C-P-7

RADIOACTIVE AEROSOLS IN GRANITIC REGIONS OF KARNATAKA STATE, INDIA

C. Ningappa, J. Sannappa,

Department of Physics, Yuvaraja's College, Mysore-570 005, India
Tel: +91-821- 2519870, Email: sannappaj@yahoo.com

Introduction

Most of radionuclides naturally occurring are ^{222}Rn, ^{220}Rn and their progenies released from ^{238}U and ^{232}Th series. ^{222}Rn is a naturally occurring radioactive noble gas. As a noble gas with half-life of 3.82 days, it decays to short lived and long-lived progenies [1]. The progenies are heavy metal radionuclides that attach to other atmospheric components to form aerosol particles and are responsible for health hazards. Many surveys on radon, thoron and their progenies owing to their hazardous effects on health after inhaling them revealed that ^{222}Rn and ^{220}Rn progenies cause the main part of the radiation dose to the lungs with the contribution depending on the relative amounts of the radionuclides in the air. The area of the present study is granite region of Karnataka State, India. The geology of this part of southern India [3] forms predominantly a granitic terrain with numerous varieties of granite and granitic gneiss, charnockite, alkaline rocks etc. The rocks are of peninsular gneiss and are widely distributed throughout the study area. In the present study the concentrations of radon and thoron progenies were measured in granitic regions of Karnataka State and are presented and analysed.

Methodology

^{222}Rn, ^{220}Rn and their progenies concentrations in granite regions of Karnataka state were measured using Solid State Nuclear Track Detectors (SSNTD) based twin cup dosimeters and activity of ^{226}Ra and ^{232}Th were measured by using HPGe detector. The inhalation dose due to ^{222}Rn and ^{220}Rn can be estimated by using the formula –1.

$$D\ (mSvy^{-1}) = \{(0.17 + 9F_R)\ C_R + (0.11 + 32F_T)\ C_T\} \times 1750 \times 10^{-6} \quad \text{---------- 1}$$

Where C_R and C_T are the ^{222}Rn and ^{220}Rn concentration, F_R and F_T are the equilibrium factor for ^{222}Rn and ^{220}Rn concentration respectively. Occupational factor of 1750 hours is used.

Results and discussion

The activity of ^{226}Ra, ^{232}Th and concentrations of ^{222}Rn, ^{220}Rn and their progenies were measured in granitic regions of Karnataka State (Mysore, Bangalore, Chitradurga and Tumkur districts) are presented in Table -1. From the Table we observe that, the activity of radium varies from 30 to 165 Bq.kg^{-1} with a median of 69 Bq.kg^{-1}and thorium varies from 37 to 541 Bq.kg^{-1} with a median of 107 Bq.kg^{-1}. The concentration of radon and thoron varies from 22 to 265 Bq.m^{-3} with a median of 59 Bq.m^{-3} and 12 to 153Bq.m^{-3} with a median of 40 Bq.m^{-3} respectively. The corresponding progenies vary from 0.2 to 4.8 mWL with a median of 0.6 mWL and 0.3 to 1.8 mWL with a median of 0.55 mWL respectively.

Concentrations of ^{222}Rn and ^{222}Rn are mainly depends on radionuclides present in soil and bedrock. The maximum concentration of ^{222}Rn, ^{220}Rn and their progenies were observed in Alanahally and Maralebekuppe of Bangalore district. Because these villages

are situated where the granite rocks are well exposed to the surface compared to other areas and the area is attributed by pink granite. The bedrock or soils have more concentrations of radionuclides and mining activity was takes place during the time of study. Due to mining activity, the bedrock gets destroyed and fissured. Hence higher concentrations of ^{222}Rn and ^{220}Rn are observed. The concentrations of progenies are depends on human activity, meteorological parameters and concentrations of parent gases. Slightly less concentrations of ^{222}Rn, ^{220}Rn and their progenies were observed in Ramanahally and Hosahally of Bangalore district compared to Alanahally and Maralebekuppe. This may be due to lower concentration of radionuclides. The lower concentration of ^{222}Rn, ^{220}Rn and their progenies were observed in Maharajakatte, P.D. Doddi and Kabballi of Bangalore, Siddaganga hills, Koratagere and Madhugiri of Tumkur and Chitradurga Districts and Chamundi granite of Mysore. In Maharajakatte, P.D. Doddi and Kabballi of Bangalore district mining activity is completely stopped and the pink granite rocks are overlapped by dolerites and altered granites. Dolerites have lower concentrations of radionuclides compared to granites. In Chitradurga and Tumkur districts, granites contain minimum concentration of radionuclides. Hence in these regions lower concentrations of ^{222}Rn, ^{220}Rn and their progenies were observed.

Conclusion

The maximum concentrations of radon, thoron have been observed in the in the granite region where the mining activity was takes place. The concentration is mainly depends on the activity of radionuclides present in soil and rocks. The results show that the impacts of radiation hazard due to mining activity (crushing and loading) on the laborers and public near the granite regions are considerable. There is a poor correlation between parent and progenies concentrations. The activity of ^{226}Ra and ^{232}Th, concentration of radon and its progenies are higher than global average [1].

References

1. UNSCEAR, United Nations Scientific Committee on the Effects of Atomic Radiation. Sources, Effects and Risks of Ionizing Radiation, Report to the General Assembly, United Nations, New York, 2000.
2. Steinhausler, F., 1996. Environmental ^{220}Rn; a review, Environment International; 22(1), S1111.
3. Raghuveer, Lalgondar B A and Jayaram S. Physical properties of earth with special reference to ornamental stones of Karnataka geological studies. No.272, Department of mines and geology, Bangalore, 1997.
4. Bachli, R, Burkart W Influence of subsoil geology and construction technique on indoors air ^{222}Rn levels in 80 houses of the central Swiss Alps. Health Phys. 56 423 1989.

Table-1 Average activity of ^{226}Ra, ^{232}Th, concentrations of ^{222}Rn, ^{220}Rn and their progenies and equivalent effective dose.

Location	Activity of radionuclides ($Bqkg^{-1}$)		Concentration ($Bq.m^{-3}$)		Progeny conc. (mWL)		Eq.eff.dose ($mSv.y^{-1}$)
	^{226}Ra	^{232}Th	^{222}Rn	^{220}Rn	^{222}Rn	^{220}Rn	
A. Mysore 1. Chamundi granite	30	68	22	12	0.2	0.1	1.2
B. Bangalore 2. Ramanahally	63	144	126	92	1.4	0.9	1.4
3. Alanahally	70	145	185	92	2.4	1.8	1.8
4. Maralebekuppe	165	530	265	153	4.8	1.6	2.6
1. Maharajakatte	42	189	74	52	0.6	0.3	0.8
2. Kabballi	32	37	53	38	0.2	0.4	0.6
7. PD Doddi	69	211	65	42	0.3	0.2	0.7
8. Hosahally	123	541	164	130	1.1	0.6	1.8
C. Tumkur 9.Siddaganga hills	75	60	50	20	0.4	0.6	0.4
10. Koratagere	75	70	43	18	0.7	0.8	0.4
11. Madhugiri	59	65	45	13	0.3	0.4	0.4
D. Chitradurga 12. Chitradurga	69	67	36	14	0.6	0.5	0.3
Average	75.7	177.3	94	56	1.1	0.7	1.0