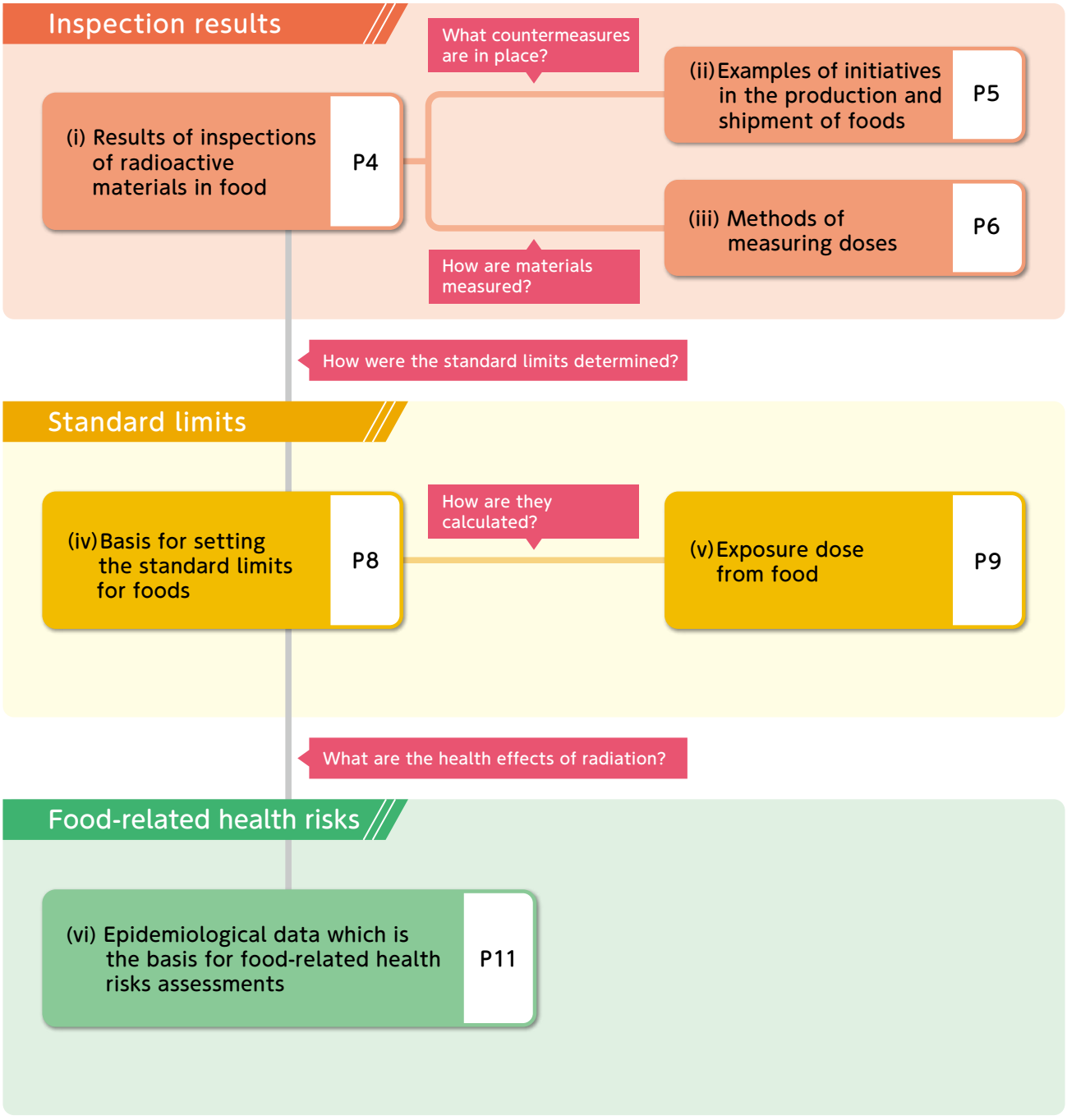
Health Effects of Radiation: 5 Themes

Food

To promote a correct understanding of the effects of radioactive substances on food and to deepen understanding of food safety, here we explain the standard limits for radioactive materials in food, the results of inspections, effects on health, and efforts to reduce the concentration of radioactive materials in food.

