



THE IMPORTANCE OF INDOOR AIR QUALITY

What is People Matter 1st ?

Understanding the effect of particulate matter on our health and providing solutions to protect people inside our buildings.

Two striking facts perfectly illustrate why we need to place air quality at the top of the environmental and human health agenda. First, the quality of the air we breathe has a huge impact on our health and wellbeing; globally, air pollution is the leading environmental cause of shortened life, contributing to the equivalent of 5% of all deaths worldwide. Second, each of us inhales more than 25 million particles with every breath we take; the more contaminants we ingest, the greater the chance of sickness and ill-health.

That's why we have launched the 'People Matter 1st' campaign to highlight the dangers (and solutions) relating to poor air quality within our buildings, focusing on some of the smallest and most harmful particulates – PM₁.

To complement this initiative, we are publishing this white paper which examines the causes, effects and solutions to poor air quality, focusing on the internal environment of which we have more control.



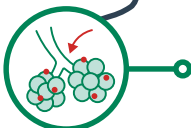
What makes up PM₁

PM₁ comprises of a mixture of solid and liquid particles

Nitrates
Sodium Chloride
Black Carbon
Ammonia
Mineral Dust
Water Sulphate

PM₁ Particles in the blood

These very small particles can reach the lungs and pass through the cell membranes



PM₁ Every day exposure



We eat
1kg food



Drink 2kg
beverage



Breathe
15kg air

Why is air quality important?

Type 'air quality' into a search engine and you will be presented with more than four billion responses – a bewildering array of answers that reflect the importance of the subject and the breadth of the questions that surround it.

But it is not just the sheer number of Google results that is shocking; the evidence surrounding the dangers of poor air quality is alarming too.

Here are four facts that support this assertion:

- Children who live in areas with high levels of particulates and NO₂ have up to 10% less lung capacity than those who don't.
- Particulate Matter and NO₂ cost the National health service and social care in England almost £43 million in 2017. This is expected to increase to £1.6 billion by 2025.
- In the UK, long-term exposure to particulate air pollution is estimated to have an effect equivalent to 29,000 deaths a year.
- An estimated 1,327,424 new cases of the disease are predicted by 2035, which are attributable to PM that has a diameter of less than 2.5 microns.

If outdoor air is not effectively filtered and cleaned, there is a risk that the indoor air will contain a very large quantity of the harmful particulates that find their way into people's respiratory tracts and circulation systems. These particles and other substances can combine with those already present inside buildings and become more aggressive and harmful, **making indoor air pollution many more times as hazardous as the outdoor variety**. But with quality air filters in air handling units, a significant proportion of these harmful outdoor particles can be stopped before they are spread through the ventilation system.

This means that in polluted cities like London, Paris, Los Angeles, Beijing and New Delhi, it is possible to improve the quality of the indoor air until it reaches an acceptable level using the ventilation system alone. If a mobile air purifier is installed in rooms as an extra measure, a consistently high level of air quality can be achieved, even if the number of particulates and other substances in the outdoor air varies significantly.

5.5 million

Premature deaths around the world each year from air pollution



Indoor air pollutants

Pollutants that can affect air quality inside buildings fall into one or more of the following categories:



Particulate matter

Includes dust, smoke and tobacco smoke, pollen, animal dander, particles generated from combustion appliances such as cooking stoves, and particles associated with tiny organisms such as dust mites, mould and bacteria.



Gaseous pollutants

Come from combustion processes. Sources include solid fuel heating sources with insufficient venting, gas cooking stoves, vehicle exhaust and tobacco smoke. They also come from building materials, furnishings, adhesives, paint and varnish, cleaning products and pesticides.



Environmental pollution

Outside contaminants such as vehicle fumes and industrial pollution can seep into buildings, but there is also a risk from naturally occurring gases such as radon.



Human Contamination

The people in our offices and buildings are often the carriers of Viruses which can spread around the building. These viruses can sometimes spread through the air we breathe.

What is 'bad' air?

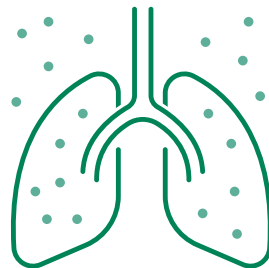
Poor air quality results from particulate matter (PM) in the air. PM comprises a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. Its major components are sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water.

PM has both physical and chemical characteristics, man-made and natural sources that vary by location. Spending a day on the streets of Beijing, for example, will have the same negative effect on your respiratory tract as staying 30 days in Paris. It should be noted, however, that people will react differently to poor quality air, depending on their sensitivity.

