



# Visiting

Here, we introduce the current state of radiation doses in the region and the health-related effects of radiation on people who visit the area affected by the disaster. Exchanges with people inside and outside the region and inside and outside Japan are expected to play a role in revitalizing the region, as well as in communicating the reality of reconstruction to the world.

## Visiting Relationship Diagram

### Regional ambient dose rates

What are the radiation doses in Fukushima?

(i) Distribution of ambient dose rates in the area surrounding TEPCO's Fukushima Daiichi NPS site

P4

How does it compare to other regions?

(ii) Comparison to other regional ambient dose rates

P5

How are ambient dose rates measured?

(iii) A method of measuring ambient dose rates

P6

Where are the measurement results published?

### Various monitoring results

Where did the radioactive materials go?

(iv) Monitoring results

P8

(v) Behavior of radioactive materials

P9

What kind of effects does radiation exposure have on health?

### Effects on health

How is the situation viewed overseas?

(vi) Comparison of exposure doses in daily life

P11

(vii) Assessments by international organizations

P12

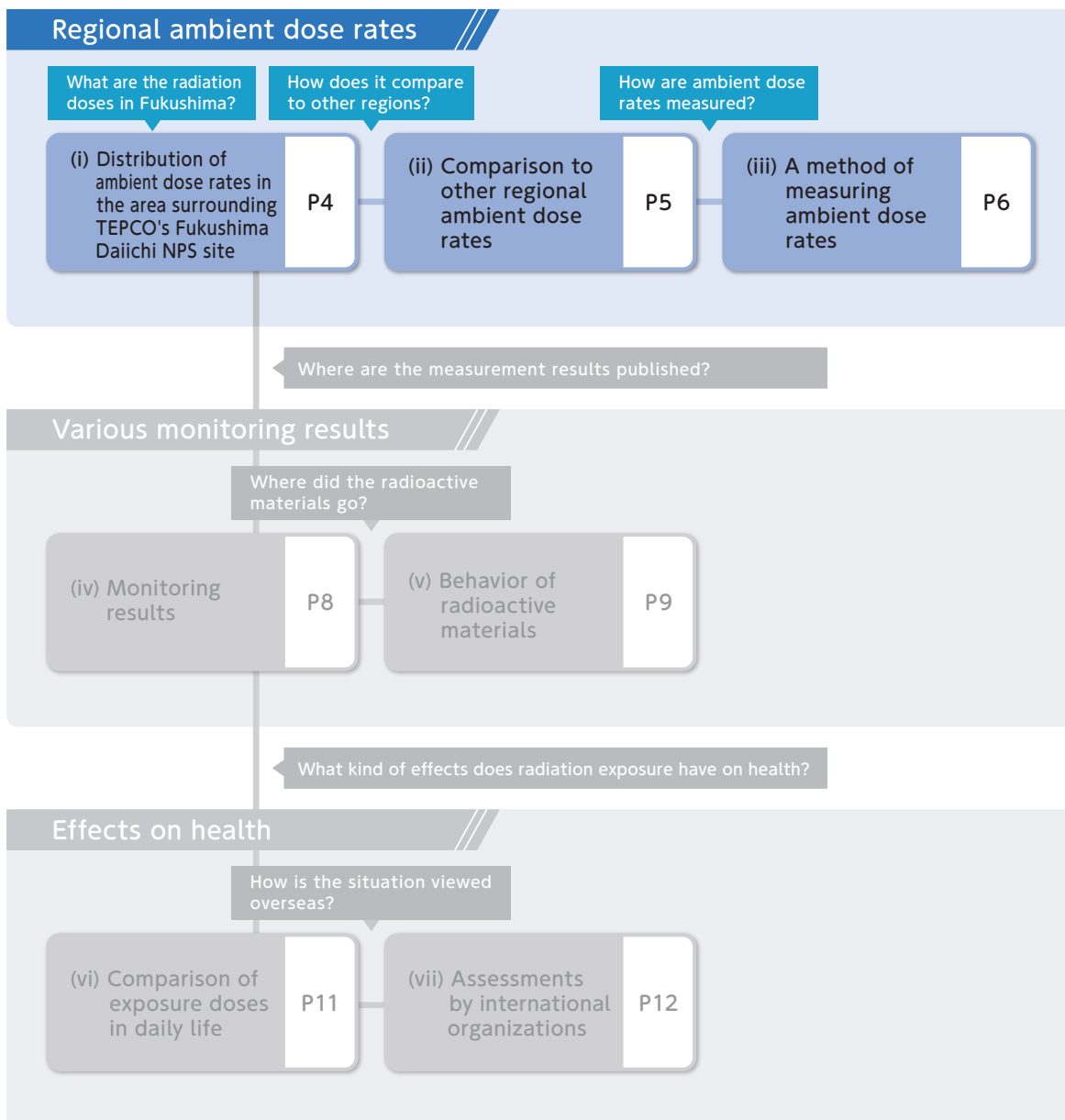


Health Effects of Radiation: 5 Themes

Visiting

# Theme: Regional ambient dose rates

Read on and you can learn about the distribution of ambient dose rates in the area surrounding the TEPCO's Fukushima Daiichi NPS, as well as how they compare to other areas. We will also introduce the measurement methods for ambient dose rates.