2022 Edition

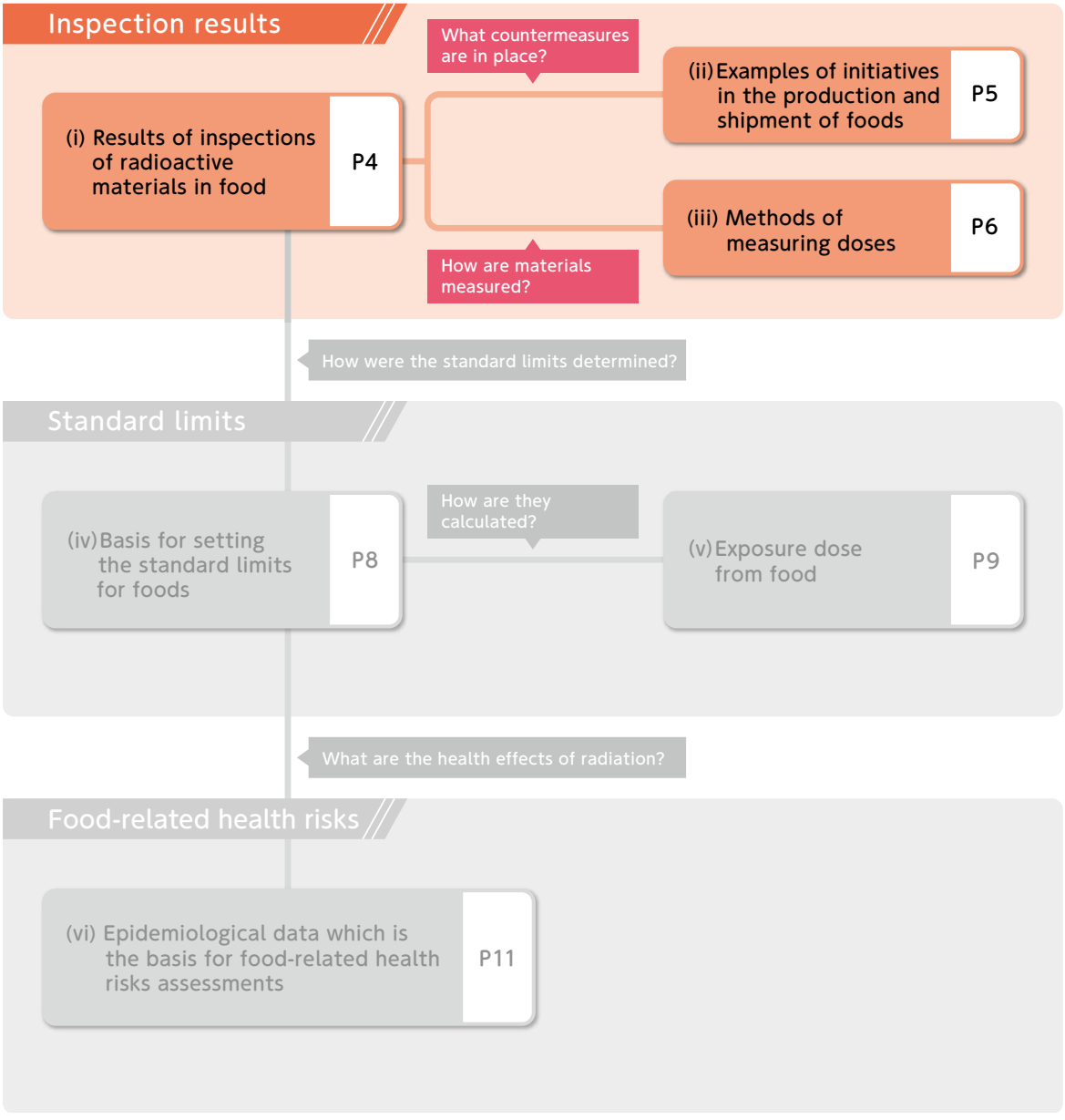
Food Relationship Diagram



Health Effects of Radiation: 5 Themes | Food

Theme: Inspection results

For foods that are often eaten in daily life, inspection results are available which show the progression of radioactive material content from after the accident to the present, divided into different categories. This section will also introduce the instruments used for measuring the concentration of radioactive materials.



(i) Results of inspections of radioactive materials in food

As a result of the TEPCO's Fukushima Daiichi Nuclear Power Station accident, concern about the radiation exposure from food spread. However, radioactive decay and various other initiatives are preventing the distribution of foods which exceed the standard limits.

