

Submission by *THRIVE* to the National Urban Policy for Australia

We wholeheartedly support the vision of the National Urban Policy for sustainable growth in our cities and suburbs and its goals and objectives for “*our urban areas to be liveable, equitable, productive, sustainable and resilient*”. For these goals and objectives to be achievable, one fundamental condition is good quality urban air. We breathe this air into our lungs 12 times a minute and, if it is polluted, it is not possible to fully achieve the set goals.

Ambient air quality is safeguarded by the National Environmental Protection Measures (NEPMs) adopted by the Australian States. The NEPMs set mandatory threshold concentration levels of harmful airborne pollutants and prescribe methods for routine monitoring to check that the concentrations meet the standards.

The existing approach to achieving good air quality applies only to outdoor air, not indoor air. To deliver a holistic Policy, the indoor air quality of buildings in our cities is of critical importance and the need for clean and healthy indoor air is the focus of our submission.

Without buildings there would be no cities. In other words, buildings are the “building blocks” of cities and the foundation for urbanisation. Around the world, city dwellers spend most of their time indoors. Australians spend more than 90% of their time indoors, including during transportation (Commonwealth of Australia 2020).

Many attributes and functions are expected of buildings. They must be designed in accordance with the mandatory requirements of the National Construction Codes (NCC 2019). Their location, appearance and functionality are features that can make them more attractive. Energy efficiency reduces the cost of operating buildings and is a critical element in our quest for a green future. Most of these aspects have an impact on air quality in buildings, positive or negative, but indoor air quality is not mandated and rarely monitored (except in research projects). There is little awareness of the importance of good indoor air quality among decision-makers, Australian public health authorities or the Australian community.

Indoor air pollution originates from both indoor and outdoor sources. In addition to sources that people intentionally operate or create indoors (e.g., combustion sources for cooking, heating or light; products with fragrances) or unintentionally introduce (e.g., wall paints or cleaning products emitting volatile organic compounds), emissions also arise from humans in the form of respiratory effluents and body odours.

A quarter of a century ago, indoor air pollution was estimated to cost Australia \$12 billion/year (about \$24 billion in today’s currency) in the form of illness and related medical costs, absenteeism, and lost productivity (Brown 1998). A recent international assessment showed that the costs could be even greater. A burden of disease study conducted in China found that the cost of indoor air pollution in residential houses was 3.45% of the country’s gross domestic product (Liu et al. 2023; Morawska 2024). The most significant impact was shown to be due to particulate matter (PM_{2.5} – particles smaller than 2.5 micrometres) and included cardiovascular and chronic respiratory diseases and lung cancer. Similar impacts of indoor particulate matter have been reported in the USA, Germany, France and Italy (Hänninen et al. 2014; Logue et al. 2012; Morantes et al. 2023; Murray et al. 2020).

Pollutants generated by indoor sources must be removed from indoor spaces to keep them healthy – this is the role of ventilation. Almost 200 years ago, nurse Florence Nightingale demonstrated the role of ventilation in lowering the risk of infection caused by pathogens emitted from human respiratory activities (Gilbert 2020). However, recent decades have seen periodic efforts to reduce ventilation rates to very low values to save energy. Sick Building Syndrome emerged as a widespread problem during a period of particularly low ventilation rates during the 1970s. More recently, low ventilation rates have been associated with increased risk of infection, leading to calls for improvement in building ventilation systems around the world (Morawska et al. 2021a) and in Australia (Morawska 2021; Morawska and Marks 2022; Morawska et al. 2022).

But if the air outside is polluted, bringing it indoors will not make indoor air clean. A downward trend in ambient air pollution occurred after the introduction of air quality standards in the 1990s. However, this trend is not continuing and the concentrations of some key pollutants in Australian cities have stagnated (de Jesus et al. 2020). Global trends show an increase in air pollution in many parts of the world with the advance of climate change, resulting in more frequent forest fires and dust storms due to desertification (Morawska et al. 2021b). The increase in air pollution caused by climate change will continue and will likely offset the decreases resulting from reduced traffic and industrial emissions. This may reverse the progress made in controlling the anthropogenic contribution to air pollution in cities around the world, including Australia. As an element of adaptation to climate change, an important role of buildings is to protect us from prolonged periods of high outdoor air pollution.

The design of contemporary buildings, however, rarely allows for adequate control of both threats: indoor generated pollution (including human emitted infectious pathogens) and pollution penetrating from outdoors. Therefore, future buildings must be designed to secure clean and healthy indoor air at all times and in all spaces, while existing buildings require retrofitting to achieve the same.

Key recommendations to consider for inclusion in the National Urban Policy to secure clean and healthy indoor air in cities are:

1. *Efforts should continue to control ambient urban air quality.* In particular, Australian air quality standards should be aligned with the new World Health Organization air quality guidelines (WHO 2021), which recommend pollutant concentration levels lower than those mandated by the NEPM.
2. *Buildings should be located as far as possible from any urban pollution sources.* Such sources should be controlled by transition to clean energies and/or by moving them away from urban areas.
3. *Buildings should be designed to protect against all air quality risks while securing thermal comfort, managing moisture and condensation, and minimising building energy consumption.* Risks comprise air pollution generated inside, including infectious pathogens, and pollution from outside, including episodic high concentrations of pollution from bushfire smoke. This will require new designs, based on new thinking and incorporating the requirements for such designs in the NCC.
4. *Indoor air quality should be mandated to the same extent as outdoor air quality* (Morawska et al. 2024). This would require a national approach to establish IAQ standards for Australia legislated by a designated national body.

