



Improving indoor air quality: The built environment and respiratory health

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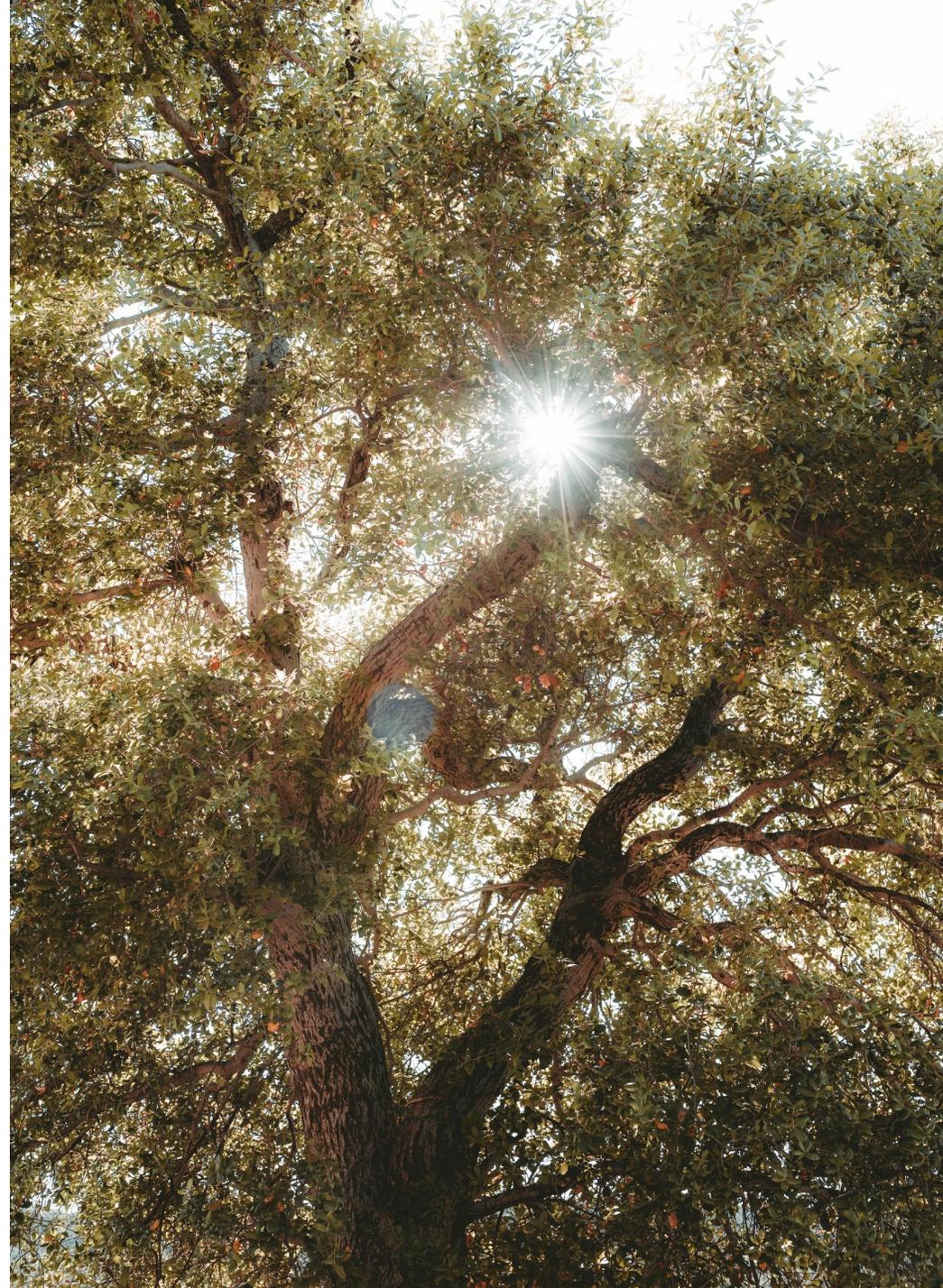
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Who we are

We are Ekkist, a building design consultancy specialising in health and well-being.

We believe that buildings should contribute to our overall quality of life, health and well-being, have the power to inspire you, grow with you and adapt to suit your needs.