◉ Inspection results by food type

In order to ensure the safety of food, inspections are conducted to prevent distribution of foods with concentrated radioactivity above a certain threshold. In addition, various initiatives are in place for preventing radioactive contamination of foods. As a result of these efforts, inspection results exceeding the standard limits are no longer being seen, and foods with radioactivity above these levels are not in distribution.
Inspection results are released by the Ministry of Health, Labour and Welfare and by local government organizations.

- Measures for Radioactive Materials in Food, Ministry of Health, Labour and Welfare
https://www.mhlw.go.jp/shinsai_jouhou/shokuhin.html
- Database of radioactive substances in food
http://www.radioactivity-db.info/

For more detailed survey results, see page 52 of Vol. 2, FY2022 edition.
For detailed information about the surveys, see pages 73, 76, 81, 84, 86 of Vol. 2, FY2022 edition.

◉ Survey of Distributed Foods (Market Basket Survey)

Amounts of radioactive materials contained in average meals have been surveyed since FY2011, using a market basket approach. According to the results of surveys, the annual radiation dose from radioactive cesium in food received by an individual is about 0.1% of the annual permissible dose of 1 mSv per year, which is the basis for the current standard limits.
Information including inspection results, shipping restrictions, and intake restrictions for specific food products is published on the websites of national and local government organizations.
URL for the applicable page on the Ministry of Health, Labour and Welfare website:
https://www.mhlw.go.jp/shinsai_jouhou/shokuhin.html

For detailed information on annual radiation doses, see page 65 of Vol. 1, FY2022 edition.
For detailed information about the inspections, see page 62 of Vol. 2, FY2022 edition.

(ii) Examples of initiatives in the production and shipment of foods

As a result of various measures, concentrations of radiation in excess of standard limits are currently almost never found in inspections.

◉ Measures for Reducing Transfer of Radioactive Materials to Crops

This section introduces some of the measures used to reduce the transfer of radioactive materials to crops.

● Decontamination of Farmland

Stripping of topsoil (Topsoil removal)

Scrape away the topsoil to remove radioactive materials which remain in shallow depth

Inversion tillage

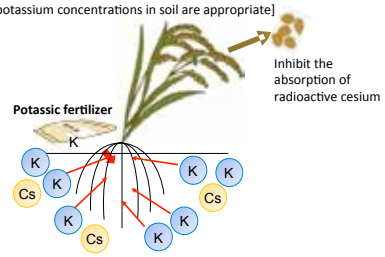
Replace topsoil with subsoil, thereby reducing radioactivity concentrations in the soil layer where plants take root

Prepared based on the "Responses at Farmland" by the Ministry of Agriculture, Forestry and Fisheries (MAFF) MAFF

● Measures to Inhibit Radioactive Cesium Absorption through Potassic Fertilization

- In paddy fields where detected radioactive cesium concentrations in brown rice are higher, potassium concentrations in soil tend to be lower.
- Potassium in soil has similar chemical characteristics as cesium and proper use of potassic fertilizer can inhibit growing crops from absorbing cesium.

[When potassium concentrations in soil are appropriate]

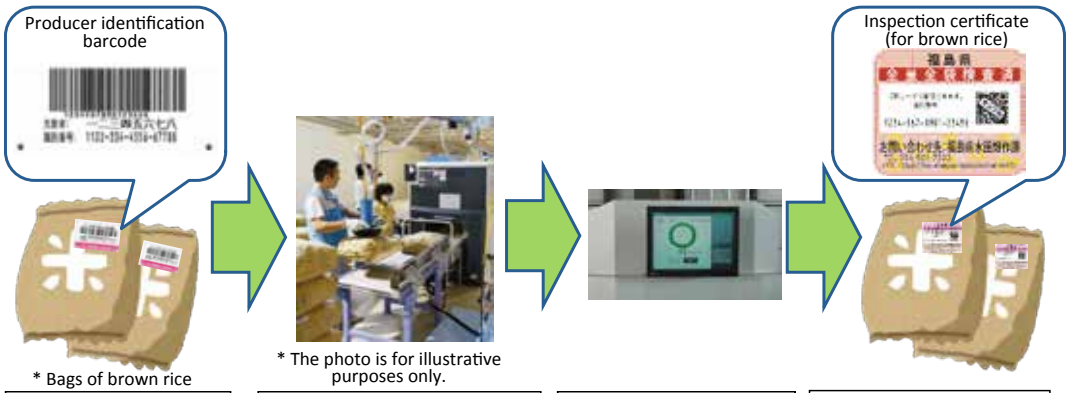


Prepared based on the "Inspection Results Concerning Radioactive Materials in Foods" by the Ministry of Agriculture, Forestry and Fisheries (MAFF) MAFF

For more detailed information about these initiatives, see pages 68 and 69 of Vol. 2, FY2022 edition.

