DETERMINATION OF THE GROSS ALPHA AND BETA RADIOACTIVITY LEVELS IN EMENDERE VILLAGE (SINDIRGI-BALIKESIR) DRINKING WATER*

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ABSTRACT

Over 40 years old 600-700 years old people in good condition live in about 300 houses in Emendere village. Most of drinking and usage water, and 70% of Sindirgi's (Balikesir) drinking water are supplied by two main natural sources from Emendere. Apart of those sources, restorative water source near the village settlement place is commonly used for bathing.

The gross alpha and beta radioactivity levels in Sindirgi's drinking water are firstly determined by ÇNAEM (Çekmece Nuclear Research and Training Centre) in 1999. Determined levels were both higher than the limits accepted by WHO (World Health Organisation) and TSE (Turkish Standards Institute) in drinking water.

In this study, the gross alpha and beta radioactivity levels in usage and drinking water in the same place are determined by using more sample collected over the village and obtained results are conclude according to the standards determined by WHO and TSE. Ca and Mg concentrations, temperatures and pH are also determined and conclude.

A health team from Balikesir State Hospital is also searched through the most of the village population. None of the radiation caused sickness was found during this search.

1. INTRODUCTION

The first gross alpha and beta radioactivity levels in drinking water supplied from Emendere village sources of Sindirgi which its population 12,000 are mentioned by ÇNAEM at the end of 1999. The radioactivity levels in mentioned report were over the standards limits accepted by WHO and TSE and they were determined from a few tap water samples. Since we believed that analysing a few tap water samples might not be cover all over the city's drinking water radioactivity characteristics, we tried to work on more samples taken from various places through the way to taps.

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2. DESCRIPTION OF THE AREA

Emendere is 6-7 km far from Sindirgi. 70% of Sindirgi's drinking water is supplied from this village. Most of usage and drinking water in Emendere are coming through the natural sources run over the mountain. The other usage water is supplied by Çaygören dam's lake. Kaolin, perlite and uranium minerals are most found in the soil formation [1]. Most of the area is shown geothermal characteristics.

3. MATERIAL AND METHOD

3.1. The Sample Preparation

The water samples are collected from the sources, water stores, common used taps and house taps in 1 L sterilised bottles to get homogeneity all over the area. It is also the mixed points of the ground and underground waters are sampled. The samples pH and temperatures are measured by using digital pH-meter (WTW pH-330) and thermometer.

The water samples are then transferred from the bottles into the beakers that are pre-washed by 98% pure H_2SO_4 added $K_2Cr_2O_7$ baths. The water samples are then evaporated at 60 ^{0}C until 5-10 cm^3 obtained in beaker and then the remaining are transferred to the planchets in 1.89 cm diameter. The planchets are then exposed by ultraviolet radiation.

Three sediments are prepared from each sample in the same way and each of them is counted in turn background counts.

3.2. The Detection System and The Radioactivity Calculation

The gross alpha and beta radiation counting are made by using 44 mm diameter ZnS(Ag) solid and 2059 plastic scintillators through the 7286 Low Level Alpha and SR8 Counters (Oxford Inc.), respectively. The system calibration is made by using the same way was indicated in [2, 3].

The sediment activity was calculated by using equation below.

$$A = (N \times VDF) / 2.22$$

Where, A is the gross radioactivity in pCi, N is the background subtracted counts and VDF is the efficiency correction factor [4-6].

4. THE RESULTS AND CONCLUSION

4.1. The Gross Alpha and Beta Radioactivity Levels

Collected 22 samples from different places of the area were counted and their calculated gross alpha and beta activities were given in Table 1. The maximum and minimum alpha and beta activities were determined in samples 10 and 19, and samples 1 and 22, respectively.

According to TSE standards 22 samples and WHO standards 6 samples gross alpha activities exceed the permitted upper radioactivity limit in drinking water [7].

Table 1: The gross alpha and beta activities in drinking water of Emendere village.

Sample No	Gross Alpha Activity (Bq/L)	Gross Beta Activity (Bq/L)
1	0,1747 ± 0,0324	0,4525 ± 0,0109
2	0,3107 ± 0,0243	0,0330 ± 0,0031
3	0,2811 ± 0,0235	0,0275 ± 0,0037
4	0,2885 ± 0,0251	0,0201 ± 0,0029
5	0,5238 ± 0,0411	0,1700 ± 0,0108
6	0,6077 ± 0,0429	0,0635 ± 0,0098
7	0,1639 ± 0,0346	0,1400 ± 0,0103
8	0,4783 ± 0,0395	0,0939 ± 0,0108
9	0,1794 ± 0,0334	0,0664 ± 0,0103
10	0,1499 ± 0,0336	0,0963 ± 0,0096
11	0,4752 ± 0,0471	0,0495 ± 0,0086
12	0,3051 ± 0,0258	0,0213 ± 0,0032
13	0,2606 ± 0,0256	0,0267 ± 0,0027
14	0,3178 ± 0,0258	0,0124 ± 0,0029
15	0,5146 ± 0,0446	0,0285 ± 0,0092
16	0,2347 ± 0,0197	0,0365 ± 0,0059
17	0,2996 ± 0,0250	0,0647 ± 0,0028
18	0,1588 ± 0,0563	0,1683 ± 0,0076
19	0,6430 ± 0,0438	0,1375 ± 0,0102
20	0,2692 ± 0,0576	0,0209 ± 0,0062
21	0,2586 ± 0,0471	0,1045 ± 0,0075
22	0,2461 ± 0,0424	0,0088 ± 0,0081

