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# DETERMINE THE LEVEL OF RADON IN SOME SELECTED ROOMS OF BOYS HOSTEL BLOCK A OF ABUBAKAR TAFAWA BALEWA UNIVERSITY, BAUCHI STATE

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## ABSTRACT
The goal of this paper is to obtain the level of Radon in the boys hostel block A at Abubakar Tafawa Balewa University (ATBU). The level of Radon has been obtained. Room 4 has been considered with the highest level of Radon for both day and night. It is noted that Radon is higher at night compared with day time.
**Keyword:** Radon, Boys Hostel, Room 4 and Block A

## INRODUCTION
Radon is a chemical element with the symbol Rn and atomic number 86. It is a radioactive, colorless, odorless, tasteless noble gas. It occurs naturally in minute quantities as an intermediate step in the normal radioactive decay chains through which thorium and uranium slowly decay into lead and various other short-lived radioactive elements. Radon itself is the immediate decay product of radium. Its most stable isotope, 222Rn, has a half-life of only 3.8 days, making it one of the rarest elements (Bratsch, 1988). Since thorium and uranium are two of the most common radioactive elements on Earth, while also having three isotopes with half-lives on the order of several billion years, radon will be present on Earth long into the future despite its short half-life. The decay of radon produces many other short-lived nuclides, known as radon daughters, ending at stable isotopes of lead (Brenner, 2000). Unlike all other intermediate elements in the aforementioned decay chains, radon is, under standard conditions, gaseous and easily inhaled, and therefore a health hazard. It is often the single largest contributor to an individual's background radiation dose, but due to local differences in geology, the level of exposure to radon gas differs from place to place (Kusky, 2003). A common source is uranium-containing minerals in the ground, and therefore it accumulates in subterranean areas such as basements. Radon can also occur in some ground water like spring waters and hot springs (Saito, 1999). Epidemiological studies have shown a clear link between breathing high concentrations of radon and

incidence of lung cancer. Radon is a contaminant that affects indoor air quality worldwide. According to the United States Environmental Protection Agency (EPA), radon is the second most frequent cause of lung cancer, after cigarette smoking, causing 21,000 lung cancer deaths per year in the United States . About 2,900 of these deaths occur among people who have never smoked. While radon is the second most frequent cause of lung cancer, it is the number one cause among non-smokers, according to EPA policy-oriented estimates (Bader, 2008). Significant uncertainties exist for the health effects of low-dose exposures (Dobrzynski et ., 2017). Unlike the gaseous radon itself, radon daughters are solids and stick to surfaces, such as airborne dust particles, which can cause lung cancer if inhaled (Samet,1992). Boys hostel Block A is a hostel in Bauchi, boys hotel block A is situated in Yelwa, close to Yalwa Primary Health clinic. The hotel is at latitude 10° 16′ 49.3′′ north and at longitude 9° 47′ 42.8′′.

## MATERIALS AND METHOD

### Study Area

The research was conducted in Abubakar Tafawa Balewa University. The University is located in Bauchi, the capital of Bauchi State, Nigeria. The hotel is at latitude 10° 16′ 49.3′′ north and at longitude 9° 47′ 42.8′′.

### Sample Collection

The study took place at the block A boys hostel of Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria. Sampling was conducted in ten rooms of the same building materials, dimension and age. The study took place from January, 2020 to January, 2021. The dimension of the offices was within a floor area of 21 m2, a gross volume of 63 m3 and a net volume of about 56.38 m3 (obtained by subtracting the volume of fixtures). The windows of the rooms were usually kept closed especially during working hours, a typical practice in other workplaces in Nigeria. However, natural ventilation condition involving opening of windows and doors were employed throughout the period of measurement.

The radon gas detector was suspended where the ventilation slits will not be blocked and such that it is at least 1.2 m above the floor, a height in the breathing zone of a seated person (Katase et al., 2017). The detector was at least 0.9 m from windows, doors, or any other potential openings in the exterior walls. No other objects were placed within 0.1 m of the detector. These

positions, which were fixed throughout this work, were maintained since radon level had been discovered to depend remarkably on the sampling position (Doi et al., 2019).

