# $Cs^{137}$ AND $Sr^{90}$ DIETARY INTAKE AND URINARY EXCRETION FOR CHILDREN, AFTER THE CHERNOBYL ACCIDENT

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## INTRODUCTION

Since the accident from Chernobyl, an important number of studies were focused on the effects of the accident but, nine years after the accident, we still don't know enough about its impact on public health and environment.

A major problem after the Chernobyl accident was to asses the effects of the irradiation for different age groups, especially for children. Our group measured $Cs^{137}$ and $Sr^{90}$ dietary intake and urinary excretion for children of different ages (between 4 and 12 years), at different time intervals after the accident. From the intake data, a trend of the annually committed effective doses was deduced. The paper presents the dose values for different age groups, as well as the balance of the intake and excretion, given here as the "observed ratio", defined as:

$OR = (\frac{Cs-137_{urine}}{K_{urine}}) / (\frac{Cs-137_{intake}}{K_{intake}})$ for $Cs^{137}$, and

$OR = (\frac{Sr-90_{urine}}{Ca_{urine}}) / (\frac{Sr-90_{intake}}{Ca_{intake}})$ for $Sr^{90}$. Both Ca and K are given in grams, while the Cs ans Sr contents are in Bq.

## MATERIAL AND METHODS

The group which undergone the study consisted of children, separated in three age subgroups : 4-6 years old, 7-9 years old and 10-12 years old . These children were living in the kindergardens and schools hostels. The data for the dietary intake and urinary excretion for the children was compared with similar data for the adult women working as teachers and educators at the schools, and taking their meals together with the children. These women were aged between 24 and 49 years. The food samples were prelevated from the schools' cafeterias. The 24 hour urine samples were prelevated the next day after the prelevation of food samples.

All the measurements were performed by radiochemical methods of analysis [1,2]. After the radiochemical separation of caesium and strontium, the radiometric measurement was performed with a low-level anticoincidence beta counting system, with high efficiency.

## RESULTS AND DISCUSSION

During 1986 - 1995, we have selected four time periods in which we have studied the dietary intake and urinary excretion of $Cs^{137}$ at children, for all three age groups, in comparison with the adult women group. We will present here the differences between the first period, (caharacterised by a strong contamination), and the last period of study.

The first period was September 1986 - December 1987. From the point of vue of the ingestion and excretion processes, this was the most complex period. During this period, an intake peak occurred in October 1986 at all the age groups, including the women. After this date, $Cs^{137}$ dietary intake is continuously decreasing, but the slope of the decrease is age-dependent. The OR for this period is presented in Fig. 1.

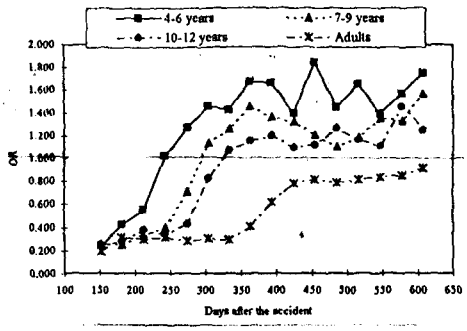


Fig. 1: OR for $Cs^{137}$, during September 1986 - December 1987

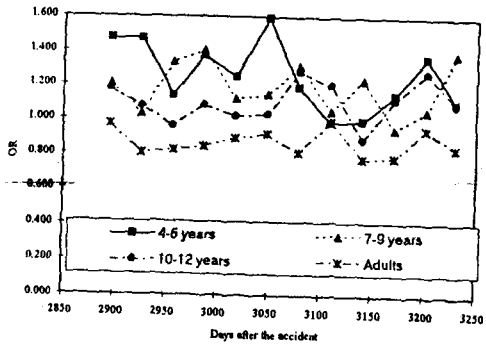


Fig. 2: OR for $Cs^{137}$ during April 1994 - March 1995

At 4-6 years and 7-9 years children, the OR reaches a plateau in April 1987 while at 10-12 years old children the plateau occurs in May 1987. The values of the OR, in the plateau zone, are also different, the value for 4-6 years children being the highest, and the value for adults being the lowest. The OR for the last period (April 1994 - March 1995) took values situated in the plateau area , for all age groups, as can be seen in Fig. 2.

As it can be seen, within the same age group, the OR tends to decrease as the time goes by; for example, at the 4-6 years old children, the OR decreased from an average value of 1.643 in 1988 - 1989 to 1.256, nine years after the accident.

During 1986 - 1994, we have selected three time periods in which we have studied strontium-90 dietary intake and urinary excretion for the same three groups of children compared with adult women. The first interval of study was September 1986 - September 1988. The maximum strontium intake in children was 1.198 Bq/(gCa.day), reached in October 1986. The observed ratio, has different values for the two age groups studied in the first period, as can be seen in Fig. 3.

