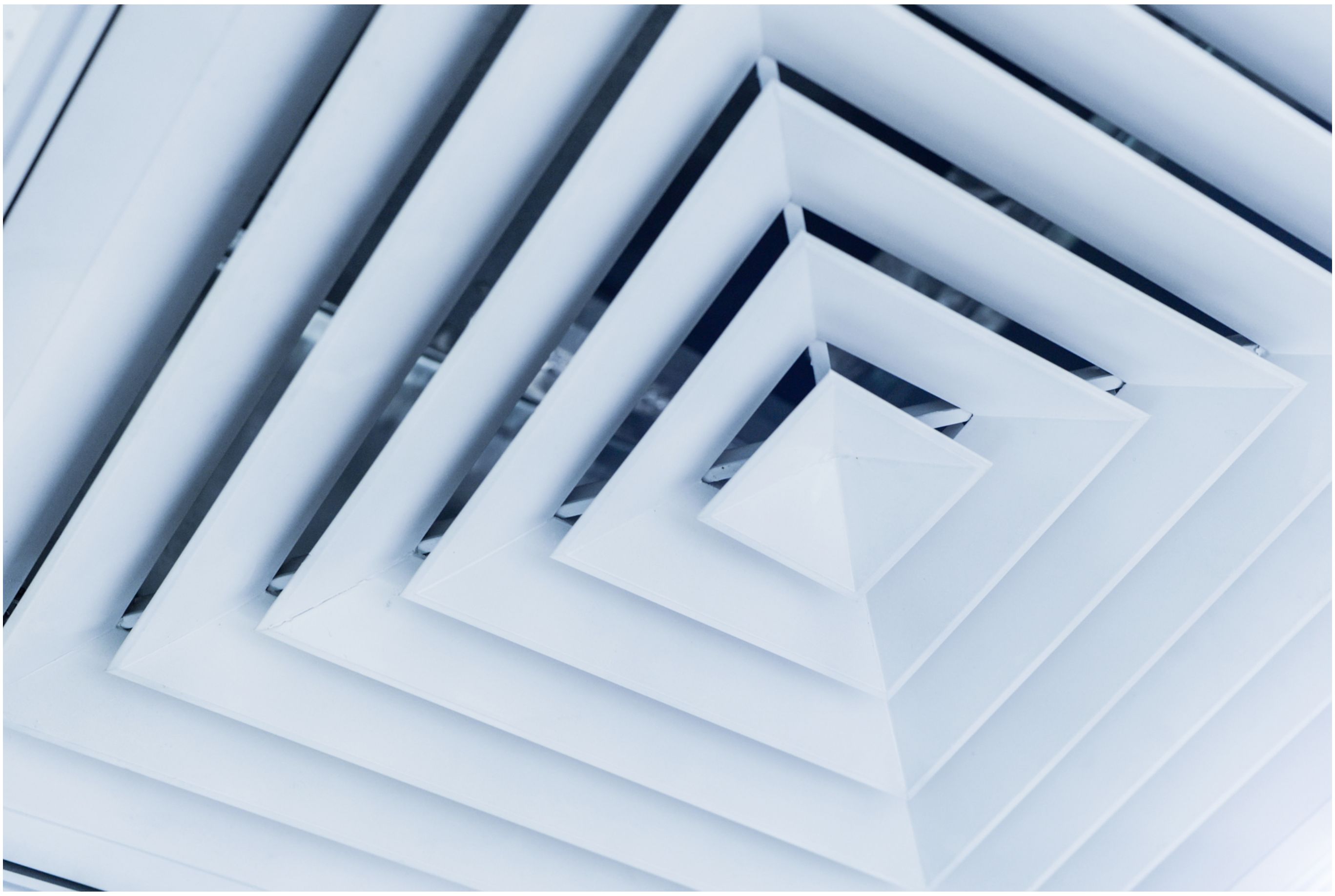

# Invisible and ignored: Why indoor air quality deserves our attention

11 September 2025

Julie Bennett, Caroline Halley, Mikael Boulic, Amanda Kvalsvig, Michael Baker, Manfred Plagmann, Lucy Telfar-Barnard, Lidia Morawska

# Summary

We think a lot about the food we eat and the water we drink, but rarely do we consider the air we breathe, especially when we are indoors where we spend around 90% of our lives. Breathing is essential to survival. We can live weeks without food, days without water, but only minutes without air. Every breath draws in not just oxygen but also invisible pollutants (dust, fungi, pathogens, chemicals, particulates, and carcinogens) that can harm our health and impact our productivity. The evidence is clear that clean indoor air reduces illness, improves cognitive function, productivity and prevents the spread of respiratory infections. The challenge is that air remains invisible, undervalued, and largely absent from building codes and health policy. Aotearoa New Zealand needs a national authority established to drive a comprehensive indoor air quality strategy, coordinating surveillance, research, guidelines, and policies to provide clean air for all.

