THE CONTENTS OF RADIONUCLIDES Ru-103 AND Ru-106 IN FOOD

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The paper presents the results of radionuclides Ru-103 and Ru-106 contents evaluation in different foodstuff : milk and dairy products, meat, vegetables, fruit and honey. Samples came from some European countries after the nuclear accident in Chernobyl, from May to December 1986. The contents of the radionuclides in the fresh samples of food was determined on a Ge(Li) detector by the means of standard gamma spectroscopy.

The results indicate the activity of Ru-103 and Ru-106 in the investigated samples of food sampled during May and June 1986, to range up to 10^2 Bq/kg , except for some vegetable - the contents found to be 10 - 10^2 times larger. In food sampled in November and December 1986, the contents of Ru-103 was no longer within the measurable range, whereas the activity of Ru-106 was between $2x10^1$ and $5-8x10^1$ Bq/kg.

Considering only a few data about the metabolic ways of ru - tenium inside body , one can see that there is a need for sistematic and continuous study of the contents of these radionuclides, especialy Ru-106 , in food.

INTRODUCTION

The time dinamics of the Chernobyl accident in 1986 , followed the similar nuclear accidents over the world : on the first, at the end of April and during May 1986, the magnitude of contamination of the biosphere was basically determined by short-lived radionuclides , J-131 above all. Later on, as J-131 decayed, the comparatively short-lived radionuclides (Sr-89 ,

Zr-95, Nb-95, Ce-141, Ru-103, Ba-140) made an appreciable contribution to the radioactivity on the whole and finally, the main role in the process of contamination overtook the long-lived radionuclides : Sr-90, Cs-134,137 and partialy , Ru-106. But the composition of the radionuclide release was specific to some point [2]: about 3-5% of the relatively refractory elements (Sr,Ru,Pu) escaped from the reactor, that was much more than would be expected in a light-water reactor core melt. Besides, although ruthenium is less volatile then strontium , it appeared in appreciable quantities in filter samples throughout Europe, while strontium did not.

So far , ruthenium was not considered as a biologically significant radionuclide and the data on the mechanisms of it metabolism are only few, even though there are indications of the biochemistry similar to one of iron. All that points to the need of determination of contents of Ru-103,106 in food , so as the level of ruthenium intake in the human body could be evaluated.

MATERIAL AND METHOD

Sampled originated from different localities over Europe: from a period imediately after the accident (May-June, 1986) and some time after, at the end of 1986. The contents of the radionuclides Ru-103,106 in the fresh samples of food was determined on a Ge(Li) detector (ORTEC,USA) and a 4096 channel analyzer (NUCLEAR DATA ND-100).

Calibration was performed with a point etalon source Eu-152 (ET-75220 EGMA3) for the energy range of 121.78 - 1403.08 keV. The efficiencies for the measuring geometries (nonstandard Marinelli bottle 0.6 l and 200g PVC cilindric box) and different foodstuff were determined by "secondary standards" for fluid and solid state radionuclide carriers[1].

The activities of Ru-103 and Ru-106 were determined for the energies of 497.5 keV and 621.8 keV, respectively.

Table I . The contents of radionuclides Ru-103 and Ru-106 in food

Sample	Number of samples	Period of sampling	Activity* (Bq/kg) Ru - 103	Ru - 106
milk	27	May - June'86	1.7-11.7	2.4-10.4
cheese	22	May - June'86	1.4-93.0	8.0-82.1
	4	Nov.-Decem'86	-	19.0-59.3
milk powder	17	May - June'86	6.8-90.2	31.0-52.4
	2	Nov.-Decem'86	-	-78.2
yogurt	3	May '86	5.0-11.4	4.5-23.4
fruit and vegetable	12	May '86	3.5-11200	24.5-3570
honey	4	May - Sept'86	38.0-67.3	24.2-50.0
Meat :				
lamb	16	May - June'86	12.5-33.0	24.2-32.0
pork	21	May - June'86	3.5-9.8	15.2-20.5
	45	Nov. - Decem'86	-	11.0-16.4
beef	23	May - June'86	0.6-1.0	15.4-27.0
	6	Nov.-Decem'86	-	20.2-25.3
rabbit	8	July-Avg.'86	2.4-5.0	19.0-91.2
	6	Nov.-Decem'86	-	10.5-18.8
fish	5	May '86	9.4-26.5	16.0-32.8

* activities are presented in Bq/kg except for milk - in Bq/l; the table presents ranges of activities of Ru-103,106 in different foodstuff in the period of sampling ; the mean error is $\pm$ 15% , on the average

RESULTS AND DISCUSSION

The results of the radionuclides Ru-103 and Ru-106 contents evaluation in different foodstuff after the nuclear accident at Chernobyl in 1986, are presented in Table I. In the table there are presented the ranges of the activities of Ru-103 and Ru-106 for different samples of food in the two sampling periods.

The maximum contents of radionuclides Ru-103 and Ru-106 was found in rabbit, lamb, mutton milk and mutton milk dairies, as it could be expected considering the cattle feeding in that period of year. The extrimely high activities of ruthenium in some vegetable , green latice above all, immediately after the accident were due to surface contamination. At the end of the year, in a shortly established steady state, the contents of Ru-106 was found to be in a relatively narrow range, no matter the food. That indicates a specific mehanism of metabolism and distribution of this radionuclide inside the body and over the food chain.

The obtained results are in good correlation with the contents of radionuclides Cs-134,137 in food sampled in the same period.

Referencies :

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