



# No child should have to breathe unhealthy air

“After a hard fought seven-year campaign, my daughter Ella is now the first person in the world to have her death directly linked to air pollution.

The second inquest into her death in 2013 from a severe and rare form of asthma has set a legal precedent that should lead to proper enforcement of air quality guidelines and highlight the fact that air pollution is killing millions of people worldwide every day. Through Ella's short life, children now have proper recognition of their suffering and those in power in our societies now have a legal (and moral) obligation to act and clean up the air.



While I learned much about the exposure and the impact of traffic and other external sources of pollution during the campaign, I have always been aware, due to Ella's chronic condition, that indoor air quality (IAQ) is an equally serious issue - with many contributory factors.

Through my work with BESA, I am also learning. We must recognise that this is something each of us as individuals can control using low-cost technologies and by changing our behaviours.

**This guide is an invaluable non-technical introduction to the issue of IAQ and explains how we can make our own indoor environments safer and healthier for us and our children. We must always remember breathing clean air is our fundamental right.”**

## Rosamund Adoo-Kissi-Debrah

Founder & executive director of The Ella Roberta Family Foundation, World Health Organisation advocate for clean air and child health, and Honorary President of the BESA Health & Wellbeing in Buildings Group.

# Every breath we take

“We spend a lot of time thinking about what we eat and what we drink, but very little on the quality of what we breathe - despite our air intake being many times greater than the amount of food and drink we consume.

The average adult, when resting, inhales and exhales about **13kg of air per day**. We eat around **2kg of food and drink** and about **3kg of fluids each day** - yet health advice on eating and drinking is all around us.



We breathe a lot and among all those breaths are some very nasty particles and gases. Pollution may be the invisible health threat, but that doesn't mean it isn't real - and now millions of people are wearing face coverings! Why? Because they are now more aware of airborne health threats.

## The invisible threat made visible.

This guide will explain why the air you breathe inside buildings is often many times worse than the polluted air outside, but also how much more control we have over our indoor air quality (IAQ) and how we can turn our homes, offices and leisure places into 'safe havens' from polluted and contaminated air. Thank you to the whole BESA Health & Wellbeing in Buildings Committee who contributed to this Guide, and especially our IAQ group Shaun Hill, Fiona Li and Craig Booth for their amazing input.”

### Nathan Wood

Chair of the BESA Health & Wellbeing in Buildings Group.

# Introduction

Air pollution is one of the biggest health problems we face today. Figures from Public Health England show that in the UK, pollution causes between

**24,000 and 36,000**  
**deaths every year.**<sup>1</sup>

According to the Government, air pollution is the fourth biggest killer after cancer, obesity and heart disease.

The Government estimates<sup>2</sup> the cost of health impacts from air pollution is likely to exceed between

**£8 billion and**  
**£20 billion.**

The air you breathe affects every part of your body, from your lungs to your heart and brain.

What's more, the air in our homes, offices, schools and factories is also contaminated - with polluted outdoor air as well as other impurities generated indoors.

The World Health Organisation (WHO) identifies a number of serious long-term illnesses associated with poor air quality, including lung conditions from asthma to cancer; heart disease; Alzheimer's disease; and inflammatory conditions.

The UK government highlights that poor air<sup>2</sup> quality is particularly damaging to children who can face a lifetime of health issues as a result of long-term exposure to pollution.

**Mitsubishi Electric** is working with the **Building Engineering Services Association** (BESA) and **Global Action Plan** to raise awareness of the dangers of air pollution. We are calling on government to establish policies, raise and enforce standards on outdoor air quality.

We are also asking businesses to play their part in ensuring good air quality inside their buildings whilst also supporting the **British Lung Foundation** as part of their Living Well Alliance which is calling on the UK government to improve air quality laws across the UK.

This short guide is aimed at professionals with responsibility for the facilities management of small and medium workplaces (for example offices, hotels or leisure facilities) as well as schools and colleges. It offers suggestions for improving air quality for employees and visitors. And as so many employees are now working from home, we also provide some easy tips you can share for optimising indoor air quality at home.

You will also find links to more information and organisations that can offer further advice.

“ We believe that everyone has the right to clean air, and that can only be achieved if we work together to raise awareness of the risks of pollution and to drive change in our legislation and behaviours. ”

**Graeme Fox** CEng FInstR, Head of Technical, BESA

# Outdoor pollutants

The World Health Organisation points out that even though the impacts of pollution are more obvious than ever, the dangers are growing year-on-year.

The WHO identifies a wide range of pollutants that have an impact on a global scale and continues to research their **threat to human health.**

Particle  $\geq 10 \mu\text{m}$

PM<sub>10</sub>: Particle  $\leq 10 \mu\text{m}$

PM<sub>2.5</sub>: Particle  $\leq 2.5 \mu\text{m}$

PM<sub>1</sub>: Particle  $\leq 1 \mu\text{m}$



The four listed here are regarded as **particularly dangerous**:



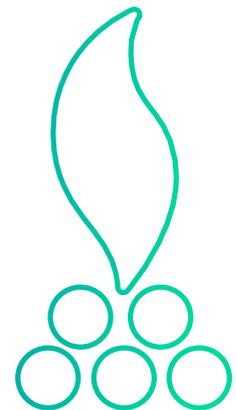
### 1. Particulate Matter

PM

**Description:** A combination of solids and liquids present in the air. Includes carbon, sulphates, nitrates and water. The smaller particles are the most potentially damaging to our bodies as they are the easiest to inhale.