Typical particulates found in air include:

- Coarse particles, often 10 microns (μm) or bigger ($1\mu\text{m} = 1/1,000\text{th}$ of a millimetre). Examples include visible coarse dust, sand, leaves, hairs and other large organic particles.
- PM_{10} – airborne particles $\leq 10\mu\text{m}$ in diameter including coarser fine dust and organic particles.
- $\text{PM}_{2.5}$ – airborne particles $\leq 2.5\mu\text{m}$ in diameter such as pollen, spores and other organic particles.
- PM_1 – airborne particles $\leq 1\mu\text{m}$ in diameter, including dust, combustion particles such as diesel fumes, bacteria and viruses.

The human body can filter coarse particles. PM_{10} particles can be stopped as they enter the throat. $\text{PM}_{2.5}$ particles are dealt with in the lungs and alveoli. PM_1 however, penetrate into the bloodstream and can contribute to serious illness. At worst, PM_1 can contribute to deadly diseases like heart attacks, lung cancer, dementia, emphysema, edema and other serious disease, leading to premature death.



Making clean air ‘law’

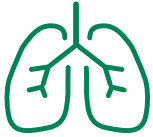
It's not just Camfil that's raising awareness of poor air quality. Momentum is gathering around the world in regards to the damaging effect of polluted air. In the UK, the government's Clean Air Strategy outlines Whitehall's ambitions relating to reducing air pollution in the round, making our air healthier to breathe.

Sitting alongside three other government strategies – Industrial Strategy, Clean Growth Strategy and 25 Year Environment Plan – the clean air strategy sets a direction for the UK's air quality policies and goals.

The Clean Air Act that will result from this strategy will attribute legal responsibility to property owners and landlords to ensure that the building occupants are protected. Facilities/Estate managers, for example, will also find their roles changing because they are the ones who will be expected to put the practical solutions in place so that their employers are not exposed to legal jeopardy.

The government says: “We have already adopted ambitious, legally-binding international targets to reduce emissions of five of the most damaging air pollutants (fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide, non-methane volatile organic compounds) by 2020 and 2030. We are now also proposing tough new goals to cut public exposure to particulate matter pollution, as recommended by the World Health Organization.” The strategy comes at a good time because awareness of the impact of poor IAQ is growing rapidly, and a strong determination to tackle the problem is also developing.

Benefits of clean air



Cleaner Lungs



Improved Mood



Lower Medical Cost



Improved Productivity



Better Immune System



Longer Life Span



Better Sleep



Improved Digestion



Better For Your Blood Pressure



Reduced Allergies & Asthma Symptoms

Filtering out particulate matter

Using the right air filter will not only help you to maintain healthy IAQ, but it will also help you to save energy and money. Filters are available today to meet the stricter demands for the removal of PM₁ contaminants, such as Camfil's Opakfil ES, Hi-Flo XLT7 and Hi-Flo M7.

Filters are integral to all Camfil's offerings and constitute the largest part of our business. Our air filters can be as small as a matchbox or as large as a shipping container. But, whatever their size, the end product is clean air – free of harmful pollutants, dust, dirt, allergens, contaminants, molecular gases and, in some cases, even life-threatening radiation.

Indeed, Camfil filters are the gold standard for air filtration offering the longest life, the lowest operating and maintenance costs and the highest possible energy efficiency. By providing clean air, our filters improve people's health and performance, protect critical manufacturing processes, boost productivity and safeguard the environment. For urban environments with air pollution, we offer ePM₁-classified filters according to the new ISO 16890 standard (see later) and ozone-rated City filters that combine particle and molecular filtration. You will find many of our energy efficient air filters in the air handling units of ventilation systems

in buildings like schools, offices, homes, hospitals and airports. They work hard to provide a clean, healthy and productive indoor environment with high IAQ.

In addition to selecting the right particle efficiency, there are other important filter product features to consider, such as long life, a low pressure drop and low energy consumption. When building owners purchase quality filters like Camfil's for high IAQ, they also benefit by getting the lowest total cost of ownership for their filtration solution.

For added indoor air filtration in polluted urban environments, Camfil also offers advanced room-air purifiers for both particle and molecular filtration. The latter are increasingly used in offices and retail stores in large international cities with air pollution issues.



Indoor air can be between 5 to 50 times
more polluted than outside air

High standards are critical

The best way to gauge the right filter products for use in specific applications is to apply the appropriate standard.

