

Commentary

India's steps towards carbon dioxide monitoring in public assembly spaces for ventilation measurement for airborne infection control and other factors

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This commentary describes the work done by the Indian National Green Tribunal by instructing the Central Pollution Control Board to formulate guidelines and issue directions for important matters related to Indoor Air Quality and Airborne Infection Control. What started as a Public Interest Litigation in the Hon'ble Delhi High Court led to an application in the National Green Tribunal for three matters. The first being Carbon Dioxide monitoring of enclosed air conditioned spaces of public assembly nature as Carbon Dioxide is a surrogate for Ventilation in a space. The second being including inclusions in Split Air Conditioners as they simply recirculate the indoor air without any fresh air intake which increases probability of airborne infection spread apart from other issues. The last being having appropriate window design in building byelaws to promote openability of windows with wire mesh so that fresh air intake is possible for airborne infection control.

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In India, the Judiciary is the guardian of the Citizen's right to Life, which includes the Right to a Healthy Environment under Article 21 of the constitution of India^{[1][2][3]}. The first author was the sole petitioner in the Delhi High Court for implementation of dilution ventilation in public assembly buildings which was directed by the Hon'ble Court to be treated as a representation to government authorities including the ministry of the environment, the ministry of housing, the standard making body and the pollution control boards among others^[3]. One of the respondents, the Delhi Pollution Control Committee, stated that the Indoor Air is not within the Air (Prevention and Control of Pollution) Act, 1981 and hence not within the committee's mandate^[4]. To clear the position of the law, on the basis of an application by the

first author, the National Green Tribunal adjudicated in this matter and ruled that Indoor Air is within the purview of the Air Act, 1981^[5]. In another application before the National Green Tribunal, which is India's fast track environmental statutory court, the first author, prayed for inclusion of compulsory carbon dioxide monitoring in assembly buildings, among others, as a surrogate for the ventilation in a space. The Hon'ble Tribunal has directed a committee in the Central Pollution Control Board to issue guidelines/norms in this matter^[6].

What is important to note is the significance of carbon dioxide measurement which is recognised as a surrogate measure for the level of ventilation in an occupied space, and is recognised as such in the National Building Code of India^[7]. This level of carbon dioxide in a space, as a biomarker, has also been related to airborne infection risk and models have been developed for predictive and retrospective modelling in this regard^{[8][9][10][11][12][13]}.

The problem stated by the second author in a news feature of the Nature is that 'the general public has no idea' about the fact that a high carbon dioxide concentration in a space is 'a sign that the room has poor ventilation and could pose a risk for COVID-19 infection.'^[13]

The solution to this issue of ventilation and its relation with spread of airborne diseases like Tuberculosis and COVID-19 among others, can be mandatory carbon dioxide monitoring in enclosed public spaces and the display of the values in conspicuous position so that all the inhabitants know about the levels and an awareness regime is started. Governments and municipalities around the world should take cue from the work done by the judiciary in India in order to implement the groundwork so that we can ensure healthy indoors for our citizens.

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References

1. [△]Bakshi PM. *The Constitution of India; Selective Comments*. Delhi: Universal Law Publishing;
2. [△]Udit Raj Rai. *Fundamental Rights and their Enforcement*. Eastern Economy Edition. New Delhi;
3. [△][♠]Singh R, Dewan A. *Using global research on ventilation and airborne infection control for impacting public policy through the Indian Judiciary*. *Indoor Built Environ*. 2022 Feb 23;1420326X211061997.

4. [△]Dr. M.P. George, Scientist, Delhi Pollution Control Committee. Subject: Writ Petition (C) 7810/2021 titled as 'Raja Singh vs Union of India & Ors.' 2021.
5. [△]Singh R, Dewan A. Progress on indoor air quality regulation in India. *Int J Tuberc Lung Dis Off J Int Union Tuberc Lung Dis*. 2022 Aug 1;26(8):801b–802.
6. [△]Principal Bench. Raja Singh vs. Ministry of Housing and Urban Affairs and Anr. [Internet]. 2022. Available from: https://greentribunal.gov.in/gen_pdf_test.php?filepath=L25ndF9kb2N1bWVudHMvbmd0L2Nhc2Vkb2MvanVkZ2VtZW50cy9ERUxISS8yMDIyLTA5LTE5LzE2Nm2NjYyNDQyMDY2MzMxODQ1NjMyOTg4NDQzMGIzOS5wZGY=
7. [△]Bureau of Indian Standards. National Building Code 2016. 2016. (SP 7: 2016).
8. [△]Xu C, Liu W, Luo X, Huang X, Nielsen PV. Prediction and control of aerosol transmission of SARS-CoV-2 in ventilated context: from source to receptor. *Sustain Cities Soc*. 2022 Jan 1;76:103416.
9. [△]Burridge HC, Fan S, Jones RL, Noakes CJ, Linden PF. Predictive and retrospective modelling of airborne infection risk using monitored carbon dioxide. *Indoor Built Environ*. 2022 Jun 1;31(5):1363–80.
10. [△]Rudnick SN, Milton DK. Risk of indoor airborne infection transmission estimated from carbon dioxide concentration. *Indoor Air*. 2003;13(3):237–45.
11. [△]Richardson ET, Morrow CD, Kalil DB, Bekker LG, Wood R. Shared air: A renewed focus on ventilation for the prevention of tuberculosis transmission. *PLoS ONE*. 2014;9(5):1–7.
12. [△]Issarow CM, Mulder N, Wood R. Modelling the risk of airborne infectious disease using exhaled air. *J Theor Biol*. 2015 May;372:100–6.
13. [△][‡]Dyani Lewis. Why indoor spaces are still prime COVID hotspots. *Nature*. 2021 Mar 30;2021(592):22–5.

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