Natural radioactivity level of the Kestanbol Pluton (Ezine- Çanakkale) and its environmental importance, Turkey

[a]Örgün Y, [b]Altınsoy N, [c]Şahin S Y, [a]Erarslan C, [d]Karahan G, [d]Çelebi N

This study summaries the data on the natural radionuclides in Kestanbol granitic pluton and evaluate their environmental effect in point of building material, groundwater and outdoor. The Kestanbol pluton is lithologically made up dominantly quartzmonzonite and partly monzogranite. Its mineralogical composition consists of orthoclase, plagioclase, quartz, hornblende, biotite, opaque minerals and radiogenic minerals. Defined radiogenic minerals are sphene, zircon, allanite, apatite, epidote, thorite, uranothorite; their total content range from 0.22 wt % to 5.88 wt %. U and Th content of the pluton are high and vary from 7.3 to 24.2 ppm (avg. 12.86) and 29.9–85.7 ppm (avg. 53.69), respectively. To assess the radiological hazard of the natural radioactivity, the absorbed dose rate, the radium equivalent activity (Raeq) and the external hazard index were calculated, and in situ gamma dose rates were measured. The high-activity concentrations were measured in the pluton and beach sands, which was originated mainly from the pluton. The average activity concentrations of 238U, 232Th and 40K are 174.78, 204.69 and 1171.95 Bqkg^{-1} for pluton, and 290.36, 532.04 and 1160.75 Bqkg^{-1} for sands, respectively. The average absorbed dose rates for the granitic and sand samples were calculated to be 251.6 and 527.92 nGy h^{-1}, respectively. The maximum contribution to the total absorbed gamma dose rate in air was due to the 232Th (52.3% for pluton and 67.1% for sands). The Raeq activities of the pluton and sands are higher than the recommended maximum value of 370 Bq kg^{-1} criterion limit of Raeq activity for building materials. In all of the granitic samples Hex value is higher than the unity with a mean of 1.52. The values of annual effective dose rates are higher than the worldwide average (70 μSv yr^{-1}, outdoor annual effective dose, published in UNSCEAR, 2000). These values show that the natural radioactivity is quite high in the study area, especially around the pluton and coastal region. In terms of natural radioactivity and U-Th content, it was determined that there is very strong relationship between the groundwater and the granitic rocks in the region. U concentration and gross-α activity concentrations in the groundwater varied from 0.27 to 91.09 μg/l and from 9.6 to 214 Bq/l, respectively. In situ measuring was carried out in 93 different locations (villages and beaches). The values that were obtained from the villages and their vicinity range from 46–794 nGy h^{-1} (aver. 212.90 nGy h^{-1}).

[a] *Faculty of Mines, Istanbul Technical University (ITU), Turkey (orgun@itu.edu.tr)*
[b] *Institute of Energy, Istanbul Technical University (ITU), Turkey*
[c] *Department of Geophysics, Engineering Faculty, Istanbul University, Turkey*
[d] *Cekmece Nuclear Research and Training Center, Istanbul, Turkey*