◉ Radioactivity Inspections of Rice in Fukushima Prefecture

Fukushima Prefecture has inspected all bags of rice harvested in the prefecture since 2012, separately from inspections performed under inspection guidelines. As no bags were found to exceed the standard limits for the five years from 2015, for rice produced from 2020 onward the prefecture has transitioned from inspection of all bags to monitoring (sampling) inspections, with the exception of some areas including former Areas under Evacuation Orders.



Radioactivity Inspection results can be checked using QR (quick response) codes.
"Fukushima Association for Securing Safety of Agricultural Products (https://fukumegu.org/ok/kome)(in Japanese)"

* Prepared based on the website of the Fukushima Prefectural Government

Prepared based on the "Responses at Farmland" by the Ministry of Agriculture, Forestry and Fisheries (MAFF) MAFF

For more details about these initiatives, see page 75 of Vol. 2, FY2022 edition.

(iii) Methods of measuring doses

In order to prevent distribution of foods with radioactivity concentrations exceeding the standard limit, inspections of radioactive materials in foods are implemented. This section will explain how these inspections are conducted.

◉ Inspection procedures

The food inspections are carried out using the following procedures.

Non-destructive inspection methods enable measurement without shredding.

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

For more details about the inspection procedures, see page 66 of Vol. 2, FY2022 edition.

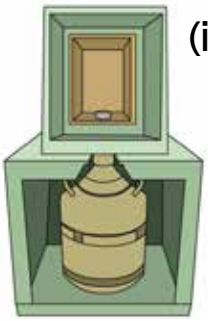
◉ Type of inspections

Inspections are conducted with consideration for efficiency and safety using the combination of (i) an efficient screening test and (ii) a rigorous inspection.

For more details about the individual inspections, see page 66 of Vol. 2, FY2022 edition.

(i)NaI (Tl) Food Monitor

Since handling is simple and detection efficiency is relatively high, this method is suitable for efficient radioactivity measurement of materials such as foods.



