

RADIOCESIUM ACTIVITY IN TURKISH TEA FOLLOWED THE CHERNOBYL AFTER THIRTEEN YEARS

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ABSTRACT

The aim of the study is to investigate the distribution of ^{137}Cs activity levels in Turkish tea widely consumed in the Country in 2000. The results obtained from gamma radiometric measurements were shown that the average radiocesium level in marketing tea was 72 Bq/kg.

INTRODUCTION

The accident in April 1986 at the Chernobyl Nuclear Power Station in the former Union of Soviet Socialist Republics in which large amounts of radioactive materials were released into the environment was the most serious ever to have occurred in connection with the use of nuclear energy to generate electricity. Changing meteorological conditions during the active phase of accident with winds from different directions at various altitudes and continuing releases over a ten day period, resulted in a very complex dispersion pattern (1). The plumes of contaminated air had spread over into the environment. The total release of radioactive materials is estimated to have been 1-2 EBq, the principal radionuclides being ^{131}I (630 PBq), ^{134}Cs (35 PBq) and ^{137}Cs (70 PBq). The proportional amounts dispersed beyond the USSR were determined to be 34% for ^{131}I and 56% for ^{137}Cs (2).

Immediately after the fallout from the Chernobyl accident, measurements of activity concentrations in virtually all foodstuffs were initiated in most countries in Europe (3). After the accident at Chernobyl, large areas in northern Turkey were heavily contaminated with radiocesium by wet deposition in early May 1986. During this emergency, Çekmece Nuclear Research and Training Center performed analyses of various substances, including foodstuffs to assess population risk. In their reports, it has been noted that the soil surface ^{137}Cs activity of the eastern part of Black Sea mountains was around 4000-4500 Bq/kg at the 0.5 cm soil in the year 1988 and a considerable fallout occurred on this area where tea plants had been densely cultivated (5). Levels of radiocesium in Turkish tea were found to be maximum value of 44 000 Bq/kg for the 1986 product by Gedikoglu and Sipahi (6). High activity concentration in the tea plants decreased progressively for each of the following years. Ünlü et al. have been reported that the mean value of ^{137}Cs in tea leaves decreased from 13602 Bq/kg to 201 Bq/kg between the years 1986 and 1992 (5). TAEK reported that the tea included the radiation 89000 Bq/kg in December, 1986. At the same year, various tea samples were measured by TAEK

followed as: 8350, 10500, 28970 and 29530 Bq/kg. The cesium activity in tea samples bought from Turkey, were measured as 6000-30000 Bq/kg in June 1987 in Germany.

This paper reports the distribution of ^{137}Cs activity concentrations in many brands of tea obtained from supermarkets from 1987 to 2000.

MATERIAL AND METHODS

Various tea samples which grown in east cost of Black Sea region were collected from the different markets. Marketing tea samples were weighted as 370 g of samples and sealed in a plastic Marinelli beaker. The measurements were made using a high resolution gamma-ray spectrometer which consist of a 184 cm³ HPGe coaxial detector (the typical detector specification was 2.00 keV full width at half-maximum of the 1.33 MeV Co-60 line, a peak to Compton ratio of 57:1 and a 25% relative efficiency), a Ortec Model-671 spectroscopy amplifier and a Canberra PC-based MCA (Wilkinson ADC with 8K spectral memory).

Tea samples were measured for 20000 s and minimum detectable activity concentration was 1 Bq/kg. The standart contained a known amount of ^{137}Cs activity (Amersham) diluted with starch (about 100 Bq/kg) was used for calibration

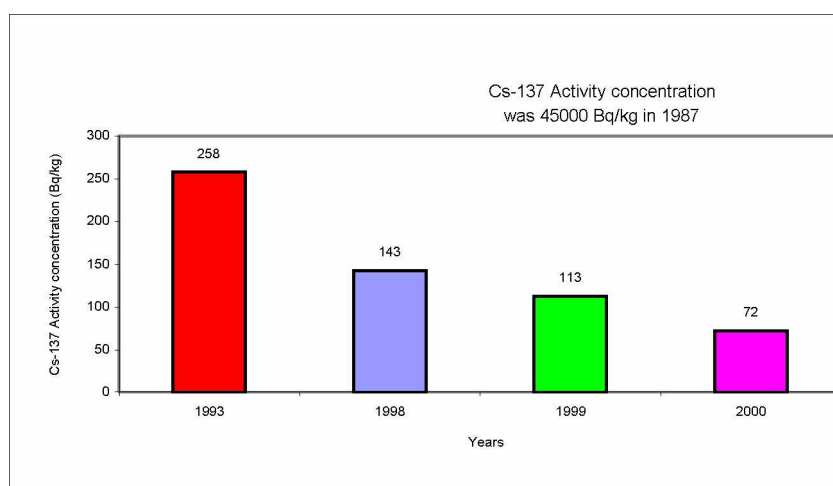
RESULTS AND DISCUSSION

Radiocesium concentration (Bq/kg) of tea samples collected during 1987-2000 from different markets is indicated in Table 1 and Figure 1.

Table 1. ^{137}Cs Activity Concentrations in Turkish Tea

Years	^{137}Cs Activity concentratons (Bq/kg)
1987	45000 $\pm$ 52
1993	258 $\pm$ 8
1998	143 $\pm$ 8
1999	113 $\pm$ 8
2000	72 $\pm$ 7

As it shown in Table 1 and Figure 1, the mean value of ^{137}Cs in tea samples decreased from 45000 Bq/kg to 72 Bq/kg between the years 1987 and 2000 (The permissible level is defined by ICRP as 600 Bq/kg).



The decrease in activity concentration in tea is caused by the following features:

- radioactive decay;
- weathering effects (wash-off, leaching, losses of plants parts);
- dilution due to plant growth;
- transfer into non-edible or non-usable parts of the plant (e.g., roots)
- removal from root-layer of soil by transfer of activity into deeper soil layers or other effects;
- and
- continuing fixation of radionuclides in soil.

While the first three effects are dominating the short-term decrease and cause a significant reduction of the activity concentration in the first few months after followed, the long term decrease is mainly caused by the last two effects. These two effects lead to significant reductions in activity concentrations, in particular of long lived radionuclides such as ^{90}Sr , ^{134}Cs and ^{137}Cs . Each effect, apart from the first one, causes a decrease which is lay for more rapid than that resulting from radioactive decay alone (3).

The conclusion drawn from this study is the presence of ^{137}Cs activity concentration in new tea plants although no more nuclear accidents have occurred in the world. It is explained that tea plants take ^{137}Cs only by root uptake from the soil.

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