# (i) Distribution of ambient dose rates in the area surrounding TEPCO's Fukushima Daiichi NPS site

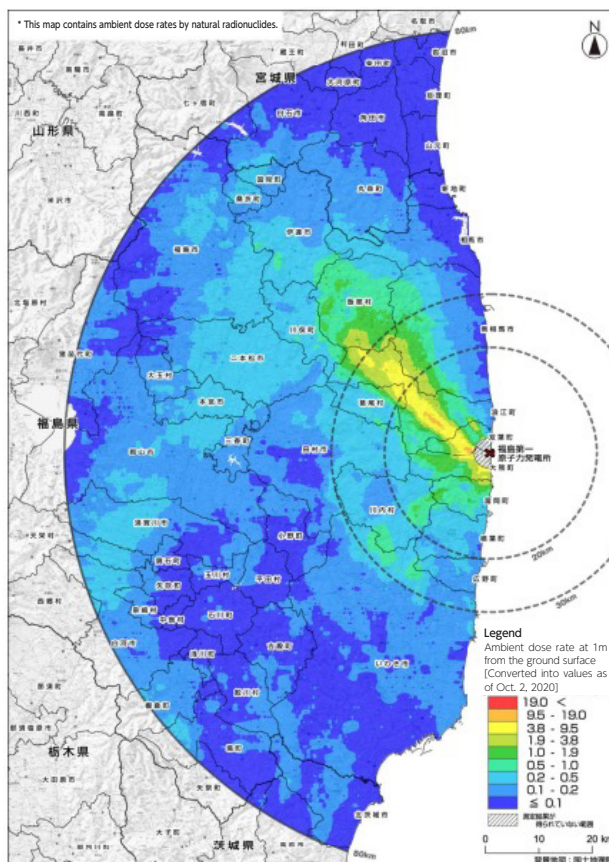
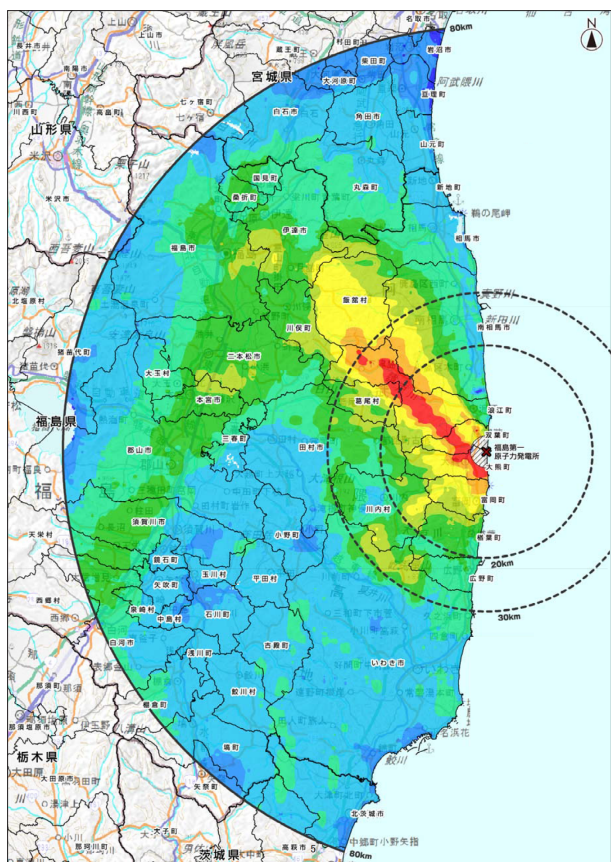
Visiting

Through the implementation of decontamination efforts and the passage of time, ambient dose rate values in the area surrounding TEPCO's Fukushima Daiichi NPS site have decreased from the levels immediately after the accident.

## ● Distribution of Ambient Dose Rates within the 80-km Zone of TEPCO's Fukushima Daiichi NPS

● Released by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) on Dec. 16, 2011

● Released by the Nuclear Regulation Authority on Feb. 15, 2021



Regional ambient dose rates

Various monitoring results

Effects on health

In order to ascertain the changes in the effect of radioactive materials, an airborne monitoring survey is being conducted continuously within an 80-km radius from TEPCO's Fukushima Daiichi NPS.

It was confirmed that ambient dose rates within the 80-km zone decreased over time both in areas showing higher dose rates (areas extending to the northwest of the NPS) and areas showing lower dose rates.

For more information about the distribution of ambient dose rates, see page 24 of Vol. 2, FY2022 edition.

