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# ASSESSMENT OF NATURAL RADIATION DOSE RATES IN AND AROUND UKHRUL TOWN OF MANIPUR, INDIA

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## ABSTRACT

The natural background gamma radiation levels were measured in the dwellings of Ukhrul district of Manipur, India using Micro-R survey meter.The measured minimum, maximum and average radiation levels for outdoors were found to be 5.50 ± 0.58, 10.00 ± 0.84 and 7.13 ± 0.77 µR/hrrespectively. Whereas, the measured minimum, maximum and average radiation level for indoors were 5.80 ± 0.84 (Stone wall house with mud floor), 12.20 ± 0.84 (RCC building) and 9.40 ± 0.87 µR/hr respectively. The annual effective dose to the individuals due to the exposure of the natural background gamma radiation levels for Ukhrul district of Manipur based on the present study is estimated to be 0.78 ± 0.08 µGy/year.

## I. INTRODUCTION

Exposure to ionization radiation from natural sources is a continuous and unavoidable feature of human being. There is no place on the Earth where we cannot find natural radionuclides as they are common in rocks and soil that made our planet. Radionuclides $^{238}U$,$^{232}Th$,$^{40}K$,$^{222}Rn$ and$^{220}Rn$ are present in the indoor and outdoor environment constituting the natural background radiation. But the distribution and availability of the radionuclides mainly depends on the geology and geographical characteristics of the place and human activities [1-2]. The presence of natural radionuclides in the construction of buildings may cause increase in the exposure of radiation (gamma radiation) in the general population as most of the dwellers spend almost 80% of their time indoors [3]. Since natural radiation is the largest contributor to the annual effective dose received by the world population, the assessment of the gamma radiation dose from natural sources is the most important and immediate concern to world population because any amount of radiation can be dangerous for its potential effect on the living cells [4-5]. It can disrupt normal chemical processes of the cells, causing them to grow abnormally that could eventually lead to cancer or to cell death.

In view of the above, the knowledge of natural radioactivity as well as dose rate of one place has become important to understand its associated radiation effect of the particular site. The present study is to assess the dose rate of the natural background radiation in the Ukhrul, District of Manipur, India.

## II. EXPERIMENT

**Apparatus:**The survey meter that we used in the experimental work is a Micro-R Survey Meter type UR 705 manufactured by Nucleonix Systems which is designed to measure low level Gamma and X-rays radiation. This portable Survey Meter works with a NaI(Tl) Scintillator offering an optimum performance in counting Low-Level Gamma Radiation dose rate. This unit can measure and display dose rates in the range of 0-10000µR/hr.

**Data collection:**The Micro-R-Survey meter is used for instantaneous measurement of natural radiation level by holding it above 1m from the ground and 1m away from nearby objects like house, car, etc. The site of study is in Ukhrul district of Manipur (Figure 1), the total area is 4,544$Km^2$ with a total population of 183998 as per 2011 census. Natural dose rate was monitored from 49 villages of Ukhrul districtwhich are marked in the map of the district (Figure 2). Natural radiation level was monitored both for outdoor as well as indoor areas.

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## III. RESULTS

The outdoor natural radiation dose rate was monitored from 49 villages of Ukhrul district of Manipur.The findings are placed in Table 1. The minimum, maximum and average gamma radiation level obtained are 5.50 ± 0.58 (Finch Corner), 10.00 ± 0.84 (Naphang tang) and 7.13 ± 0.77 µR/hrrespectively. The indoor natural radiation dose rate was monitored for five houses of different types within this monitoring area. The results are placed in Table 2. The minimum, maximum and average gamma radiation level are found to be respectively 5.80 ± 0.84 (Stone wall house with mud floor), 12.20 ± 0.84 (RCC building) and 9.40 ± 0.87 µR/hr.

## IV. DISCUSSION

The natural background gamma radiation levels were monitored in India by many workers [6-7]. National average dose rate value as evaluated by Nambi*et al.*wasreported to be 9.00 µR/hr [7]. The outdoor average natural background radiation dose rates of the 49 different villages under Ukhrul district arefoundto be almost in agreement to the national average [7].The natural dose rates corresponding to altitudes may be fitted by a straight line with co-efficient of determination $R^2 = 0.02$ as shown in Figure 3. It shows a tendency of increasing dose rate with increasing altitude. One probable reason could be the cosmic effect at higher altitudes.

The indoor background radiation dose rates for the five different houses given in Table 2 shows RCC buildings and Bricks wall houses with concrete floor in the higher sides followed by mud wall houses with mud floor and mud wall houses with wooden floor and stone wall house with least value. This mud floor/wall is associated with the natural soil available in the location. This observation is in agreement with the earlier works of Reddy et al. [6].