(ii)Ge Semiconductor Detector

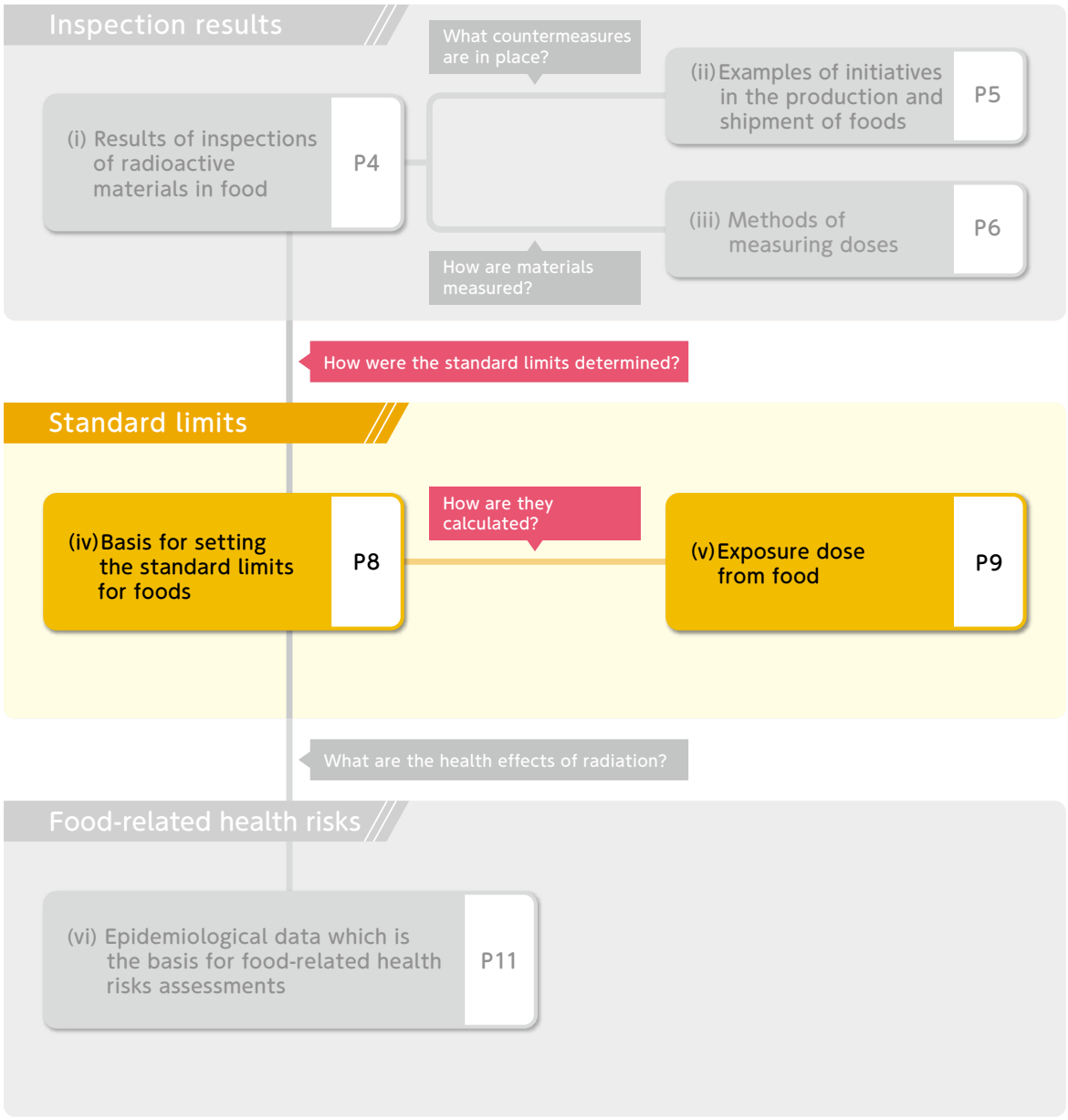
Used for radioactivity measurement of foods and soil. Provides superb gamma ray resolution and is effective for measuring low-level concentrations of radiation.

For more details about the measuring instruments, see page 44 of Vol. 1, FY2022 edition.

Health Effects of Radiation: 5 Themes | Food

Theme: Standard limits

In order to ensure safety and consumer peace of mind for food, a standard limit for radioactive materials in foods is established. This section will explain the approach for the establishment of the standard limits selected and also present a calculation example for exposure doses from foods from the perspective of related health risk.



(iv) Basis for setting the standard limits for foods

Handling measures are implemented to ensure that food products found to have radioactive cesium concentration in excess of the standard limit in radioactive material inspections do not enter distribution. The present standard limits are based on the idea that the annual radiation dose from foods should not exceed 1 mSv.

◉ Present standard limits concerning radioactive cesium*

Present standard limits concerning radioactive cesium in food are as follows.

Category	General foods	Infant foods	Milk	Drinking water
Standard limit	100	50	50	10

(Unit: Bq/kg)

*The effects of other materials such as strontium-90 and plutonium were also considered when setting the standard limits.

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

For more information about standard limits, see page 53 of Vol. 2, FY2022 edition.

◉ The Idea of the Standard Limits

The annual additional dose limit for radiation is 1 mSv. How was this value determined?

Why were the standard limits set based on the annual permissible dose of 1 mSv?

(i) They are in line with the international indicator based on scientific knowledge.

The Codex Alimentarius Commission, which establishes international specifications for foods, has set indicators so that the annual dose does not exceed 1 mSv.

Note) The International Commission on Radiological Protection (ICRP) considers that stricter requirements below 1 mSv/year would not achieve any significant additional dose reduction. Therefore, based on this, the Codex Alimentarius Commission specifies indicators.

(ii) They are intended to reduce radiation exposure as low as reasonably achievable.

Radiation monitoring surveys have shown considerable decreases over time in radioactivity concentrations measured in foods.

