

Evaluating Indoor Air Quality and Associated Health Risks in a Basement Office Building at Kompleks PKNS, Shah Alam

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Structured Abstract

Background: Indoor air quality (IAQ) plays a vital role in determining the health, comfort, and productivity of building occupants, especially in enclosed basement offices where ventilation is limited. These environments are prone to pollutant accumulation due to restricted airflow, nearby vehicle exhaust, and high humidity that promotes microbial growth, especially in Malaysia's humid tropical climate. Although the Department of Occupational Safety and Health (DOSH) has issued the Industry Code of Practice (ICOP) 2010 with IAQ limits, enforcement and consistent monitoring remain weak, especially in older or enclosed buildings. This study aimed to (1) assess IAQ in a basement office at Kompleks PKNS, Shah Alam; (2) identify IAQ-related symptoms among occupants; and (3) evaluate potential health risks through a Health Risk Assessment (HRA).

Methods: A cross-sectional study was conducted to measure physical (temperature, relative humidity), chemical (CO, CO₂, PM₁₀, TVOCs, formaldehyde), and biological (airborne bacteria and fungi) parameters using calibrated instruments according to ICOP 2010. A walkthrough inspection identified pollution sources and ventilation conditions, and a standardized health symptom survey was distributed. HRA was conducted based on U.S. EPA methods to evaluate carcinogenic and non-carcinogenic risks.

Results: Several parameters exceeded ICOP thresholds: temperature (>26°C at some points), CO₂ (mean 1321.19 ppm), PM₁₀ (up to 0.28 mg/m³), and intermittent exceedances in CO, TVOCs, and formaldehyde. Total bacterial and fungal counts exceeded 500 cfu/m³ in most areas, particularly where carpeting and occupancy were high. Occupants reported symptoms including fatigue, headache, dry throat, dizziness, and eye irritation. HRA results showed all non-carcinogenic hazard quotients (HQ) were below 1.0, while the cumulative hazard index (HI) was 0.524, suggesting potential long-term effects. The carcinogenic risk from formaldehyde (ELCR = 9.1245×10^{-6}) was within the US EPA acceptable range.

Conclusion: The findings confirm suboptimal IAQ in the basement office, with several exceedances linked to reported symptoms and signs of Sick Building Syndrome (SBS). Although overall health risks were within regulatory limits, cumulative exposure may still affect vulnerable individuals. The study highlights the need for improved ventilation, regular monitoring, and proactive IAQ management in enclosed work environments.

Keywords: Indoor air quality (IAQ), basement office, health risk assessment (HRA), Sick Building Syndrome (SBS), ICOP 2010

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