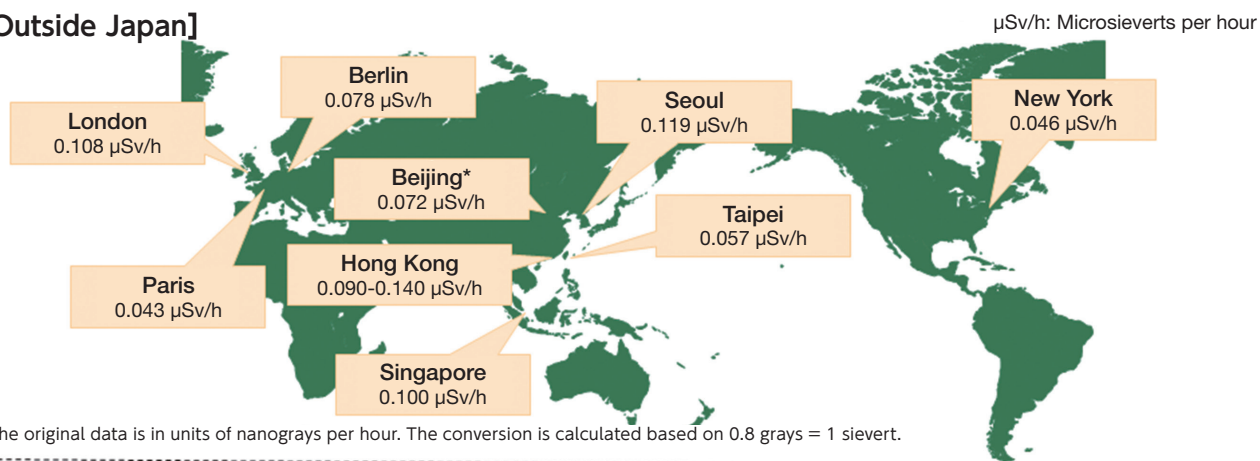


## (ii) Comparison to other regional ambient dose rates

Comparing the ambient dose rates shown here for 4 municipalities in Fukushima Prefecture and other major cities inside and outside of Japan shows that as a result of decontamination efforts and physical attenuation of radioactive materials, the levels are roughly the same.

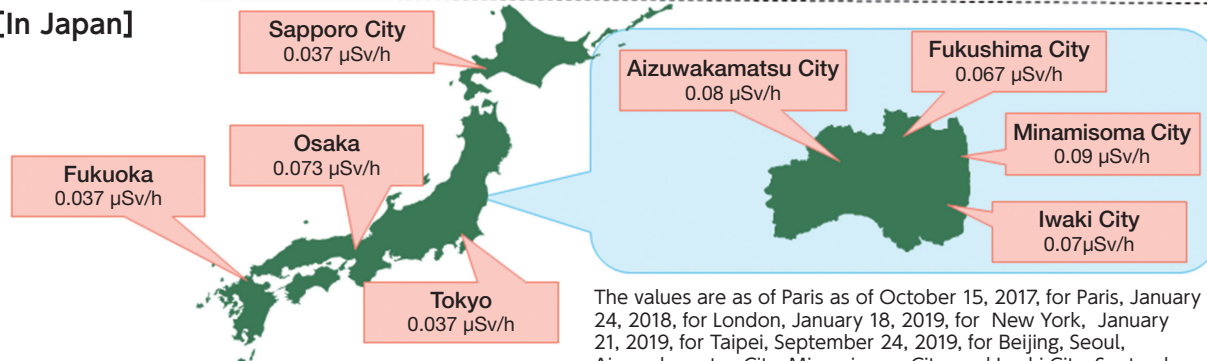
### Measurement results for ambient dose rates in major cities

#### [Outside Japan]



\*The original data is in units of nanograys per hour. The conversion is calculated based on 0.8 grays = 1 sievert.

#### [In Japan]



The values are as of Paris as of October 15, 2017, for Paris, January 24, 2018, for London, January 18, 2019, for New York, January 21, 2019, for Taipei, September 24, 2019, for Beijing, Seoul, Aizuwakamatsu City, Minamisoma City, and Iwaki City, September 26, 2019, for Singapore, September 27, 2019, for Berlin and Hong Kong, and September 18, 2019, for the rest.

Source: Prepared based on data by the Japan National Tourism Organization (<https://www.japan.travel/en/news/post-2011-3-11-general-information/>, as of December 2018)

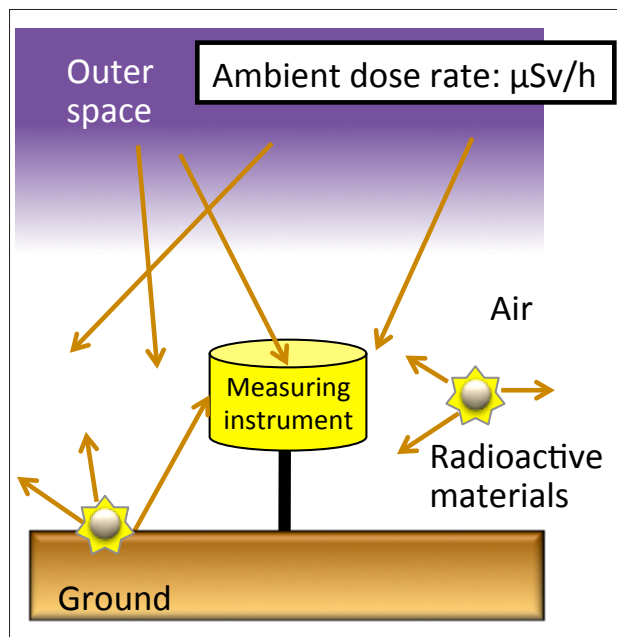
This figure shows ambient dose rate measurements for major cities in Japan and other parts of the world in 2017 or 2018. Radiation dose can be seen to vary by region. This is due to variations in the amount of ground radiation, mainly caused by differences in soil and rock composition.

For more information about ambient dose rate measurement results for major cities, see page 69 of Vol. 1, FY2022 edition.

### (iii) A method of measuring ambient dose rates

At the radiation monitoring posts set up in various areas of Fukushima Prefecture, ambient dose rate measurements are taking. This section explains how these radiation monitoring posts are measuring the ambient dose rate.

