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Real-Time Radiation Monitoring at Outdoor of Mitford Hospital Campus and Estimation of Radiation Risk on Public

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The objective of the present work is to:

(i) examine the distribution of outdoor environmental gamma radiation dose rates around the Mitford Hospital Campus, Dhaka;
(ii) Calculate the annual effective dose on public and estimation of the excess life-time cancer risk (ELCR) based on real-time radiation data.

Introduction:

The natural gamma radiation dose rate is an important contribution to the average dose rate received by the world's population. Various surveys of indoors & outdoors gamma radiation have been performed in advanced countries, but relatively few have been conducted in developing countries. Estimation of the radiation dose distribution is important in assessing the health risk to a population, and to serve as the reference in documenting changes to environmental radioactivity in soil due to human activities. Large variations in dose rates due to environmental gamma radiation are found depending on where the measurement is made. Human beings are exposed indoors & outdoors to the natural gamma radiation that originates predominately from the upper 30 cm of the soil materials.

Biological effects of ionizing radiation on human are evaluated based on the effective absorbed dose rate. Annual effective absorbed dose from background gamma radiation was determined using the algorithm below :

$E_{total} = E_{Out} + E_{In} = (D_{Out} \times OF_{Out} + D_{In} \times OF_{In}) \times T \times CC$

$E_{Out} = T \times D_{Out} \times CC \times OF_{out}$

$E_{In} = T \times D_{In} \times CC \times OF_{In}$

Where E_{total} is the total annual effective absorbed dose rate (mSv/y), E_{In} is the indoor annual effective absorbed dose rate (mSv/y), E_{Out} is the outdoor annual effective absorbed dose rate (mSv/y), T is time in hours (8760 hours for a year), D_{In} is the absorbed dose rate in indoor (nSv/h), D_{Out} is the absorbed dose rate in outdoor (nSv/h), OF_{In} is the indoor occupancy factor (80% for indoor), OF_{out} is outdoor occupancy factors (20% for outdoor) and CC is Conversion coefficient (0.7 Sv·Gy^{-1} for adult) reported by UNSCEAR (2000) to convert absorbed dose in air to the effective dose in human.

Materials and Methods:

A portable gamma scout detector was used. The study was conducted in the months of January-March 2020. The field measurement of environmental gamma radiation was based on the assumption that there exist laterally uniform distribution of natural radionuclides in the environment and that the vertical contribution from the soil is limited to the first horizon (10 cm to 30 cm). Measurements were performed twenty one locations of Mitford Hospital. The outdoor environmental gamma radiation dose was measured for 1h for each monitoring place using portable Gamma-scout detector through in-situ technique. The detector was set on a tri-pod at 1m height from the ground level.

Results & Discussion :

The measured outdoor environmental gamma radiation dose rates due to natural sources of radionuclides were ranged from 0.085 μSv.h^{-1} to 0.1901μSv.h^{-1} with an average of 0.145265 ± 0.0251μSv.h^{-1}. No artificial radionuclides were observed in this study.

Fig.1: In-Situ gamma-ray dose rate monitoring set up.

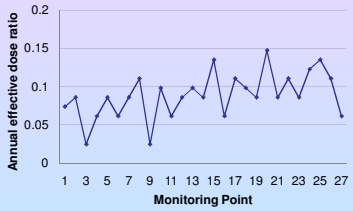

Fig.2: Outdoor annual effective dose values normalized to the minimum annual effective dose for each MP.

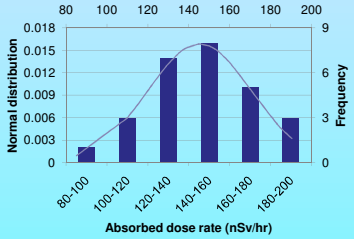

Fig.3: Frequency distribution of the absorbed dose rates (nSv.h^{-1}) at area of Mitford Hospital under Dhaka City follow normal distribution

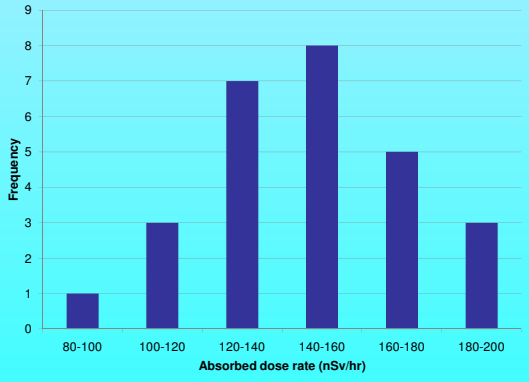

Fig.4: Frequency distribution of the absorbed dose rates (nSv.h^{-1}) at area of Mitford Hospital.

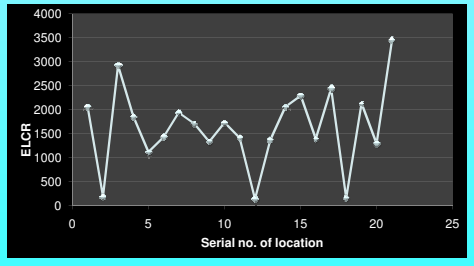

Fig.5: Excess life-time cancer risk (ELCR) on public at outdoor locations of Mitford Hospital Campus, Dhaka.

Conclusion:

This kind of study is required to detect the presence of man-made radionuclides (if any) releasing from the hospital and thereby keeping the environment free from radiation hazard.

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