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A Study of Exposure of Overall Background Radiation In Syangja District of Nepal

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Abstract: *This study presents general exposure of background radiation to the people living or visiting nine places of Syangja district. A portable GM counter was used to quantify the total radiation at those places. The findings of this study show variation of radiation level at different places. Comparatively large values of radiation counts are observed at high altitude places (Gurung Dada: 70.23 cpm and Pokhari Dada: 64.77 cpm). The value of radiation count inside room is comparatively larger than that at outside room for these places. Moreover, small value of radiation count is observed at river side (Bank of Aandhikhola river: 21.63 cpm). Little large values are observed near Saligram stones and ancient statue than at other regions of one historical/religious place. Hence, results show fluctuations of background radiation level for different places. Some places have comparatively large value of radiation count while some places have comparatively small value. But there is no any abnormal value of radiation counts for all sample places. So there is, generally, no significant risk of public exposure to the background radiation for sample places.*

Keywords: Background Radiation, CMP

1. INTRODUCTION

Radiation can be referred as the energy in motion or energy in the form of waves or particles. Radiation is present everywhere around us in many forms. The sources of radiation may be of different types such as radiation from outer space (cosmic rays), radiation from the radioactive atoms present in earth's surface, radiation from our own bodies etc. The dose of radiation varies at different locations. In accordance with energy, radiations can be classified into two types namely ionizing and non-ionizing radiations. Those types of radiations which have sufficient energy to knock out electrons from the outermost orbit of an atom are known as ionizing radiations. These radiations are also known as high energy radiations or strong radiations. Some examples of ionizing radiations are: alpha radiation, beta radiation, gamma radiation, X-ray etc. Whereas, those types of radiations, which lack the sufficient energy required to knock out electrons from outermost orbit of an atom are known as non-ionizing radiations. These radiations are low energy radiations or weak radiations. Some examples are microwave radiation, radio wave radiation, infrared radiation etc.

2. THEORY

2.1 Detection and Measurement of Radiation

There are various instruments for detecting and measuring ionizing background radiation level such as Geiger Mueller (GM) counter, semiconductor counter, environmental radiation monitors etc. Among them the instrument incorporated in this study is GM counter. The schematic diagram of this counter is as follows:

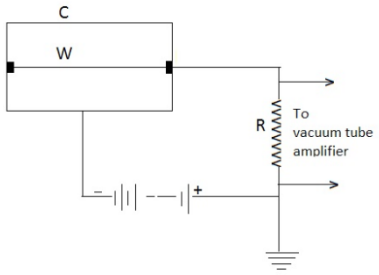

Fig. 1: Schematic Diagram of GM counter

When ionizing radiation such as an alpha, beta, or gamma particles enters the tube, it can ionize some of the gas molecules in the tube. From those ionized atoms, an electron is knocked out of the atom and the remaining atom is positively charged. The high voltage in the tube produces an electric field inside the tube. The electrons that knocked out of the atom are attracted to the positive electrode and the positively charged ions are attracted to the negative electrode. This produces a pulse of current in the

wires connecting the electrodes and this pulse is counted by counter. After the pulse is counted, the charged ions become neutralized and the Geiger Counter is ready to record another pulse. For proper use of the Geiger counter, one must have the appropriate voltage across the electrodes. If the voltage is too low, the electric field in the tube is too weak to cause a current pulse. If the voltage is too high, the tube will undergo continuous discharge, and the tube can be damaged. Usually manufacture recommends the correct voltage to use for the tube. Larger tubes require larger voltages to produce the necessary electric fields inside the tube. This is the photograph of the GM counter employed in this study.

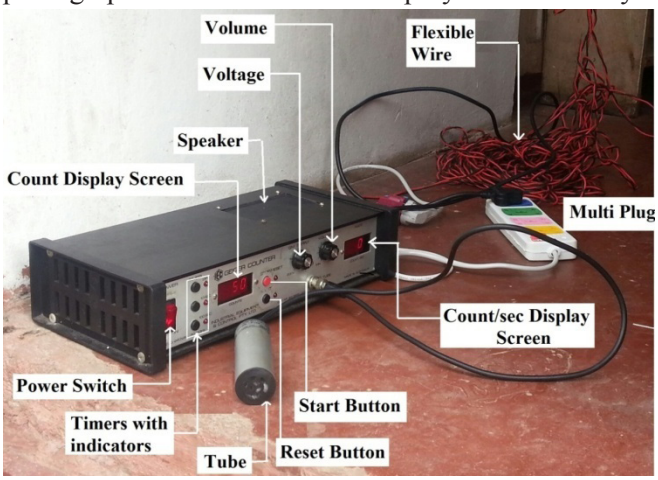

Fig. 2: Instruments Used in Radiation Survey (GM tube set)