ISO 16890 is the new common global particle filter test standard which replaced the EN779 filter test standard in Europe in June 2018 and is intended to replace the ASHRAE 52.2 filter test standard in US over a longer transition period. For the first time, in ISO 16890 we have an air filtration standard that actually tells people specifically what a filter does. It is also more accurate than its predecessors and is a global standard that offers a single test for all customers.

The standard came about because of the need to test air filters closer to real life conditions by testing a wider and more representative range of particles. It tests efficiency on 0.3-10µm (micron) particles and relates test result to PM₁, PM_{2.5} and PM₁₀. It also offers 30 classes in three groups (compared with nine classes under

EN779 and 16 classes under ASHRAE 52.2.) The new international standard describes equipment, materials, technical specifications, requirements, qualifications and procedures to produce laboratory performance data. It also enables the designer to calculate an efficiency classification based upon the measured fractional efficiency which is converted into 'particulate matter efficiency' (ePM) expressed as a percentage of the PM captured by the filter.



Five benefits of the ISO 16890 standard



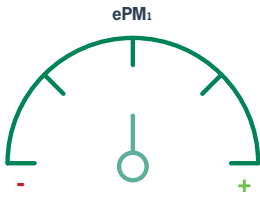
ISO 16890 the new standard for air filter



Eliminating Confusion



Encourage global trade



A minimum of **50%** efficiency



Transparency, quality and opportunities

Under the new Eurovent classification, the demands on energy efficiencies have increased, meaning many filters previously considered A+ have been downgraded to A, forcing manufacturers to improve the performance of their filters and acknowledging the general developments within the industry since the original Energy Rating was introduced in 2015. All air filters can be graded from A+ to E. Grade A+ stands for the lowest energy consumption and E for the highest.

The classification will give customers a better understanding of the annual energy consumption, average efficiency and minimum efficiency, with A+ filters contributing to reductions in energy usage and CO2 emissions - while also improving IAQ. Based on a robust certification process, Eurovent certified products must show Annual Energy Consumption (kWh/y) specific to each ISO efficiency rating and be tested in independent laboratories and through sampling on manufacturers sites. This certified data is available to view at the Eurovent website: www.eurovent-certification.com

Reducing indoor contaminants

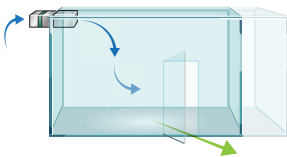
Air Cleaners or Air Purifiers are often used in offices and other commercial buildings to help improve the indoor air quality within the building. Reducing particulate levels, removing nuisance odours and removing airborne particles such as viruses are often key uses of air cleaners

Features of a suitable air cleaner

- All air cleaners should have HEPA filters that are tested and certified to EN1822 factory test standards
- For the removal of odours or nuisance gases (such as formaldehyde) the use of a combination molecular filter is advised
- Adequate sizing to your room requirements is advised. A small air cleaner in a big room may not have the desired affect. Know your airflow rate
- Low noise levels are key. In office environments noisy air cleaners can be a distraction. Choose air cleaners with a low noise level

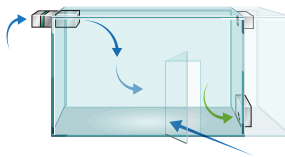
Options for Air Cleaners

Camfil air cleaners can be used in 3 main applications



Positive Pressure Environment -

By ducting your air cleaner to the outside you can introduce clean fresh air into your environment (For areas with little or no ventilation).



Negative Pressure Environment -

By ducting the exhaust air outside, air cleaners can create negative pressure or isolation environments (Used in hospital environments).



Air Recirculation -

Used to supplement the existing ventilation system, air cleaners can be used to recirculate clean air around the environment.

Camfil – a global leader in air filters and clean air solutions

For more than half a century, Camfil has been helping people breathe cleaner air. As a leading manufacturer of premium clean air solutions, we provide commercial and industrial systems for air filtration and air pollution control that improve worker and equipment productivity, minimize energy use, and benefit human health and the environment. We firmly believe that the best solutions for our customers are the best solutions for our planet, too. That's why every step of the way – from design to delivery and across the product life cycle – we consider the impact of what we do on people and on the world around us. Through a fresh approach to problem-solving, innovative design, precise process control and a strong customer focus we aim to conserve more, use less and find better ways – so we can all breathe easier.

The Camfil Group is headquartered in Stockholm, Sweden, and has 30 manufacturing sites, six R&D centres, local sales offices in 30 countries, and about 4,800 employees and growing. We proudly serve and support customers in a wide variety of industries and in communities across the world. To discover how Camfil can help you to protect people, processes and the environment.

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