The indoor gamma radiation level is observed higher than the outdoor. The probable reason could be due to the gamma radiation emitted from radioisotopes present in the walls of the house.The annual effective dose to the individuals due to the exposure of natural background gamma radiation levels as estimated from the present study for Ukhrul district of Manipur state as0.78 ± 0.08 µGy/year.

## V. CONCLUSION

The observations of this study reveal that the average natural background gamma radiation levels in this study area is in agreement with the national average. The indoor gamma radiation level is observed higher than the outdoor. The indigenous mud and stone based houses in this region show comparatively lower natural background gamma radiation dose rate than the modern type of RCC building or bricks based buildings.

## VI. ACKNOWLEDGEMENTS

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***Table 1: Outdoor natural radiation dose rate of various location of Ukhrul district, Manipur***

| *Sl. No.* | *Location name* | *GPS reading* | *Altitude (m)* | *Average Dose rate (μR/h)* |
|---|---|---|---|---|
| | | | | |
| 1 | Gwaltabi | 24° 55.040'N 94° 8.176'E | 823 | 6.75±0.96 |
| 2 | Thoyee | 24° 55.224'N 94° 9.174'E | 909 | 8.75±0.96 |
| 3 | Shankai | 24° 56.607'N 94°10.239'E | 882 | 6.00±0.82 |
| 4 | MakotChepu | 24°57.013'N 94°11.882'E | 901 | 6.25±0.96 |
| 5 | Litan | 24°57.083'N 94°12.229'E | 914 | 6.67±0.58 |
| 6 | LitanSareikhong | 24°57.005'N 94°12.182'E | 905 | 7.00±1.00 |
| 7 | TM Kasom | 24°58.014'N 94°13.492'E | 933 | 6.75±0.96 |
| 8 | Shokvao | 24°59.927'N 94°15.514'E | 1359 | 7.25±0.50 |
| 9 | Lambui | 25°0.520'N 94°16.561'E | 1437 | 6.50±0.58 |
| 10 | Shanshak | 25°0.058'N 94°19.901'E | 1613 | 6.33±0.58 |
| 11 | Shanshak War Memorial | 25°0.255'N 94°19.868'E | 1663 | 7.50±0.58 |
| 12 | Finch Corner | 25°0.878'N 94°18.652'E | 1349 | 5.50±0.58 |
| 13 | Nungshangkhong | 25°1.907'N 94°19.058'E | 1799 | 7.50±0.58 |
| 14 | HungpungLuson | 25°3.694'N 94°20.603'E | 1799 | 8.00±0.82 |
| 15 | HungpungKazi-phung | 25°3.854'N 94°20.873'E | 1824 | 8.50±0.58 |
| 16 | HungpungAwung tang | 25°4.310'N 94°21.089'E | 1792 | 7.00±0.89 |
| 17 | HungpungDungrei Junction | 25°5.093'N 94°21.424'E | 1839 | 6.00±0.82 |
| 18 | Mini Secretariat Ukhrul | 25°5.511'N 94°21.598'E | 1880 | 8.00±0.82 |
| 19 | Phungreitang | 25°5.811'N 94°21.699'E | 1900 | 5.75±0.96 |
| 20 | Vewland | 25°5.989'N 94°21.653'E | 1885 | 6.00±0.96 |
| 21 | Winobazar | 25°6.291'N 94°21.688'E | 1847 | 6.00±0.82 |
| 22 | Rayotang | 25°6.573'N 94°21.553'E | 1846 | 6.50±0.82 |
| 23 | Awontang | 25°6.913'N 94°21.683'E | 1809 | 5.75±0.58 |
| 24 | Awungtang | 25°7.047'N 94°21.815'E | 1833 | 5.67±1.26 |
| 25 | Luiyainao tang | 25°7.264'N 94°21.915'E | 1831 | 6.75±0.58 |
| 26 | Kharaphung | 25°7.552'N | 1772 | 7.50±1.26 |