**Source:** Diesel and petrol engines; friction from car brakes; dust from roads and construction works. It is also produced by wood-burning fires which the UK government reports is now the biggest single source of PM.

**Impact on health & wellbeing:** Particulate matter can cause irritation to the nose and throat. For people with asthma and other lung conditions, it can lead to hospital admissions. PM also has an adverse effect on people with heart conditions and stroke sufferers. It has also been linked to anxiety and hypertension.



### 2. Nitrogen Dioxide

NO<sub>2</sub>

**Description:** A gas.

**Source:** Diesel and petrol engines are the main sources of NO<sub>2</sub> as a pollutant.

**Impact on health & wellbeing:** Harmful to the lining of the lungs, and can reduce immunity to other illnesses such as bronchitis.



### 3. Sulphur Dioxide

SO

**Description:** A gas.

**Source:** Burning fossil fuels, for example in coal-fuelled power stations.

**Impact on health & wellbeing:** Exposure to sulphur dioxide impacts those with lung conditions such as asthma and COPD most, but it can cause anyone to become more prone to chest infections.



### 4. Ozone

O<sub>3</sub>

**Description:** A gas.

**Source:** Formed by a combination of other pollutants in the air. Detected more often in hot weather.

**Impact on health & wellbeing:** Causes inflammation of the respiratory tract, nose and throat.



# Indoor pollutants

Unfortunately, being indoors at home or work doesn't protect you from polluted air. In the UK, we spend a large proportion of our time indoors - the most common estimate is around **90%** of our day.

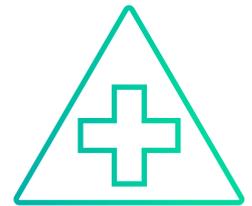
So indoor air quality (IAQ) has a significant impact on our wellbeing.



IAQ is partly dependent on the quality of outdoor air. Pollutants will enter a building through windows, doors and gaps in the structure. Outdoor air is also drawn into buildings by mechanical ventilation systems such as ventilation or air conditioning, which include filters to remove many outdoor pollutants, in order to refresh indoor air and to dilute pollutants inside the building.

**But there are also pollutants created and present inside buildings.** They mix with outdoor air, creating a potent cocktail of substances which we are all breathing every day.

There are a number of pollutants that are found indoors that can have a negative impact on our health:



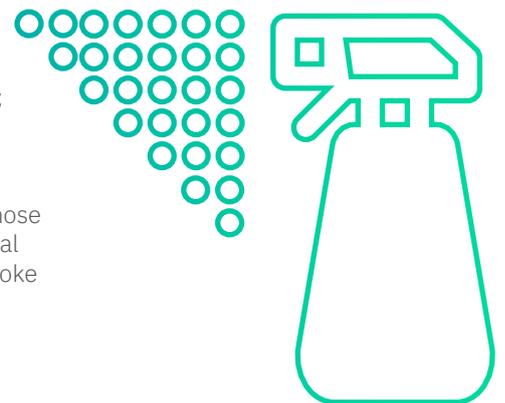
## 1. Particulate Matter

PM10 & PM2.5

**Description:** Solids and liquids present in the air in the form of particles of various sizes.

**Source:** Produced indoors by activities such as cooking and cleaning; exhalation; shedding of dust from people and processes; from fixtures and fittings such as carpets and furniture.

**Impact on health & wellbeing:** Particulate matter can cause irritation to the nose and throat. For people with asthma and other lung conditions, it can lead to hospital admissions. PM also has an adverse effect on people with heart conditions and stroke sufferers. It has also been linked to anxiety and hypertension.



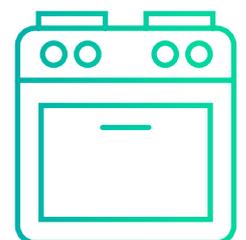
## 2. Carbon Monoxide

CO

**Description:** Gas.

**Source:** Combustion, especially gas appliances in the home (cookers; gas boilers).

**Impact on health & wellbeing:** Lethal at high levels. At lower levels causes headaches, dizziness, nausea.



# Indoor pollutants



## 3. Carbon Dioxide

CO<sub>2</sub>

**Description:** Gas.

**Source:** Naturally present in the air and caused by respiration; can build up in poorly-ventilated spaces.

**Impact on health & wellbeing:** Leads to asphyxiation at extremely high levels. At low levels reduces concentration, causes drowsiness, headaches.



