Study of Ambient Gamma Radiation Level in Costal Uttara Kannada District, Karnataka, India

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Abstract: **Ambient gamma radiation level in costal Uttara Kannada district is measured using an environmental radiation dosimeter (sensitivity 1μR/h).Measurements were made in 17 locations both in disturbed and undisturbed areas of study locations. The measured dose rate varies from 45.6 to 131.3 nGyh^{-1}. Relatively higher radiation levels around some places are obviously due to the presence of granitic outcrops in these regions. Significant seasonal variations in gamma dose rate were not observed during the study.**

Key words: **Ambient gamma radiation, dosimeter, lateritic, Granites, radionuclides.**

I. INTRODUCTION

All living organisms are continuously bombarded by radiation emanated from naturally occurring radionuclides. A major portion of this radioactivity stems from primordial radionuclides whose half-lives are sufficiently long and from secondary radionuclides which are derived from the primary radionuclides. The bulk of the natural radiation to which terrestrial organisms are exposed is generated by ^{40}K, ^{238}U, ^{232}Th and their decay products of the last two radionuclides. The sources of natural radiation are of terrestrial as well as of extraterrestrial origin. Exposure to radiations may be from external sources as well as from radio nuclides taken into the body. Cosmic rays that are extraterrestrial in nature are important sources of external exposure. Radiation from radio nuclides in earth's crust and in other terrestrial matrices give rise to both external and internal exposure. Natural radiation levels generally remain constant with time but may vary significantly with location due to variation in regional geology.

The occurrence of radio nuclides varies from place to place on the globe depending on regional geology and geography. For example, the high background radiation along the **coastal belt of South India**, places like Brazil etc, has been found due to the presence of monazite sand. Relatively high background radiation levels were also observed in some parts of Singhbhum District, India, Southern Saskatchewan, Germany etc., due to the presence of granites. The local population in such localities receives relatively a higher radiation dose. Several researchers have measured the ^{210}Po activity in and around nuclear power plants such as Kalpakkam and **Kaiga (near the study area of the present investigation)**. Measurement shows that ^{210}Po activity is considerably high in these regions than other areas. Thus the characterization of the various environmental matrices with respect to their radioactivity content is essential for correlation of dose estimates.

The geology of Uttatkannada includes Granites, Lateritic rocks, Iron ore, Bauxite ore etc., and Soil types include lateritic soil, alluvial soil, red loamy soil, cotton soil etc. As granites contain higher concentration of U and Th and also K, one can expect higher terrestrial radiation level in this region. Consequently, dose to population in this region could be higher than normal. It was therefore proposed to study radiation level and ^{210}Po activity in various environmental matrices of costal Uttara kannada. This type of work has not been carried out so far in this part of the country and happens to be first of its kind.

II. ABOUT STUDY AREA: COSTAL UTTARAKANNADA DISTRICT

The Uttara Kannada district is located in Karnataka state of India between north latitudes13^0 55' 02"to 15^0 31' 01" and east longitudes 74^{0}0'35" to 75^{0}10' 23".The total area of Uttara kannada district is 10291 sq.km and the total population in the district is around 14.36 lakh (as per 2011census), out of which rural population constitutes 10.18 lakh. The District experiences tropical monsoon climate.Genarally the weather is hot and humid on the coastal areas throughout the year. The district falls under the Hilly agro climatic zone except for western parts of Karwar, Ankola, Kumta, Honnavar and Bhatkal taluks which fall under coastal agroclimatical zone. The temperatures start rising from January to May. The highest day time temperatures rise sometime up to 38^{0}C. Average annual rainfall is around 1166.3 - 3672.5 mm.