## Measurement

This study employed the use of an active electronic device (Pro3 radon gas detector, model HS71512) for the measurement of indoor 222Rn in some rooms in block A boys hostels of Abubakar Tafawa Balewa University, Bauchi, Bauchi States, Nigeria. The detector has a dimension 4.7×3.1×2.1 inches and an accuracy of±20% or 1 pCi per litre. The detector consists of an ionization chamber with sensor. It has a full scale reading display ranging between 0.0 and 999.9 showing the level of radon gas in pico Curie per litre of air. However, the displayed readings in pCi/L by the detector were converted to Bq/m3 by multiplying the value by 37. The detector is designed to take sample for two days (48 h) before an accurate result can be displayed. Subsequently, for the same location, readings are updated every hour. New values of the indoor radon concentration are displayed if the level of the radon differs from the stored value, previously determined from the 48 h sampling.

## Radiation Dose Estimation

The exposure to radon daughters in the offices was calculated on the basis of the measured radon concentration using the following equation and EPA methodology.

The annual effective dose due to radon in the dwellings has been estimated using the following formula:

$$DE = ER \times DCF \quad (2) \qquad \ldots\ldots 1$$

where, DE is the annual effective dose (mSv y–1) due to radon daughters, ER is the exposure to radon daughter in

WLM y–1 as per equation (1) and DCF is the dose conversion factor (mSv per WLM). For the determination of effective doses in the dwellings, the dose conversion factor of 5.75 mSv per WLM has been used.

The excess lifetime cancer risk (ELCR) due to radon exposure of the population in the dwellings was determined using the following equation based on the methodology described in EPA report.

$$ELCR = ER \times T \times FR \qquad \ldots\ldots 3.2$$

## RESULTS AND DISCUSSION

The results of the study for the radon concentration recorded for the period January 2020 to January, 2021 are presented in Table 1.

**Table 1: Values of Indoor Radon Concentration in the day and night (January, 2020 to January, 2021)**

| Rooms identity | Mean Radon conc. in the day time | Max. conc. in the night time |
|---|---|---|
| ROOM1 | 24.8 | 25.5 |
| ROOM2 | 24.7 | 25.5 |
| ROOM3 | 25.6 | 29.1 |
| ROOM4 | 34.2 | 36.0 |
| ROOM5 | 22.2 | 24.1 |
| ROOM6 | 24.7 | 27.1 |
| ROOM7 | 20.4 | 23.6 |
| ROOM8 | 19.3 | 23.0 |
| ROOM9 | 19.2 | 23.5 |
| ROOM10 | 20.5 | 24.8 |

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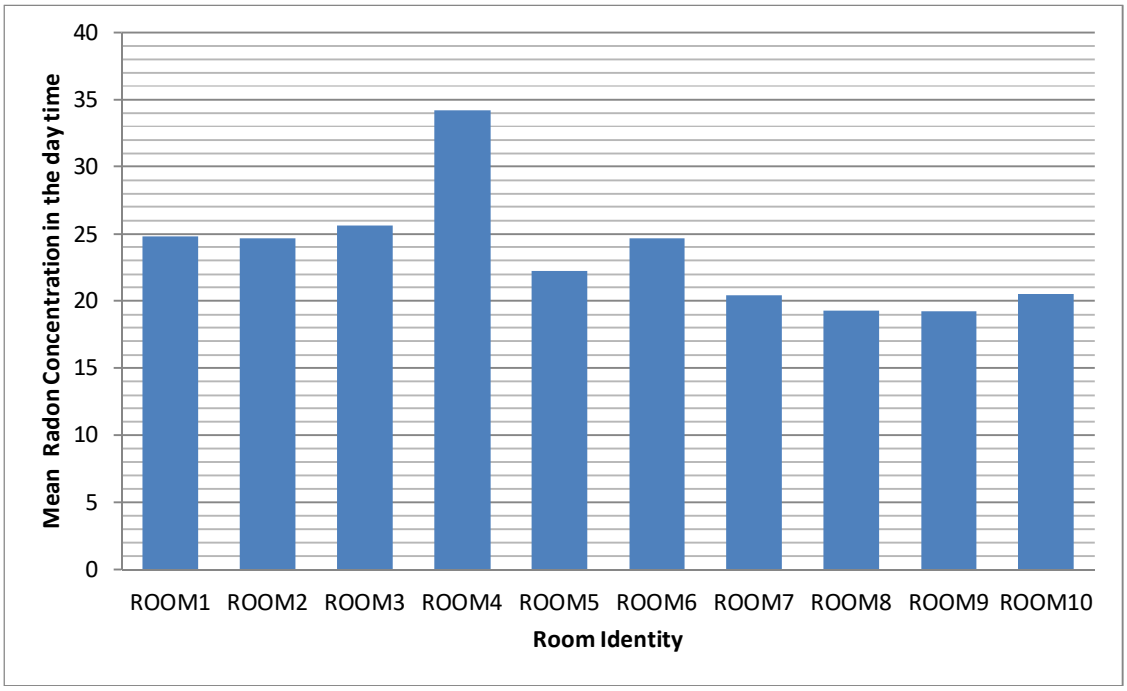


