

Online submission

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## **Australian Academy of Science submission on the *Inquiry into clean indoor air***

The Australian Academy of Science (the Academy) commends the Parliament of NSW for recognising the threat posed by poor indoor air quality to health and productivity through launching an inquiry into this important issue.

Last year, the Academy published [Indoor air: the science of indoor air and pathways to improve indoor air quality in Australia](#). The report addresses the terms of reference of the inquiry in detail and is attached as a supplementary file.

From this report, the Academy emphasises two core messages:

1. There is a robust and growing body of scientific evidence showing that poor indoor air quality has a negative impact on our health and wellbeing.
2. There are known and available technological and policy solutions to improve indoor air quality.

Australia should introduce enforceable indoor air quality performance standards in public buildings. The Academy recommends a phased approach, leveraging Australia's successful workplace health and safety framework that enables Commonwealth leadership and state and territory alignment. We have the scientific evidence, technological capacity and policy tools to act now. The responsibility and the opportunity sit with government, industry and academia to work together to implement evidence-informed solutions to deliver healthier indoor air for everyone.

Below we provide a summary of the report's key findings relevant to the inquiry's terms of reference and note the relevant pages of the report for further detail.

The Academy commends two additional Australian reports to the committee.

The [State of indoor air in Australia 2025](#) report, authored by Adjunct Associate Professor Wendy Miller and Professor Lidia Morawska at Thrive at Queensland University of Technology, provides a baseline profile of ten pollutants measured in different Australian building types and examines risks, exposure limits, health and economic consequences, and possible policy responses. This report provides evidence that has never before been collated and reveals data gaps. The findings are important to inform the actions of legislators, regulators and policy leaders at the state and federal level.

[Safer shared air: a critical accessibility and inclusion issue](#), a report by the Safer Air Project, articulates the case for indoor air quality as an accessibility issue and calls for urgent action to make indoor spaces safer, healthier and more inclusive. It provides lived experience of the impact of poor indoor air quality, as well as a preliminary cost-benefit analysis for investing in safer indoor air.

Together, these three reports provide a strong foundation to understand the state of indoor air quality in Australia, the current science, and possible solutions.

### Summary of the Academy's report aligned to terms of reference.

#### Impacts of poor indoor air quality due to airborne pollutants and pathogens (a)

##### **Health (i)**

Exposure to indoor air pollution is associated with a range of acute and chronic health outcomes. Short-term health impacts include exacerbation of asthma, and the acute symptoms of airborne diseases such as influenza. Long-term impacts include elevated cancer and cardiovascular disease risk.

*For further detail see pages 14-18 of attached report.*

## **Productivity and economic output (ii)**

Studies show a significant economic burden associated with indoor air pollution, with annual economic impacts in the billions. The costs associated with poor indoor air quality include increased healthcare costs, reduced productivity and absences from work and school.

Likewise, studies also indicate potential significant economic benefits associated with improving indoor air quality.

*For further detail see page 17 of attached report.*

## **Work health and safety (iii)**

A central economic argument for indoor air quality, are the productivity losses and workplace absences that could be avoided.

It is also the Academy's view that workplace standards are a strong framework from which to improve indoor air quality.

The way indoor air quality is addressed in work health and safety obligations could be strengthened.

NSW could lead the country in strengthened workplace standards for indoor air quality, creating an impetus for change to our national work health and safety framework.

While indoor air quality is addressed to some degree in Australia's work health and safety framework, it is currently inadequate leaving workers exposed to risks.

In many workplaces, a safe work environment cannot be assured in relation to indoor air quality as key parameters are not measured.

The Academy recommends a three-phase approach to achieve enforceable indoor air quality performance standards:

1. require indoor air quality monitoring in all workplaces.
2. introduce a workplace reporting standard, mandating specific parameters to be measured and reported.
3. legislate standards for all public buildings, requiring selected parameters to be monitored and controlled within designated safe levels.

*For further detail see pages 32-34 of attached report.*

## **Equity of access to public services and spaces (iv)**

The Safer Air Project report [Safer shared air: a critical accessibility and inclusion issue](#) addresses this TOR in detail.