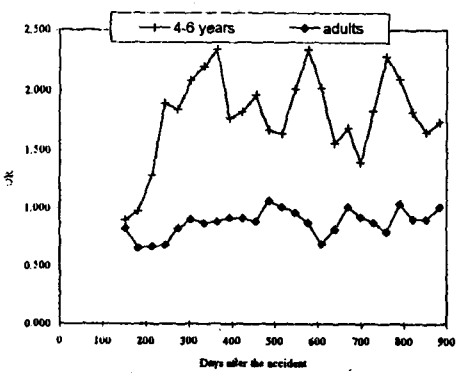


Fig. 3: The OR for $Sr^{90}$, during September 1986 - September 1988

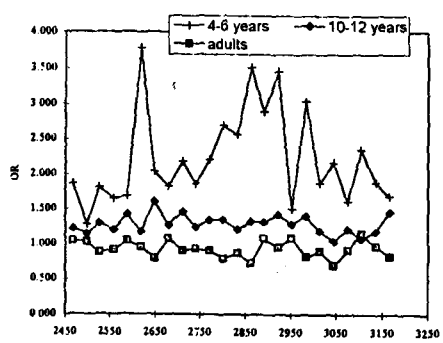


Fig. 4: The OR for $Sr^{90}$, during January 1993 - December 1994

The last period of study - since January 1993 until December 1994 - included measurements of $Sr^{90}$ dietary intake and urinary excretion for two children groups - 4-6 years and 10-12 years - and the group of adult women. The OR evolution is shown in Fig. 4. This period is caracterised by low values of $Sr^{90}$ dietary intake and urinary excretion. The average amount of ingested strontium for this period was 0.073 Bq/(gCa.day) for 4-6 years children and 0.102

Bq/(gCa.day) for 10-12 years children. As it can be seen from Fig. 4, $Sr^{90}$ urinary excretion had higher values than the dietary intake, for both children groups (OR>1), while cc for adult women the two values are roughly equal (OR~1).

The intake values for $Sr^{90}$ and $Cs^{137}$ resulted in the effective doses committed annually. In order to calculated these doses, we used the dose factor recommended by ICRP 67 [3]. The effective doses committed due to $Cs^{137}$ intake, in each time interval studied, are presented in Fig. 5. As it can be seen, the lower the age, the lower the dose and, for all age groups, the doses are decreasing as the time goes by. The doses committed due to $Sr^{90}$ intake are presented in Fig.6.

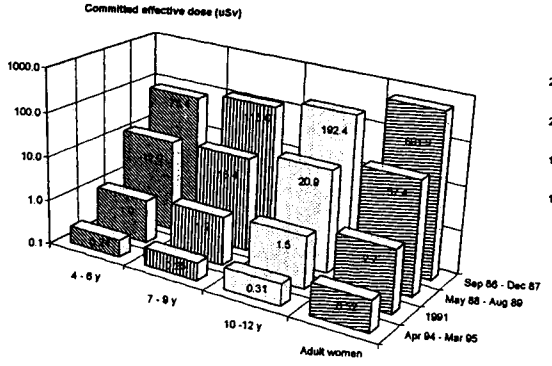


Fig. 5: Effective doses committed due to $Cs^{137}$ intake

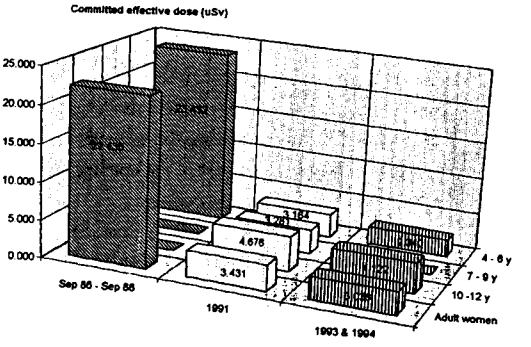


Fig. 6: Effective doses committed due to $Sr^{90}$ intake

These doses were obtained by suming the doses to red marrow and bone surface (Toader and Vasilache, 1995 [4]). In this case, there is no more linear age dependence of the dose. Fig. 6 seems to indicate that the highest doses were committed by the 10-12 years old children, but the data are not suficient to consider this hypothesis as sure. However, the doses committed due to $Sr^{90}$ are decreasing as the time elapses, as the doses due to $Cs^{137}$ do.

## CONCLUSIONS

The results of this study allowed us to estimate the effective doses committed due to $Cs^{137}$ and $Sr^{90}$ intake. The effective doses committed by the children , due to $Cs^{137}$ intake, are lower than the doses committed by the adults. As in the case of the doses committed by the adults, the doses committed by children decrease as the time goes by. In the case of the doses committed due to $Sr^{90}$ intake, the values for children are comparable to the values for adults.

## REFERENCES


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