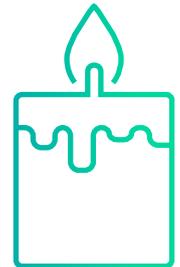
## 4. Volatile Organic Compounds

VOCs

**Description:** Include a range of chemicals found in the air indoors.

**Source:** Cleaning products; aerosol sprays; paints, carpets, scented candles; glues, resins, cigarettes, printers, photocopiers.

**Impact on health & wellbeing:** VOCs are thought to be responsible for a range of health problems from headaches and eye irritation to serious long-term illness such as cancer.



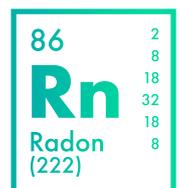
## 5. Radon

Ra

**Description:** Gas.

**Source:** Produced from naturally-occurring uranium (especially in granite bedrock areas). Seeps into buildings from the ground.

**Impact on health & wellbeing:** The Health & Safety Executive (HSE) highlights that radon is the second largest cause of lung cancer in the UK after smoking.



## 6. Mould

**Description:** Mould spores transferred by air currents.

**Source:** Mould caused by damp conditions and poor ventilation; accumulation of dirt.

**Impact on health & wellbeing:** Impact lung health; causes allergic reactions and asthma attacks.



## 7. Excess Humidity

**Description:** Moisture in the air (condensation) or damp penetrating walls / floors.

**Source:** Often a result of poor heating and ventilation; also from activities such as drying clothes in unventilated spaces.

**Impact on health & wellbeing:** Exacerbates the presence of mould; can cause respiratory problems and infections.



**Particulate matter** is a serious problem both outside and indoors.

It is recognised by the WHO as one of the air pollutants that is most damaging to health because it can penetrate via the lungs deep into the bloodstream and organs. Particulates are categorised by size, which influences how they impact the human body.

PM10 refers to particles that are less than 10 micrometres (also called ‘microns’) in diameter. This measure is shown by the symbol  $\mu\text{m}$  and is equal to 0.001mm. This size of particle is known as ‘coarse PM’.

For comparison, a human hair is generally around 50 to 70 microns thick.

The smaller the particles of PM, the more harmful they are to humans because they are more easily transferred through our airways into other parts of the body. The size of fine particulate matter is PM2.5 or below - increasing attention is now being focused on PM1 .

This is particulate matter smaller than 1 micron. PM1 is particularly harmful and includes some types of dust, bacteria and viruses. It can enter the bloodstream and cause damage to the body, even contributing to heart attacks, lung cancer and dementia.

In the UK, the Air Quality Standards Regulations (2010) set limits on exposure to particulate matter. **The regulations state that concentrations of PM in the UK must not exceed the levels shown in the table:**

Particulate	Annual average limit	24-hour average limit
<b>PM10 (coarse)</b>	<b>40 <math>\mu\text{g}/\text{m}^3</math></b> (40 micrograms per meter cubed of air)	<b>A 24-hour average of 50 <math>\mu\text{g}/\text{m}^3</math> more than 35 times in a single year.</b>
<b>PM2.5 (fine)</b>	<b>25 <math>\mu\text{g}/\text{m}^3</math></b> (25 micrograms per meter cubed of air)	<b>No 24-hour average limit</b>

(Air Quality Standards Regulations 2010)

However, the World Health Organisation guidelines differ from these figures:

Particulate	Annual average limit	24-hour average limit
<b>PM10 (coarse)</b>	<b>20 <math>\mu\text{g}/\text{m}^3</math></b>	<b>50 <math>\mu\text{g}/\text{m}^3</math></b>
<b>PM2.5 (fine)</b>	<b>10 <math>\mu\text{g}/\text{m}^3</math></b>	<b>25 <math>\mu\text{g}/\text{m}^3</math></b>

(WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005 Summary of risk assessment)

# Improving and maintaining air quality

While poor air quality has negative effects on health, the opposite is also true. Improving air quality could benefit national health outcomes, reduce pressure on the NHS and prevent premature deaths.



Research by the UK Health Forum and Imperial College London (for Public Health England) estimated that a  $1 \mu\text{g}/\text{m}^3$  reduction in fine PM could prevent around

**50,900 cases of coronary heart disease, 16,500 strokes, 9,300 cases of asthma and 4200 lung cancers over 18 years.<sup>3</sup>**