The geographical conditions are most favorable in the formation of different types of soils. Heavy rainfall and alternative seasons of heat and cold have lead to the formation of lateritic soil. Such lateritic rocks are the parent material of rock types in and around Uttara kannada. The dense forest of Western Ghats have provided very conducive environment for soil formation. The hills of Western Ghats is covered by iron rich lateritic soil which is reddish brown in colour. The narrow strip of Sharavathi enriches the river banks and the

flood plains with alluvial soil, which is the most potential soil for agriculture. Along the coast the costal alluvial soil is occurring on western most parts of the district. The most rugged hilly parts of the district are covered by hilly type soil and surrounded by lateritic soil having less rugged features. On eastern parts, the lateritic soils change to red loamy soils. Some parts on eastern most parts of Mundgod taluk are covered by semi black cotton soils. In the district there are two big and two medium sized industries and 7736 small industries are located in the district. Main surface water resources Kali and Kadra rivers are used for generating electricity Major Atomic power plant is situated in the bank of River Kali at Kaiga.

Figure 1Geological Map of the Study Area

Kasarkod Beach

APMC Ramathirtha

Lateritic Stone Quarry at Manki

III. NUCLEAR INSTRUMENTATION

MICRO R SURVEY METER: MICRO R SURVEY METER (Type: UR 705) manufactured by NUCLEONIX SYSTEMS is exclusively meant for low level radiation measurement. This portable survey meter, designed around integrally coupled 1" X 1" NaI (Tl) Scintillator to a $1\frac{1}{2}$ " PMT, will offer an optimum performance in counting low level Gamma radiation It is an ideal choice for environmental radiation monitoring and also for geological prospecting for radioactive minerals..

IV. METHODOLOGY

Ambient Gamma Level

The ambient gamma exposure in the environs of costal Uttara Kannada was measured using an environmental radiation dosimeter (sensitivity **1μR/h**). Measurements were made 1m above the ground level in seventeen locations both in disturbed and undisturbed areas of study locations.

V. RESULTS AND DISCUSSIONS

TABLE-1: AMBIENT GAMMA EXPOSURE LEVEL IN THE STUDY AREA

S. No.	Location	No. of Readings	Absorbed Dose in $nGyh^{-1}$	Annual Effective Dose in μSvy^{-1}
1	SDM College Surroundings	60	76.3	93.5
2	ITI College	60	77.9	95.5
3	APMC Ramthirtha	60	86.7	106.3
4	Latratic stone Quarry	60	82.6	101.3
5	Indore stadium Behind SDM college	60	96.7	118.6
6	Anjumanabad , Bhatkal	60	95.6	117.2
7	Near Karki Mudaganapati Temple	60	81.5	100.0
8	Apsarkonda	60	82.6	101.3
9	Granitic stone Quarry near Karwar	60	131.3	161.0
10	Chandavar Stone Quarry	60	119.4	146.4
11	Aresamikere	60	75.4	92.5
12	Kalsanmoote	60	61.1	74.9
13	Manki College Ground	60	69.9	85.7
14	Anantavadi	60	73.8	90.5
15	Hosapattana bridge	60	62.4	76.5
16	Muroor Kumta	60	66.9	82.0
17	kasarkod beach	60	45.6	55.9

