

Brought to you by [INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA](#)

Scopus

[Back](#)

A review of indoor air quality in heritage buildings and confined spaces: Implications for occupational safety and health

[Vietnam Journal of Science and Technology](#) • Review • Open Access • 2026 •

DOI: 10.15625/2525-2518/22424

[Osman, Mohamad Romizan](#)^{a,b}; [Azid, Azman](#)^a ; [Samsudin, Mohd Saiful](#)^c; [Yunus, Kamaruzzaman](#)^b; [Rani, Nurul Latiffah Abd](#)^d

^a School of Aquatic Science and Environment, Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus, Terengganu, Besut, 22200, Malaysia

[Show all information](#)

0

Citations

[View PDF](#)[Full text](#) [Export](#) [Save to list](#) [Document](#)[Impact](#)[Cited by \(0\)](#)[References \(65\)](#)[Similar documents](#)

Abstract

The quality of indoor air environments in heritage buildings and confined spaces, such as tunnels, is a critical concern for occupational safety and health (OSH). These environments often contain airborne contaminants, including particulate matter (PM_{2.5} and PM₁₀), heavy metals, silica, asbestos, bacteria, fungi, and microplastics, which pose serious health risks to workers and visitors. The deterioration of building materials, inadequate ventilation, and resuspension of settled dust contribute to poor indoor air quality (IAQ), leading to long-term exposure hazards. Heritage buildings, constructed with materials such as lead-based paint, asbestos insulation, and decaying wood, release hazardous particles into the indoor environment over time. Meanwhile, confined spaces like tunnels experience high concentrations of silica dust, toxic gases, and microbial

proliferation, exacerbating occupational exposure risks. Recognizing the importance of IAQ to occupational health, regulatory bodies such as DOSH Malaysia have introduced the Industry Code of Practice on Indoor Air Quality (ICOP 2010, revised 2024) to establish workplace IAQ standards. The ICOP 2010 guidelines emphasize the importance of monitoring airborne pollutants, maintaining adequate ventilation, and implementing mitigation measures to minimize health risks indoors and enclosed workspaces (DOSH, 2024). This review analyzes the sources, distribution, and health effects of IAQ degradation in historical and enclosed environments and evaluates existing regulatory frameworks, including ICOP 2010, in addressing these concerns. It compares IAQ standards with regulatory exposure limits set by organizations such as ICOP 2010, the Occupational Safety and Health Administration (OSHA), and the World Health Organization (WHO). The health effects of prolonged exposure to PM-bound heavy metals, asbestos fibres, and microbial contaminants are discussed, with particular emphasis on respiratory diseases, lung cancer, and neurological impairments. The paper also evaluates IAQ management strategies, including real-time air quality monitoring, ventilation improvements, filtration technologies, and personal protective equipment (PPE). It highlights the effectiveness of mitigation methods in reducing occupational exposure and proposes future research directions to develop sustainable IAQ solutions in heritage conservation and underground infrastructure projects. Aligning IAQ control measures with ICOP 2010 guidelines ensures that workplaces adhere to best practices for safeguarding worker health, preserving historical structures, and maintaining regulatory compliance. © 2026, Publishing House of Natural Science and Technology, VAST. All rights reserved.

Author keywords

confined spaces; heavy metals; heritage buildings; indoor air quality; microplastics; occupational health; particulate matter

Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
Universiti Sultan Zainal Abidin See opportunities by UniSZA ↗		UniSZA
Dana Penyelidikan Universiti 2.0	UniSZA/2022/DPU2.0/12	

Funding text

This project was supported by Universiti Sultan Zainal Abidin (UniSZA) under Dana Penyelidikan Universiti 2.0 (UniSZA/2022/DPU2.0/12).

Corresponding authors

Corresponding author A. Azid

Affiliation School of Aquatic Science and Environment, Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus, Terengganu, Besut, 22200, Malaysia

Email address azmanazid@unisza.edu.my

© Copyright 2026 Elsevier B.V., All rights reserved.

Abstract

Author keywords

Funding details

Corresponding authors

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)