4.2. The Gross Radioactivity Distribution

The higher alpha activities were determined in commonly used tap water, restorative water source and first water store. The frequency distributions of the alpha and beta activity levels were shown in Figures 1a and 1b, respectively. As indicated in Figure 1, about 60% of the alpha activity levels are between 0.1 and 0.4 Bq/L.

4.3. The Variation of the Radioactivity Levels with Ca and Mg concentrations, pH and Temperatures

The variation of Emendere village drinking water alpha and beta activity levels with Ca concentration, Mg concentration, pH and temperatures were indicated in Figures 2a and 2b, 3a and 3b, 4a and 4b, 5a and 5b, respectively.

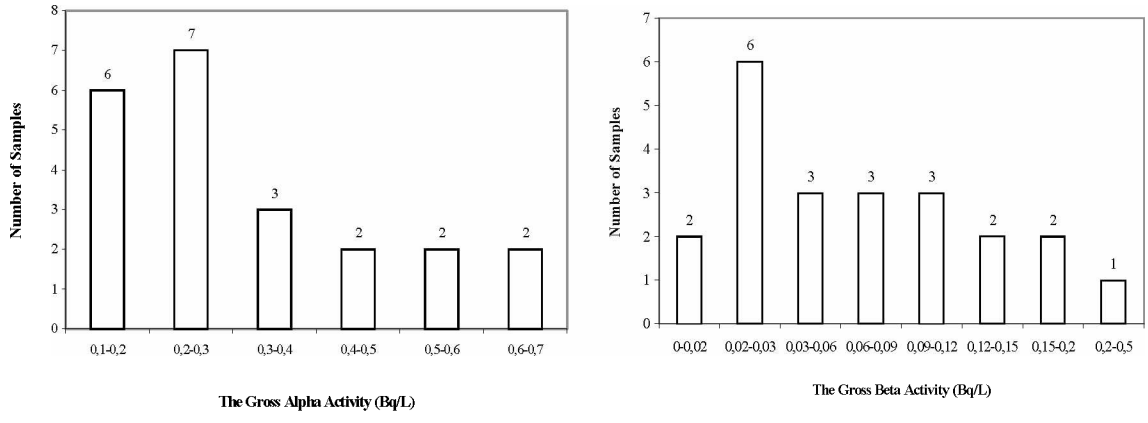
Contrarily to the correlation between the alpha and beta activities with Mg concentration, there is a good correlation between the alpha and beta activity levels with Ca concentration and the presented results are in good agreement with [8].

A good correlation has seen between beta activity and water pH, but there were no correlation has determined between alpha activity and water pH. In both cases, minimum activities were determined at higher pH values [8].

In agreement with [8, 9], we have determined linear correlation between the alpha and beta activity levels and water temperatures. Our results on the gross alpha and beta activity levels were also agreed with the results mentioned by ÇNAEM, Health Ministry and Cities Bank.

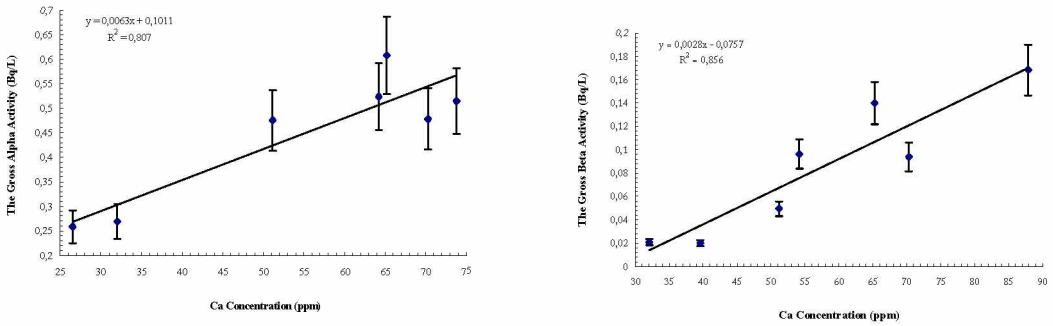
Since Emendere village area has a geothermal characteristics and uranium mineral are present, determined higher alpha activity is a normal result [9, 10], but still dangerous for human being.