#### ● Ambient dose rate measurement



Ambient dose rate measures  $\gamma$  (gamma) rays in the air  
Indicated in microsieverts per hour ( $\mu\text{Sv/hr}$ )



Actual measuring instrument  
(radiation monitoring post)

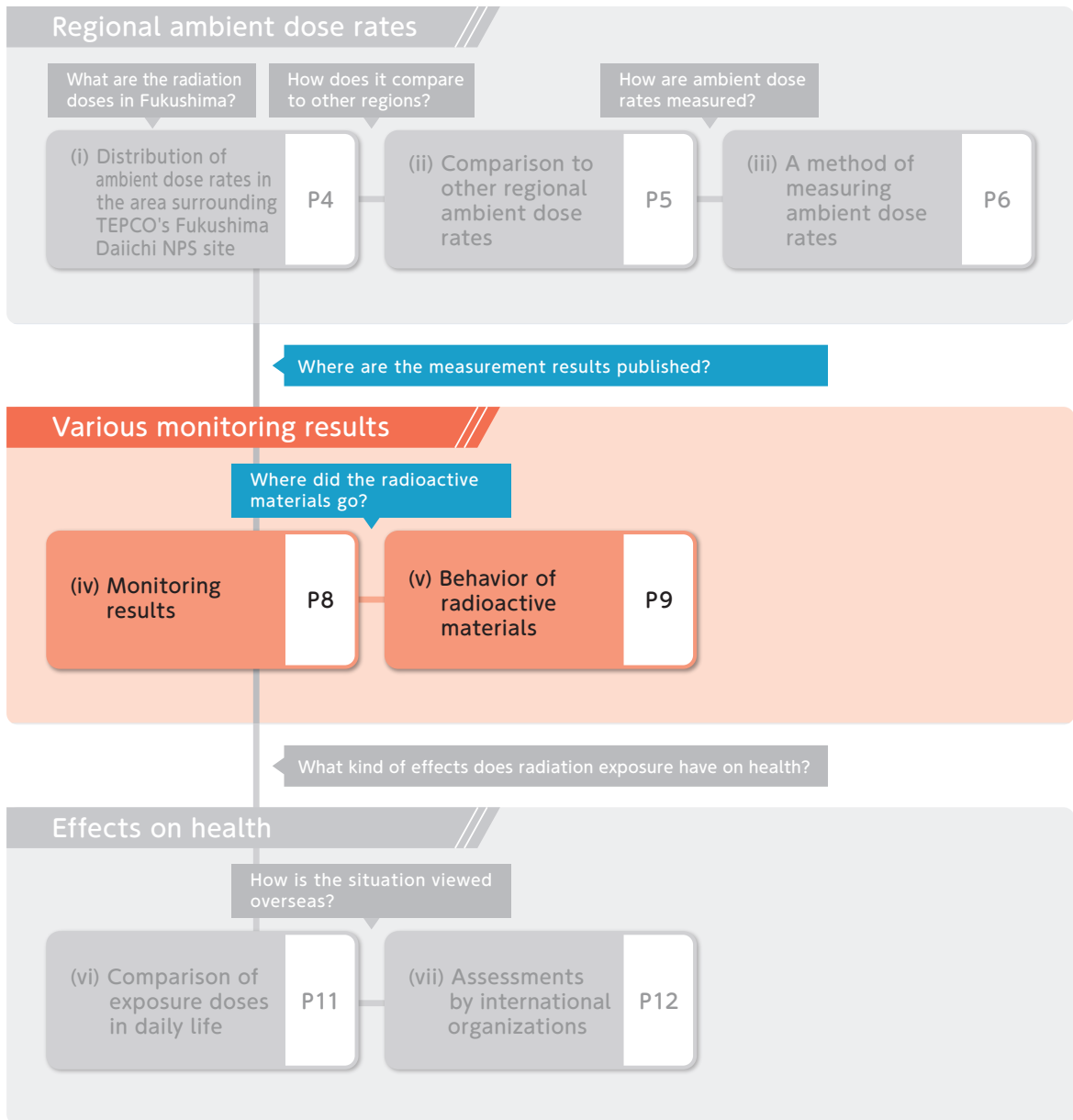
The ambient dose rate is obtained by measuring  $\gamma$ -ray doses in the air, and is indicated in microsieverts per hour. The measured value is not limited to the amount of radiation derived from accidents. Natural radiation mainly comes from the ground and cosmic rays. Normally, a measuring instrument is placed at a height of about 1 m from the ground, because most important internal organs are located at this height in the case of an adult. The height of measuring instruments may be set to 50 cm from the ground in places mainly visited by children, such as schools and pre-schools.

For more information about ambient dose rates, see page 52 of Vol. 1, FY2022 edition.



# Theme: Various monitoring results

We introduce a variety of monitoring surveys carried out in connection to the accident at TEPCO's Fukushima Daiichi NPS. We also explain the movements of released radioactive materials within the environment.



Regional ambient dose rates

Various monitoring results

Effects on health



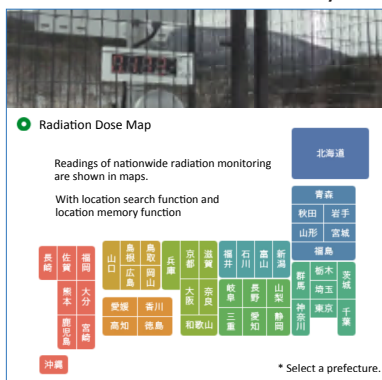
## (iv) Monitoring results

Within Fukushima Prefecture, monitoring of various data in addition to ambient dose measurements is being conducted in order to maintain awareness of radiation dose and radioactive materials.

### Comprehensive Radiation Monitoring Plan and Information Disclosure

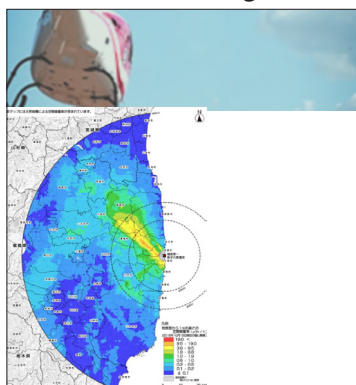
At the Monitoring Coordination Meeting held at the Nuclear Emergency Response Headquarters, a Comprehensive Monitoring Plan was determined, and monitoring is being carried out in coordination with related organizations and nuclear operators. The results are posted on the websites of these organizations and updated as needed.