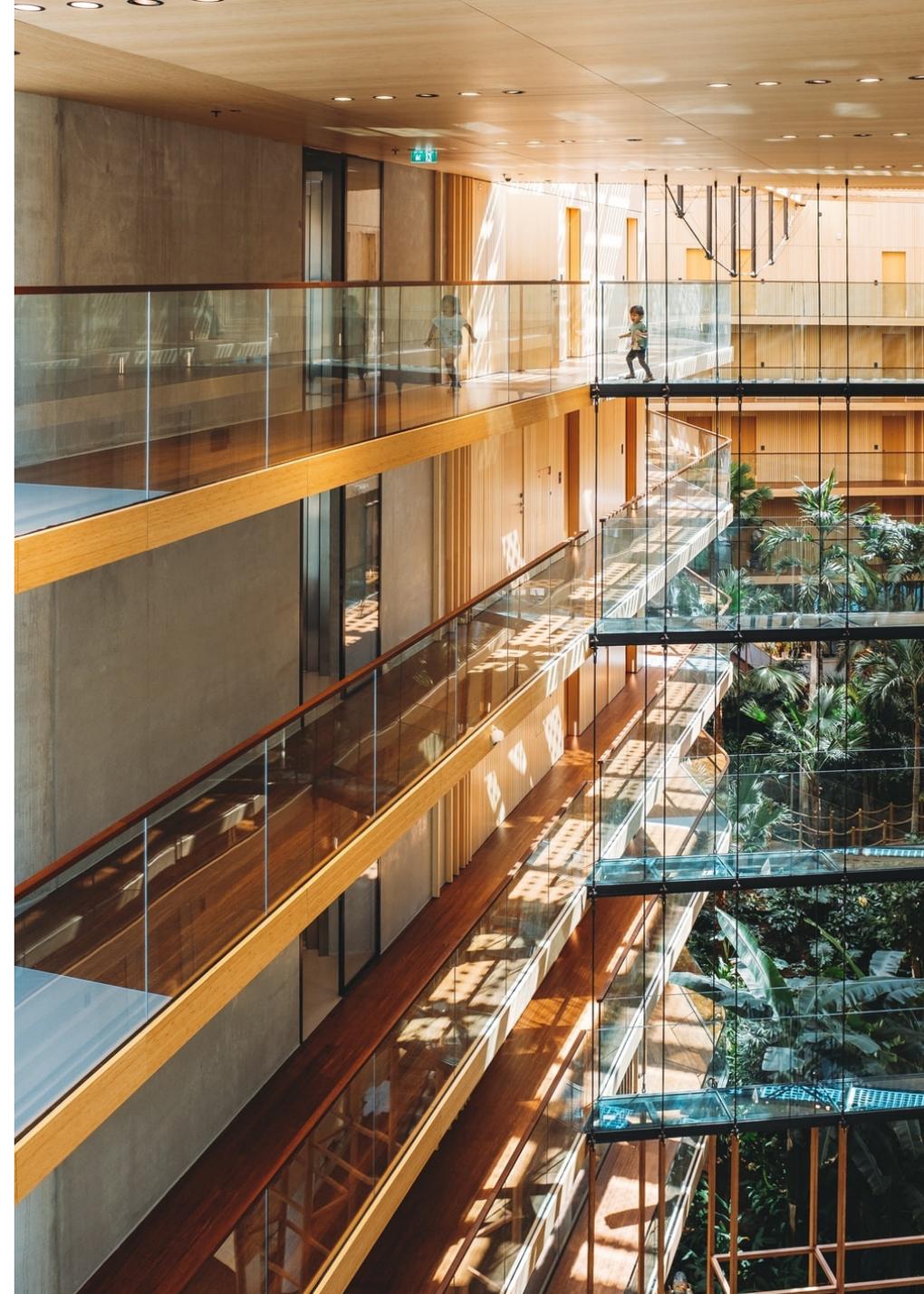
We are passionate about creating healthy buildings using the latest scientific research. We are led by one of the UK's first WELL Faculty™ members and represent the new international design benchmark for healthy buildings: the WELL Building Standard™.



