationship between occupancy levels and ventilation (rates and balance).

In 2019 the global average atmospheric carbon dioxide level was approx. 410ppm. From a direct health perspective, EH40/2005 workplace exposure limits are:

- 5,000 ppm - long-term exposure limit (8-hr TWA reference period)
- 15,000 ppm - short-term exposure limit (15-minute reference period)

Increasing research is also linking higher CO2 concentrations (in some instances as low as 1,000ppm), with symptoms such as, headache, shortness of breath, loss of concentration and poorer cognitive performance.

Pandemic controls over concerns in relation to airborne SARS-CoV-2 transmission has seen ventilation rates and CO2 used to monitor and manage indoor space ventilation. As a result, the HSE introduced the following information:

- "A consistent CO2 value below 800ppm is likely to indicate that an indoor space is well ventilated
- Where there is continuous talking, singing, or high levels of physical activity, indoors keeping CO2 levels below 800ppm is recommended
- CO2 levels consistently higher than 1500ppm in an occupied room indicate poor ventilation and you should take action
- It is important to remember that CO2 measurements are only a broad guide to ventilation rather than 'safe levels'"

Having been monitoring CO2 levels in workplace environments for over 35 years, we see that levels below 800ppm are very common in well-ventilated, well-maintained spaces, even where historically much of the air was recirculated. The use of CO2 monitors within the workplace has increased with the pandemic, although the quality, calibration and accuracy of these meters can be very variable. We have seen against our calibrated instruments some monitors to be very accurate and other to have "drifted" significantly. In instances, the siting of the equipment has also led to issues with inaccurate/unrepresentative results.

Depending on the levels, frequency and timings of staff returning to work, CO2 will remain an important ongoing parameter for demonstrating good IAQ, but only if the data gathered is reliable and accurate.

7. IAQ in summary

10 points to consider when developing or delivering your workplace environment management:

1. Well maintained, well managed, well monitored buildings, deliver good IAQ and many were doing such before the pandemic.
2. Successfully managing IAQ is a product of the active management of dust micro-organisms and gases relevant to the environment, its use and occupancy.
3. Ductwork cleaning is not a requirement in buildings where systems are well maintained and demonstrably clean.
4. As staff return, consider the ventilation system, as well as the space when re-populating the workplace.
5. If you continue to monitor workplace CO2 levels make sure your equipment is properly calibrated and appropriately located.
6. Where new equipment, especially furnishings in bulk is brought into the office, recognise it may "off gas" chemicals when unwrapped and manage accordingly.
7. Specify paints, glues and other such products to be used in the workplace to limit or eliminate the release of VOCs.
8. Where installed, make sure any portable humidification equipment is properly cleaned and maintained.
9. Optimise your mechanical ventilation system filter changes. Changing filter too frequently can affect air quality as adversely as not changing them frequently enough (all filters take time to reach optimum efficiency).
10. Employees will be very aware of air quality - introduce an independent, accredited programme of assessments to help demonstrate how effective your management is.