#### Real-time Dose Measurement System



Ambient dose rates measured at mobile monitoring posts nationwide and by the Real-time Dose Measurement System are shown in a map.

#### Airborne monitoring



Monitoring using airplanes is conducted on a regular basis, centered on Fukushima Prefecture. The results are compiled into ambient dose rate maps and released.

#### Sea area monitoring



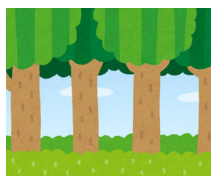
Relevant ministries and agencies conduct monitoring of seawater, marine soil and marine organisms and release measurement results.

Nuclear Regulation Authority radiation monitoring information <https://radioactivity.nra.go.jp/ja/>  
Taken from the comprehensive radiation monitoring plan <https://radioactivity.nra.go.jp/ja/list/511/list-1.html>

For more details about the comprehensive radiation monitoring plan, see page 23 of Vol. 2, FY2022 edition.

The major results from the monitoring implemented in accordance with the comprehensive radiation monitoring plan are shown below.

#### Changes in ambient dose rates in Fukushima Prefecture forest areas



Average ambient dose rate values at 362 continuously-measured areas show a significant decline, falling to 20% or less of the values measured immediately after the accident.

#### Fukushima Prefecture well water inspection results



Radioactive materials have never been detected from well water in the inspections conducted so far. Inspection results have all been "ND" (not detected; below the detection limit).

#### Monitoring results for public water areas in Fukushima Prefecture and the surrounding region\*1



Monitoring has been conducted at about 600 sites. At all but a very small number of these, no radioactive materials are detected.

#### Tap water monitoring results for Fukushima Prefecture and the surrounding region\*2



There has been no report of radioactive cesium detection at a level exceeding 10 Bq/kg since June 2011.

\*1: All of Fukushima Prefecture, Miyagi Prefecture, Ibaraki Prefecture, Tochigi Prefecture, and Gunma Prefecture, as well as parts of Iwate Prefecture and Chiba Prefecture

\*2: Fukushima Prefecture and 10 neighboring prefectures (Miyagi, Yamagata, Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, and Niigata)

For more information about the results of inspections, see pages 30, 33, 36, and 41 in Vol. 2, FY2022 edition.

