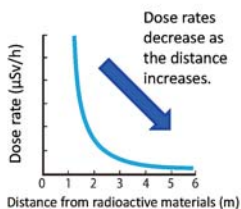
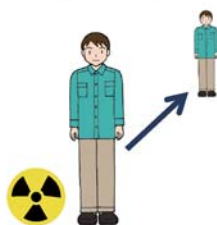
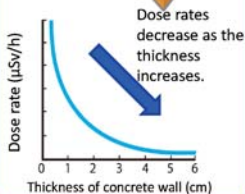


## Three Principles of Reduction of External Exposure

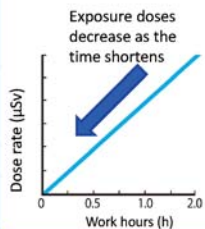
### (i) Keep away (distance)



### (ii) Place something heavy in between (shielding)



### (iii) Shorten time while being close to radioactive materials (time)



There are three ways to reduce external exposure doses.

The first is to keep away from radioactive materials such as by removing soil contaminated with radioactive materials and isolate it from people's living environment.

The second is to shield radiation such as by staying indoors, replacing topsoil contaminated with radioactive materials with subsoil, and using uncontaminated soil as a shielding material.

The third is to shorten the time to stay at places with high ambient dose rates. (Related to p.50 of Vol. 1, "Characteristics of External Exposure Doses")

Included in this reference material on March 31, 2013

Updated on March 31, 2019

## Internal Exposure - Responses Immediately after a Nuclear Hazard -

- Prevent radioactive materials from entering the body through the mouth, nose or wounds, in principle.
- Be careful not to lose nutritional balance, being excessively worried about a small amount of radioactive materials below the standard limit.
- Be aware of information on the release of radioactive materials.
- Wash off soil immediately from the body, shoes and clothes.



As causes of internal exposure, both inhalation and ingestion of foods need to be taken into consideration. For example, when calculating exposure doses for children engaging in outdoor activities at places with high ambient doses, doses due to internal exposure account for only around 2% to 3% and exposure doses are mostly due to radiation from outside of the body. Therefore, people do not have to be too nervous about exposure through inhalation and proper daily hygienic control (taking a bath, getting a haircut, washing hands, cleaning, and doing the laundry, etc.) is effective in reducing internal exposure to some extent.

In the meantime, regarding the possibility of internal exposure caused by ingestion of foods, attention needs to be paid to foods from which radioactive cesium is detected at high levels. In particular, special attention is required for ferns and mushrooms, which have a property to concentrate cesium. Data on radioactivity concentrations in foods is released by the Ministry of Health, Labour and Welfare and the Ministry of Agriculture, Forestry and Fisheries.

Radioactivity in the body can be measured with a whole-body counter. Some local governments and private hospitals, etc. provide opportunities for checking internal exposures using whole-body counters.

Included in this reference material on March 31, 2013

Updated on March 31, 2019

## Radioactive materials can be reduced through cooking.

Item	Cooking/Processing methods	Removal rate (%)
Leaf vegetables (spinach, etc.)	Washing - Boiling	7~78
Bamboo shoots	Boiling	26~36
Japanese radish	Peeling	24~46
Nameko mushrooms (raw)	Boiling	26~45
Fruits (grape, persimmon, etc.)	Peeling	11~60
Marron	Boiling - Peeling astringent skin	11~34
Japanese plum	Salting	34~43
Cherry leaves	Salting	78~87
Fish	Cooked lake smelt soaked in Japanese sweet and peppery vegetable sauce	22~32

- Avoid eating wild foods too much.

$$\text{Removal rate (\%)} = \left(1 - \frac{\text{Total amount of radioactivity in cooked or processed foods (Bq)}}{\text{Total amount of radioactivity in raw materials (Bq)}}\right) \times 100$$

Source: Prepared based on the "Environmental Parameters Series Expanded Edition (2013): Radionuclide Removal Rates through Cooking and Processing of Foods - Centered on Data on Radioactive Cs Removal Rates in Japan -" (September 2013), Radioactive Waste Management Funding and Research Center

Immediately after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, radioactive materials detected from vegetables were only attached to the surface thereof, and such radioactive materials could be washed off to some extent.

At present, radioactive materials are seldom attached to the surface of vegetables, but some radioactive materials in soil may be taken into vegetables through their roots. However, radioactive cesium adsorbed into vegetables from the roots can be removed through cooking or processing with some ingenuity.

The table above shows removal rates of radioactive cesium in foods.

When boiling vegetables, the longer the boiling time is, the larger the removal rate is. This is considered to be because radioactive cesium in vegetable cells comes out into the boiling water as vegetable cells break. Also in the case of salted vegetables, the longer the salting time is, the larger the removal rate is. This is considered to be because radioactive cesium in vegetables is replaced with sodium in salt.

When cooking meat or fish, the amount of radioactive materials can be halved by discarding the cooking liquid. It is known that the removal rate is higher when boiling or cooking than grilling them.

Refer to the webpage (<https://www.rwmc.or.jp/library/other/kankyo/>, in Japanese) for the details of the related data.

Included in this reference material on March 31, 2017

Updated on March 31, 2019