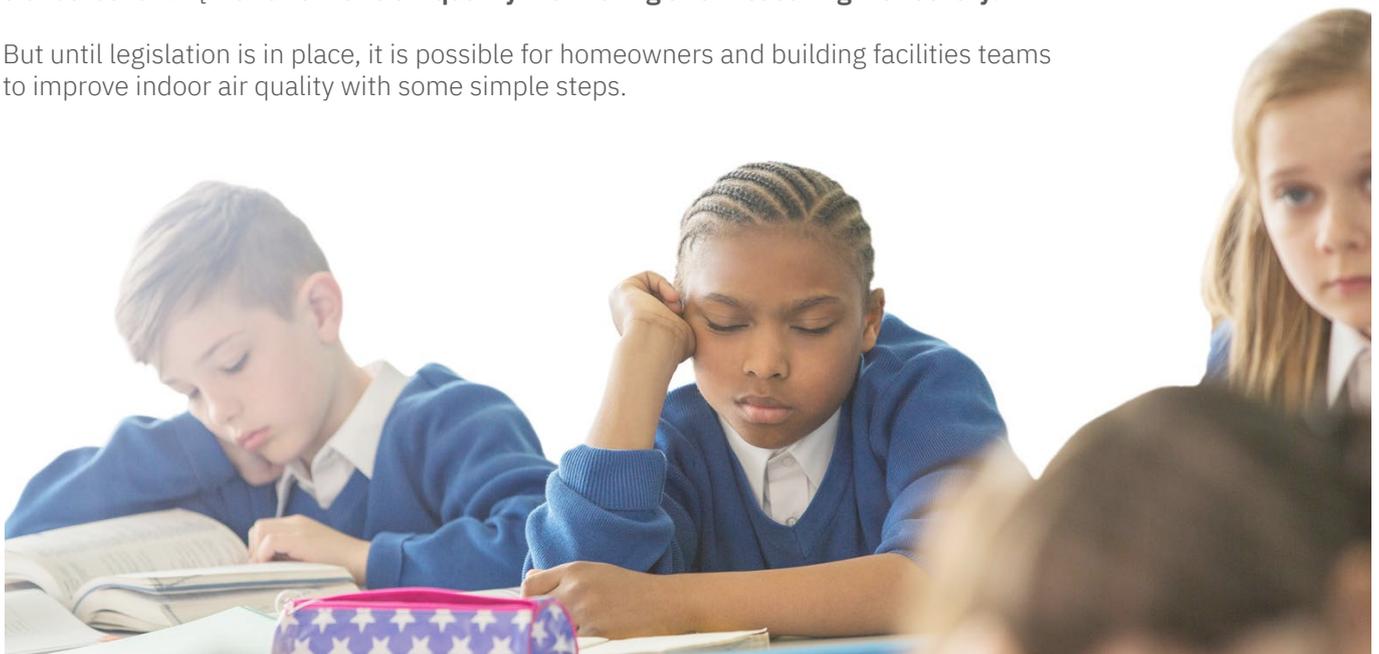
Good air quality has been shown to improve a range of mental and physical health factors. For example, joint research by Global Action Plan, the Philips Foundation and the University of Manchester shows that reducing air pollution improves children's ability to learn.

Their research showed that cutting air pollution levels (particularly PM<sub>2.5</sub> and NO<sub>2</sub>) near schools by **20%** could improve a child's working memory by **6% - the equivalent of four weeks extra learning time each year.**

The UK 2020 Environment Bill includes legislation on outdoor air quality, and requires government to introduce a legally-binding target for particulate matter by October 2022. This would also change current targets on PM and other pollutants, including long-term targets for air quality (up to 2037). The Environment Bill will also give local government more powers and encourage cooperation with a range of organisations that can help to tackle local air pollution.

The Bill also gives government the power to enforce environmental standards for vehicles and to prohibit the sale of polluting wood burners. However, there is less regulation for indoor air quality and no single Government department has responsibility for setting guidelines or legislation. While there are legal standards for levels of ventilation in homes and other buildings, limits on particulate matter or VOCs are not currently set by law. Some organisations, such as the Building Engineering Services Association (BESA), are campaigning for government to set legal standards for IAQ - **and to make air quality monitoring and measuring mandatory.**

But until legislation is in place, it is possible for homeowners and building facilities teams to improve indoor air quality with some simple steps.



# Achieving good indoor air quality

Given the hazards in outdoor air, it's important to regard our homes and workplaces as potential safe havens - areas that can achieve higher levels of indoor air quality with the right approach.

The UK Green Building Council report **'Health, Wellbeing & Productivity in Offices'**<sup>4</sup> also highlights the benefits of good IAQ.

**The report points out that IAQ is improved through ventilation,** but that it is also important to reduce indoor air pollutants at source.



**There is a range of legislation in place that covers different workplaces such as factories and also in schools.** Building Regulations for non-domestic properties prioritise the circulation of clean air. But there is also a great deal of guidance available from industry bodies (see our further information section).

The Building Engineering Services Association (BESA) has published a number of technical bulletins with advice on indoor air quality, filtration and ventilation.

**In the workplace, building owners and managers can reduce sources of pollution, take actions to mitigate pollution and monitor the effectiveness of these steps:**

### Ensure good standards of ventilation

It is important to strike a balance between the benefits of ventilation against issues such as:

- The energy required to heat (and/or cool/humidify/de-humidify) the outdoor air before it enters the building
- Causing discomfort to occupants with air that is too cold or too warm
- The risk of introducing more pollution into the building
- The possible increase of noise in the building caused by additional mechanical ventilation or through open windows.

In areas with high levels of outdoor pollution, filtering the incoming air is vital. But this means that ventilation and air conditioning (HVAC) equipment must be powerful enough to accommodate this approach.

In the absence of sophisticated HVAC equipment, some building users may be able to open windows and make a judgement as to whether the costs in terms of energy use, noise and possible discomfort are worthwhile. Simple strategies like airing a building outside of peak pollution times of day such as rush-hour can form part of a rational response.