### **Indoor air quality standards and monitoring (b)**

There is a sufficient knowledge-base and technology to begin implementation of indoor air quality monitoring now.

A scientific consensus paper recommends monitoring of four parameters: three pollutants (PM2.5, CO and CO2 as a proxy for ventilation and infection transmission) and the ventilation rate in mechanically ventilated buildings.<sup>1</sup>

These parameters offer policymakers a basis for establishing and monitoring compliance with indoor air quality standards. They could be expanded in the future as monitoring technologies advance.

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<sup>1</sup> Morawska, L., et al. (2024). Mandating indoor air quality for public buildings. *Science*, 383(6690), 1418–1420. <https://doi.org/10.1126/science.adl0677>

Mature low-cost sensor technologies already exist for these pollutants, CO<sub>2</sub>, PM<sub>2.5</sub> and CO. Low-cost sensors can be part of robust monitoring protocols for indoor air quality, when calibrated against lab-grade instruments, correctly located and installed in a building, appropriately maintained and accompanied by strict criteria for accuracy and sensitivity. For an example see the protocol for PM<sub>2.5</sub> monitoring described by Morawska et al. (2025) (see pages 24-25).

Measuring all potential pollutants in a space – or even all the pollutants recommended by the WHO air quality guidelines – is not technically or financially feasible, nor is it necessary.

It is not currently technologically feasible to routinely monitor indoor pathogens in real time. While research is underway to explore the possibility of developing indoor air biosensors, it is very early stage with no products viable for implementation at scale.

*For further detail, see pages 23-27 of attached report.*

### Solutions to improve indoor air quality (c)

There are well established practices and technologies to improve indoor air quality, as well as a pipeline of emerging technologies and solutions. The three general approaches for improving indoor air quality are source control, ventilation and air cleaning. There is ongoing research into the effectiveness and safety of some air cleaning technologies.

Ideally, indoor air quality monitoring will be integrated with HVAC control systems to support automated responses based on real-time occupancy and air pollution levels. Smart building systems represent an emerging opportunity to optimise indoor air quality. Data driven, automated control systems, informed by continuous monitoring of key parameters, can dynamically adjust ventilation. This would help reduce indoor air pollution while also meeting the other requirements like energy efficiency and thermal comfort. AI and machine learning tools also hold potential to improve indoor air quality prediction and management in buildings.

*For further detail see pages 10-13 and 27 of attached report.*

### Implications for climate resilience and pandemic preparedness (d)

#### **Implications for pandemic preparedness**

Airborne diseases are transmitted via indoor air. Pathogens enclosed in liquid-based particles are emitted from an infected person's nose or mouth when breathing, speaking, sneezing and coughing. Airborne transmission describes the process whereby these particles exhaled by an infected person are inhaled from the air by another person.

Ensuring buildings are built and managed to reduce airborne disease transmission will increase the resilience of Australia to future pandemics with an airborne transmission pathway. In tandem with other public health measures, our buildings are a critical front in public safety. While this is no doubt a powerful reason to motivate change, we emphasise that there are substantial, every-day benefits for improved indoor air quality outside of pandemic scenarios.

#### **Implications for climate resilience**

Indoor air quality management technologies can be energy-intensive, however, the technologies and operational practices to address both climate change and indoor air quality exist. For example, smart building systems which respond to real time occupancy and sensor data to direct ventilation where it is needed to ensure indoor air quality is managed while energy is used as efficiently as possible.

Improving how we manage indoor air quality will also be critical to adapting to climate change, for example, safeguarding against more frequent exposure to pollutants during longer and more intense bushfire seasons.

### Other related matters (e)

While the report's recommendations focus on the federal government, the same core principles apply for state-level action on indoor air quality. Further, NSW has an opportunity to be leader in innovating approaches in indoor air quality and provide learnings for national action.

*For further detail see pages 28-37 of attached report.*

To discuss or clarify any aspect of this submission, please contact Lauren Sullivan, Manager Policy at [science.policy@science.org.au](mailto:science.policy@science.org.au).