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| | | | | |
|---|---|---|---|---|
| | | 94°22.128'E | | |
| 27 | Luishiphung hospital | 25°7.716'N 94°22.310'E | 1713 | 8.00±1.05 |
| 28 | Meizailung tang | 25°7.896'N 94°22.413'E | 1681 | 8.20±0.82 |
| 29 | Naphang tang | 25°8.192'N 94°22.578'E | 1634 | 10.00±0.84 |
| 30 | Kasomtang | 25°7.311'N 94°21.811'E | 1842 | 8.00±0.82 |
| 31 | Kashung tang | 25°7.241'N 94°21.802'E | 1851 | 6.75±0.82 |
| 32 | Alungtang | 25°6.732'N 94°21.693'E | 1825 | 8.60±0.96 |
| 33 | Tangrei | 25°6.633'N 94°21.634'E | 1841 | 8.33±0.55 |
| 34 | Greenland | 25°6.471'N 94°21.791'E | 1831 | 8.25±0.82 |
| 35 | Khampasom tang | 25°5.900'N 94°22.033'E | 1849 | 7.60±1.26 |
| 36 | Harkuikathe tang | 25°5.876'N 94°22.048'E | 1708 | 6.83±0.55 |
| 37 | Seipet tang | 25°5.761'N 94°21.806'E | 1818 | 6.75±0.75 |
| 38 | Mayotang | 25°5.480'N 94°21.836'E | 1823 | 7.20±0.71 |
| 39 | Hamleikhong Block-C | 25°5.253'N 94°21.676'E | 1822 | 6.75±0.79 |
| 40 | Sangmayang | 25°5.407'N 94°22.020'E | 1750 | 6.50±0.71 |
| 41 | BRTF Camp Ukhrul | 25°5.774'N 94°22.447'E | 1680 | 7.00±0.82 |
| 42 | Old Jail Ukhrul | 25°5.671'N 94°22.992'E | 1686 | 7.00±1.00 |
| 43 | Langdangphunghon | 25°6.412'N 94°23.773'E | 1782 | 6.50±0.55 |
| 44 | LangdanPhungcham | 25°7.134'N 94°24.668'E | 1771 | 6.33±0.58 |
| 45 | ShiruiChingkha | 25°7.586'N 94°24.827'E | 1864 | 7.00±0.82 |
| 46 | ShiruiChingthak | 25°7.835'N 94°25.224'E | 1892 | 6.33±0.58 |
| 47 | Phangrei | 25°8.689'N 94°27.757'E | 2004 | 9.75±0.50 |
| 48 | Viewland 3 | 25°6.078'N 94°22.149'E | 1772 | 8.00±0.82 |
| 49 | Kahumtang | 25°6.250'N 94°22.032'E | 1818 | 7.75±0.50 |
| | | | **Average dose rate** | **7.13 ±0.77** |

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*Table 2: Indoor natural radiation dose rate of different types of houses of Ukhrul district, Manipur*

| Sl. No. | Types of houses | Dose rate (μR/h) | | |
|---|---|---|---|---|
| | | Minimum | Maximum | Average |
| 1 | Mud wall house with mud floor | 9 | 11 | 9.80±0.84 |
| 2 | Brick wall house with concrete floor | 10 | 12 | 11.00±1.00 |
| 3 | Mud wall house with wooden floor | 7 | 9 | 8.20±0.84 |
| 4 | Stone wall house with mud floor | 5 | 7 | 5.80±0.84 |
| 5 | RCC building | 11 | 13 | 12.20±0.84 |
| | | | **Average** dose rate= | 9.40±0.87 |