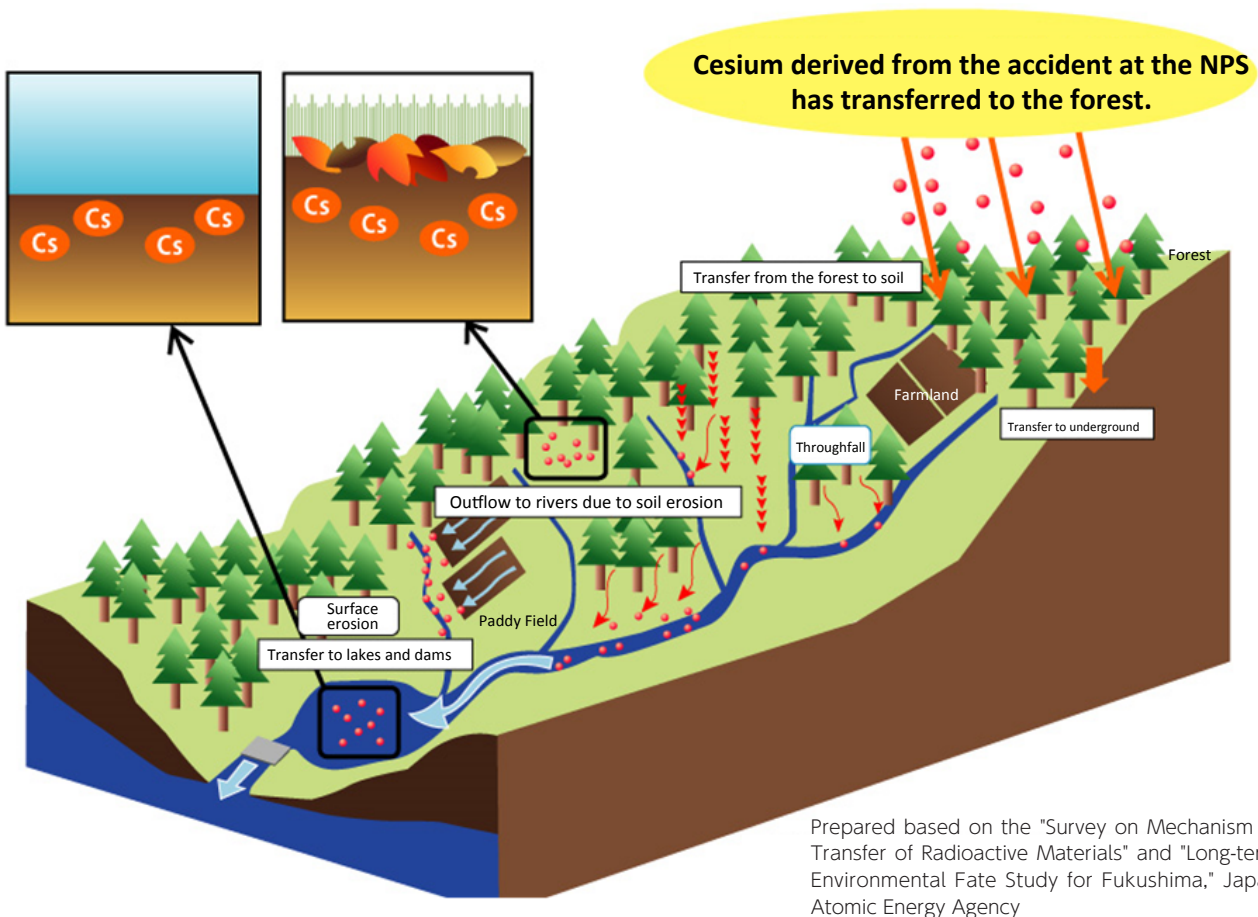




## (v) Behavior of radioactive materials

In various monitoring results, radioactive material detection is decreasing.  
Where has the cesium released into the environment gone?

### ● Transfer of Fallen and Deposited Cesium in the Environment



The above figure illustrates the process of fallen and deposited cesium in the forest flowing from upstream to a downstream dam lake. The two enlarged pictures show the forest floor and the sediment at the bottom of the dam lake, both indicating that the cesium is deposited in the surface layer of soil.

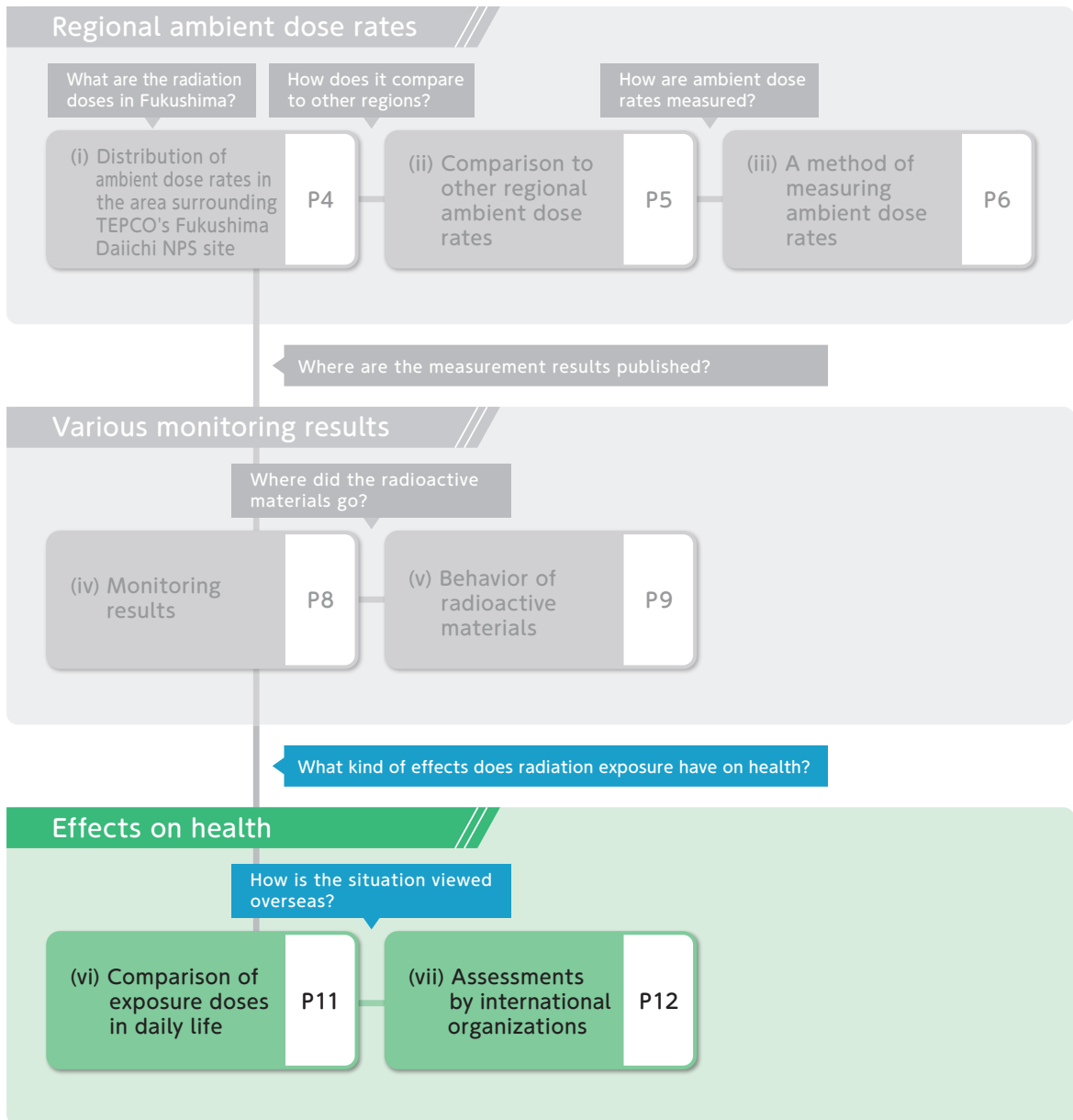
Distribution of radioactive cesium released into the environment due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS has changed significantly over time. Cesium that adhered to tree bark, branches and leaves immediately after the accident transferred onto the forest soil due to leaf fall and precipitation, etc. At present, over 90% is found to be located within a depth of 5 cm from the ground surface.

For more information about transfer of cesium in the environment, see page 184 of Vol. 1, FY2022 edition.



# Theme: Effects on health

This is a summary of the radiation exposure in daily life. We will also introduce assessments of radiation exposure by international organizations.