Areas of consideration

There are some key themes that should be considered when designing and managing a healthy building:

- Indoor air quality
- Water quality
- Lighting design
- Acoustics
- Materials
- Biophilic design
- Layouts for well-being
- Building management for well-being
- Operational initiatives
- Masterplanning for well-being (where relevant)



The air quality problem

Poor air quality is one of the world's biggest killers:

- 8.7 million deaths globally in 2018 from poor air quality as a result of burning fossil fuels (The Guardian)
- This is 1 in 5 deaths globally – more than smoking and malaria combined
- Over 13% of deaths under five years old in Europe
- 91% of the world's population live in places where air quality exceeds WHO guideline limits
- Top 4 causes of death worldwide can all be exacerbated by poor air quality (heart disease, stroke, pulmonary disease, respiratory infections - WHO)



Indoor air quality

Outdoor air pollution is only part of the problem

- Indoor air causes an estimated 4.3 million global deaths per year (WHO)
- Poor indoor air quality linked to increased risk of pneumonia, lung disease, heart disease and cancers
- Can also aggravate chronic conditions like asthma and allergies
- Even pre-COVID, we were spending 90% of our time indoors
- Quality of indoor air has declined significantly due to buildings becoming increasingly airtight to improve energy efficiency



Key IAQ issues

Particulate matter (PM_{2.5}, PM₁₀)

- Fine particles that can penetrate the lungs and bloodstream
- Main indoor sources are combustion (e.g. heating, cooking, candles), mechanical processes and biological particles
- These can also emit pollutants such as carbon monoxide and nitrogen dioxide
- Short term exposure to particulate matter can cause irritation of the airways, coughing and cardiovascular problems
- Long term exposure to particulate matter can cause premature death from heart and lung diseases such as cancer



Key IAQ issues

Volatile Organic Compounds

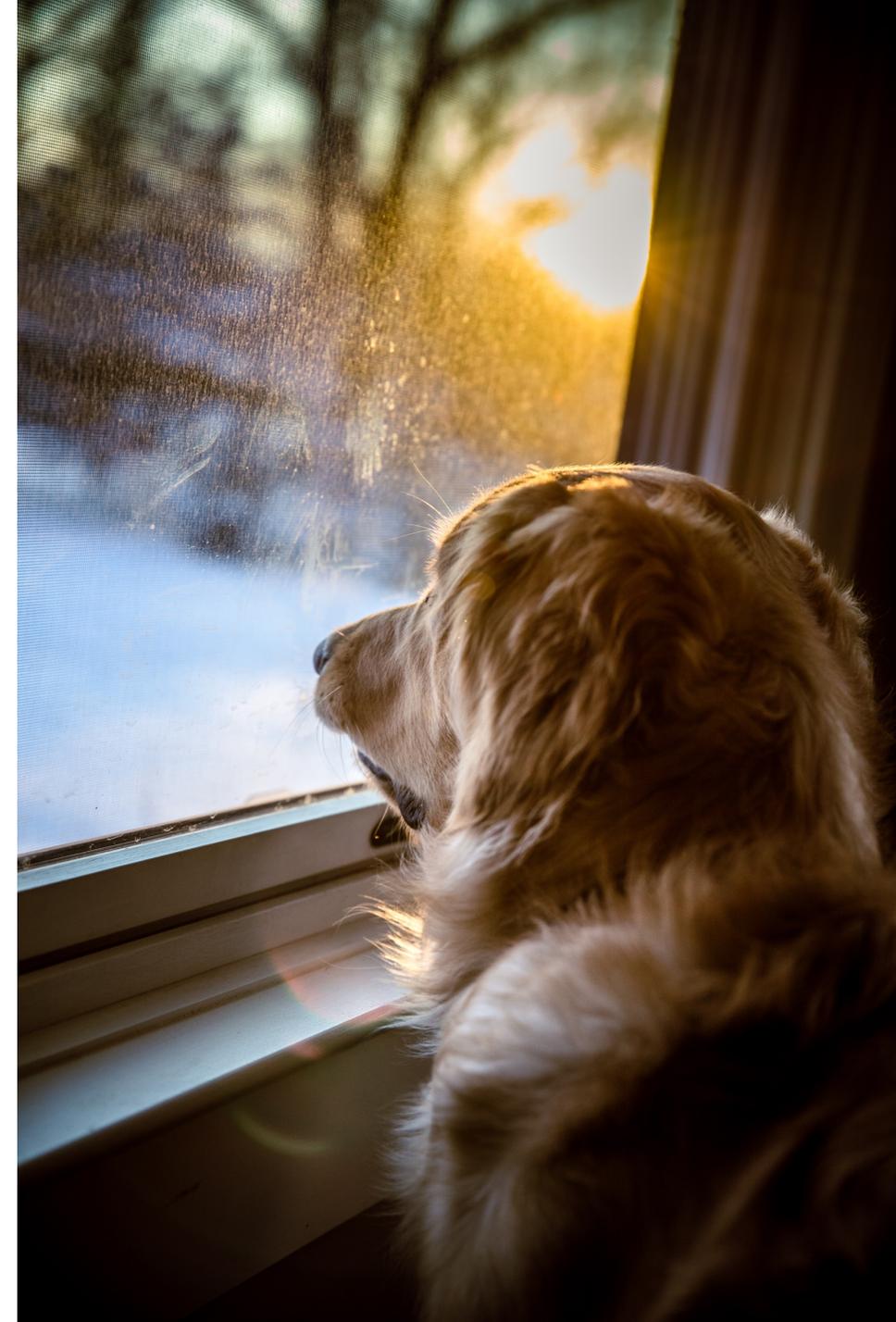
- A wide range of chemicals, which can be emitted over periods of weeks or years from construction and furnishing products.
- Sources include sealants, paints, wall and floor coverings, cleaning products, air fresheners and candles
- Short-term exposure can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders and memory impairment
- Higher concentrations of VOCs are linked with allergies, asthma, and poor respiratory health
- Long- term health effects include prolonged eye, nose and throat irritation, as well as liver, kidney and central nervous system damage and even cancer