108 women and 100 men who live in this area are also medically scanned by health team from Balikesir Government Hospital to determine the affect of the higher alpha activity level in the usage and drinking water. They have not found any sickness caused by radiation. They also determined that the average life of the population who live here is higher than the mean life of the population who lives over the country.



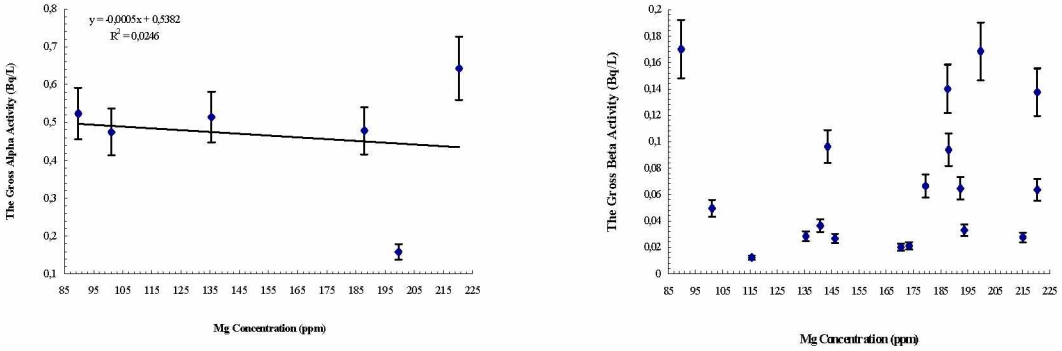
(a) (b)

Figure 1. The distribution frequency of the activity levels (a) Alpha, (b) Beta



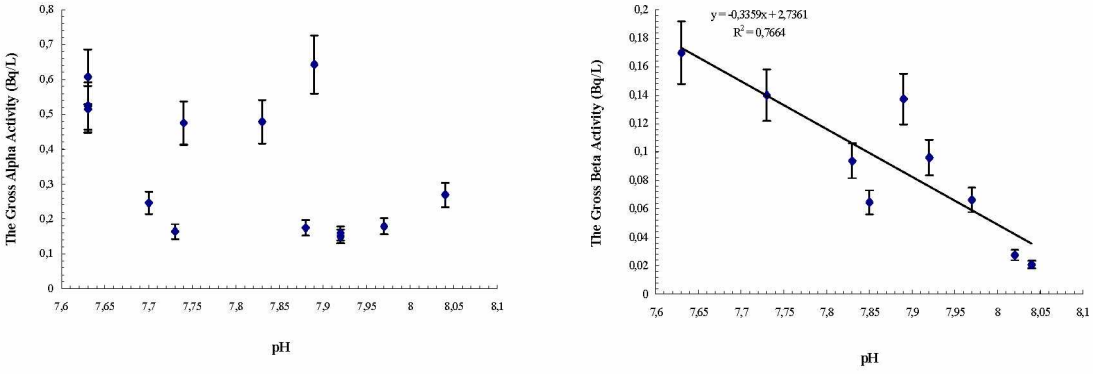
(a) (b)

Figure 2. The correlation between Ca concentration and activity levels (a) Alpha, (b) Beta.



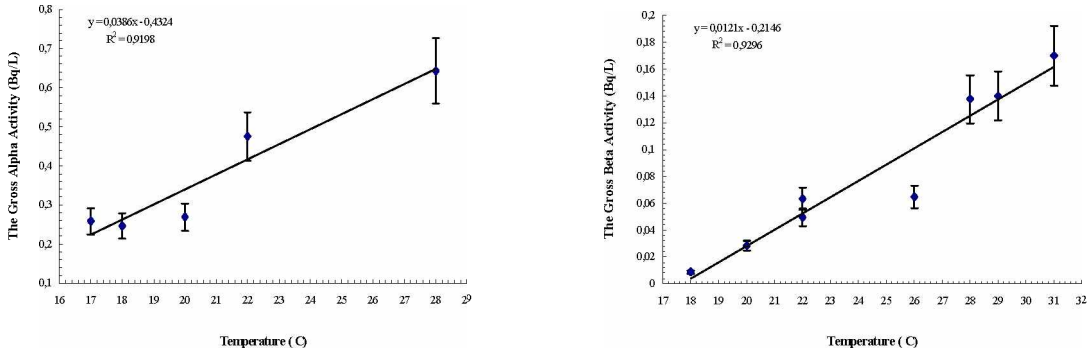
(a) (b)

Figure 3. The correlation between Mg concentration and activity levels (a) Alpha, (b) Beta.



(a) (b)

Figure 4. The correlation between pH and activity levels (a) Alpha, (b) Beta.



(a) (b)

Figure 5. The correlation between temperature and activity levels (a) Alpha, (b) Beta.

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