---

## Why indoor air quality is invisible?

While the pandemic briefly made indoor air quality part of public conversation, once the masks came off, the momentum for change faded.[1] Unlike water or food contamination, poor air quality is often unseen, unable to be tasted or smelt. While food and water borne illness can cause sudden, dramatic crises, poor indoor air quality rarely triggers a sudden, obvious event. People tolerate stuffy rooms or symptoms such as headaches, eye and nose symptoms, and asthma without recognising that these may be a sign of poor air quality. Culturally, there’s a widespread assumption that air is naturally “clean” unless there’s an obvious cue like smoke or a bad odour. In reality, viruses, bacteria, and pollutants are silently circulating indoors. This invisibility makes indoor air quality easy to overlook in public policy, where health risks with clear, immediate consequences tend to get priority.

While water and food safety are regulated and enforced, air quality inside buildings has no comparable standards. Building codes typically focus on energy efficiency, which can unintentionally reduce fresh air intake. Public health frameworks may treat air as a personal responsibility - open a window or wear a mask, rather than a systemic infrastructure issue. This leaves schools, workplaces, public buildings and public transport dependent on individual decision-making and budgets. Without set standards, improvements tend to happen only in wealthier institutions or after major outbreaks.

## Health implications

The health effects of poor indoor air quality are profound. According to the World Health Organization, each year indoor air pollution is responsible for millions of premature deaths worldwide, predominantly due to respiratory diseases and cardiovascular conditions.[2] In children, poor indoor air quality is associated with increased rates of asthma and allergies.[3] [4]

## Productivity implications

Furthermore, indoor environments with high levels of carbon dioxide ($CO_2$) can impair cognitive function, leading to decreased productivity and increased absenteeism in workplace and learning settings.[5] [6] Research shows that employees in well-ventilated spaces demonstrate improved decision-making and higher efficiency.[7] A healthier indoor air environment not only supports physical health but also enhances overall well-being and productivity, ultimately benefiting both individuals and organisations.[8]

## Economic implications

Poor indoor air quality carries significant economic costs in Aotearoa New Zealand (NZ), impacting healthcare expenses, workplace productivity, and absenteeism. Studies suggest that improving air quality in public buildings could save the country around $1 billion annually through reduced healthcare costs and higher productivity.[9] Businesses face millions in losses due to diminished employee focus, fatigue, and increased sick leave.[10] Investments in ventilation and air filtration have shown strong returns; for example, schools with upgraded systems report better student attendance and academic performance, demonstrating the broad benefits of healthier indoor environments. [11]

## Current legislation and guidelines for Indoor Air Quality in NZ

NZ’s legislation mainly targets outdoor air quality, with the Resource Management Act (1991) focusing on outdoor pollution and offering limited attention to indoor environments. The NZ Building Code provides basic ventilation requirements aimed at reducing dampness and some indoor pollutants, but lacks enforceable standards for key factors like $CO_2$ levels. Guidelines such as NZS 4303:1990 and Ministry of Education recommendations emphasise ventilation, especially in schools, but enforcement is inconsistent. Overall, the absence of a cohesive indoor air quality strategy and reliance on natural ventilation (people opening windows) pose challenges, particularly in NZ’s temperate climate where indoor moisture and mould can become problematic.

## Solutions to improve Indoor Air Quality in NZ

NZ has no national agency with clear responsibility for indoor air quality. Many countries have this role assigned to environment, health, or safety ministries.[12] Examples include the US Environmental Protection Agency (EPA), Health Canada and the French Agency for Food, Environmental and Occupational Health & Safety ANSES.