### Reduce sources of pollution

Apply a **'green' buying policy** to the use of paints, finishes, furniture and cleaning products. These sorts of materials are increasingly tested and certified for their pollutant capability. Separate potential polluters such as printers and combustion equipment from regularly occupied areas of the building where possible. Keep room surfaces and hidden surfaces in air ducts in HVAC equipment clean (see the BESA publication TR19 for best practice guidance on ductwork cleaning).

[Click to view](#)

[TR 19® Guide to Good Practice - Internal Cleanliness of Ventilation Systems](#)



# Achieving good indoor air quality

## Monitor indoor air quality

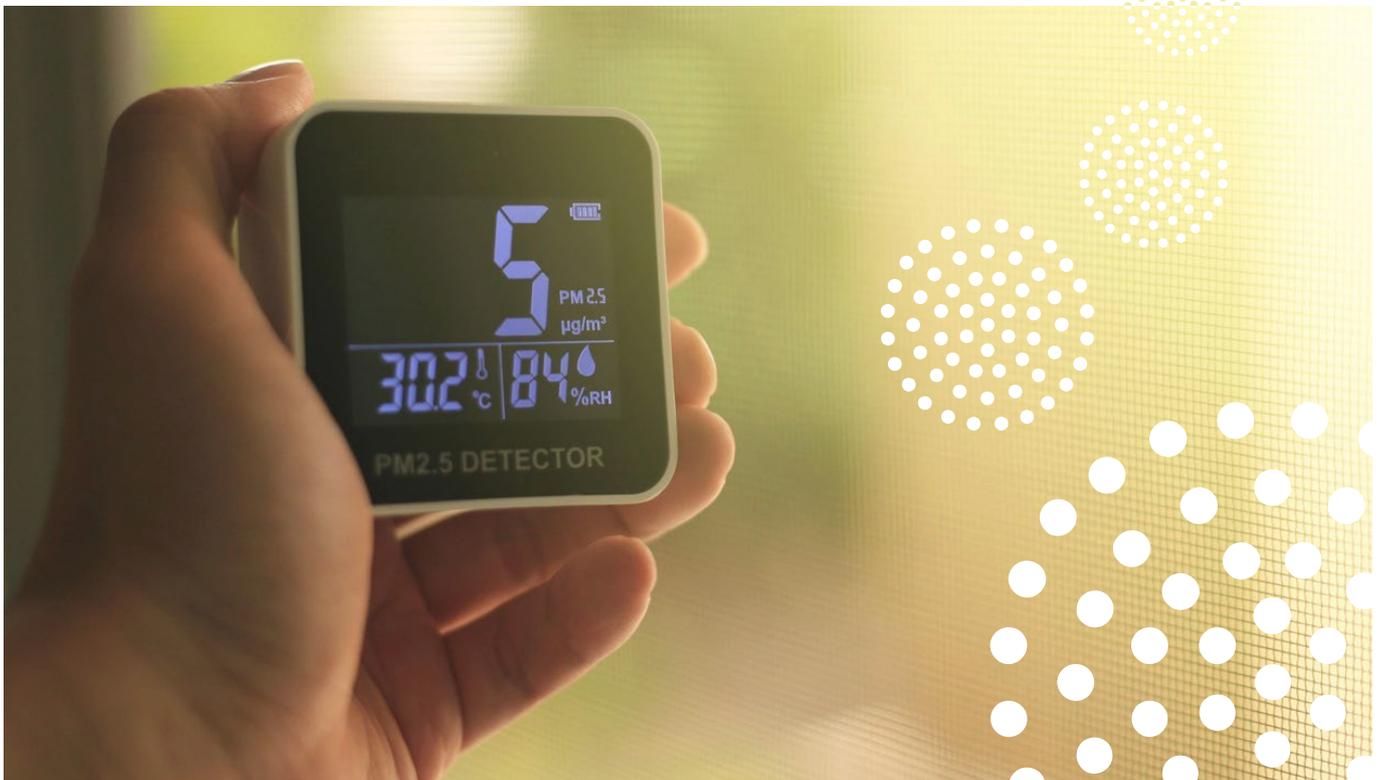
**There are many competing monitoring and certification schemes for buildings, relating to IAQ and other health and wellbeing aspects.**

They tend to be most used by developers of high-value buildings to produce a valuable credential.

However, some of these schemes are extremely stringent and assume access to high cost specialists, state-of-the-art instruments and sophisticated laboratory analysis techniques.

There are cheaper indoor air quality monitors on the market, but these are not entirely reliable as they tend to drift away from any calibration quite quickly. What's more, interpretation of results and recommended actions should be carried out by experts.

A middle way is emerging whereby certified, professional-grade calibrated instruments are coming on to the market and the knowledge and experience to interpret the results are becoming more widespread.



### Review and implement continuous improvement

**Indoor air quality can vary, even on an hourly and daily basis.** Continuous monitoring is recommended with regular recalibration and updating of policies. Regular cleaning of ductwork and filters should also be considered a key part of air quality improvement.