Regional ambient dose rates

Various monitoring results

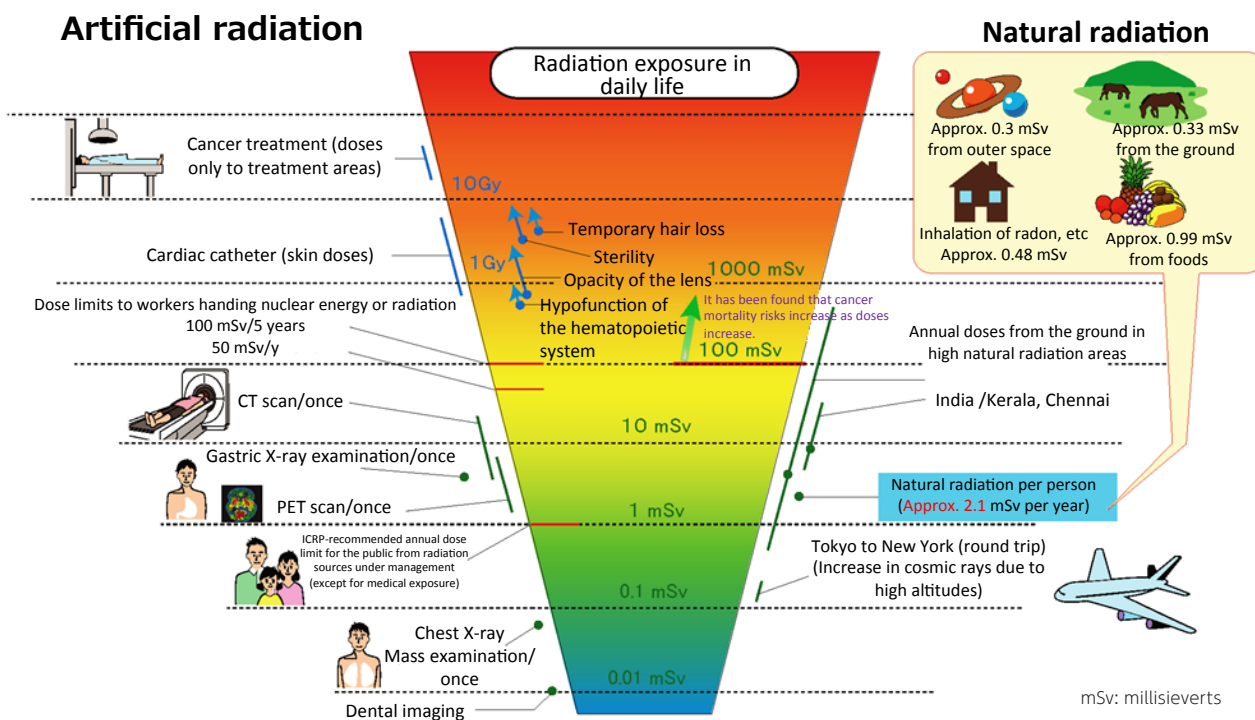
Effects on health



## (vi) Comparison of exposure doses in daily life

What exposure doses are present in daily life?

### Comparison of Exposure Doses (Simplified Chart)



Sources:

- The 2008 UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation) Report
  - The 2007 ICRP (International Commission on Radiological Protection) Report
  - The exposure guideline of the Japan Association of Radiological Technologists
  - "Life Environmental Radiation (Calculation of the National Dose)," new edition
- Prepared by the National Institute of Radiological Sciences based on the sources above (May 2018)

For more information about comparison of exposure doses, see page 77 of Vol. 1, FY2022 edition.

Exposure doses found to have health effects on people are considered to be at levels exceeding 100 millisieverts.

For more information about survey results, see page 117 of Vol. 1, FY2022 edition.



