UNIVERSITI TEKNOLOGI MARA

COMPARISON OF INDOOR AIR QUALITY (IAQ) IN A SELECTED SAMPLE OF LINKED AND DETACHED HOMES IN THE KLANG VALLEY, MALAYSIA

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ABSTRACT

Indoor air pollution is consistently reported to be two to five times- and occasionally up to 1,000-times higher than outdoor levels (Arant, 2005; Eek, 2005; Soper, 2005). This is alarming considering that the majority of people tend to spend an average of 70% to 96% of their time in indoor environments (Arant, 2005; cited in ARPDC, 2005a; ARPDC, 2005b), of which approximately 60% to 75% of the time is spent at home (CARB, 2005; cited in ARPDC, 2005a; ARPDC, 2005b). For these reasons, when compared to other threats to human health and well-being, the United States Environmental Protection Agency and its Science Advisory Board consistently rank poor indoor air quality (IAQ) amongst the top five most urgent environmental risks to public health and well-being (Arant, 2005; cited in 3M & ALA, 2004; cited in Paras, 2004); the World Health Organization (WHO) ranks indoor air pollution as one of the top five risk factors contributing to the global burden of disease (cited in Eek, 2005); and the World Bank ranks indoor air pollution in developing countries as one of the four most critical global environmental concerns (cited in ITERI, 2002; cited in Unobe, 2003).

IAQ, however, is still a relatively unexplored topic in Malaysia. This study was therefore conducted to examine IAQ from a local perspective. IAQ monitoring was conducted in a selected sample of linked and detached homes in the Klang Valley. Six homes were monitored overall, from two main types of contemporary Malaysian housing designs: terrace (linked) and bungalow (detached) homes. IAQ parameters measured in this study include carbon dioxide (CO_2), carbon monoxide (CO), temperature, relative humidity and air velocity. IAQ measurements were taken for 24 hours at 15 minute intervals each in the most frequently used areas within the monitored homes, namely the living room, bathroom, kitchen, family room, and bedroom. The IAQ data were supplemented with time activity diaries that record the occupants' time of occupancy, activities undertaken during occupancy, and cooling or ventilation techniques used during the IAQ monitoring periods. The results were compared to existing IAQ guidelines and standards, as well as between the monitored areas and homes.

IAQ was found to be generally satisfactory in all six monitored homes. However, the CO_2 and CO contents at times exceeded the recommended maximum IAQ guideline values. Furthermore, the air velocity level in all six monitored homes was well below the minimum air velocity IAQ guideline value recommended by the WHO. Additionally, nonparametric data analysis indicated that statistical differences exist for CO concentration between the monitored homes, as well as air velocity between the monitored areas.

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CHAPTER 1

INTRODUCTION

> "The continuing obsession with outdoor pollution from industries and motor vehicles is quite misleading."
> Sumeet Saksena and Vikram Dayal, India's Tata Energy Research Institute researchers (Kumar, 1997).

> "With all the attention surrounding dangerous levels of smog, ozone, and other pollutants in the air we breathe outdoors, many lose sight of the fact that these same pollutants – as well as pollen and other allergens can easily find their way indoors."
> Mark LaLiberte, American Lung Association's Health House Project building expert and technical advisor (Health and Energy, n.d.).

1.1 Introduction

The main purpose of this chapter is to introduce the topic of indoor air quality (IAQ). Also presented in this discussion is an explanation on the importance of IAQ. In addition, the problem statement, research issues, rationale for research, significance of research, research objectives, and scope and limitations of this study, as well as the thesis organisation are also discussed in this chapter.

1.2 Research Background

Air pollution is usually assumed to be an outdoor phenomenon. Conversely, indoor environments are usually assumed to be free from air pollution (Pollution Probe, 2001; Graham, n.d). In reality, however, indoor environments are far from free of air pollution. In fact, in most indoor environments, there is a continuous air exchange between indoors and outdoors through openings, joints, and cracks in walls, floors, ceilings, and around windows and doors; through opened windows and doors; and