

## HEALTH ASPECTS OF FOOD RADIOACTIVITY

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### ABSTRACT

The aim of the paper was to analyze the results of food radioactivity control in Nis in five year period after the war in 1999 and to identify possible health hazards. The routine food safety control were done in Public Health Institute, Nis from 2000-2004. Samples of food were analyzed in certified institutions of Serbia for radioactivity control by using standard procedure. 676 food samples were controlled (196 domestic and 480 imported food). The radioactivity of analyzed food samples was at the normal environmental levels and we do not anticipate health consequences.

### INTRODUCTION

In Serbia, the monitoring of environment for radionuclides was established in 1963 for the sake of preventive protection of population and environment from the harmful effect of ionizing radiation. The objective of this monitoring programme is to prevent unacceptable damage to environment and human health.

The main pathways of radionuclides in the human body are inhalation and ingestion through food and drinking water. Radionuclides may enter human food chain by direct deposition on the leaves or other parts of plants, by persistence in layers of soil from which they are taken up into growing plants through the roots, by re-suspension as dust from exposed surfaces and from water sources.

The aim of this paper was to present results of the measuring of radioactivity in food between 2000-2004 in Public Health Institute, Nis (Serbia) and to identify possible health hazards.

## MATERIAL AND METHOD

The paper includes data of the samples of food collected from 2000- 2004. in the locations of south-east part of Serbia. The sampling was performed by the Public Health Institute team and the food samples were analyzed by using standard procedure. Each food sample was dried at room temperature, crushed and homogenized. The levels of the natural radionuclides and artificial radionuclides in food were determined by high-gamma spectrometry.

All samples were counted on appropriate geometry (marinelli beakres or other adopted from laboratory) with pure germanium detectors EG&G ORTEC with relative efficiency 255 and resolutions 1,85keV on 1.332 MeV. The detector was contained in 10 cm thick lead well internally lined with cadmium and copper folios. Through a linear amplifier the detector was connected to an 8192 channel pulse height analyzer on line to a PC. Data analysis was performed taking into account sample geometry, self-absorption in the sample and background.

## RESULTS

The total number of samples was 676 (Table 1). The highest number of foods tested for radioactivity was imported foods (71%) and every third sample was from domestic production (29%).

Table 1. Food samples tested for radioactivity in Public Health Institute, Nis

Year	Domestic samples	Samples of imported foods	Total number
2000	56	108	164
2001	51	44	95
2002	51	61	112
2003	0	31	31
2004	38	236	274
$\Sigma$	<b>196</b>	<b>480</b>	<b>676</b>

The measurements of radioactivity were carried out in the foodstuff characteristic for the national diet of Serbia. The largest number of tested samples were legumes, cereals (18,8 %) and confection (15.2%) (Table 2).

Table 2. Types of foods tested for radioactivity in Public Health Institute, Nis from 2000-2004

Type of food	Number of tested food samples
Cereal,leguminous	127
Sugar, bombons, chocolate, honey	103
Fruits	97
Fishes,shells, crab-fishes	63
Vegetables	44
Children foods and dietetic foods	43
Aditive and spices	43
Coffee, cocoa, spices	33
Milk and products of milk	31
Alcoholic drinks	22
Ready meals	19
Cakes	17
Non alcoholic beverages	14
Other	22

Gammaspectrometric measurements of food samples evidenced low values of the natural radionuclides, as well as  $^{137}\text{Cs}$  obtain from the locations in the region of Nis. Presence of the depleted uranium in food products has not been evidenced (Table 3).

Table 3. Specific activity of different radionuclides (average values) in food of Nis from 2000-2004

Specific activity (Bq/kg)	$^{137}\text{Cs}$	$^{40}\text{K}$
CEREAL	<0.4	416±20.85
Legumes	<0.3	16.65±0.73
Milk *	<0.2	33.5±3.95
Products of milk	<0.5	48.4±6.7
Fruit	<0.2	14.78±2.22
Vegetables	<0.3	61.45±8.95
Sugar	<0.2	14.89±0.74
Cakes	<0.1	50.97±2.55
Non alcoholic beverages*	<0.3	68.95±7.30

\* (Bq/l)

## DISCUSSION

Mostly of food samples tested for radioactivity in Public Health Institute, Nis from 2000-2004 were imported foodstuffs, as required by regulations (Official Gazette 9/99). It would be very useful to increase the control of the domestically produced food in the future.

On the basis of our measurements, it was concluded that the activity of both natural and long-lived radionuclides of artificial origin ranged within low levels in all food samples. The activity level of radionuclides of all samples was under maximum permitted levels.

The measurements of systematic radioactivity monitoring in period 1999 – 2003 from other part of Serbia showed similar results. They indicated that there were no deviation in the natural radioactivity compared to the foods samples before 1999. The activity levels of fission (artificiale) radionuclides ( $\text{Cs}^{137}$ ,  $\text{Sr}^{90}$ ) also have very low values (Pantelic et al 2004). The artificial radionuclides could have been ejected in the environment due to nuclear accidents and nuclear weapons use. In 1999, during NATO bombing at the South of Serbia (Vranje), contamination of soil by depleted uranium ammunition was established (UNEP 2002, Pantelic et al 2002). During 2001 and 2002, the presence

of depleted uranium has not been confirmed in samples of food from this site (Javorina et al 2004) .

The results of systematic radionuclides measurements in Serbia from 1999 showed that the radionuclide  $^{137}\text{Cs}$  in vegetables, fruits, crops and fresh milk samples was detected below minimum detectable activities (Pantelic et al 2000).

After the Chernobyl accident, out of analyzed samples of milk, milk products, baby food and human milk in Belgrade, 81,7% had 1000 times greater  $\text{Cs }^{137}$  specific activity than in the period before the accident (Ajdacic et al.1992).

Compared with other countries, the natural radioactivity levels of food from Nis region market are similar to that of European countries.

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