## (vii) Assessments by international organizations

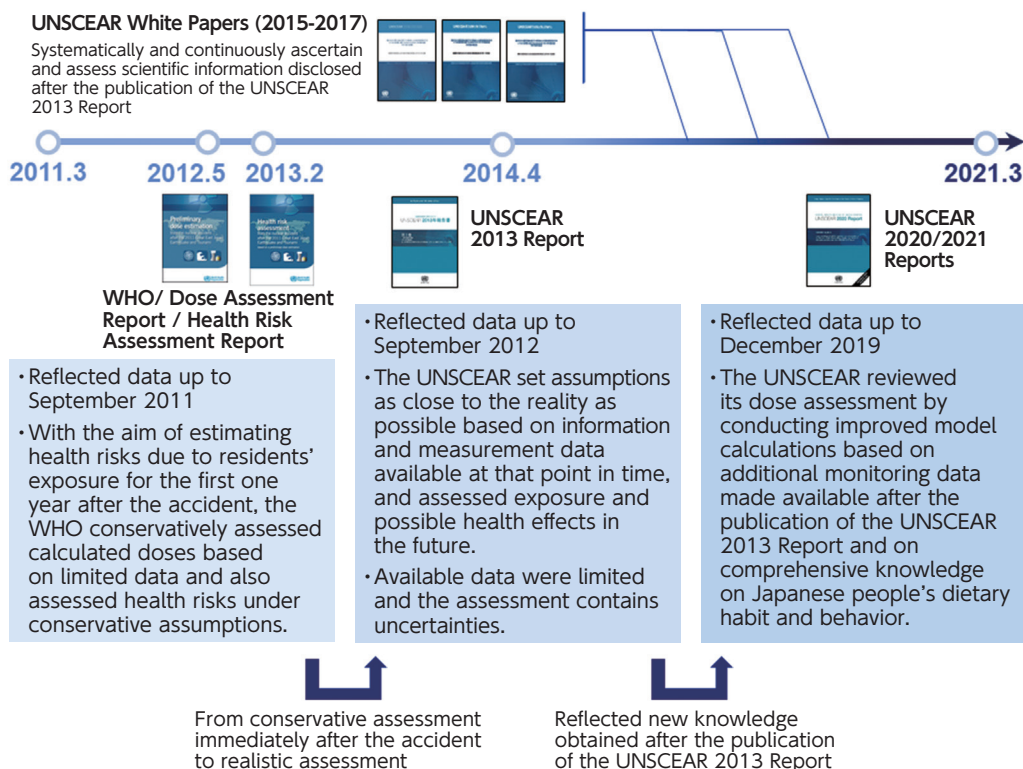
Visiting

Regional ambient dose rates

Various monitoring results

Effects on health

After the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, the World Health Organization (WHO) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) published reports on assessment of exposure doses due to the accident and on health effects of radiation exposure.



How did international organizations assess the effects of the accident at TEPCO's Fukushima Daiichi NPS? Let's take a look at the main conclusions by major international organizations.

	Major conclusions
WHO Reports	<ul style="list-style-type: none"> <li>Even in the area where the highest exposure dose was estimated, no significant increase would be observed in risks of childhood thyroid cancer and other types of cancer or leukemia and increased incidence of these diseases exceeding natural variation is hardly expected.</li> <li>The results suggest that increases in the incidence of diseases attributable to the additional radiation exposure are likely to remain below detectable levels.</li> </ul>
UNSCEAR 2013 Report	<ul style="list-style-type: none"> <li>It is not likely that any significant changes attributable to radiation exposure due to the accident would arise in future cancer statistics.</li> <li>There is the possibility that thyroid cancer risks may theoretically increase among the group of children whose estimated exposure doses were at the highest level. Therefore, their situations need to be closely followed up and assessed.</li> </ul>
UNSCEAR 2020/2021 Report	<ul style="list-style-type: none"> <li>No adverse health effects among Fukushima residents directly attributable to radiation exposure have been observed, and future health effects directly related to radiation exposure are unlikely to be discernible.</li> <li>Increases in incidence of thyroid cancer in the Thyroid Ultrasound Examination that has been conducted in Fukushima after the nuclear accident are considered to be the result of sensitive ultrasound screening procedures.</li> </ul>

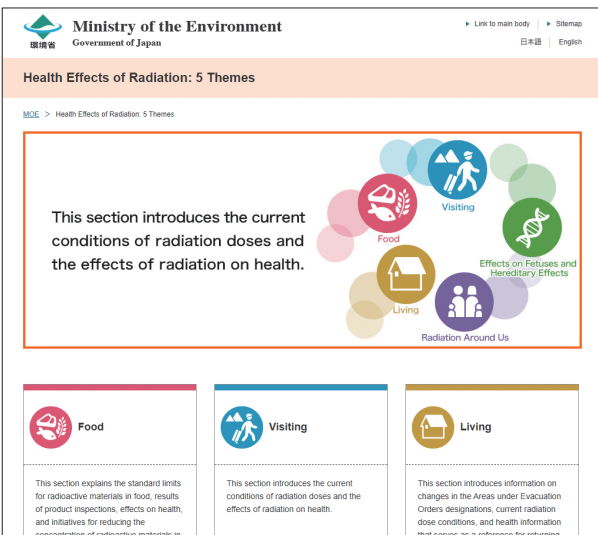
The WHO Reports published in 2012 and 2013, along with the UNSCEAR 2013 Report, state that their assessments of exposure doses contain certain uncertainties due to uncertainties inherent to basic data. However, the UNSCEAR 2020/2021 Report shows conclusions with less uncertainties on many issues as a broader range of knowledge became available.

For more information about survey results, see pages 189 and 190 of Vol. 1, FY2022 edition (available in Japanese only).



## Portal site regarding the health effects of radiation

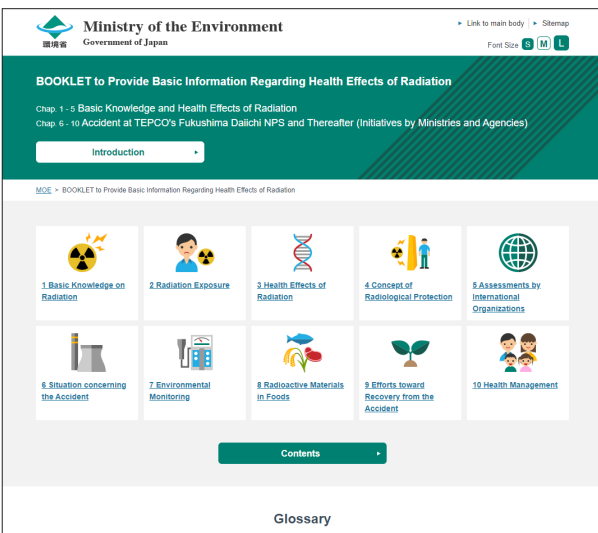
Additional resources such as the “BOOKLET to Provide Basic Information Regarding Health Effects of Radiation” which this digest document summarizes, Q&As, the latest information concerning the effects of radiation on health, and other related documents and articles are available in a searchable format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



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



## BOOKLET to Provide Basic Information Regarding Health Effects of Radiation



<https://www.env.go.jp/en/chemi/rhm/basic-info/>

