Radiation Protection Measurement in Different Buildings of King Abdulaziz University, and Evaluation of Awareness among Employees

Abstract

The study aims to measure ionizing radiation in different buildings of King Abdulaziz University and evaluate awareness among the University's employees. Twenty buildings in the University were surveyed in order to measure the ionizing radiation emitted from the buildings. These buildings are classified as new and old buildings while noting that the construction of the new buildings has made use of a range of radiation-emitting sources. The sodium iodide survey meters (Fh-40 and Dsm-500-Sn: D5002001) estimated the dosage rate for the building data. Ionization radiation awareness was measured by distributing a questionnaire to university staff (71). If any, the University's 20 buildings were inspected for ionizing radiation. The faculty of sciences recorded the highest radiation value in the group of new buildings and was 0.9 mSi/Y. In contrast, the lowest value recorded from the I-One building was 0.6583266 mSi/Y. The highest radiation value in the group of old buildings, recorded by the faculty of tourism, was 0.403236 mSi/Y. The lowest result was 0.2524608 mSi/Y from the Faculty of Dentistry. The present study shows that KAU new buildings have a 3 times higher average exposure dosage rate than existing ones. The radiation level of all 20 KAU buildings is below the safety limit (1mSv/y) (ICRP, 2000). Thus, King Abdulaziz University buildings emit safe radiation that does not affect students or staff. University workers have little radiation awareness. Employees should take ionizing radiation awareness classes. This is Saudi Arabia's first research on university personnel' radiation awareness.

Keywords: *Radiation protection, Buildings, Awareness, Employees, KAU*

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Introduction

King Abdulaziz University is a prestigious university in the Kingdom of Saudi Arabia; its buildings are expanding significantly with a clear increase in its employees. Therefore, we found a necessary and urgent need to ensure that its buildings and facilities are free from ionizing radiation harmful to the health of staff and students.[1] We have accomplished this important and recent research of its kind.

Constructions of the new buildings at the University of King Abdulaziz were using granitic rocks as building materials. Some radioactive elements such as (U, K, and Th) are contained in the Granitic rock that releases ionizing radiation with time.[2-5] The ionizing radiation could affect the health of humans.[2, 6] Several studies have recently been conducted to evaluate ionizing radiation levels emitted from the buildings, in which a variation in measurements has been reported.[3, 5-18]

Materials and Methods

The 20 buildings that were surveyed at the King Abdulaziz University for the measurement of the ionizing radiation emitted from the buildings. The classifications of these buildings are set as new and old buildings, noting that the construction of the new buildings has made use of a range of radiation-emitting sources.[19] The detectors used are a Sodium iodide survey meter (model: Fh-40) and a sodium iodide survey meter (model: Dsm-500-Sn: D5002001). These detectors were utilized to estimate the dose rate data from the buildings. Geohazards Research Center, KAU, supported us by providing the required equipment. The survey followed the following steps. First, a wipe sample was taken from the walls. Then, a second wipe sample was taken from the columns.

The last wipe sample was taken from the floors. A questionnaire was built for 71 employees in order to measure their awareness of ionization radiation for the first time in the kingdom's university

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Results and Discussion

The amount of radiation emitted by buildings was measured in (mSi/Y). **Table 1** illustrates that 20 buildings in the KAU were surveyed in order to measure ionizing radiation emitted from them. The highest radiation value in the group of new buildings was recorded by the faculty of sciences and was 0.9 mSi/Y. In contrast, the lowest value recorded from the I-One building was 0.6583266 mSi/Y. The highest radiation value in the group of old buildings, recorded by the faculty of tourism, was 0.403236 mSi/Y. In comparison, the lowest value recorded was from the Faculty of Dentistry and was 0.2524608 mSi/Y. **Figure 1** showed the highest dose rate in new and old buildings with P-value < 0.05). **Figure 2** shows the lowest dose rate in new and old buildings with a P-value <0.05. The average exposure doses were 0.845 mSv/Y and 0.306 mSv/Y for new and old buildings, respectively. The highest dose rate, 0.9 mSv/y, was recorded by the Faculty of Sciences. It is very close to the global radiation safe limit of 1 mSv/y. **Figure 3** illustrates the total attendance of the radiation protection course, were the highest percentage 80% was did not attend.