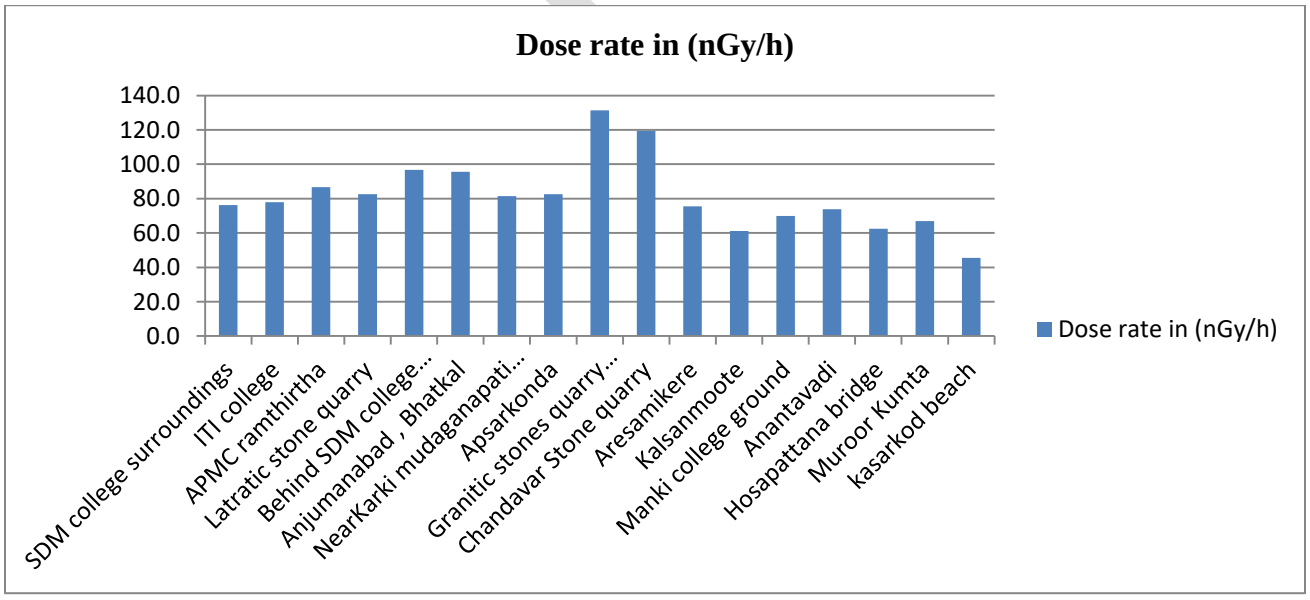

Figure 2: Variation of Dose rate with Location

The knowledge of natural radiation level is very important due to the fact that it accounts for the largest contribution to collective dose received by man. This study provides the base line data required to assess the exposure of population in areas of high natural radioactivity chosen for this study. The ambient gamma levels have been measured at 17 different regions present in the Uttara Kannada DistrictThe measurements have been made using environmental radiation dosimeter ER-705. The results are summarized in Table 1

It can be seen that the mean gamma dose rates vary from 45.6 to 131.3 $nGyh^{-1}$. Similar to the observations made elsewhere, (BrunoSansoni 1982, Nagaiah,1996 Anandaram,1998)) higher than normal dose rates were found in the regions where granitic outcrops were prominent and granite quarrying is taking place. Granitic quarry near Karwar, Chandavar stone quarry, fall under this category. Indoor stadium behind SDM college premises, Anjumabad in Bhatkal,though the places are lateritic , the dose rates in these places were found to be relatively high compared to the dose rate in Manki college ground, Hosapattana Bridge, Kalsanmoote, etc. Very low dose rate was observed in the Kasarkod beach, which is slightly low compared to dose rate of 75 $nGy.h^{-1}$ in Karnataka (Nambietal 1987, BARC highlights, 1988) and is significantly low compared to the dose rate observed near areas such as Ullal beach, Manavalakurichi (Kerala), Kalpakkam beach, South west coast of Tamilnadu, etc., where monazite is known to occur. Since the number of observations made at sea level was small as compared to readings taken elsewhere in the study area. Abnormal weather conditions and rough sea conditions might have influenced significantly in obtaining such low dose rates. More definitive conclusions can be drawn only after studying primordial radionuclide distribution in this region.

The gamma dose rate in the Granitic quarry near Karwar, Chandavar stone quarry, premises were found to be 131.3 $nGy.h^{-1}$ and 119.4 $nGy.h^{-1}$ respectively, which are marginally high compared to the dose rate sobserved in general. It is known that elevated levels of uranium, thorium and decay products are generally present in granites. The higher radiation levels around these places are obviously due to the presence of granitic outcrops in these regions.

The values of gamma dose rate obtained in the present study are comparable with those obtained in the other environs and also with the world average. They are well within the ranges of values observed at other places.

VI. CONCLUSION

The measurement of environmental is very much important, since inhabitants of earth are continuously being exposed to such radiations ever since the birth of this planet. In this respect monitoring of harmful health effects caused by such radiations to the general public becomes highly essential. The readings shown in this study have been taken very much painstakingly during all the three seasons with the available resources and equipments.

ACKNOWLEDGEMENT

The authors will express their deep sense of gratitude to Dr. Gopukumar, Secretary, UGC SWRO, Bangalore for extending financial support, through which this research work is possible. Thanks are also to Dr.M.P Karki, President MPE Society and The Principal, S. D. M. Degree College, Honavar for encouragement thought this work.

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