FACTOR AFFECTING RADIATION EXPOSURE IN BUILDING OF UiTM PERAK

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Abstract: The paper consider the radiation study in UiTM Tapah building. The objective of this study is to measure radiation dosage in UiTM Tapah building and differentiate the radiation by building design and variable time. The radiations were measured using a survey meter in terms of µSv/hour. Four different buildings at UiTM Tapah have been selected and survey meter equipment is used to measure the radiation dosage in the buildings. Each place of building is measured in a three points of locations with a distance of 1 meter of each point. The reading was taken 1 meter from the ground and preparation was setup before the reading obtained. The highest radiation observed is 0.770 µSv/hour at PTAR library and the lowest is 0.350 µSv/hour at College Gamma. The type of building design and variable time give the significant differences values of radiation at UiTM Tapah buildings.

Keywords: *Radiation, factor, building design, variable time.*

INTRODUCTION

Buildings are very important in human life because most of people spend about 80% of their time indoors. Buildings hold significant importance in the lives of individuals since a substantial majority, approximately 80%, of people allocate their time predominantly indoors (Lu et al., 2014). According to Yasir research (2007), radiation from buildings is due to the presence of natural radionuclides in the building materials element such as from rock, soil, brick, sand, cement and tiles. Radiation exposure from natural sources contributes about 87% of the total dose received by the public. People received radiation dose from gamma and alpha radiation emitted by radionuclides present in building materials. The naturally occurring radionuclides in contribute to radiation exposure in two ways. First, the external radiation originating from gamma radiation and the internal radiation due to radon inhalation, leads to deposition of decay products in the respiratory tract (Tchorz-Trzeciakiewicz et al., 2019). The type of radiation in the environment is commonly from gamma radiation, composed from ionizing radiation. The aim of the study is to measure the radiation dose in UiTM Tapah buildings and differentiate the radiation in terms of factor building type and variable time. The highest dose is 0.770 µSv/hour and the lowest is 0.350 µSv/hour.

METHODOLOGY

Study areas were selected from four different buildings located at Universiti Teknologi MARA (UiTM) Perak, Tapah Campus based on the building design or construction type that was categorized into two categories: opened space buildings (Cafe Plaza and Gama College) and closed space buildings (PTAR Library and Physics Laboratory). The areas are the common space frequently used by the UiTM locals. Portable survey meters with Radiation Alert® Observer USB Software are used to detect the radiation for six days within three consecutive weeks. Each location was measured for the same period of time. The measurements were taken one meter above the floor in the center of the room. The radiation readings are taken from three points of location with a distance of 1 meter of each point.

FINDINGS

The radiation dose and its mean for both opened and closed space buildings is illustrated in Figure 1 and 2.

