

# Human Exposure to High Natural Background Radiation in Bangladesh

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## 1. Introduction

Natural radioactivity is widely found in soil, sand, water, air, rocks and plants of the environment. According to UNSCEAR (1993), about 87% of the radiation dose received by mankind is due to natural radiation sources and the remaining is due to anthropogenic radiation [1]. It is observed that most of natural radioactive elements present in soil are primordial radionuclides from the uranium series, thorium series, and  $^{40}\text{K}$  [2]. There are few sea beach in the world such as Brazil, China, India, Iran and France where the background radiation levels were found very high, varying over an order of magnitude depending upon the site-specific terrestrial radioactivity. Following that, this study was carried out to find out the effect of radiation to the people and environment in the Kuakata Sea beach which is located at Patuakhali district in Bangladesh.



Location of Kuakata beach on the Bangladesh map

Fig. 1. Kuakata sea beach in Bangladesh.

Assessment of any release of radioactivity to the environment is important for the protection of public health; especially if the released radioactivity is a matter of direct population exposure and can enter into the food chain. The RESRAD family of codes is

developed at Argonne National Laboratory for estimating radiation doses and cancer risks to an individual located on top of radioactively contaminated soils. RESRAD-ONSITE code was used to assess radiation exposures of a human receptor located on top of soils contaminated with radioactive materials [4]. The study was carried out for the people who are working in the sea beach, living in the sea beach.

## 2. Methods

Kuakata Sea beach is the area of interest in the present study, which is located at 65 kilometers away from Patuakhali district is one of the attractive tourist place in Bangladesh. A simulation was conducted earlier using a high resolution high purity germanium detector of relative efficiency 40% where the activity concentrations of  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$  were found in the soil samples were found  $20.98 \pm 3.96$  to  $42.92 \pm 4.76$  Bq/Kg,  $59.25 \pm 15.62$  to  $144.34 \pm 18.52$  Bq/Kg and  $570.43 \pm 100.3$  to  $1165 \pm 166.27$  Bq/Kg respectively [3].

Table 1. Soil samples of this study

Name of the Nuclide	Activity (Bq/kg)
$^{226}\text{Ra}$	23
$^{232}\text{Th}$	80
$^{40}\text{K}$	700

Different pathways such as Inhalation, Aquatic foods and Soil ingestion were considering for this study. Using above radio nuclides and their corresponding activities in the RESRAD-ONSITE Code the following outputs were found.

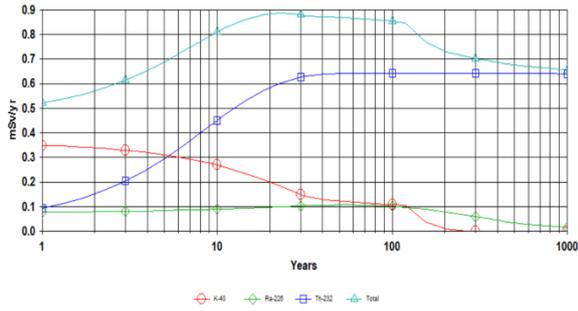


Fig. 2. Dose: all nuclide summed, all pathways summed.

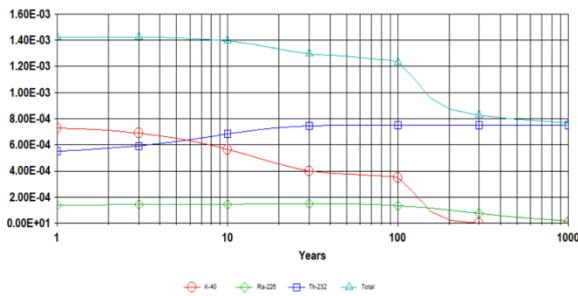


Fig. 3. Cancer risk assessment for all pathways.

### 3. Results

After the simulation it is shown that the total effective dose was increasing with time until 30 years, after 30 years it is decreasing. The maximum effective dose for all pathways was 0.888 mSv at 23 years. The cancer risk assessment for all pathways was 1.40E-03 after 1 year and it is saturated until 10 years. After 10 years' cancer risk assessment is decreasing with increasing time. So, Cancer risk in the Kuakata sea beach area is very low.

Table 2. Individual dose and total dose with time

Time (year)	Name of the nuclide (mSv/year)			Total Dose (mSv/year)
	<sup>40</sup> K	<sup>226</sup> Ra	<sup>232</sup> Th	
0	0.359	0.077	0.033	0.469
1	0.349	0.078	0.094	0.522
3	0.329	0.081	0.204	0.615
10	0.269	0.090	0.451	0.810
30	0.150	0.104	0.626	0.880
100	1.080	0.102	0.642	0.852
300	0.000	0.059	0.642	0.702
1000	0.000	0.015	0.641	0.656

### 4. Conclusion

For assessing radiation exposures of a human receptor located on top of the contaminated soils with radioactive materials RESRAD-ONSITE code was used. In the Kuakata sea beach the mainly dominating nuclide particle is <sup>40</sup>K for certain time, then <sup>232</sup>Th is dominated. The effect of <sup>226</sup>Ra nuclide is not significant. Finally, it can be concluded that the Kuakata Sea Beach is not harmful for fisherman, as well as for tourist.

### ACKNOWLEDGEMENT

This research was supported by 2019 Research Fund of the KEPCO International Nuclear Graduate School (KINGS), Republic of Korea.

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