

CESIUM-137 ACTIVITY IN SOIL FROM AN AGRICULTURAL LAND IN WEST ANATOLIA

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ABSTRACT

Due to the radiocesium derived from the accident at Chernobyl in 1986 deposited on the soil, this study presents experimental data on Cs-137 activity concentrations in soil samples taken from agricultural land of Aegean Region in Turkey in 1997 and 1998. The activity of Cs-137 for these soil samples was found in the range between 0.92 ± 0.15 Bq/kg and 20.75 ± 0.29 Bq/kg. The distribution of Cs-137 in the soil can differ, being dependent on soil properties.

INTRODUCTION

In the last 14 years, the predominant contributor of Cs-137 contamination in Europe was the Chernobyl accident on 26 April 1986.

Radiocesium, because of its high fission yield, relatively high volatility, long half-life ($t_{1/2}=30.17$ yr), high solubility and close physico-chemical similarity to potassium (a vital chemical element) can be considered as one of the most hazardous radionuclides in the environment and one of the dangerous products of nuclear fission.¹ Radiocesium continues to be recirculated in soil and plant systems for many years following pulse of contamination. Cesium is easily engaged into a potassium metabolic cycle and is reached to human body through food chain pathways. Another important aspect of Cs-137 is that it undergoes biologic magnification as it becomes increasingly concentrated in higher trophic levels of the food chain. Cesium is a potential genetic hazard because it accumulates in many types of tissues and its penetrating gamma rays reach all body cells.²

Most long lived radionuclides, deposited on the soil by fallout, are sorbed rather efficiently by the various soil components (soil organic matter, clay, minerals, sesquioxides). As a consequence, the concentrations of these radionuclides in the soil solution are usually quite low. Nevertheless, this quantity is of fundamental interest for a given radionuclide and for a given soil, because it is the fraction which is most readily available for ecological processes, such as plant uptake and vertical migration in the soil. The soil solution, however, contains not only dissolved inorganic ions but also various amounts of dissolved organic matter (e.g. fulvic and humic acids) depending on the soil type, the soil horizon and the pH.³

The mobility and bioavailability of deposited radionuclides are influenced by the physicochemical form of the fallout and, in particular, the fraction of radionuclides associated with fuel particles.⁴ We know more information about processes bringing radionuclides to man's foodweb.⁵

MATERIAL and METHOD

The soil samples (~5 kg) filling an area of 30x30 cm and at a depth of 20 cm were taken at 48 sites of the Buyuk Menderes Basin during the period from October 1997 to July 1998 (Fig.1). Each soil sample was dried at room temperature, placed in an oven at 105°C for 24 hours, gridding, passed through a 1 mm sieve and homogenized prior to analyses. Samples were placed in a one litre polyethylene Marinelli beaker for up to 20000 s to provide great counting efficiency and were analysed for Cs-137 by gamma spectrometer. Samples of constant geometry were counted with low deadtime.

RESULT

The Cs-137 levels in the Büyük Menderes Basin shows a normal distribution and the mean value is 7.70 ± 3.81 Bq/kg. The high activity concentration of Cs-137 was observed in Ortaklar district as 20.75 ± 0.29 Bq/kg, and the low concentration was observed in the same district as 0.92 ± 0.15 Bq/kg.

The Buyuk Menderes Basin has an anomaly in radiocesium concentration during the period of sampling. Whereas the north side of the basin has high concentrations (~20 kBq/kg), lower concentrations were found on the other side. The measured radiocesium activity is the sum of the Chernobyl accident contribution and the residual activity of pervious contamination. As explained by Uyttenhove *et al.*, correlation between the rainfall and the residual Cs-137 concentration may be shown. However, the maximum values on the distribution map cannot be coincided because of the fact that the rainfall data were integrated over the whole day. The variation in the air activity must be taken into consideration in this type of study. The rise of Cs-137 activity concentrations in the middle of the area could be explained with the variation of rainfall and wind activities on the days after the Chernobyl accident on 26 April 1986.

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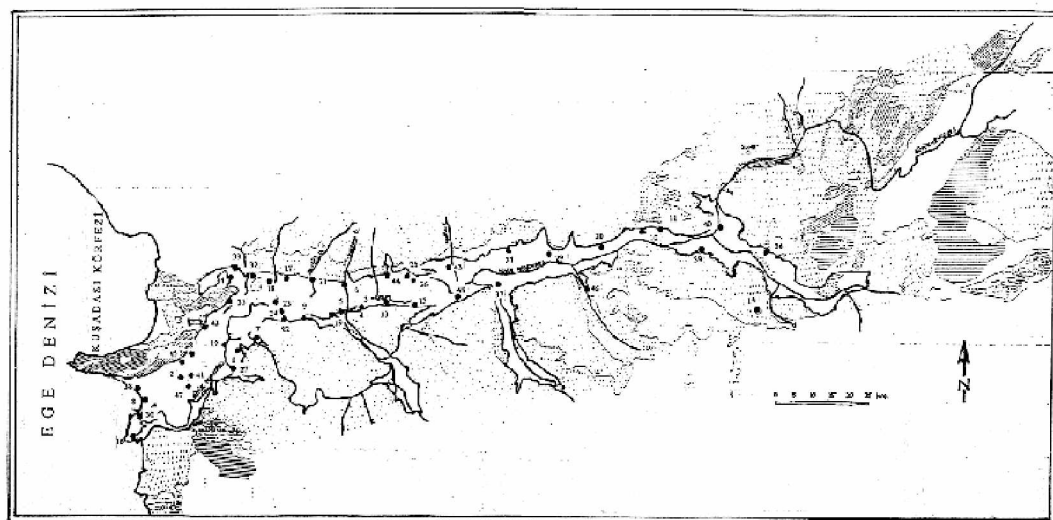


Fig. 1. The sampling sites in the Büyük Menders Basin.