Key IAQ issues

Carbon Dioxide

- A naturally occurring, odourless gas which makes up 0.04% (400ppm) of air
- Common indoor CO₂ sources are human and animal respiration and combustion
- Occupied indoor concentrations of CO₂ are significantly higher than outdoor concentrations
- There is a recognised association between elevated indoor CO₂ levels and increases in Sick Building Syndrome (SBS) symptoms
- Elevated levels of CO₂ can impair cognitive function and decision making ability
- High indoor CO₂ levels can aggravate respiratory problems and can cause stress, kidney calcification and bone demineralisation



Key IAQ issues

Humidity

- A measure of the concentration of water vapour in the air
- Moisture in the air can be caused by respiration and day-to-day activities like washing and cooking
- Low humidity (below 30%) can cause eyes and skin to become dry and irritated and can aggravate conditions such as asthma
- Also increases the risk of developing common colds, flu and viruses
- High humidity (above 60%) can make us lethargic and exacerbate allergies and respiratory diseases, and cause issues like damp and mildew
- High levels can also affect concentration of VOCs



Improving indoor air quality

Materials

- Specify products with low or no VOC emissions
- Be aware of key risk products such as flooring, furniture, sealants and insulation products
- Select products with transparent ingredients and supply chains
- Consider materials such as clays, which can help to maintain a healthy relative humidity (40-60%)
- Prioritise natural materials which can also offer benefits to mental wellbeing



