Determination of indoor radon concentration in some buildings

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Abstract

In this paper, the indoor radon concentration in some buildings in Yadanabon University was determined by using SSNTD technique with LR–115 type II detector. The alpha track densities, the radon concentration and annual effective dose of the radon were measured by using these data. It was found that the calculated values of radon concentration in the samples varied from 170.85±11.16 Bqm^{-3} to 259.96±13.15 Bqm^{-3}. The average annual effective dose is 2.93 ± 0.19 $mSvyr^{-1}$ to 4.47 ± 0.22 $mSvyr^{-1}$ which is lower than the International Commission on Radiological Protection (ICRP) recommended value, 5 $mSvyr^{-1}$.

Keywords: radon concentration, LR 115 type II detector, alpha track densities, annual effective dose, recommended value.

Introduction

The health effects of radon, most notably lung cancer, have been investigated for several decades. Radium–226 decays to form radon–222 gas. Radon's half–life 3.8 days, provides sufficient time for it to diffuse through soil and into homes, where it further disintegrates to produce the more radiologically active radon daughter. Since radon is constantly escaping from the ground, it is always present in the air, but under certain circumstances the concentration of radon in building can increase significantly over its normal outdoor level. Measurement of indoor radon is rather important because the radiation dose to human constitutes more than 60% of the total dose, including that from the natural sources. Several techniques have been used to measure radon and are daughters concentration.

Materials and Methods

Study Area

The present work is aimed to determine the indoor radon concentration in some buildings in Yadanarbon University. Yadanarbon University is situated on 21°53'19"north latitude and 96°04'21" East longitude. It is located in map of Yadanarbon University in Amarapura as

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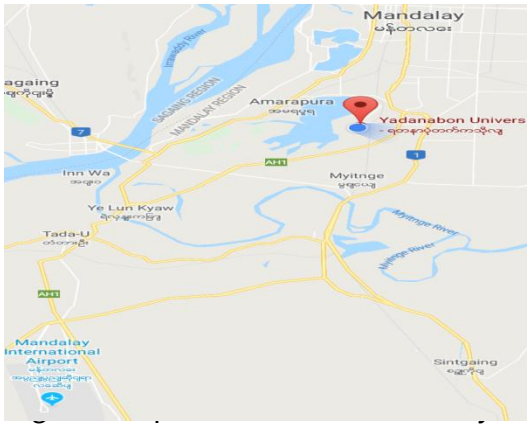
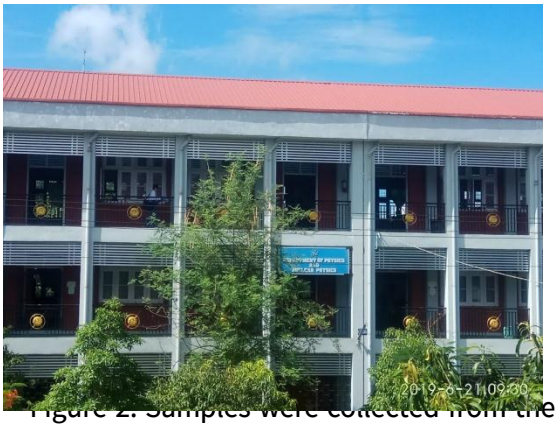
shown in Figure 1 and near the Taung Tha Man Lake. Samples were collected from the department of physics and nuclear physics as shown in Figure 2.



Amarapura



department of physics

Table (1) Samples location at the study area

Sample	location
S–1	ground of the room(first floor of CR–35)
S–2	Wall of the room (first floor of CR–35)
S–3	Outdoor of the room (first floor of CR–35)
S–4	Base of the room (ground floor of CR–35)
S–5	Wall of the room (ground floor of CR–35)
S–6	Outdoor of the room (ground floor of CR–35)

Tables (2) Experimental Conditions

Detector	–	LR–115 type II cellulose nitrate red dyed
Measurement Technique	–	Open technique (or) direct method
Samples	–	six samples in different rooms in Physics department
Exposure Time	–	90 days
Etchant	–	2.5 NaOH at 60˚C
Etching Time	–	60 minutes
Microscope	–	supereyes digital microscope

held

USB digital microscope

PC computer

from S–3 sample

Data Analysis

After etching process, the SSNTDs (LR–115 type II) detector were detected and the alpha tracks were counted by 50 fields of view under a supereyes® microscope. According to the observation of the different views of the microscope, alpha tracks were counted to reduce the statistical errors. Alpha track densities were calculated by the following equations.

$$\text{Average number of track} = \frac{\text{Total number of tracks}}{\text{Number of view}} \quad \ldots\ldots\ldots (1)$$

$$\text{Net number of tracks} = \text{Number of tracks} - \text{Background number of tracks} \quad \ldots\ldots\ldots (2)$$

$$\text{Net number of density} = \frac{\text{Net number of tracks}}{\text{Area of counting} \times \text{Exposure time}} \quad \ldots\ldots\ldots (3)$$

the radon concentration and annual effective dose were calculated by the following equations

Radon Concentration (Bqm^{-3}) = $\frac{\text{Net number of density}}{0.05016}\left(\text{track cm}^{-2}\text{day}^{-1}\right)$ .... (4)

Annual effective dose (Bqm^{-3}) = Radon Concentration × 0.0172 $mSvyr^{-1}$ …..... (5)

