

Measurement Of Absorbed Outdoor Dose Rate Due To Gamma Radiation In Northern Part Of Chittagong City Corporation

Abadat Hossain, QMR Nizam, MM Rahman

Abstract: The health hazard due to background radiation is prime concern now a day. Chittagong has a lot of industry beside the residential area in the city. Except this, naturally radioactive material has a vital role to create health hazard for public. To assess the health hazard outdoor absorbed dose rate is one of the vital parameter. This parameter was measured by using survey meter in northern part of Chittagong City Corporation. The average value of outdoor absorbed dose rate was 0.022 mR/h. The corresponding dose equivalent is 0.22 μ Sv/h. This value is lower than the danger limit 0.5 μ Sv/h set by the Bangladesh Atomic Energy Commission. In order to prepare a research-data-bank for the radiological thread, the output of this work will be useful.

Keywords: Background Radiation, Dose measurement, Chittagong City Corporation, G-M tube, Gamma ray, Survey meter, Dose rate.

1 INTRODUCTION

Human beings are inexorably exposed to natural background radiations from cosmos, earth stratum, building materials, food, air, and even elements that constitute their own body. Although influence of cosmic rays and cosmogenic radionuclides cannot be ignored, the real threat to public health is imposed by naturally occurring radionuclide materials, i.e., primordial radionuclides [1]. Almost 90% of the radiation exposure for the population arises from natural sources and the other 10% is derived from medical exposure and miscellaneous sources with an artificial origin [2]. The study of outdoor gamma radiation exposure describe in this paper has been design to achieve, first, an assessment of radiation doses to the population of northern part of Chittagong City corporation from terrestrial gamma rays outdoor in order to define the contribution to the total dose from natural radiation sources in dwelling and, secondly to provide background data for the identification of areas with high natural radiation and the likely impact of a possible nuclear accident derived from an accurate knowledge of the prevailing natural radiation levels.

2. MATERIALS AND METHODS

The ambient outdoor gamma dose rate measurements were taken in air one meter above ground at different locations. The survey meter named "Inspector alert", type-GM survey alarming rate meter made by International Medicom was used for measuring doses due to gamma radiation exposure.

The device (shows in Figure-1) works well within the temperature range 10°C to 50°C (14°F to 122°F). Sensitivity of the devise is 3500 CPM/mR/h referenced to Cs-137. Smallest detectable level for I-125 is 0.02 μ Ci at contact. The exposure rate that can be measured is ranges from 0.001 mR/h (1 μ R) to 100 mR/hr or CPS - 0 to 5000. The accuracy is mR/h \pm 10% typical (NIST), \pm 15% max. This device was electronically calibrated with a pulse generator to factory specifications. The accuracy is typically \pm 15% of reading relative to ¹³⁷Cs. This electronic calibration complies with MIL STD 45662.



Figure 1: Inspector alert survey meter

This survey was carried out in the northern part of Chittagong City Corporation. Total 21 locations were selected for measuring dose. Table-1 shows the location. For every location two measurements (at different times) were taken, each spanning over time period of 1 min. The average value of two measured value is used as a final value in this paper. The values were measured in the unit of mR/h. Then it was converted to effective dose rate mSv/h by using the following conversion formula [4].

$$1 \text{ mR/h} = 10 \mu\text{Sv/h} \quad (1)$$

Where R is Roentgen unit of exposure and Sv is Seivert unit of dose equivalent.

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Table-1: dose measurement location

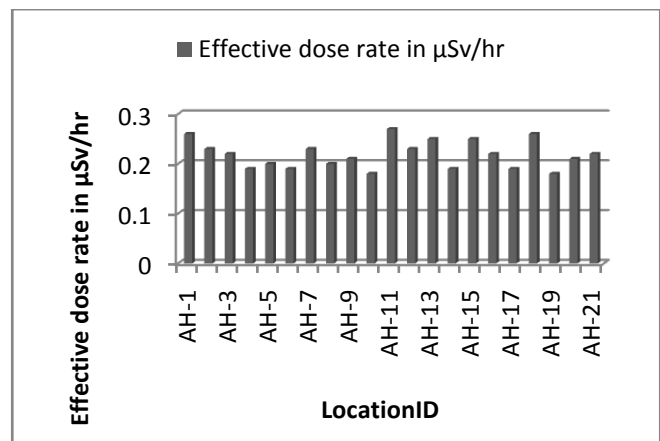
Location ID.	Local Name of Sample collection area	Geographical position	
		Latitude	Longitude
AH-1	NandirDighi (Nandir Hat)	N22°27'05.9"	E91°49'02.2"
AH-2	BoroDighir par (Katakhal Road)	N22°26'07.3"	E91°49'03.1"
AH-3	Natunpara(Chikondandi)	N22°25'05.2"	E91°49'07.0"
AH-4	Kulgong(Mazar gate)	N22°24'03.1"	E91°49'02.9"
AH-5	Kuaish	N22°24'04.8"	E91°50'02.0"
AH-6	Saheed Nagar (Pathanpur)	N22°24'02.1"	E91°51'03.2"
AH-7	Bayezeed (Pharika R/A)	N22°23'02.4"	E91°49'03.2"
AH-8	Kalurghat Road (Sunnia Madrasa)	N22°23'04.1"	E91°50'01.5"
AH-9	Bohaddar hat	N22°23'03.4"	E91°51'04.0"
AH-10	Sulokbahar (Sunnia Madrasa)	N22°23'01.3"	E91°52'02.2"
AH-11	Foy's Lake	N22°22'02.1"	E91°48'03.2"
AH-12	Sholoshahar (Rail Line)	N22°22'06.6"	E91°49'06.1"
AH-13	Al-Falah Mosque	N22°22'02.5"	E91°50'01.7"
AH-14	Chawk Bazar Road	N22°22'05.1"	E91°51'02.5"
AH-15	Uttar kattli	N22°21'02.1"	E91°48'01.3"
AH-16	Ishpahani Hall	N22°21'03.1"	E91°49'01.2"
AH-17	West bakalia	N22°21'03.4"	E91°50'02.1"
AH-18	South Kattli	N22°20'01.1"	E91°47'02.2"
AH-19	Sarai Para	N22°20'02.3"	E91°48'01.1"
AH-20	Eidgah (Kacha Rasta)	N22°20'03.1"	E91°49'02.2"
AH-21	Station Polo Ground	N22°20'02.1"	E91°50'01.2"

