DIURNAL AND DAILY VARIATION OF INDOOR RADON CONCENTRATION IN A BEDROOM FOR THE MONTH OF NOVEMBER 2007

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ABSTRACT

A month hourly measurement of radon concentration was taken in the bedroom of a two story link house in Kuala Lumpur. The house is a typical urban house in Malaysia, constructed with bricks, concrete and cement plaster. These materials are natural sources of radon in the house. The hourly radon concentration was found to vary from 0 $pCiL^{-1}$ to 3 $pCiL^{-1}$. It was found to peak during early morning and to minimize in the evening. The daily average radon concentration varied from 0.2 $pCiL^{-1}$ to 1.0 $pCiL^{-1}$.

ABSTRAK

Satu pengukuran kepekatan radon setiap jam untuk selama satu bulan telah dilakukan untuk sebuah bilik tidur di sebuah rumah dua tingkat di Kuala Lumpur. Rumah tersebut adalah jenis yang biasa bagi rumah bandar di Malaysia, dibina dengan bata, konkrit dan plaster simen. Bahan-bahan ini adalah sumber semulajadi radon dalam rumah. Kepakatan radon setiap jam berubah dari 0 $pCiL^{-1}$ hingga 3 $pCiL^{-1}$. Ianya didapati mempunyai puncak pada awal pagi dan minima pada sebelah petang. Kepekatan radon purata harian berubah dari 0.2 $pCiL^{-1}$ hingga 1.0 $pCiL^{-1}$.

Keywords: Radon, diurnal variation, daily variation, seasonal variation

INTRODUCTION

The only gaseous decay product from the natural decay series is radon. The most abundant isotope is ^{222}Rn with half=life of 3.82 days. Being chemically inert, it can easily diffused through the soil grain into the atmosphere. Radon can also emanate from building material made from soil such as brick, concrete, cement and tiles. Rooms constructed from these materials would have a higher radon concentration especially if the room is poorly ventilated. Besides building material, environmental condition such as temperature and pressure would also influence the indoor radon concentration.

Radon has been shown to be the main contributor (more than 50 %) to the radiation dose received by man from natural sources (UNSCEAR 1988). It would be useful to know how the indoor radon concentration varies with time in order to get a better estimate of the dose received by the occupier of the room.

MEASUREMENTS

The room chosen for this study is the master bedroom on the top floor of a two-storey link house. It is constructed using bricks, concrete and cements plaster. This is a common type of construction for houses in urban area in Malaysia.

The indoor radon concentration was measured using an active radon monitor (Sun Nuclear 1027) that gives average hourly readings. Detection is based on the alpha decay of radon detected by a surface barrier detector. The measurement was part of a one-year measurement project. However, this paper will only report on the measurement done during the month of November 2007.

RESULTS AND DISCUSSION

The radon concentration in the bedroom was found to vary widely throughout the day. It may vary from 0 to 3 $pCiL^{-1}$. As an example, the readings for 5 November 2007 is shown in Figure 1. The radon concentration sees to peak during early morning.

A smoother curve can be obtained by looking at the monthly average at different time of the day, as shown in Figure 2. The daily average varied from 0.2 $pCiL^{-1}$ to 1.0 $pCiL^{-1}$. The radon concentration is maximum at 5.00 am and minimum at 4.00 pm.

Figure 3 shows the daily average radon concentration for different days of the month. It is scattered between 0.2 $pCiL^{-1}$ and 1.0 $pCiL^{-1}$. No trend was found in the daily average.