Improving indoor air quality

Ventilation

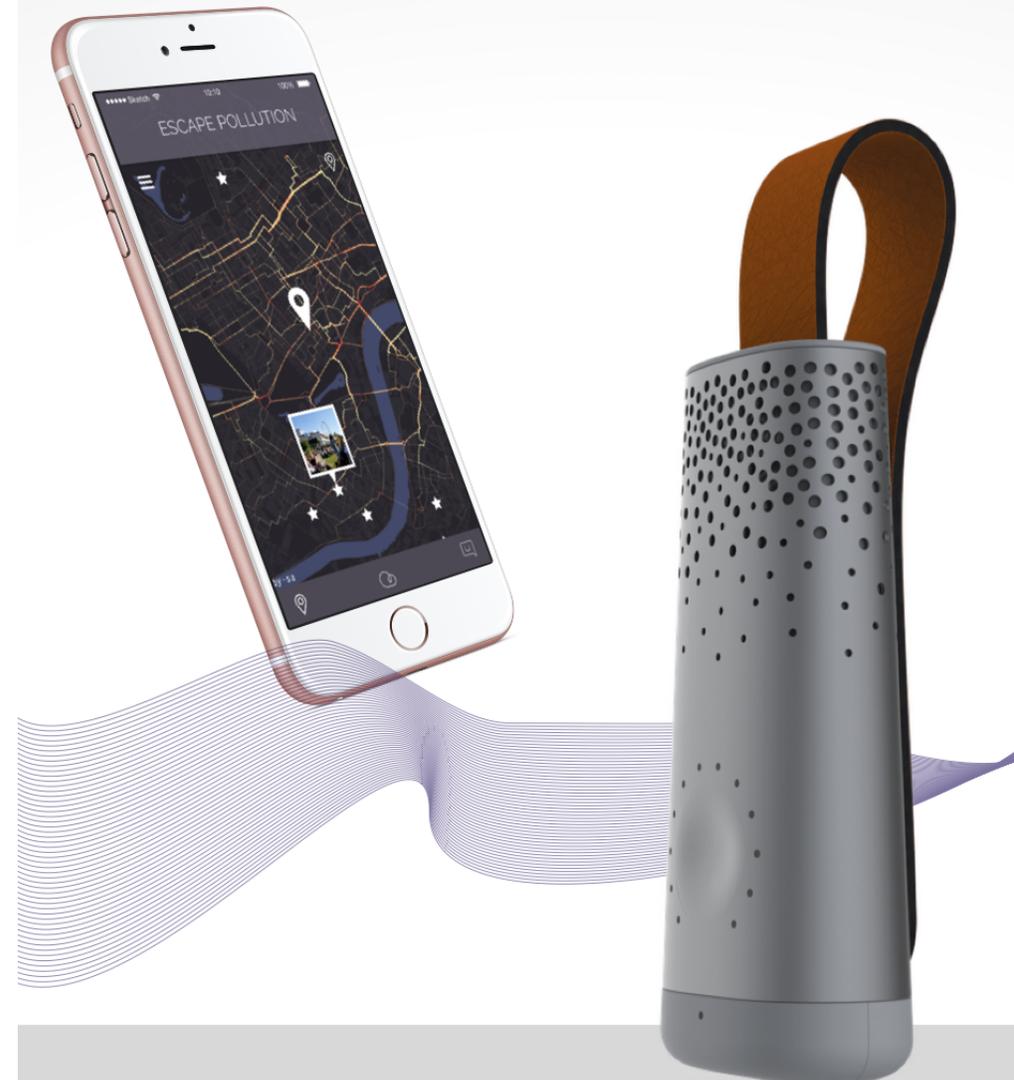
- Whether using natural or artificial ventilation, ensure sufficient air flow rates for the project type
- Integrate activated carbon filters to combat VOCs
- Integrate media filters to remove particles such as PM2.5
- Clean all duct systems and replace all filters post-construction to address construction pollution
- Consider strategies such as UV Air Treatment to address mould and microbes within ventilation systems



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Measure

- Without understanding what the key areas of concern are, it is impossible to address the problems
- Types and concentrations of indoor pollutants fluctuate throughout the day
- Real-time monitoring can identify any deviations in indoor quality metrics and help minimize occupant exposure to pollutants
- A range of 'off the shelf' sensors are available, as well as professional certifications such as AirScore (by AirRated)



Flow air quality tracker: Plume Labs

Improving indoor air quality

Healthy operations

- How we manage buildings can also have a significant impact on indoor air quality
- Regular cleaning is essential to address issues like dust and microorganisms such as mites
- However, be aware of ingredients in cleaning products
- Avoid or reduce pesticide use
- Implement non-smoking policies where appropriate
- Review use of combustion-based appliances such as stoves, fireplaces and space heaters
- Even traditional candles can emit particulate matter, so opt for organic alternatives if possible



Ekkist

Thank you!



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