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

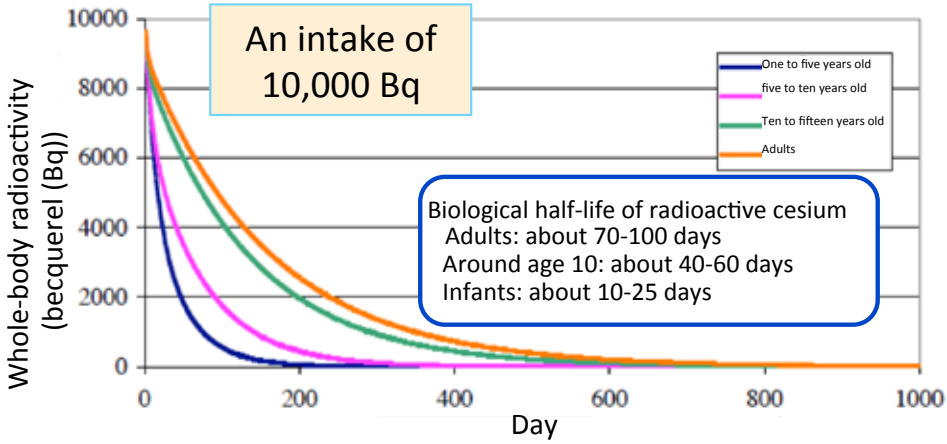
For more information about the idea of the standard limits, see page 57 of Vol. 2, FY2022 edition.

(v) Exposure dose from food

Internal exposure dose is calculated based on intake volume of foods containing radioactive materials.

◉ The Idea of Internal Exposure

Radioactive materials remain in the body for a certain period of time after being taken into the body. In the meantime, the body will be continuously exposed to radiation. Thus, the total amount of radiation that a person will be exposed to into the future is calculated as dose due to internal exposure based on a single intake of radioactive materials.
Any radioactive materials taken into the body will decrease over time. For adults, the time required for radioactive cesium that enters the body to reduce to half is said to be about 70 -100 days.

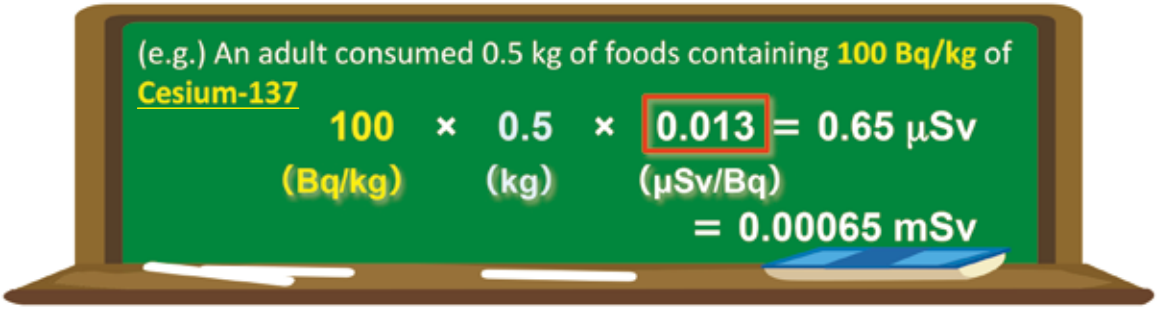


Source: Modified from a material released for the Japan Society of Radiation Safety Management Symposium in Miyazaki (June 29, 2012)

For more information about the idea of internal exposure, see pages 56 and 62 of Vol. 1, FY2022 edition.

◉ Exposure Doses from Foods (Example of Calculation)

For example, the dose that an adult who consumed foods containing Cesium-137 will receive is calculated here.



Source: ICRP Publication 119, Compendium of Dose Coefficients based on ICRP Publication 60, 2012, International Commission on Radiological Protection (ICRP)

The 0.013 in the red box is the coefficient for converting from Bq to Sv defined by the International Commission on Radiological Protection (ICRP). When calculating internal exposure dose, consider the committed effective dose. Committed effective dose coefficients are defined in detail for each type of radioactive material, each intake route (inhalation or ingestion), and each age group. Based on market basket surveys, annual radiation doses received from radioactive cesium in foods were estimated to be 0.0005 to 0.0011 mSv, 1% or lower of the annual permissible dose of 1 mSv/y, based on which the standard limits were established. Thus, annual radiation doses were confirmed to be extremely small.

For more information about these calculations, see page 58 of Vol. 1, FY2022 edition.