Fig 1: Room identity against Mean Radon Concentration in the Day time

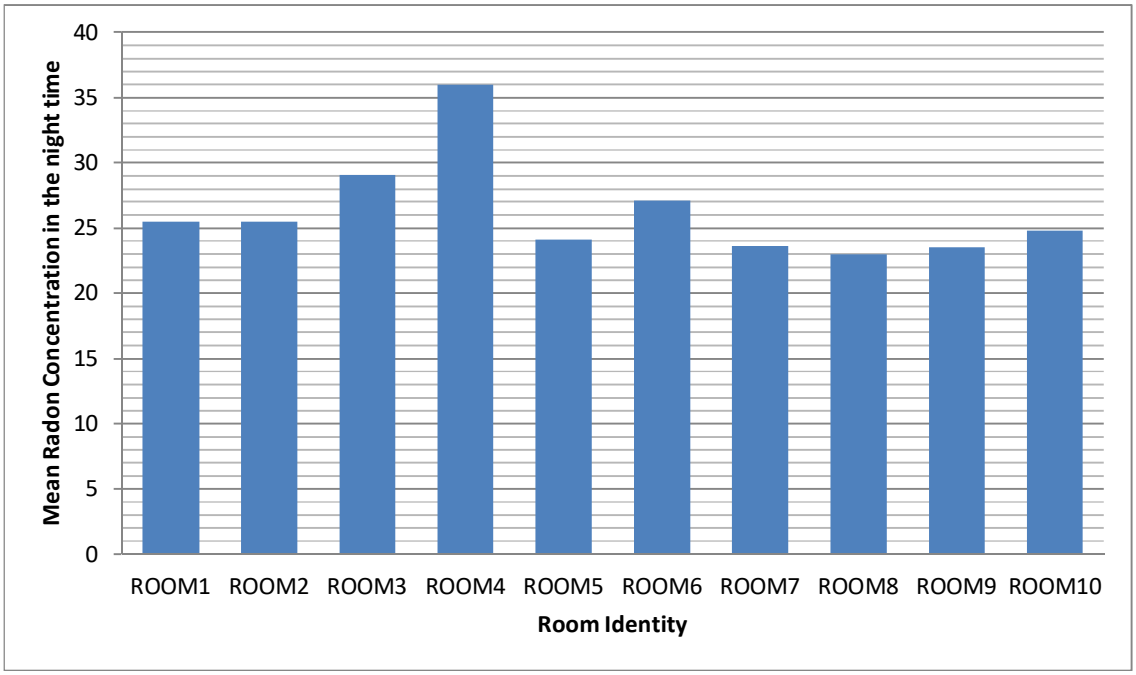


Fig 2: Room identity against Mean Radon Concentration in the night time

Figure 1 show for Room identity against mean Radon concentration in the day time. The figure indicate that Room 4 has the highest level of Radon follow by the following Rooms 3, 1, 6, 2, 5, 7, 10, 8 and 9.

Figure 2 indicate that Room identity against Mean Radon Concentration in the night time. The figure shows that Room 8 has the lowest level of Radon follow by the following Rooms 9, 7, 5, 10, 1, 2, 6, 3 and 4. Observing the both figures of day and night indicate that the Rooms have higher Radon during the night than during the day time. Among all the Rooms for both day and night Room 4 has the highest level of Radon.

## CONCLUSION

Radon is considered present in all the Rooms for both day and night. Also Room 4 has the highest level of Radon for both day and night. The lowest level Radon during the day time is Room 9 while during the night is Room 8.

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