Measures for Radioactive Materials in Foods

Approach for the Calculation of the Standard Limits (1/2)

How was the standard limit for radioactive cesium concentration in general foods figured out to be 100 Bq/kg based on the annual permissible dose of 1 mSv?

1. Preconditions for calculation

- **For drinking water, the standard limit is set to be 10 Bq/kg in line with the WHO's guidance level.**

→ The annual permissible dose allocated to general foods is approx. 0.9 mSv (0.88 to 0.92 mSv/y), which is obtained by subtracting that for drinking water (approx. 0.1 mSv/y) from the total annual permissible dose of 1 mSv.

- **Domestically-produced foods are assumed to account for 50% of all distributed foods.**

* The standard limits are calculated on the assumption that domestically-produced foods contain radioactive materials at levels close to the maximum permissible limit.

2. Conversion from radioactivity concentrations (Bq) to radiation doses (mSv)

Radiation dose (mSv) = Radioactivity concentration (Bq/kg) × Amount of consumption (kg) × Effective dose coefficient (mSv/Bq)

Under the preconditions mentioned in 1. above, the maximum limit for radioactive materials in 1 kg of general foods is calculated so that doses from general foods do not exceed the annual permissible dose for general foods.

(e.g.) < In the case of males aged between 13 and 18 >

0.88 mSv = X (Bq/kg) × 374 kg (50% of the annual consumption of foods) × 0.0000181 (mSv/Bq) (effective dose coefficient in consideration of the effects of all covered radionuclides)

X = 120 (Bq/kg) (rounded off to three digits)

* For adults, the effective dose coefficient for Cs-134 is 0.000019 and that for Cs-137 is 0.000013. The effective dose coefficient thus differs by radionuclide. Therefore, based on respective radionuclides' concentration ratios in foods, the effective dose coefficient in consideration of the effects of all covered radionuclides was used for the calculation of the maximum limits.

* Concentration ratios change over time as each radionuclide has a different half-life. Therefore, the coefficient on the safest side over the coming 100 years was adopted.

* The above explanation is just the outline. For more detailed calculation methods, refer to the reference material of the Pharmaceutical Affairs and Food Sanitation Council.

Prepared based on the Ministry of Health, Labour and Welfare's website, "Measures for Radioactive Materials in Foods" 厚生労働省

This figure shows the approach for the calculation of the standard limits, explaining the relation between the annual dose limit (1 mSv) and the standard limit for radioactive cesium concentration in general foods (100 Bq/kg).

First, the annual permissible dose of 0.88 to 0.92 mSv is allocated to general foods by subtracting approx. 0.1 mSv permitted for drinking water from the total annual permissible dose of 1 mSv. Next, in consideration of the status of food self-sufficiency in Japan, it is assumed that 50% of all distributed foods (all of the domestically-produced foods) contains radioactive materials. Based on that assumption, in the case of males aged between 13 and 18, 374 kg of foods or 50% of the total annual consumption per person (approx. 748 kg) is supposed to be domestically produced. Additionally, the effective dose coefficient in consideration of the effects of all covered radionuclides (0.0000181 mSv/Bq) is to be used for calculation.

Then, the calculation formula is as follows.

0.88 mSv = (Radioactivity concentration: Bq/kg) × 374 kg × 0.0000181 (mSv/Bq)

(Radioactivity concentration: Bq/kg) = 120 Bq/kg

If concentrations of radioactive materials in general foods do not exceed 120 Bq/kg, the annual dose will remain within 0.88 mSv.

Therefore, the standard limit for general foods (100 Bq/kg), which is lower than 120 Bq/kg, is the value set on the safe side to guarantee safety.

(Related to p.51 of Vol. 2, "Standard Limits Applied from April 2012," and p.58 of Vol. 2, "Approach for the Calculation of the Standard Limits (2/2)")

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