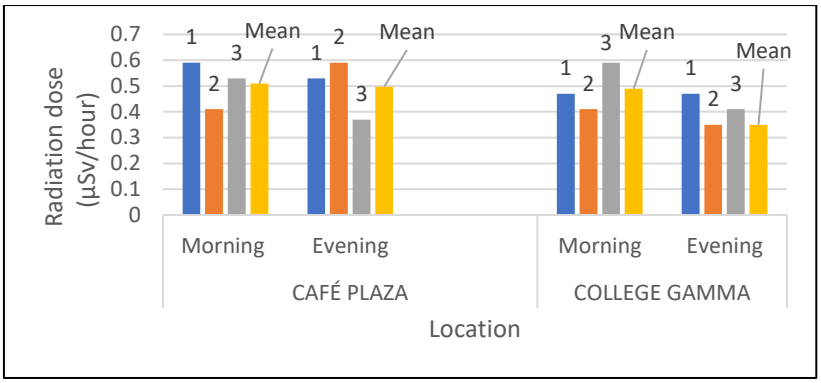

Figure 1. Radiation dose rate in opened space buildings

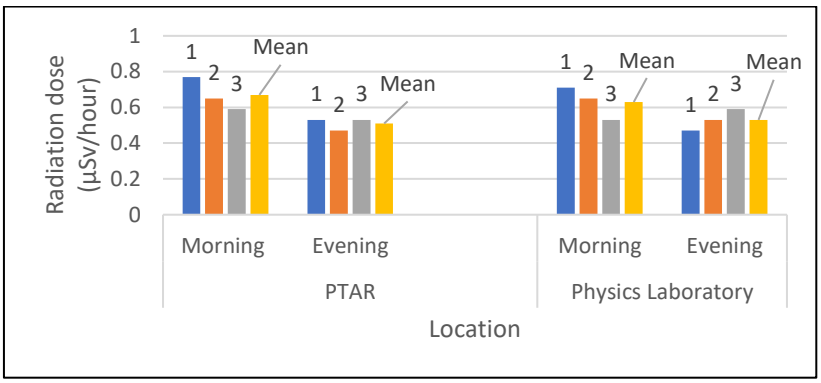

Figure 2. Radiation dose rate in closed space buildings

Figures 1 and 2 show that closed space buildings have experienced the highest radiation levels compared to opened space buildings. Specifically, the PTAR Library recorded a radiation level of 0.770 µSv/hour, while the Physics laboratory measured a slightly lower level of 0.710 µSv/hour in morning session. Meanwhile for opened space building, College Gamma has been found to exhibit the lowest radiation level, measuring at a rate of 0.350 µSv/hour. In contrast to open space buildings, which employ more construction materials, closed space buildings are designed with totally enclosed buildings. Hence, more radiation in those buildings compared to open space buildings. A previous study found that rock is the main component of most Malaysian building materials. Naturally emitting radionuclides are found in all rocks. Though, the radiation hazard indexes of building materials were lower than the maximum value (Yasir et al., 2007). Sand, concrete blocks, and cement increased indoor radon concentration when used simultaneously for construction, according to Amin (2015). This is due to the different in nature and content of the sample in construction material. The terrestrial radiation also occur due to primordial radionuclides and radionuclides are present in rocks, soils, building materials, water and air at concentrations that differ from place to place, especially depending on the geology of the region. The building material usually consists of radium that generate radon to migrate into the building. Radon is trapped in building materials and emit gamma radiation which cause exposure to the building occupant. (Okeyodea et al., 2019). Construction design gives a significant factor in the radiation dose in a building. However, all the radiation value varies from one building material to another.

The mean radiation for opened and closed buildings is summarized in Table 1. Based on Table 1, PTAR library and Gamma College recorded the highest mean radiation dose in the morning compared to the evening for both types of building design.

Table 1. Mean radiation dose in buildings

		Mean Radiation dose (µSv/hour)			
Design Type		**Closed Space**		**Opened Space**	
Location		PTAR Library	Physics Laboratory	Cafe Plaza	Gamma College
Session time	Morning	0.670	0.630	0.510	0.490
	Evening	0.510	0.530	0.497	0.350

The earth's surface is in a stable condition at night until early morning, thus the surface layer and atmosphere have almost the same temperature, allowing radon to accumulate near the surface. During the day it causes the difference between surface and atmosphere temperature as the temperature rises during the day. Heat transfer process occurs and the atmospheric surface layer becomes unstable and produces convection. Hence, radon gas upward and spread away from the surface. In the evening, the surface temperature began to decrease, and the opposite behaviour of radon. This stabilizes the atmospheric conditions, allowing radon to gather again close to the earth's surface (Chao et al., 1997, Khalid et al., 2013). Thus, the morning radiation is observed to be higher compared to the evening. Also, according to Nuclear Malaysia, the exposure dose limit for the public is set at 1 mSv/ year. The findings show that the radiation in buildings is significantly low and not harmful to humans.

CONCLUSIONS

The radiation dose in buildings is concluded to be related to two main factors; the type of building or construction, whether it is a closed space or an open space, and the variable time. The closed space buildings have higher radiation dose compared to the opened space building detected at PTAR Library with 0.770 µSv/hour and the lowest radiation is 0.350 µSv/hour at Gamma College. In closed space, morning radiation reaches 0.670 µSv/hour, while evening radiation in opened space is 0.350 µSv/hour. The study also reveals that the radiation doses in the building of UiTM Tapah, Perak were found to be below 1 mSv, indicating a small amount of radiation and within safe limits for human exposure. Further research will focus on the specific materials and elements employed in various structures, as well as the radiation type.

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