In general, maintenance should be prioritised and indoor air quality made one of its key objectives. These IAQ-related activities can be readily incorporated into the building facilities maintenance process, particularly where using a benchmark system such as SFG20, for example.

### Technologies to support air quality

**Mechanical ventilation with heat recovery (MVHR)** - MVHR systems can reduce energy consumption while maintaining the required ventilation to remove internally generated heat, moisture and pollutants.

They are key to maintaining good indoor air quality and as such should be equipped with the highest appropriate quality of filtration and installed so that they can be easily maintained and kept clean. It is possible to carry out an outside air quality assessment near the building to determine the level of filtration required.

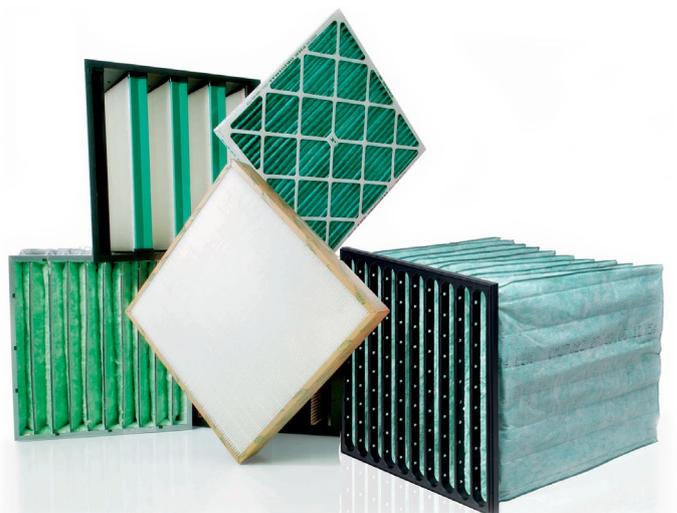
**Filters** - these can play a crucial role in removing many major pollutants from air as it enters a building via ventilation and air conditioning systems. There are recognised standards in place for application of filters, as well as ratings for low energy filters.

The global technical standard **ISO 16890:2016** includes three efficiency classes for filters: **ePM1** (best-performing); **ePM2.5** (intermediate); and **ePM10**, the lowest efficiency ('e' stands for filtration efficiency).

PM1 sized particles are small enough to be inhaled deep into the lungs and can enter the bloodstream.

The use of ePM1 class filters is highly recommended in buildings that are close to roads and in city centres.

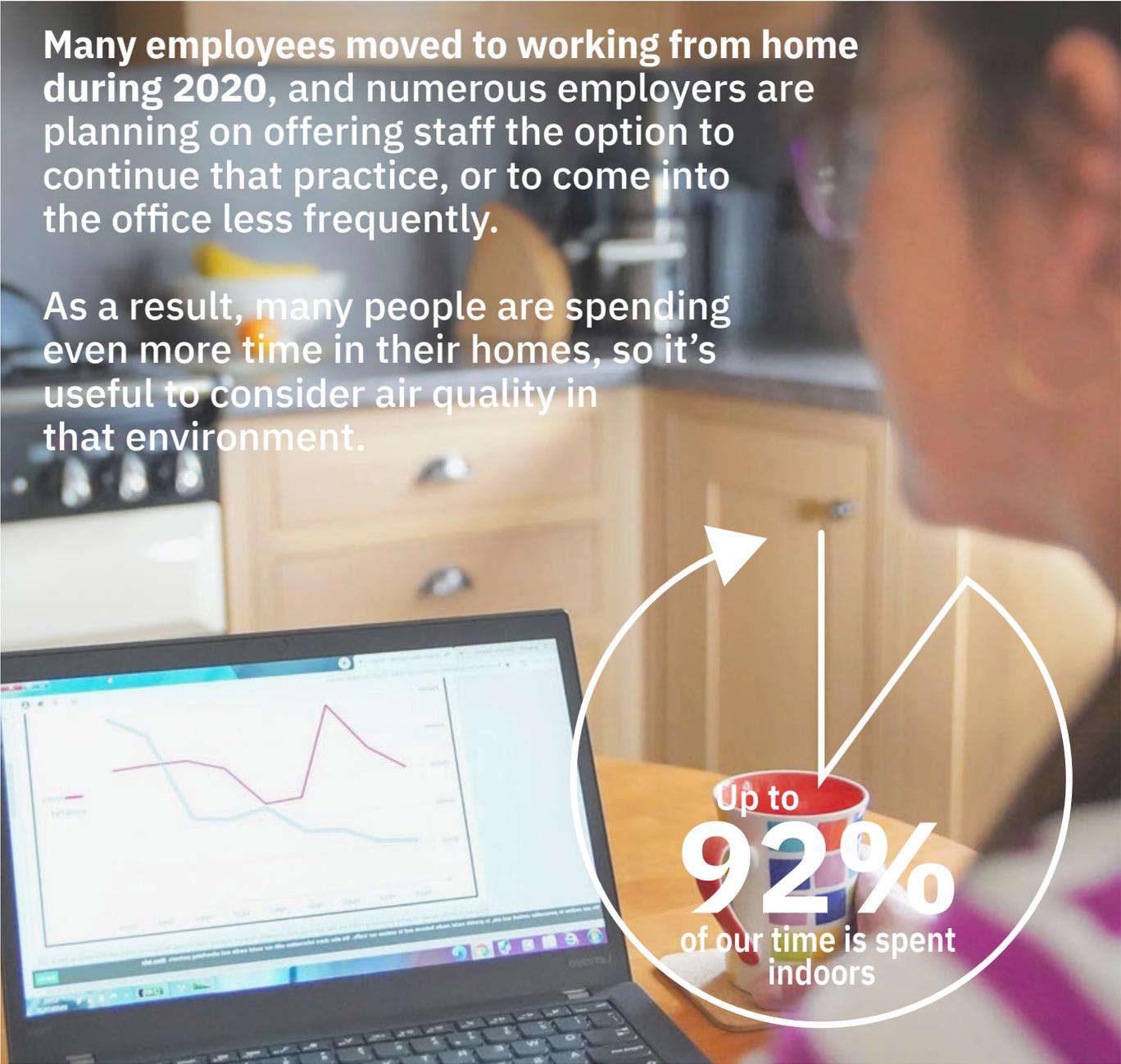
Most standard mechanical ventilation with heat recovery (MVHR) system filters are designed to protect the unit itself, rather than to improve indoor air quality. BESA recommends checking if your MVHR system can accept high-grade filters such as those mentioned above.



