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A STUDY OF BACKGROUND RADIOACTIVITYLEVEL FOR EDIRNE, TURKEY

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Abstract

The main purpose of this study is to measure the outdoor gamma dose rates of central district of Edirne and to calculate the annual effective dose equivalent to the public. For this aim, Measurements were taken with a plastic scintillation detector SP6 (via using portable counter ESP2, Eberline) from 14 different points in central district of Edirne. According to the calculations, the lowest gamma concentration was measured to 19,6 nGy/h while the highest value was measured to 60 nGy/h. The gamma dose average of 14 points was calculated to 38,5 nGy/h. And, the average annual effective dose equivalent to the public was calculated to 47,3 μSv/y. The impressions obtained about the region were evaluated in terms of live health.

Keywords: Scintillation detector, outdoor gamma dose rate, Edirne, Turkey

1. Introduction

Terrestrial radionuclides and cosmogenic radiation are two determinants of the level of environmental radioactivity. Terrestrial radiation is a radiation emitted by naturally occurring radioactive materials on the earth. There are four common terrestrial radionuclides; K-40, U-238, U-235 and Th-232. These radionuclides emit alpha, beta and gamma radiation. Also, high-energy nuclear particles are spreading to the atmosphere because of the cosmic radiation coming from space. Therefore, human beings are always exposed to cosmic radiation [1, 2].
One of the most important factors that increase environmental contamination is man-made radionuclides. In the past, nuclear weapons tests and nuclear power plant accidents have

greatly increased environmental contamination. Radiological studies that have been carried out for many years also support this increase [3].

Environmental radioactivity studies are being conducted to determine the radioactive status of a region. With such studies, it is possible to show the level to which living organisms living in the region are exposed to radiation. This study was carried out in order to reveal the radioactivity state of the central district of Edirne [4].

2. The Studying Area

The studying area, Edirne province, is located in western Thrace region (Figure 1). Edirne has a total of 9 districts. The district with the highest population density is the Merkez [5]. Edirne province has an important geographic position due to the fact that Europe and the Anatolian continents are at the crossing point [6].

Figure 1. Edirne districts [7].

3. Material Method

Environmental radioactivity studies have come into question with the widespread use of nuclear energy in the world. Today, such studies are usually done by examining soil, sediment, water and air [8]. Field studies with scintillation detector are advantageous due to its fast measurement capability. This study was done by taking air measurements. Within the scope of the study, outdoor gamma dose rates were measured by a high resolution Eberline smart portable device ESP2 (via SP6 scintillation detector). Measurements were taken at the level of gonad cells thought to be about 1 m high from the ground level.

4. Results

During the fieldwork, 14 gamma dose rate measurements from 14 different stations were taken from Merkez district of Edirne province. The measured dose values are given in Table 1.

The average annual effective dose equivalent (AEDE) was calculated by using the following equation:

$$AEDE = ADRA \times DCF \times OF \times T \quad (1)$$

Where ADRA is absorbed dose rate in air (nGy h^{-1}), DCF is dose conversion factor (0.7 Sv Gy^{-1}), OF is outdoor occupancy factor (0.2), respectively, and T is the time (8760 hy^{-1}) [9].

Table 1. Gamma dose rates of Edirne Merkez district.

	Coordinates		**Gamma Dose Rates**	**AEDE**
	Latitude	**Longitude**	**(nGy/h)**	**(µSv/y)**
1	41.6405	26.6060	19,6	24
2	41.6770	26.5518	19,8	24,2
3	41.6814	26.8527	56,2	68,9
4	41.6917	26.5754	55,2	67,7
5	41.6855	26.5560	60,0	73,5
6	41.6879	26.5362	34,6	42,4
7	41.6777	26.5251	31,2	38,2
8	41.6684	26.5532	32,4	39,7
9	41.6621	26.5123	43,2	52,9

10	41.6506	26.5271	39,6	48,6
11	41.6603	26.5437	32,8	40,2
12	44.6601	26.5672	42,0	51,5
13	41.6655	26.5911	40,5	49,6
14	41.6517	26.6044	32,8	40,2
Average			**38,5**	**47,3**

As a result of the measurements, outdoor gamma dose rates in air were found ranging from 19,6 nGy/h to 60 nGy/h. The average of 14 stations was calculated to 38,5 nGy/h. And, the average annual effective dose equivalents of 14 stations are calculated to 47,3 µSv/y.

Figure 2 shows the average gamma activity levels in the Edirne Merkez map.

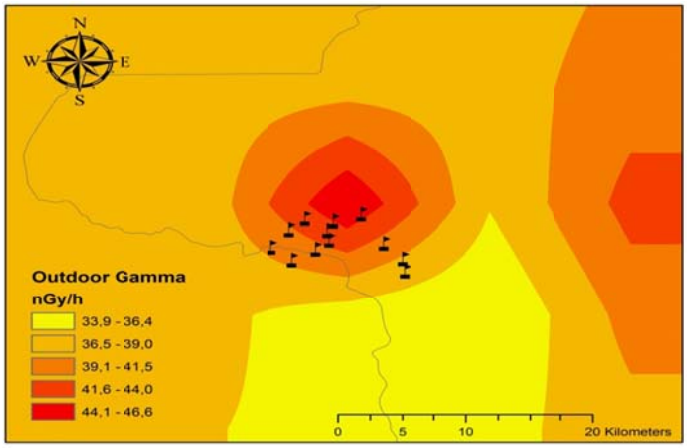

Figure 2. Ordinary kriging type interpolated estimated map for the distribution of gamma activity concentration in study area

The results of the present study were compared with different studies (Table 2).

Table 2. Gamma dose values of different stations.

Stations	Average Dose Rates (nGy/h)	Average Annual Outdoor Gamma Dose (µSv/y)	References
Istanbul, Turkey	65	80	[10]
Kirklareli, Turkey	118	144	[9]
Kastamonu, Turkey	48.03	58.9	[4]
Tekirdag, Turkey	43	52.7	[11]
Hatay, Turkey	52.13	63.93	[12]
World Average	59		[13]
Present Study	38.5	47.3	

5. Conclusion

In this study, outdoor gamma dose rates for Edirne Merkez district were measured. Average gamma dose value of the study area was calculated to 38.5 nGy/h. The average annual effective dose equivalents also calculated to 47.3 μSv/y. These results were compared with the similar studies in Turkey. The measurement results are below the world average determined by UNSCEAR. In conclusion, average AEDE value indicated that there was no threat to live health in the region.

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