3. RESULT

Background radiation counts for different places of Syangja district have been successfully collected with the help of GM counter. Raw data is in count per 100 sec and is converted into count per minute (cpm). Average values and standard deviations of cpm for different places are calculated by using MS Excel. Those can be tabulated as follows:

Table 1: Radiation counts of various places with standard deviation and peak value of count/sec

S.N.	Name of the place	Mean Count Per Minute	Standard Deviation (S.D)	Mean ± S.D
1	Syangja Hospital	28.59	2.77	28.59 ± 2.77 i.e. (25.82, 31.36)
2	Radio Chowk	30.39	3.29	30.39 ± 3.29 i.e. (27.1, 33.68)
3	Mahendra Chowk	34.23	3.48	34.23 ± 3.48 i.e. (30.75, 37.71)
4	Gurung Dada	70.23	15.97	70.23 ± 15.97 i.e. (54.26, 90.2)
5	Aandhikhola Bank	21.63	2.94	21.63 ± 2.94 i.e. (18.69, 24.57)
6	NTC Office	31.52	5.26	31.52 ± 5.26 i.e. (26.26, 36.38)
7	Sanyas Aashram	43.98	9.58	43.98 ± 9.58 i.e. (34.4, 53.56)
8	Pokhari Dada	64.77	9.09	64.77 ± 9.09 i.e. (55.68,73.86)
9	District Hospital	40.48	6.57	40.48 ± 6.57 i.e. (33.91, 47.05)

These average values of background radiation counts for various places are plotted in a bar diagram by taking X-axis as name of the place and Y-axis as average count per minute, which is shown below:

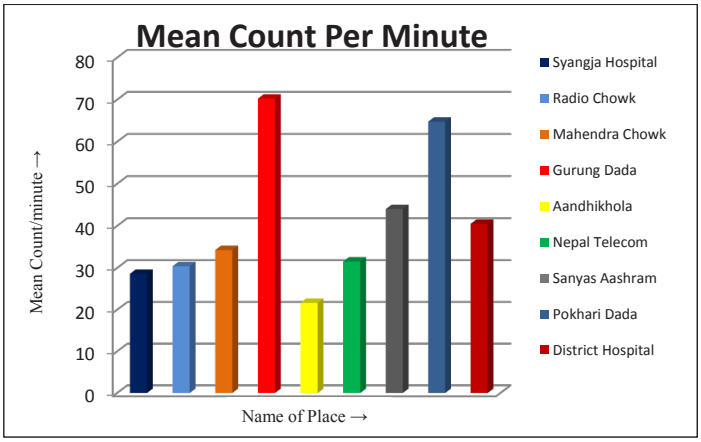

Fig.3: Variation of background radiation at different places

There are no significantly large fluctuations in the arrival of radioactive particles inside GM tube for six places while moving it at variety of regions of the same place. So counts are placed in same category. But for three places there are significant fluctuations in the count rates while moving the device at several parts. So the data are further categorized into two or three parts and average values and standard

deviations of separate parts has also been calculated. Those can be tabulated as follows:

Table.2: *Variety of Observations at Three Places*

S. N.	Places	Variety of Regions	Mean Count Per Minute	Standard Deviation
1	Gurung Dada	Inside Room	78.73	7.41
		Outside Room	46.44	2.99
2	Pokhari Dada	Inside Room	68.44	7.33
		Outside Room	53.76	1.73
3	Sanyas Aashram/ Temple	Outside Temple/ Aashram	32.7	5.9
		Near Shivalinga	41.88	3.94
		Near Saligran Stones and Ancient Statue	52.67	2.3

The average values of background radiation counts of three places (Gurung Dada, Pokhari Dada and Sanyas Aashram/ Temple) for variety of regions are plotted in another bar diagram as follows:

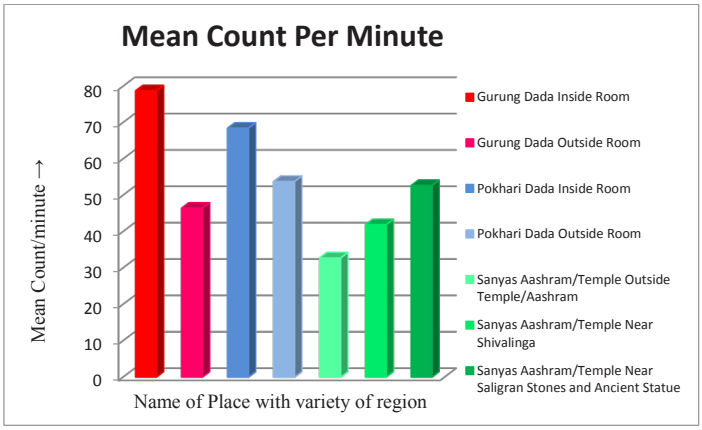

Fig 3: Variation of Radiation at Different Regions of Three Places

4. CONCLUSION

Maximum values of cpm are obtained at two nearly located villages: Gurung Dada and Pokhari Dada (70.23 and 64.77 cpm respectively). These values are higher than the values obtained at other places. In general sense, this may be due to the high exposure to cosmic rays because these villages lie at high altitude than other places mentioned above. But this explanation may not be fitted here because the background radiation count is maximum inside the rooms (78.73 and 68.44 cpm resp.) than at the free environment (46.44 and 53.76 cpm resp.). So we can have another explanation that the high radiation may be due to the presence of little amount of radioactive nuclides in house building stones and soil because insider radiation level is greater than outsider. Our instrument does not tell about the type of radiation present but we can roughly say that the detected radiations are mostly of gamma type because there was no significant change in count rates while blocking the window of the tube by thick materials. So we can guess that the detected radiation is enriched with highly penetrative gamma radiation.

The minimum value of radiation was observed at the bank of Aandhikhola river (i.e. 21.63 cpm). This may be due to absence of vegetations and radioisotopes enriched stones and sand. There may be another reason that low radiation is due to more absorption of cosmic rays by the dense atmosphere because Aandhikhola river lies at lower height than other places.

There is no doubt in saying that high energetic ionizing radiations are used in hospitals for X-ray technology or other medical procedures. Several studies had already been performed to know about the extent of occupational exposure to the radiations at hospitals. But this study does not focus on occupational exposures rather it focuses on public exposure to background radiation level. Observation have been carried out outside the hospital so as to check whether the ionizing radiations used in hospitals have higher range to produce harm to public. By analyzing the observations taken near Syangja Hospital Pvt. Ltd. And District Hospital (28.59 and 40.48 cpm), it can be said that there is no significant effect of high energy radiations used in hospitals to the public because we observed second minimum count near Syangja Hospital Pvt. Ltd. and little more but not maximum count at District Hospital; Kumalgaam, Syangja.

There may be one supposition that signal broadcasting areas have high dose of harmful radiation than in other normal places. But the observation is opposite to our supposition because background counts observed at signal broadcasting areas (Radio Chowk and NTC office area) are not significantly high (30.39 and 31.52 cpm). The main reason behind this may be that the GM counter used in this study just only counts high energy alpha, beta and gamma radiations and cannot detect microwaves and radiowaves used in these types of signal broadcasting stations as the energy of these

kinds of radiation is not enough to produce ionization. Radiation count for Mahendra Chowk (High residential area) is comparable (i.e. 34.23 cpm) to signal broadcasting areas. This may be because these places are near and located at nearly same height and net contribution of high residents to the background radiation level is negligible.

A little high value of background radiation (as compared to previous values) has been observed at Shree 1008 Champagiri Sanyas Aashram/Temple, Gundhikhola (i.e. overall 43.98 cpm). The overall average value is not significantly different from previous values but this is the average of three different values observed at three regions: outside Temple/Aashram (32.7 cpm), near *Shivalinga* (41.88 cpm) and near *Saligram* stones and ancient statue (52.67 cpm). By observing these values it can be said that the area near Shivalinga is more radiated than outer environment and the area inside the temple containing Saligram stones and ancient statue is more radiated than outer environment and area containing Shivalinga.

5. RECOMMENDATION

Findings of this or this type of research can be used to confirm and plan strategies related to possible radiation related problems in the particular area. It can also be used to raise public attention and awareness on the subject so as to help in promoting an understanding of the general feature of environment because this type of study helps to know about the quality of environment in terms of radiation dose and to alert about the radiation risk of the specific area. This research may be helpful to make health policies. This research may also be useful to generalize future investigations related to radiation measurement, which may lead to the exploration of new natural sources of radiation.

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REFERENCES

1. Henriksen, T. (2013).*Radiation and Health*. Oslo, Norway: University of Oslo.
2. Adhikari, P. B., Chhatkuli, D. N. &Koirala, I. P. (2010).*A Textbook of Physics* (Volume II, Third Edition).Kathmandu, Nepal: SukundaPustakBhawan Publisher and Distributors.
3. Background radiation Natural Versus Man-Made (2002).Washington State of Department of Health.
4. Giri, K., Giri, D., Murthy, V.K.(2007). Radiation Measurement at X-ray Centres of a Few Hospitals in Kathmandu City, Nepal (Vol I, No. IV).Dhulikhel, Kavre, Nepal: Kathmandu University Journal of Science, Engineering and Technology