## In your home

Many employees moved to working from home during 2020, and numerous employers are planning on offering staff the option to continue that practice, or to come into the office less frequently.

As a result, many people are spending even more time in their homes, so it's useful to consider air quality in that environment.



Up to  
**92%**  
of our time is spent  
indoors

Building Regulations require ventilation systems for modern homes. This means that air must be able to circulate around the house, and in areas such as kitchens and bathrooms must include extractor fans.

A sensible approach to good indoor air quality at home is to use the technology that is already installed. For example, many bathrooms include extractor fans. Use these whenever you have a bath or shower to remove condensation from the air. If left to build up, it can cause damp which leads to mould.

Some kitchens are fitted with extraction hoods that can extract pollutants produced during cooking. It's a good idea to operate these whenever you're cooking, as activities such as frying produce particulate matter. Other kitchen hoods recirculate the air rather than removing it,

making them less effective for dealing with PM, so it is a good idea to check which type you have.

It is possible to fit mechanical ventilation with heat recovery (MVHR) systems in homes. These systems simultaneously extract from the most pollutant generating rooms (bathrooms, kitchens, utility rooms, toilets) and supply to habitable rooms (living rooms and bedrooms). The layout of the extract and supply points are carefully planned out to stop pollutants spreading through the home by displacing them with the clean fresh supply air.

MVHR systems can be centralised and connected via ductwork to rooms. They are designed to run at a continuous 'trickle' rate to ensure the constant renewal of air in the home while also recovering heat. They can also be wall mounted individually in specific rooms.

But there are some other important steps householders can take to **reduce indoor air pollutants**:

### 1. Reduce sources of pollution

Even though they're very popular, scented candles produce particulate matter that can affect people with asthma and allergies. Wood-burning stoves are also major sources of particulate matter<sup>5</sup>. **Use them with caution.** The same applies to cleaning products around the home. Use them with windows open, or consider switching to brands that contain fewer toxins. Dusting and sweeping can also increase the presence of irritants that affect lungs and skin, so try to carry out these tasks with the windows open.

### 2. Cut down on damp

If your bathroom has an extractor fan, make sure that this is turned on when you have a bath or shower. Some people turn these off because the fan is noisy, but it's better for IAQ to reduce damp as it can not only cause damage to your home, it also encourages development of mould. In older homes, it may be a good idea to check on your wall and loft insulation as well as water tightness, as this can help to reduce damp by keeping your home warmer. There are government grants available if your property is eligible (see further information section).

### 3. Keep your gas appliances serviced

**Carbon monoxide is extremely dangerous**, so it is important to make sure that gas cookers and gas boilers are regularly checked. It's also a good idea to have a carbon monoxide monitor in your home. These are readily available and inexpensive.

# Conclusion

**The evidence is clear that pollution causes premature deaths and long-term serious illnesses. International and national organisations agree that improving air quality will save lives, reduce pressure on the NHS and contribute to overall national wellbeing.**

Mitsubishi Electric is working with the Building Engineering Services Association and Global Action Plan to push this agenda forward.

We are working to educate people and organisations about the importance of air quality - and lobbying government to create clear and binding regulations on indoor air quality as well as outdoor pollution.



## A beginner's guide to indoor air quality

### What can you do?

If you would like to learn more about providing and maintaining good indoor air quality in your building, school or college there is more information on the BESA website: [thebesa.com](https://www.thebesa.com)

### Are you a business?

Mitsubishi Electric is a member of the **Business Clean Air Taskforce**. The 'B-CAT' is a cross sector coalition of businesses convened by Global Action Plan and the Government's Department for Environment, Food and Rural Affairs (DEFRA).