About THRIVE

The Australian Research Council funded the THRIVE program's vision "to lead the advancement of knowledge and technological infrastructure development in pursuit of clean and healthy indoor air environments that improve mental cognition and foster productivity." To achieve this, we are building collaborative and innovative partnerships with the scientific community, governmental bodies, industry stakeholders, and the public. We are keen to offer our expertise to support the development of the National Urban Policy for Australia.

On behalf of THRIVE investigators and partners (a full list is provided in the Supplement, included in this document after the list of references),



Distinguished Professor Lidia Morawska, PhD

Australian Laureate Fellow

Centre Director, ARC Training Centre for Advanced Building Systems Against Airborne Infection Transmission (THRIVE)

Director, International Laboratory for Air Quality and Health, WHO CC for Air Quality and Health

Queensland University of Technology

2 George Street, Brisbane QLD 4000 Australia

Phone: +61 7 3138 2616 | Email: l.morawska@qut.edu.au

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Supplement – List of THRIVE investigators and partners

Title	First name	Surname	Organization
Distinguished Professor	Lidia	Morawska	Queensland University of Technology
Dr	Enoch	Adotey	Queensland University of Technology
Professor	William	Bahnfleth	The Pennsylvania State University
Professor	Scott	Bell	Metro North Health and Translational Research Institute Australia
Professor	Richard	Brown	Queensland University of Technology
Professor	Giorgio	Buonanno	University of Cassino and Southern Lazio
Associate Professor	Lindy	Burton	Queensland University of Technology
Professor	Laurie	Buys	Australian Catholic University
Mr	Patrick	Chambers	Stantec
Dr	Stephen	Corbett	Western Sydney Local Health
Mr	Charles	dePuthod	INF Associates
Mr	Marc	Dunn	Samsung Electronics Australia
Dr	Neal	Durant	Geosyntec
Ms	Sandra	Glaister	Southern Cross Care Queensland
Professor Emeritus	Keith	Grimwood	School of Medicine and Dentistry, Griffith University
Dr	Robert	Groth	Queensland University of Technology
Professor	Geoff	Hanmer	ARINA and The University of Adelaide
Mr	Paul	Hoertz	Trane Technologies
Mr	Mark	Jermy	The University of Canterbury
Ms	Pat	Keady	Handix Scientific
Dr	Kevin	Kevin	The University of Melbourne
Mr	Travis	Kline	Geosyntec
Professor	Prashant	Kumar	University of Surrey
Dr	Martin	Larbi	Queensland University of Technology
Professor	Zhiyong	Li	Queensland University of Technology
Mr	Mike	Lilly	Samsung Electronics Australia
Mr	Stuart	Lummis	Southern Cross Care Queensland
Scientia Professor	Guy	Marks	The University of New South Wales
Dr	Peter	McGarry	The University of Queensland
Mr	Graeme	McLeish	QED Environmental
Professor	Kerrie	Mengersen	Queensland University of Technology
Mr	Alexander	Mikszewski	Queensland University of Technology
Associate Professor	Wendy	Miller	Queensland University of Technology
Professor	Donald	Milton	The University of Maryland
Professor	Jason	Monty	The University of Melbourne
Dr	Heike	Neumeister-Kemp	Mycotec

Dr	Sara	Omrani	Queensland University of Technology
Dr	Henry	Oswin	Queensland University of Technology
Mr	Keegan	Palmer	VA Sciences
Dr	Hamesh	Patel	Mote
Professor	Alexander	Paz	Queensland University of Technology
Mr	John	Penny	Viscon Systems
Dr	Greg	Picker	Air-Conditioning & Refrigeration Equipment Manufacturers Association of Australia (AREMA)
Mr	Andy	Poslinski	Trane Technologies
Mr	Brad	Prezant	Prezant Environmental
Professor	Xavier	Querol	Institute of Environmental Assessment and Water Research, Spanish National Research Council
Professor	Thomas	Rainey	Queensland University of Technology
Professor	Zoran	Ristovski	Queensland University of Technology
Professor	Tunga	Salthammer	Fraunhofer WKI
Mr	Ken	Schoeneck	Trane Technologies
Associate Professor	Robyn	Schofield	The University of Melbourne
Mr	Bob	Sharon	Blue IoT
Ms	Ivi	Sims	BULCS Holdings
Professor	Kirsten	Spann	Queensland University of Technology
Professor	Luca	Stabile	University of Cassino and Southern Lazio
Dr	George	Tay	Metro North Health and Translational Research Institute Australia
Mr	Scott W.	Tew	Trane Technologies
Dr	Tim	van der Graaf	Versuni
Dr	Zubin	Varghese	Trane Technologies
Mr	Mark	Vender	Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH)
Dr	Claire	Wainwright	Children's Health Queensland Hospital
Professor	Boguang	Wang	Jinan University
Mr	Simon	Witts	VA Sciences
Professor	Bo	Xia	Queensland University of Technology
Professor	Maosheng	Yao	Peking University