Results

Table (1) Alpha track density of the six samples

Sample	Sample Name	Observed number of track	Net number of track	Alpha track density (track cm^{-2} day^{-1})
S–1	Base of room (first floor of CR–35)	16.40 ± 0.41	8.62 ± 0.55	9.49 ± 0.60
S–2	Wall of room (first floor of CR–35)	16.04 ± 0.27	8.26 ± 0.41	9.09 ± 0.45
S–3	Outdoor of room (first floor of CR–35)	15.66 ± 0.37	7.88 ± 0.51	8.57 ± 0.56
S–4	Base of room (ground floor of CR–35)	19.62 ± 0.46	11.84 ± 0.60	13.04 ± 0.66
S–5	Wall of room (ground floor of CR–35)	19.30 ± 0.58	11.52 ± 1.18	12.69 ± 1.29
S–6	Outdoor of room (ground floor of CR–35)	17.72 ± 0.23	9.94 ± 0.83	10.95 ± 0.91

Table (2) Radon concentration and annual effective dose of the six samples

Sample	Sample location	Radon Concentration (Bqm^{-3})	Annual effective dose ($mSvyr^{-1}$)
S–1	Base of room (first floor of CR–35)	189.19 ± 11.96	3.25 ± 0.20
S–2	Wall of room (first floor of CR–35)	181.22 ± 8.97	3.11 ± 0.15
S–3	Outdoor of room (first floor of CR–35)	170.85 ± 11.16	2.93 ± 0.19
S–4	Base of room (ground floor of CR–35)	259.96 ± 13.15	4.47 ± 0.22
S–5	Wall of room–19B (ground floor of CR–35)	252.99 ± 25.71	4.35 ± 0.44
S–6	Outdoor of room–19B (ground floor of CR–35)	218.30 ± 18.14	3.75 ± 0.31

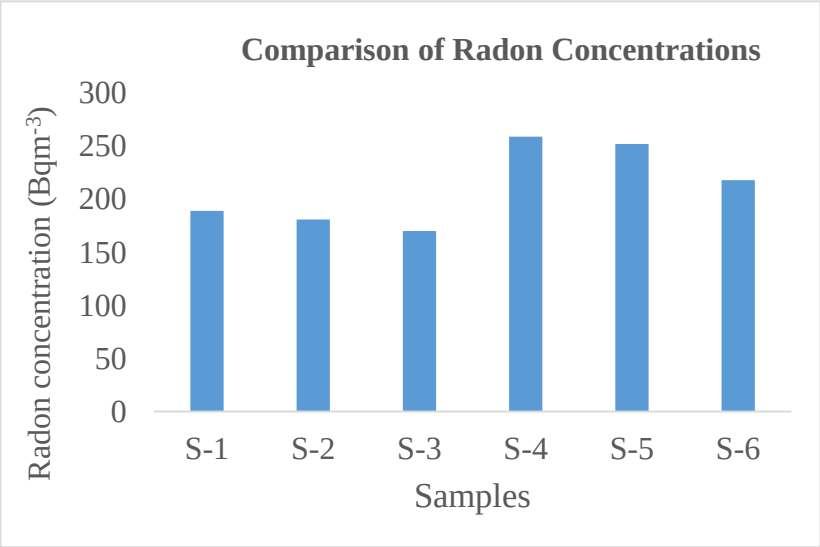


Figure (7) Comparison of radon concentrations of six samples

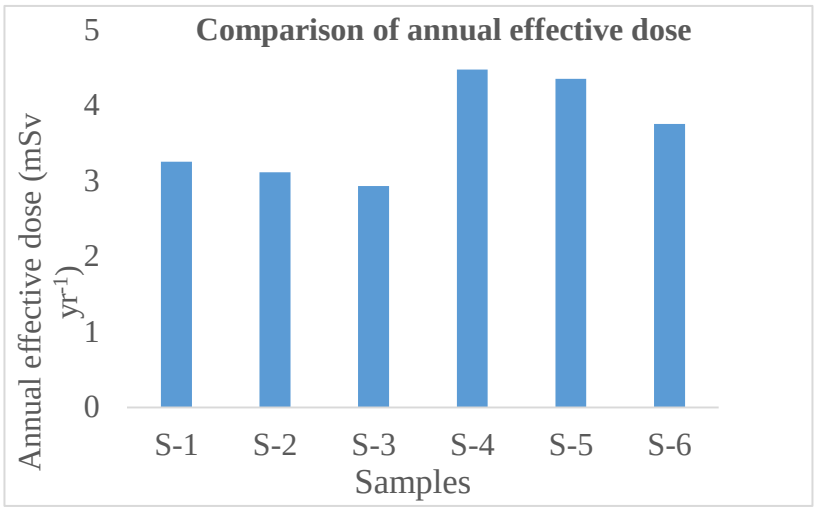


Figure (8) Comparison of annual effective dose of six samples

Conclusion

The radon concentrations were measured in two different rooms in physics department. It is observed that the radon concentrations in the indoor of rooms are higher than the outdoor because the radon gas with the air outdoor has good circulation than indoor. The radon concentrations of the upstairs are lower than those of the downstairs. The results of all samples are lower than International Commission on Radiological Protection (ICRP) recommended value, 5mSvyr $^{-1}$. So, it can be concluded that radon concentration in the buildings at Yadanabon University is not harmful to the people.

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References

A. Mukarram, "SSNTD Experiment lab Report", Oct 8, 2011.

A.S Hussein, ''Radon in the environmental: friend and foe", proceeding of the 3rd Environmental physics conference, 19–23.2008, Aswan Egypt.

P.R.L Fleisher, P.B Price. and R.M Waller, Nuclear Track and Soilds:"Principle and Applications", Berkely: Univ. of California Press, 1975.

R.C Bruno, (1983), "Sources of Indoor Radon in Houses: a Review", J.Air Poll. Contr.Assoc.33,105.

S.A Durrani and R.K Bull.," Solid State Nuclear Track Detectors", Pergamon Press, New York (1987).

http://en–wikipedia–org/w/index.php''(13,Dec, 2013)