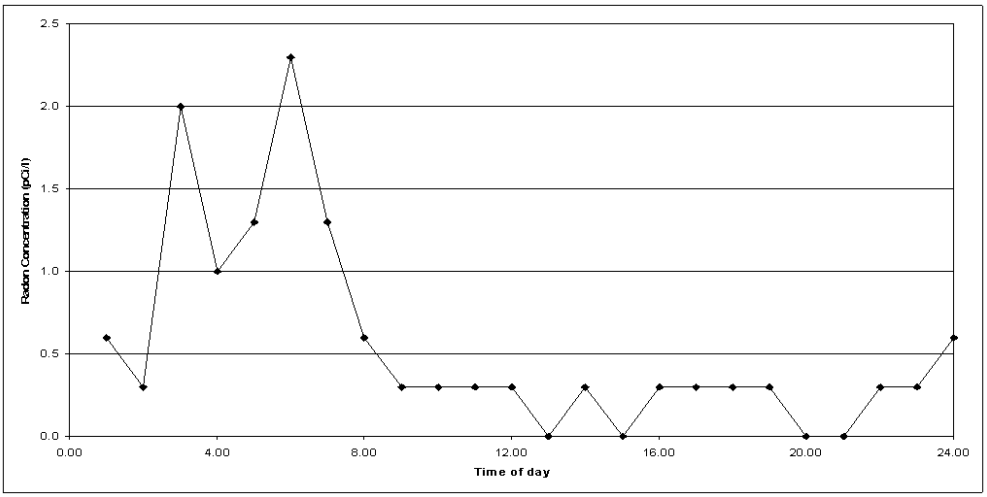

Figure 1: Diurnal variation of radon concentration on 5 November 2007

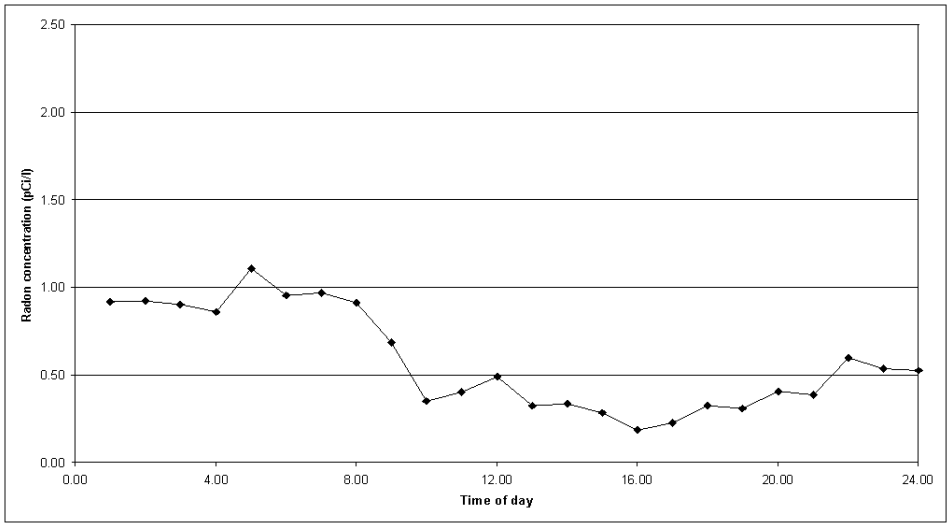

Figure 2: Diurnal variation of average radon concentration for the month of November 2007

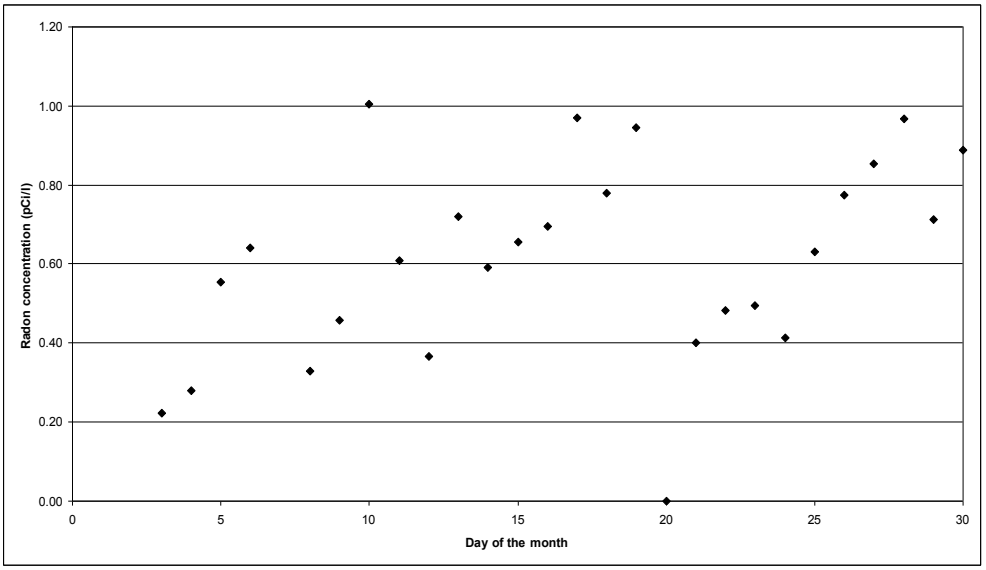

Figure 3: Daily average radon concentration for the month of November 2007

Table 1: Indoor radon concentration in selected countries

Country	Indoor radon concentration ($pCiL^{-1}$)	Reference
Malaysia	0.2 - 1.0	This study
Malaysia	1.17 ± 0.86	Bakar, 2007
Singapore	0.06 - 1.48	Chong *et al*, 1995
Brunei	0.01	Hu and Tan, 2000
Hong Kong	1.16 ± 0.78	Tso and Leung, 1991

CONCLUSIONS

The daily average radon concentration obtained is low and well within the limit of action level **(UNSCEAR 1988).** This is similar with other works done in South-East Asian countries such as Malaysia (Bakar, 2007), Singapore **(Chong *et al*, 1995), Brunei (Hu and Tan, 2000)** and Hong Kong **(Tso and Leung, 1991).** Their results are shown in the Table 1.

The indoor radon concentration was found to vary with the time of the day. There seems to be a maximum concentration at about 5.00 am and a minimum at about 4.00 pm. This could be due to weather conditions such as temperature and pressure.

REFERENCES

Bakar, Z.A., (2007), Average Indoor and Outdoor Radon Concentration and Dose in Ampang Area, Malaysia, *Proc. 3rd Maths. Phys. Sci. Grad. Cong*., P1ID-4

Chong, S., Tan, A. and Ng, T.L., (1995), Radon Review and Indoor Survey in Singapore, Center for Radiation Protection, Singapore

Hu, S.J. and Tan, K.S., (2000), Radon Concentration in Indoor Space, *Pros. Pers. Fizik Keb*. 159-164.

Tso, M.W. and Leung, J.K.C., (1991) Survey of Indoor ^{222}Rn Concentration in Hong Kong, *Health Phys*, 60:237-241

UNSCEAR, Exposure from Natural Sources of Radiation, 1988