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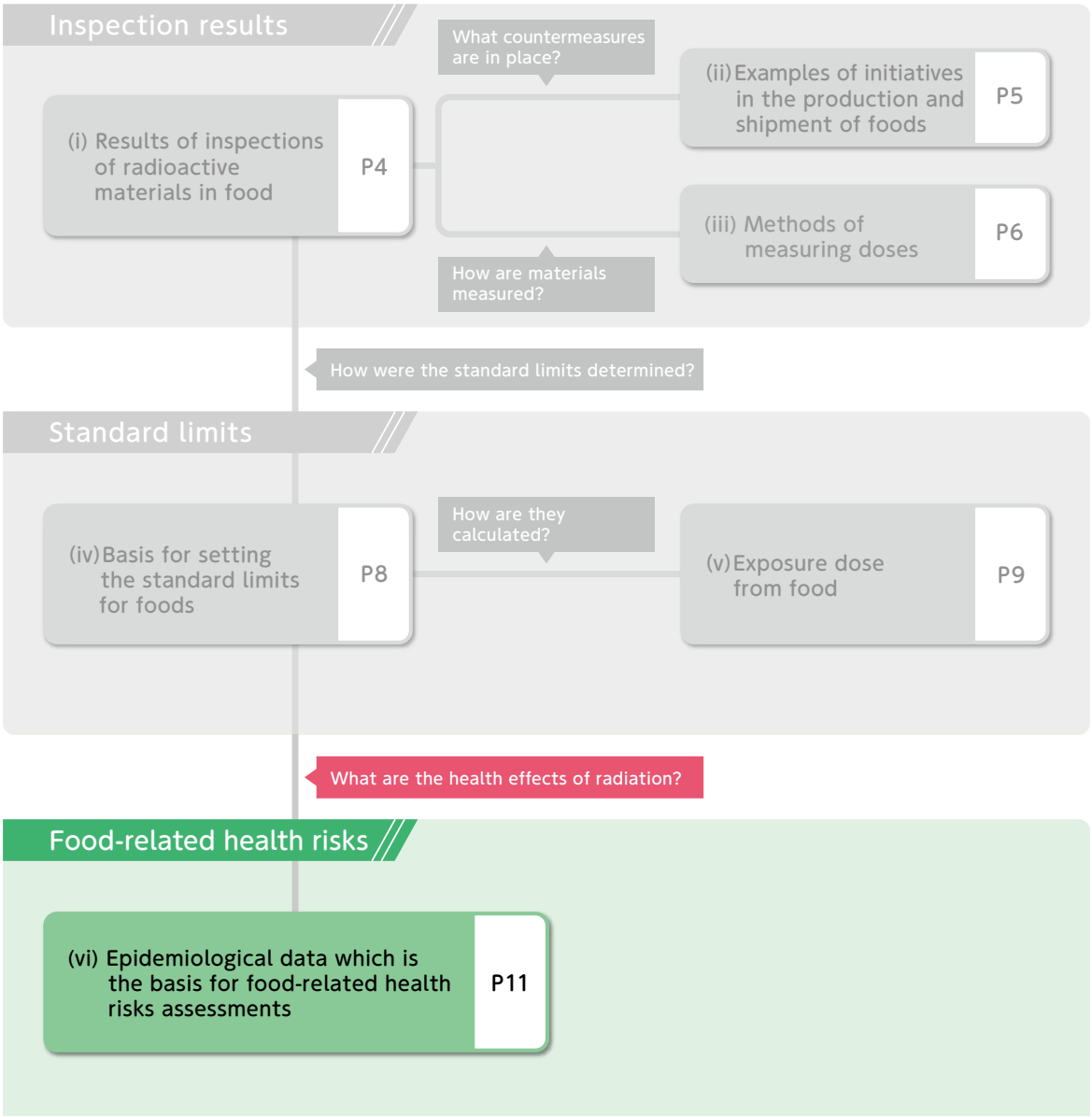
Theme: Food-related health risks

The Food-Related Health Risk Assessment (risk assessment) has been conducted regarding the radioactive materials in foods, and the results of these assessments are collected. Information about the risks of cancer related to radiation exposure and international radiation exposure assessments is also available.