A first step for NZ to advance indoor air quality would be to establish a national agency, potentially within a suitable existing agency. This centre should be resourced to provide national leadership, coordination and a comprehensive strategy to improve indoor air quality. Such a strategy could set national standards for acceptable indoor air quality, as is already available for outdoor air quality. Global indoor air quality standards for public buildings have previously been proposed by Morawska and colleagues are outlined in Table 1.[13]

**Table 1. Proposed indoor air quality standards for public buildings[13]**

| Pollutant / Parameter | Level | Averaging time or setpoint |
|---|---|---|
| $PM_{2.5}$ (µg/m³) | 15[i] | 1-hour |
| $CO_2$ (ppm) | 800 (absolute value)[ii] | Threshold [iii] |
| | 350 (delta)[iv] | Threshold [iii] |
| CO (mg/m³) [(v) (vi)] | 100 | 15 minutes |

| | | |
|---|---|---|
| | 35 | 1 hour |
| | 10 | 8 hours |
| Ventilation (L/s/person) | 14[vii] | When the space is occupied |

i. 24-hour level.[14]
ii. When 100% of air delivered to the space is outdoor air, assuming outdoor $CO_2$ is 450 ppm (classroom scenario).
iii. Threshold is the concentration level of $CO_2$ that must not be exceeded.
iv. Delta is the difference between the actual $CO_2$ concentration and the $CO_2$ concentration in the supply air.
v. At 25°C and 1 atm for CO 1 part per billion = 1.15 µg/$m^3$.
vi. 8-hour averaging time.[15]
vii. Clean air supply rate in the breathing zone.[16]

As well as setting maximum values for particulate matter and chemicals, such as carbon monoxide (CO), this strategy should also include levels for $CO_2$ as a proxy for ventilation, which will help reduce the transmission of airborne pathogens and dilute levels of other indoor pollutants. Pollutant standards for heating and cooking appliances, particularly for unflued appliances that use gas should also be considered.[17]

Meeting these standards will require practical measures, and one of the most effective is to increase ventilation,[18] exchanging polluted indoor air for cleaner outdoor air. Understanding and controlling building ventilation can improve the quality of the air we breathe and protect population health, including reducing the transmission of respiratory pathogens. In addition, high-quality air filtration, such as HEPA filters can remove pathogens, dust, pollen, and other harmful particles. We should also look to recommendations arising from the 24 September 2025 "Healthy Indoor Air: A Global Call to Action," event coming up alongside the UN General Assembly in New York.

## Conclusion

Access to clean air is a fundamental human right, yet many of our schools, workplaces, public spaces, and homes are filled with stale, contaminated air. Just as we would never accept dirty drinking water, we should not accept unhealthy indoor air. There is growing international pressure to mobilise governments to implement solutions. Protecting the air, we share is not only a matter of rights, but also an investment in health and productivity.

## What this Briefing adds

- **Indoor air quality is a hidden health issue** - often invisible, it goes unnoticed and is not well understood by the public or policymakers.
- In NZ there are no enforceable standards for indoor air quality, and existing building codes focus more on energy efficiency than on ensuring healthy ventilation.
- Poor indoor air quality costs NZ an estimated $1 billion annually through increased healthcare costs, lost productivity, and school absences, with compelling evidence that improvements deliver high returns.
- National indoor air quality standards, better ventilation, and high-quality air filtration will improve health, reduce disease transmission, and boost productivity, but require coordinated national leadership.

## Implications for policy and practice

- **Establish and resource a national agency** to lead an indoor air quality strategy, fund research into surveillance, retrofit solutions, and provide consistent guidance across sectors.
- **Prioritise ventilation and filtration upgrades in public buildings**. Especially in schools, workplaces, and healthcare facilities using evidence-based designs that reduce disease transmission and improve wellbeing.
- **Develop enforceable national indoor air quality standards** that set clear thresholds for pollutants like existing outdoor air quality regulations. Ventilation rates and $CO_2$ levels should be included.
- **Integrate indoor air quality into building codes and public health frameworks**, ensuring that ventilation and filtration are treated as essential infrastructure rather than personal responsibility.

