# Derivation of Recommended Limits for Radionuclide Contamination of Foods by the FAO

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As a consequence of the reactor accident at Chernobyl, USSR, various countries defined limits for radioactive contamination of foods at different levels. These limits ranged from a few Bq iodine 131 or cesium 134 + 137/kg (Malaysia and Canada) to more than 1000 Bq/kg (Great Britain and France). These variations in limits hindered the movement of foods in international trade. For this reason the FAO convened an Expert Consultation to derive "action levels" below which neither intervention nor constraint would be justified in terms of international movement and trade in food and drink. These limits are to find application in cases of widespread environmental contamination after an accidental release of radionuclides. They are not to be applied in cases of local release, e.g. in the vicinity of nuclear facilities.

The derivation of "action levels" by the FAO was based on the recommendations issued by the International Commission of Radiological Protection (ICRP) in May 1985. According to this recommendation the committed dose equivalent for the whole body should not exceed 5 mSv in the first and 1 mSv in the consecutive years. For radionuclides that preferentially irradiate individual organs, e.g. I 131 in the thyroid, the dose equivalent to a specified organ may be used to derive limiting values. For individual organs limiting doses of 50 mSv/a and 10 mSv/a respectively were chosen.

The FAO agreed on calling the action levels "Interim International Radionuclide Action Levels for Food" (IRALF).
For a particular radionuclide A the IRALF is defined as follows:

$$\text{IRALF [Bq kg}^{-1}\text{]} = \frac{\text{Limiting annual radionuclide intake [Bq]}}{\text{Annual or "effective" food consumption [kg]}}$$

The limiting annual radionuclide intake is calculated from the limiting dose using the appropriate dose conversion factor for ingestion as follows:

$$\text{Limiting annual radionuclide intake [Bq]} = \frac{\text{Limiting dose [Sv]}}{\text{Appropriate dose conversion factor [Sv Bq}^{-1}\text{]}}$$

It was assumed that the contaminated food commodity would represent 100 percent of the total intake by the consuming individuals. It was further assumed that the daily food intake would be 1 kg for infants and 2 kg for adults. For radionuclides with half-lives less than 70 days an "effective food intake" should be used which corresponds to the period of time equal to 5 radioactive half-lives. For radionuclides with half-lives greater than 70 days the total annual food intake value should be used, i.e. 375 kg per year for infants and 750 kg for adults.



The derived action levels for individual radionuclides (Table 1) are similar to those defined by the European Community after the reactor accident at Tschernobyl. According to the FAO recommendation the following IRALFS are calculated for the first year after the accicent:

for Cs 137 500 Bq/kg
Cs 134 350 Bq/kg
I 131 400 Bq/kg
Sr 90 70 Bq/kg

A distinction between milk, milk products, and other products is not made:

If two or more radionuclides are significantly present, the sum S calculated as follows has to be smaller than 1:

$$S = \frac{C_A}{IRALF_A} + \frac{C_B}{IRALF_B} + \ldots\ldots\ldots + \frac{C_N}{IRALF_N} < 1$$

where $C_A$ is the concentration of radionuclide A in the food product.

The IRALFs are to be applied to fresh food products. For dried or concentrated products the action levels refer to the food ready for consumption. Foods which are consumed in relatively very small quantities ( e.g. spices) may be exempted from the general application of IRALFs.

Table I: Examples of Interim International Radionuclide Action Levels for Food (IRALFs)

| Radionuclide | Target Organ | Dose Level (Sv/Bq) | Dose Conversion Factor (Sv/Bq) | Radionuclide Intake (Bq corresponding to the dose) | Food Intake (kg) | IRALF (Bq/kg) |
|---|---|---|---|---|---|---|
| Sr 90 | | | | | | |
| 1st year | bone surface (infant) | 50 | $1.9 \times 10^{-6}$ | 26,000 | 375 | 70 |
| following years | | 10 | $1.9 \times 10^{-6}$ | 5,200 | 375 | 20 |
| I 131 | | | | | | |
| 1st year | thyroid (infant) | 50 | $2.9 \times 10^{-6}$ | 17,000 | 40 | 400 |
| Cs 134 | | | | | | |
| 1st year | whole body (adult) | 5 | $2.0 \times 10^{-8}$ | 250,000 | 750 | 350 |
| following years | | 1 | $2.0 \times 10^{-8}$ | 50,000 | 750 | 50 |
| Cs 137 | | | | | | |
| 1st year | whole body (adult) | 5 | $1.4 \times 10^{-8}$ | 360,000 | 750 | 500 |
| following years | | 1 | $1.4 \times 10^{-8}$ | 71,000 | 750 | 100 |
| Pu 239 | | | | | | |
| 1st year | bone surface (infant) | 50 | $1.7 \times 10^{-5}$ | 3,000 | 375 | 10 |
| following years | | 10 | $1.7 \times 10^{-5}$ | 590 | 375 | 2 |