*Figure 1: Map of Ukhrul*

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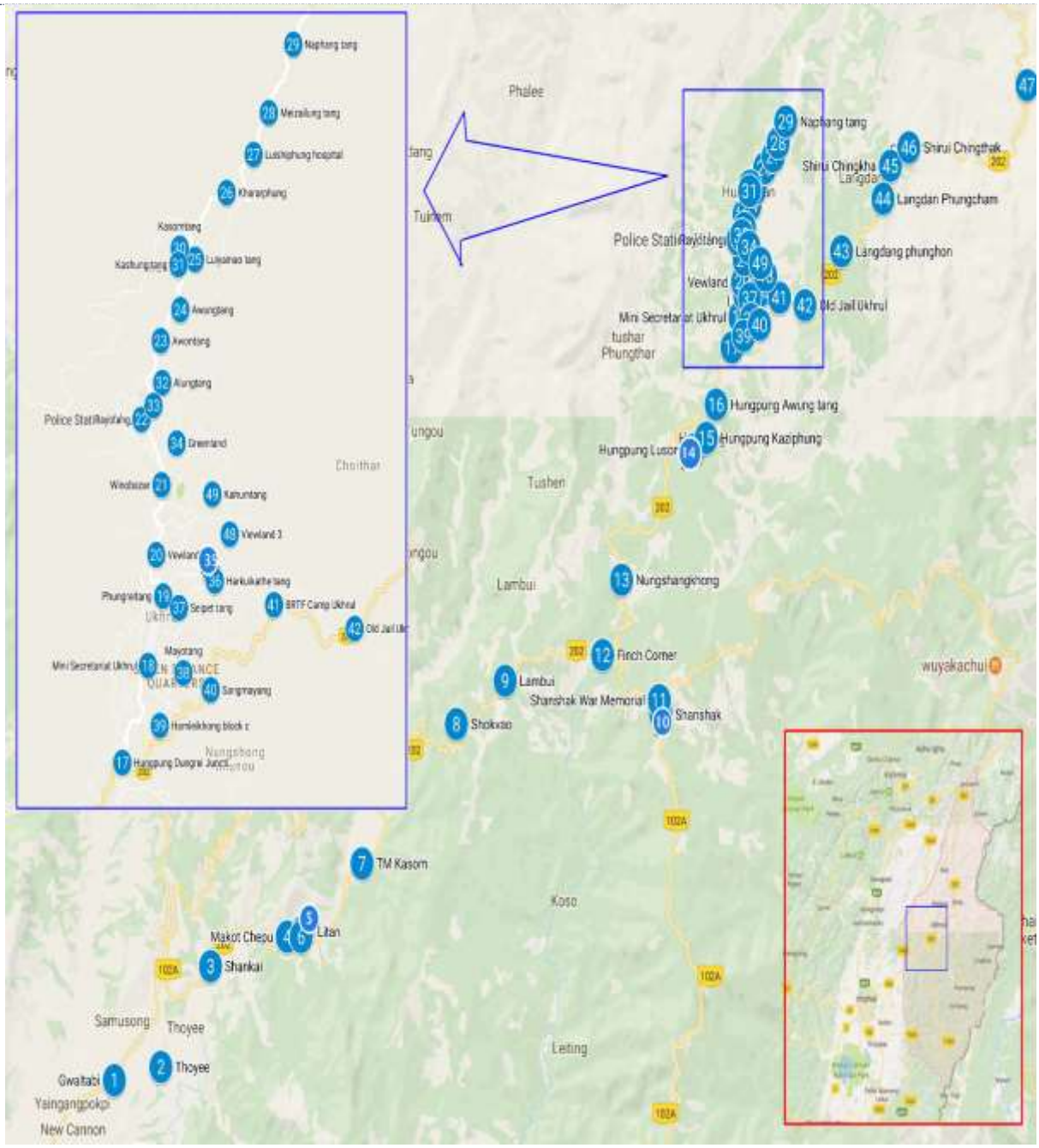


***Figure2: Natural dose rate measurement Location Map of Ukhrul District***

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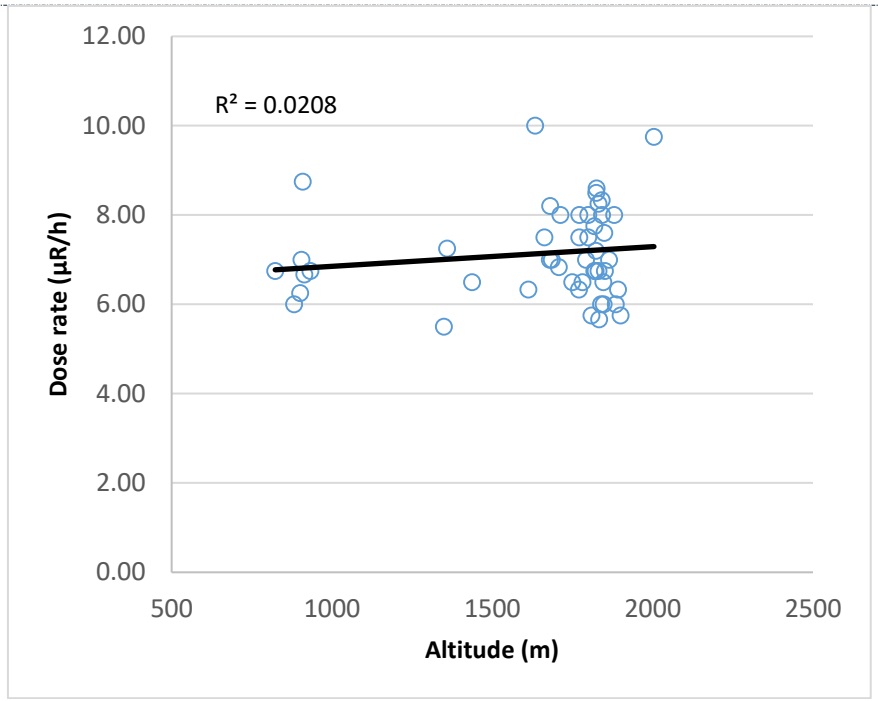


*Figure 3: Graph of natural radiation dose rate(µR/h) vs altitude (m) of Ukhrul district, Manipur*

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