Regarding part two of the current research, **Figure 4** illustrates the total awareness of the employees in KAU. 77% of 75 employees have a low level of awareness towards radiation protection and its hazards. Only 20% of 75 have attended radiation protection courses.

Table 1. 20 buildings in the KAU were surveyed to measure the ionizing radiation emitted from them. The average exposure doses were 0.845 mSv/Y and 0.306 mSv/Y for new and old buildings, respectively.

Faculties (New)	Average (mSv/Y)	Faculties (Old)	Average (mSv/Y)
Faculty of Engineering	0.709	Faculty of Economics and Management	0.290
Faculty of Earth Sciences	0.690	Faculty of Applied Medical Sciences	0.305
Faculty of Marine Sciences	0.711	Faculty of Tourism	0.403
Faculty of Meteorology and Environment	0.660	Faculty of Medicine	0.281
Faculty of Sciences	0.900	Faculty of Pharmacy	0.295
Building 435	0.765	Faculty of Dentistry	0.252
Building 434	0.837	King Fahad Medical Research Center	0.288
I-One	0.659	Basic Health Sciences No. 1	0.393
Building 471	0.728	Basic Health Sciences no.2	0.281
Faculty of Medical Rehabilitation Sciences	0.789	Basic Health Sciences no.3	0.306

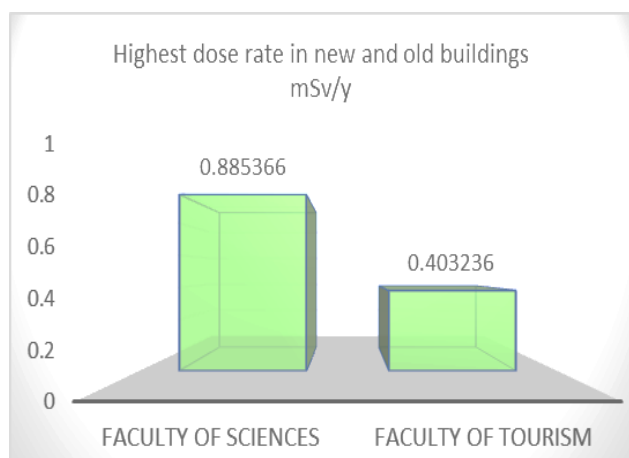
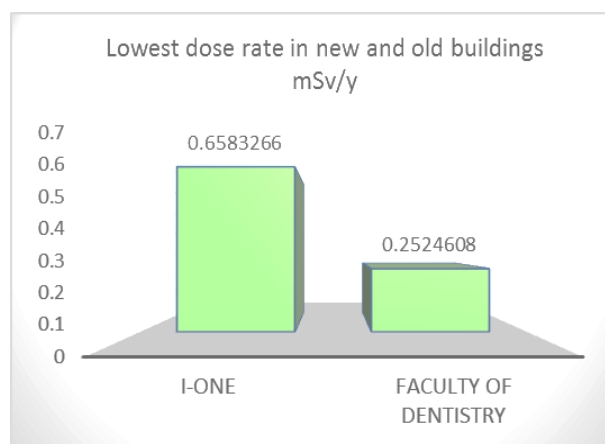Figure 1. The highest dose rate in new and old buildings (P-value <0.05).

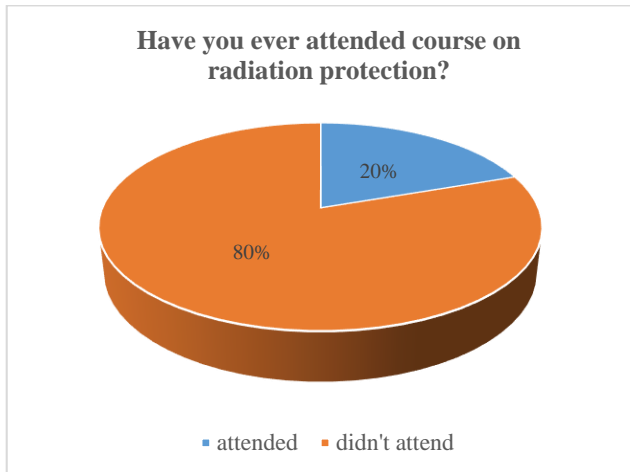Figure 2. The lowest dose rate in new and old buildings (P-value <0.05).