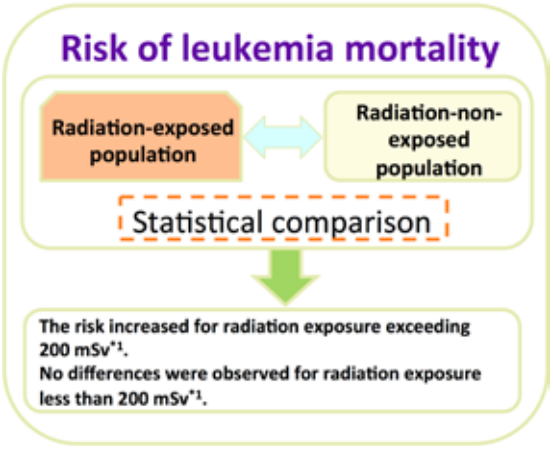
(vi) Epidemiological data on which the Food-Related Health Risk Assessment is based

The standard limits for radioactive materials in food were considered based on the results of the Food-Related Health Risk Assessment. The following epidemiological data was used as the basis for evaluating food effects on health.

◉ Basis of the Food-Related Health Risk Survey

■ **A study reporting no identification of increased cancer risk in high natural radiation areas in India where the cumulative radiation dose is 500 mSv[*1] or higher** (Nair et al. 2009)

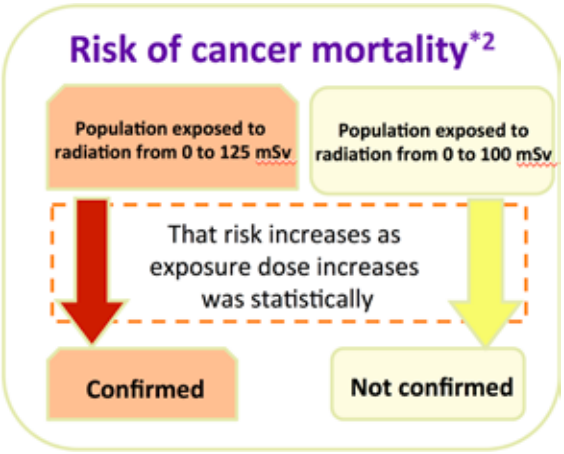
The data on atomic bomb survivors in Hiroshima and Nagasaki shows that the risk of leukemia mortality increased for the population exposed to radiation exceeding 200 mSv but that there was no statistically significant difference in the mortality risk between the populations exposed to radiation less than 200 mSv and not exposed to radiation.



(Shimizu et al. 1988; Data on atomic bomb survivors in Hiroshima and Nagasaki)

*1 In a case of exposure to β - rays or γ - rays, values are multiplied by a radiation weighting factor of one (1).

Another report which analyzed the same data of atomic bomb survivors shows that for the population exposed to radiation from 0 to 125 mSv, it was statistically confirmed that the risk of cancer mortality increases as the exposure dose increases. However, for the population exposed to radiation from 0 to 100 mSv, no statistically significant difference was observed between radiation doses and the cancer mortality risk.



*2 Data covering all solid tumors

(Preston et al. 2003; Data on atomic bomb survivors in Hiroshima and Nagasaki)

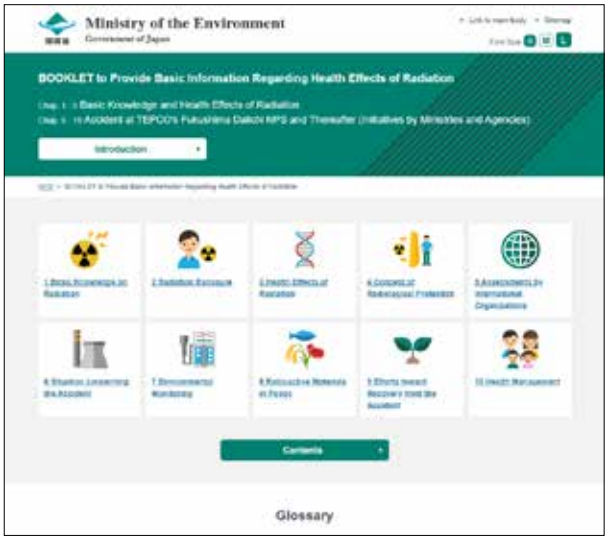
For more details on each of these evaluations, see page 56 of Vol. 2, FY2022 edition.

Portal site regarding the health effects of radiation

Additional resources such as the "BOOKLET to Provide Basic Information Regarding Health Effects of Radiation" which this digest document summarizes, Q&As, the latest information concerning the effects of radiation on health, and other related documents and articles are available in a searchable format on the portal site.

https://www.env.go.jp/en/chemi/rhm/portal/

BOOKLET to Provide Basic Information Regarding Health Effects of Radiation



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