

# We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index  
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?  
Contact [book.department@intechopen.com](mailto:book.department@intechopen.com)

Numbers displayed above are based on latest data collected.  
For more information visit [www.intechopen.com](http://www.intechopen.com)



# Introductory Chapter: Indoor Air Quality in the Closed Building

*Abderrahim Lakhout*

## 1. Introduction

Air pollution is a major concern that has been recognized throughout the world during the nineteenth and twentieth century and until now. In the Middle Ages, the heavy industry and the burning of coal in cities, especially in Europe (Belgium, French, Germany, Poland and the United Kingdom), released into atmosphere numerous chemical compounds as carbon dioxide and sulphur dioxide. In the late eighteenth century, the Industrial Revolution, beginning in the United Kingdom (UK), led to escalation in pollutant emissions based around the use of coal by both homes and industry. The sky of certain cities in Europe was covered by smoke. The air pollution in this period in UK was given the dramatic episodes known in the literature by 'London Smog'. Air quality is influenced by a variety of factors and is a complex issue according to many authors in this field. Air pollutants can be represented by a numerous of substances present in the atmosphere at concentrations above their normal background levels which can have a measurable effect on humans, animals and vegetation. The main aim of the Air Quality Index (AQI) is to help deciders or governments to understand what local air quality means to human health. The governments and non-government agencies develop air emission standards for many air pollutants. The main objective of emission standards is to establish quantitative limits on the permissible concentrations of specific air pollutants. The standards are determined in order to protect human health and environment. To determine the standard for each pollutants, many factors should be taken in account. For example, the toxicity of pollutant should be considered. More attention should be given to how the pollutant enters to the organism.

Air pollution can be defined as: the introduction of particulates (particulate matter or solid particles), biological molecules or other harmful chemical or materials into our atmosphere [1]. The air pollution can cause diseases, death to humans and damage to the environment and ecosystems. The source of air pollution can be from anthropogenic or natural Sources. The air quality can be measured by indexes. In the literature, two types (outdoor and indoor) of air pollution can be found. The present chapter is focused on indoor air quality. The indoor air quality (IAQ) is a very important aspect in the design of buildings due to the dominant exposure for humans.

## 2. Air quality in hospital

The air quality in the medical building is treated in this chapter. This is an important point that was raised in this chapter. Until recently, the health effects of indoor air pollution have received relatively little attention. In particular, air quality at hospitals is probably a risk factor with serious health consequence on the working staff, patients and visitors. Infection is a common event in hospitals, and many studies have investigated the levels, sources and characteristics of bioaerosol

in hospital [2, 3]. So the hospital sector is not shielded from the problems bound to inside air quality. Due to multiple sources of pollution and the presence of vulnerable people, this sector is particularly at risk. Moreover, outdoor air is an important source of pollution, which affects the IAQ [4].

More than 2 million people in Europe are infected due to health care-associated infection (HAI) [5]. Poor hospital IAQ may cause headaches, fatigue, eye, and skin irritations and other symptoms. Although it is believed that transfer of infection by direct contact is the main cause for HAI, there are evidences that airborne bacteria may also cause infection due to inhalation of such bacteria. Therefore, it is essential to understand the dynamics of infectious particles due to respiratory diseases such as severe acute respiratory syndrome (SARS) and tuberculosis (TB).

### **3. Air quality in the closed buildings**

In emergent countries, rapid growth in the global population requires expansion of building stock. This demand varies in time and also between different buildings; yet, conventional methods are only able to provide the comfort thermal in the building. To save energy in the building is an additional challenge. To save energy and to have a good air quality in the building are the big deals especially in cold countries. In recent years, the construction of tighter building envelopes, the increase in office equipment and the widespread use of synthetic materials have ensured that the concerns about indoor air quality are increasing. The sick building syndrome (SBS) is used, for the first time, to explain a situation in which the occupants of a building experience acute health- or comfort-related effects that seem to be linked directly to the time spent in the building. This issue is related to air quality in the building. The building is developed to save energy. The air circulation in this type of building is not good. The air spent many time in the building. The term of age of air was used for the first time to describe the time spent by the mass of air in the building. The complainants may be localized in a particular room or zone or may be widespread throughout the building. Generally, people spend about 90% of their time inside buildings [6]. To ensure the air quality in the building, Scientifics suggest using mechanical ventilation. The strategy of ventilation and its efficiency should be studied more in order to have excellent air quality with minimum of energy.

#### **Author details**

Abderrahim Lakhout

Civil Engineering Department, Faculty of Engineering, University of Tabuk,  
Tabuk, Saudi Arabia

\*Address all correspondence to: [abderrahim.lakhout@usherbrooke.ca](mailto:abderrahim.lakhout@usherbrooke.ca)

#### **IntechOpen**

© 2020 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

## References

- [1] Dominici F, Peng RD, Bell ML, et al. Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. *Jama*. 2006;**295**(10):1127-1134
- [2] Hoseinzadeh E, Samarghandie MR, Ghiasian SA, et al. Evaluation of bioaerosols in five educational hospitals wards air in Hamedan, During 2011-2012. *Jundishapur Journal of Microbiology*. 2013;**6**(6)
- [3] Li C-S, Hou P-A. Bioaerosol characteristics in hospital clean rooms. *Science of the Total Environment*. 2003;**305**(1-3):169-176
- [4] Jung C-C, Wu P-C, Tseng C-H, Su H-J. Indoor air quality varies with ventilation types and working areas in hospitals. *Building and Environment*. 2015;**85**:190-195
- [5] Pittet D, Allegranzi B, Sax H, Bertinato L, Concia E, Cookson B, et al. Considerations for a WHO European strategy on health-care-associated infection, surveillance, and control. *The Lancet Infectious Diseases*. 2005;**5**(4):242-250
- [6] Lakhout A. Modelisation de la Qualite de l'air Dans une Unite de Bronchoscopie: Influence des Strategies de Ventilation. Canada: Ecole de Technologie Superieure (Canada); 2011