The B-CAT mission is to help accelerate the transition to a society with clean and healthy air, in a way that ensures the public realises the benefit and avoids any risks of the transition.

As a member of the B-CAT and signatory to its Business for Clean Air initiative, Mitsubishi Electric encourages all businesses to develop a clean air action plan to tackle air pollution.

The Business for Clean Air initiative is free and provides companies with a toolkit to create their own clean air action plan, plus a network to learn from other businesses on everything from electric fleets to active travel for employees to clean air workplaces. Visit: [businessforcleanair.org](https://businessforcleanair.org) to find out more and become a signatory.

### Are you a school?

**The Clean Air for Schools Framework** is a free online tool to help every school develop a tailored clean air plan to tackle pollution in and around the school.

It was developed in partnership with 20 schools in Manchester and combines education, abatement and advocacy for children, teachers and the community. To find out more and download the toolkit use the link below.

Clean Air for Schools 

Download the toolkit

[transform-our-world.org/clean-air-for-schools](https://transform-our-world.org/clean-air-for-schools)



# Further information

## Mitsubishi Electric

Mitsubishi Electric has 100 years of experience in providing reliable, high-quality products and support to installers, specifiers, corporate clients and domestic customers around the world. Its mission is to provide innovative products that support sustainable, healthy living and working. Mitsubishi Electric's Vision 2021 focuses on reducing energy use in buildings and educating the next generation about renewable technologies and energy conservation. Mitsubishi Electric is working with organisations such as BESA, Global Action Plan and the British Lung Foundation in order to make these goals a reality.

[les.mitsubishielectric.co.uk/indoor-air-quality](https://les.mitsubishielectric.co.uk/indoor-air-quality)



## The Building Engineering Services Association (BESA)

The Building Engineering Services Association (BESA) was established over 115 years ago. Its members install and maintain heating, ventilating and air conditioning systems in homes and other buildings. BESA has set high standards of competence and quality for members, and supports them with technical guidance, training and advice. BESA regards indoor air quality as key to occupant health, and has called for buildings to be 'safe havens' from outdoor pollution.

[thebesa.com](https://thebesa.com)

## Global Action Plan

Global Action Plan is a charity that helps people live more sustainable lives by connecting what is good for us and good for the planet. We're the people behind Clean Air Day, the UK's largest air pollution campaign. We work with people on bringing about compassion not consumerism and increasing wellbeing - what's good for us is often greener too. And we bring business and young people together to work on a sustainable future - helping young people develop the skills and knowledge to tackle environmental issues is good for the planet and for everyone's future too.

[cleanairday.org.uk](https://cleanairday.org.uk)

## The British Lung Foundation

Mitsubishi Electric is a patron of the British Lung Foundation's Living Well Alliance which brings together companies who offer treatments, devices or products that support people to manage their lung conditions. Mitsubishi Electric has contributed financially to the furtherance of the charitable objectives of the British Lung Foundation. The British Lung Foundation remains a fully, independent, impartial and unbiased provider of health advice and support.

[blf.org.uk](https://blf.org.uk)



### Further reading and useful documents

#### BESA Standards on air filtration and air quality standards

BESA: SFG 001 Air filter selection to provide clean healthy indoor air quality for city buildings.  
BESA: SFG 003 Air filtration and HVAC systems. Life Cycle Costing and energy efficiency.  
BESA: SFG 004 Clean indoor air, for health, wellbeing and productivity.  
BESA: SFG20 The Definitive Standard for Planned Maintenance.  
BESA: TR 19<sup>®</sup> Guide to good Practice - Internal cleanliness of ventilation systems.

#### Technical Standards

BS EN15780 Ventilation for buildings. Ductwork. Cleanliness of ventilation systems.  
BS EN 16798-3:2017 Ventilation for buildings. For non-residential buildings. Performance requirements for ventilation and room-conditioning systems.

#### Green Building Standards

BRE: BREEAM / Fitwel: The Fitwel standard / IWBI: The WELL building standard v2 / RESET: The RESET standard / USGBC: LEED v4.1.

#### Guidelines from other regulating bodies

CIBSE TM40 (2020): Health & wellbeing in building services.  
REHVA Guide no.9: Indoor climate and productivity in offices.  
WHO: Guidelines for indoor air quality.  
HSE: Workplace (health, safety & welfare) Regulations.

### Glossary of terms

#### IAQ: Indoor Air Quality

**PPM: Parts per million** - a measure used to indicate the level of a pollutant in the air.

**Particulate matter:** Solid and liquid matter in the air (indoors and outside) that may be very small but have a potentially damaging effect on the human body.

**Humidity:** The amount of water vapour present in the air (indoors or outside).

**HVAC:** Heating, ventilation and air conditioning in a building.

**Ventilation:** Replaces stale indoor air with outdoor air.

**Air conditioning:** Modifies the humidity and temperature of air inside a building to create a comfortable environment.

### References

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**Note:** The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). \*These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).



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