3. RESULTS AND DISCUSSIONS

The measured value of absorbed outdoor dose rate is shown in Table-2. The corresponding value of effective dose rate is also shown in that table. From table-2 we see that the range of outdoor dose is 0.018 to 0.027 mR/h with an average value of 0.022 mR/h. And the range of effective dose is 0.18 to 0.27 μ Sv/h with an average value of 0.22 ± 0.02 μ Sv/h. In Figure-2 the effective dose of each sample is shown. This average value is lower than the limit of effective dose set by the Nuclear Safety and Radiation Control Division's rules "NSRC-97" which is 0.5 μ Sv/h. The average value of effective dose rate was compared with NSRC rules-97 value as shown in Figure-3.

Table-2: Outdoor and effective dose rate in each sample

Location ID	Outdoor dose rate in mR/h	Effective dose rate in μ Sv/h
AH-1	0.026	0.26
AH-2	0.023	0.23
AH-3	0.022	0.22
AH-4	0.019	0.19
AH-5	0.02	0.2
AH-6	0.019	0.19
AH-7	0.023	0.23
AH-8	0.02	0.2
AH-9	0.021	0.21
AH-10	0.018	0.18
AH-11	0.027	0.27
AH-12	0.023	0.23
AH-13	0.025	0.25
AH-14	0.019	0.19
AH-15	0.025	0.25
AH-16	0.022	0.22
AH-17	0.019	0.19
AH-18	0.026	0.26
AH-19	0.018	0.18
AH-20	0.021	0.21
AH-21	0.022	0.22
Average	0.022	0.22±0.02

**Figure 2:** Effective dose in each location

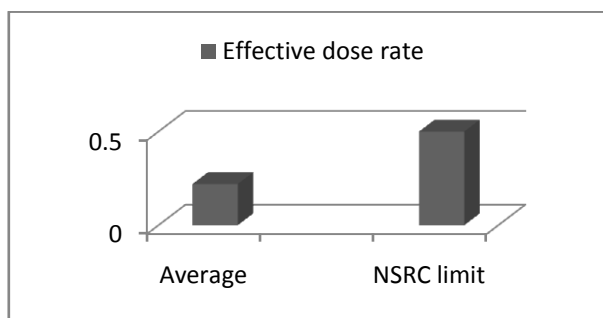


Figure 3: Comparison of measured effective dose

4. CONCLUSION

Nuclear Safety and Radiation Control Division under Bangladesh Atomic Energy Commission has set limit for public dose. This work was done to observe the condition of measured location in radiological content of view. And from following figure we see that our present value is lower than set limit according to NSRC rules-97. The research breakthrough indicates that the investigated parts of the Chittagong City Corporation pose no threat for the flora and fauna and thereby for human health at large. Further research needs to be find out in other parts of the Chittagong City Corporation in order to prepare a research-data-bank for the radioactivity level for the researchers. The output may work as useful guideline for the government agencies in taking the proper initiatives regarding radiation hazard in the Chittagong City Corporation.

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REFERENCES

- [1]. Cember H, Johnson TE , Introduction to health physics, 4th edn. Mc Graw Hill Publishers, New York, ISBN: 978-0-07-164323-8; 2009.
- [2]. ICRP 1991. Risks associated with ionizing radiations. Ann. ICRP. 22(1), 1991
- [3]. www. Inspector+ & Inspector EXP+ User Manual – Contents.com
- [4]. Herman Cember and Thomas E. Jhonson, Introduction to health physics, 4th edition, The McGraw-Hill Companies, Page-282, 2009.