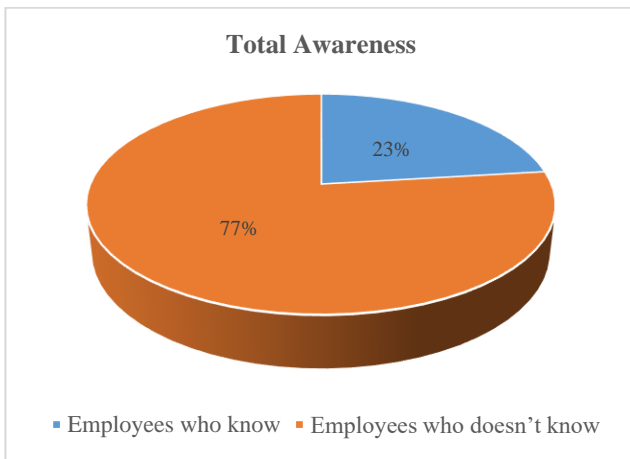**Figure 3. Total attendance of radiation protection course.**

Figure 4. Total awareness of the employees.

The purpose of this study is to measure ionizing radiation in different buildings of King Abdulaziz University and to evaluate awareness among the University's employees.

It could be noticed from our survey the KAU new buildings' average exposure dose rate (0.845 mSv/Y) was nearly close to the global radiation safe limit but was not acceding it.[20] This finding was inconsistent with the previous study for KAU,[2] which showed a higher dose rate that was up to (>3.5 mSv/y) in the new buildings of the University (due to the new granitic materials used to cover all surfaces of the buildings).[2] However, their finding was above the global radiation safe limit (1 mSv/y) according to ICRP, and it could affect the health of employees and students.[21]

It was found that in the current research, the KAU new buildings' average exposure dose rate was about 3 times greater than the average exposure dose rate of the old buildings.[22] This indicates that the use of granite rocks in the construction of the new buildings of KAU leads to an increase in the radiation dose rate; this finding was consistent with previous work.[2, 12]

All buildings we surveyed were under the global radiation safe limit with an average dose rate of (0.5258 mSv/y) and a minimum dose rate of 0.252 mSv/y. This is partly consistent with Aboud *et al*. [2] regarding the old building only. Their average dose rate was (0.714 mSv/y), and the minimum recorded dose rate was (0.1359 mSv/y)). The highest dose rate we detected was 0.90 mSv/y, as shown in **Table 1**, which is close to the global radiation safe limit (1 mSv/y). On the other hand, studies performed in different places all around the world [3, 4, 6, 8, 15, 16] showed results inconsistent with our findings, exceeding the global radiation safe limit; hence, it varies between ~1.0 mSv/y to 4.070 mSv.

The main findings in the questionnaire of the current study are that most participants, 55 (77%) out of 71 employees, indicate a considerable lack of awareness about radiation and protection. Furthermore, most of the participants, 57 (80%), reported that they had never attended a course on radiation protection.[23] However, there is similar research for measuring the awareness of employees about radiation and protection.[18] It was carried out at the Federal College of Education, Kontagora, Niger State, Nigeria, indicates a similarity of insufficient awareness of participants in their research. It showed that 10 (28.6%) out of 35 employees were totally showing a lack of awareness about ionizing radiation and their health impairment. Another similarity in this study is that most of the participants in the research did not attend any course in radiation protection and did not take any precautionary measures to avoid radiation hazards.[18]

Conclusion

The KAU new buildings' average dose rate is about 3 times greater than the average dose rate of the old buildings. Most of the 20 surveyed buildings of the KAU have radiation dose rates below the global radiation safe limit (1mSv/y) according to (ICRP, 2000). Therefore, the radiation emitted from the buildings of KAU is considered low and does not have a harmful effect on the employees. As with regards to the awareness of university employees towards radiation, the awareness levels were low. The recommendation for the employees is to attend intensive educational courses for the purpose of raising awareness levels with regard to ionizing radiation and the damages that arise from it, and we suggest that it can be once during the academic year. However, It is the responsibility of the Radiation Protection Center in KAU to spread awareness among them. This is the first study in Saudi Arabia investigating the awareness of radiation among employees of the universities.

Conflict of interest
None.

Financial support

None.

Ethics statement

None.

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