### Authors details

Assoc Prof Julie Bennett, Department of Public Health, Ōtākou Whakaihu Waka, Pōneke | University of Otago, Wellington

Dr Caroline Halley, Department of Medicine, Ōtākou Whakaihu Waka, Pōneke | University of Otago, Wellington

Dr Mikael Boulic, School of Built Environment, Massey University, Auckland

Assoc Prof Amanda Kvalsvig, Department of Public Health, Ōtākou Whakaihu Waka, Pōneke | University of Otago, Wellington

Prof Michael Baker, Department of Public Health, Ōtākou Whakaihu Waka, Pōneke | University of Otago, Wellington

Dr Manfred Plagmann, Building Research Association of NZ (BRANZ), Wellington

Dr Lucy Telfar-Barnard, Department of Public Health, Ōtākou Whakaihu Waka, Pōneke | University of Otago, Wellington

Distinguished Prof Lidia Morawska, School of Earth and Atmospheric Sciences, Queensland University of Technology, Brisbane, Australia

## References

1. Morawska L, Li Y, Salthammer T. Lessons from the Covid-19 pandemic for ventilation and indoor air quality. *Science* 2024;385(6707):396-401. doi: doi:10.1126/science.adp2241
2. World Health Organization. Household air pollution Geneva: WHO; 2023 [Available from: https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health
3. Shorter C, Crane J, Pierse N, et al. Indoor visible mold and mold odor are associated with new-onset childhood wheeze in a dose-dependent manner. *Indoor Air* 2018;28(1):6-15. doi: 10.1111/ina.12413
4. Gillespie-Bennett J, Pierse N, Wickens K, et al. The respiratory health effects of nitrogen dioxide in children with asthma. *Eur Respir J* 2011;38(2):303-9. doi: 10.1183/09031936.00115409
5. Satish U, Mendell MJ, Shekhar K, et al. Is $CO_2$ an indoor pollutant? Direct effects of low-to-moderate $CO_2$ concentrations on human decision-making performance. *Environ Health Perspect* 2012;120(12):1671-7. doi: 10.1289/ehp.1104789
6. Sadrizadeh S, Yao R, Yuan F, et al. Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment. *Journal of Building Engineering* 2022;57:104908. doi: https://doi.org/10.1016/j.jobe.2022.104908
7. Wyon DP. The effects of indoor air quality on performance and productivity. *Indoor Air* 2004;14 Suppl 7:92-101. doi: 10.1111/j.1600-0668.2004.00278.x
8. Fisk WJ. Health and productivity gains from better indoor environments and their relationship with building energy efficiency. *Annual Review of Environment and Resources* 2000;25(Volume 25, 2000):537-66. doi: https://doi.org/10.1146/annurev.energy.25.1.537
9. Radio New Zealand. Improving air quality brings health and economic benefits - report. 2024.
10. Boulanger G, Bayeux T, Mandin C, et al. Socio-economic costs of indoor air pollution: A tentative estimation for some pollutants of health interest in France. *Environment International* 2017;104:14-24. doi: https://doi.org/10.1016/j.envint.2017.03.025
11. Haverinen-Shaughnessy U, Moschandreas DJ, Shaughnessy RJ. Association between substandard classroom ventilation rates and students' academic achievement. *Indoor Air* 2011;21(2):121-31. doi: 10.1111/j.1600-0668.2010.00686.x
12. Settimo G, Yu Y, Gola M, et al. Challenges in IAQ for Indoor Spaces: A Comparison of the Reference Guideline Values of Indoor Air Pollutants from the Governments and International Institutions. *Atmosphere* 2023;14(4):633.
13. Morawska L, Allen J, Bahnfleth W, et al. Mandating indoor air quality for public buildings. *Science* 2024;383(6690):1418-20. doi: 10.1126/science.adl0677
14. World Health Organization. WHO Global Air Quality Guidelines Geneva: World Health Organization; 2021 [Available from:

https://www.who.int/news-room/questions-and-answers/item/who-global-air-quality-guidelines accessed 10 September 2025.
15. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392(10159):1923-94. doi: 10.1016/s0140-6736(18)32225-6
16. Rates AD. Proposed non-infectious air delivery rates (NADR) for reducing exposure to airborne respiratory infectious diseases. 2022
17. Gillespie-Bennett J, Pierse N, Wickens K, et al. Sources of nitrogen dioxide (NO2) in New Zealand homes: findings from a community randomized controlled trial of heater substitutions. *Indoor Air* 2008;18(6):521-8. doi: 10.1111/j.1600-0668.2008.00554.x
18. Agency USEP. Ventilation and respiratory viruses: EPA; 2025 [Available from: Ventilation and Respiratory Viruses | US EPA accessed 10 September 2025.

Public Health Expert Briefing (ISSN 2816-1203)

---

**Source URL:**
*https://www.phcc.org.nz/briefing/invisible-and-ignored-why-indoor-air-quality-deserves-our-attention*