Illustrated Handbook

Vol. 2

BOOKLET to Provide Basic Information Regarding Health Effects of Radiation

Accident at TEPCO's Fukushima Daiichi NPS and Thereafter
(Initiatives by Ministries and Agencies)

Radiation Health Management Division, Ministry of the Environment, Government of Japan
National Institutes for Quantum Science and Technology

The booklet is also available on the website.

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

Introduction

Fourteen years have passed since the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Station. In 2020, evacuation orders for Preparation Areas for Lifting of Evacuation Orders and Habitation Restricted Areas, except for Restricted Areas, were all lifted, and in 2023 evacuation orders for Specified Reconstruction and Revitalization Base Areas were also lifted. From September 2023 to February 2024, Plans for Reconstruction and Revitalization of the Specific Revitalized Residential Areas were approved for Okuma Town, Futaba Town, Namie Town, and Tomioka Town. Thus, steady progress has been made in the reconstruction and recovery of Fukushima Prefecture. The national government must ensure that residents who have returned home can rebuild their lives smoothly without worries about their health due to the radioactive materials discharged by the accident. For that purpose, the national government and the local government are committed to properly responding to their health problems and providing correct information in an easy-to-understand manner on a timely basis.

Based on the Policy Package on Radiation Risk Communication for Achieving Residents' Return (2014), the national government has endeavored to disseminate correct and easy-to-understand information and has strengthened risk communication among a small number of people.

The Radiation Health Management Division, Environmental Health Department, Minister's Secretariat, Ministry of the Environment has collected and compiled basic knowledge on radiation, and scientific expertise and initiatives of relevant ministries and agencies concerning health effects of radiation, and has prepared a booklet to provide basic information since 2012 and has updated the booklet with the latest information and statistical data, together with the National Institutes for Quantum Science and Technology. This booklet has been utilized in training sessions targeting people engaging in health and medical care, welfare, and education or on other occasions with the aim of fostering personnel who can respond to residents' worries and concerns about their health in Fukushima and neighboring prefectures.

The Radiation Health Management Division and the National Institutes for Quantum Science and Technology have jointly publicized the English version of the booklet, with cooperation of a group of experts, so that foreign nationals residing in Japan or visiting Japan or those interested in Japan can obtain basic knowledge on health effects of radiation and correctly understand changes in circumstances and efforts being made in Japan. As terms used in this field are highly professional and difficult, we also prepared a glossary. We would like to extend our gratitude to the people who offered cooperation in checking the translation and preparing the glossary.

The booklet is also available on the website of the Ministry of the Environment, from which you can download the content for use in training and classwork. We hope that this booklet will be utilized in diverse occasions.

(*) In this booklet, in some parts where the names of data sources and quotations are indicated, "Chornobyl" is spelled as "Chernobyl."

March 2025
Radiation Health Management Division,
Environmental Health Department,
Minister's Secretariat,
Ministry of the Environment,
Government of Japan
&
National Institutes for Quantum Science and Technology

Whole Picture of the "BOOKLET to Provide Basic Information Regarding Health Effects of Radiation"

Vol. 1 Basic Knowledge and Health Effects of Radiation

Basic Knowledge on Dose Assessment

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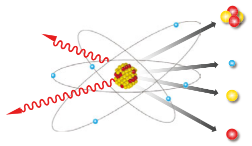
- Assessments of Health Effects due to Radiation Exposure

Reference Information for Establishing Radiation Protection Standards

Chap. 1 Basic Knowledge on Radiation

- Radiation and Radioactive Materials
- Types and Characteristics of Radiation



Mechanism of Radiation Exposure

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- Framework for Radiological Protection
- Dose Limits
- Dose Reduction
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- Radiation around Us
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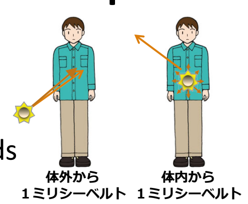

Basis for Dose Assessment

Mechanism of Radiation Health Effects

Knowledge on Radiation Health Effects

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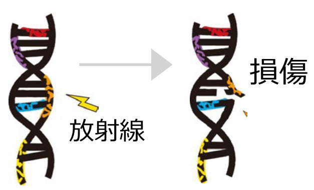
- Effects due to Radiation Exposure
  - Effects on Fetuses
  - Heritable Effects
  - Cancer and Leukemia
- Effects due to Worries over Radiation (Psychological Effects)



Scientific Basis for Health Management after Exposure

Vol. 2 Accident at TEPCO's Fukushima Daiichi NPS and Thereafter (Initiatives by Ministries and Agencies)

Information for Assessment

Chap. 6 Situation concerning the Accident

- Accident at TEPCO's Fukushima Daiichi NPS
- Efforts Immediately after the Accident
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Responses and Measures Following the Accident

Grounds for Standards, Guidelines, Laws and Regulations

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- Impacts of the Accident and Spread of Contamination
- Distribution of Ambient Dose Rates
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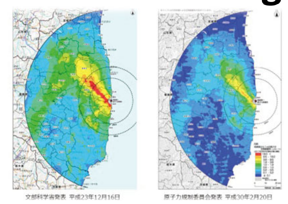

Chap. 8 Radioactive Materials in Foods

- Standard Limits and Inspection Results
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Chap. 9 Efforts toward Recovery from the Accident

- Efforts for Environmental Restoration
  - Decontamination
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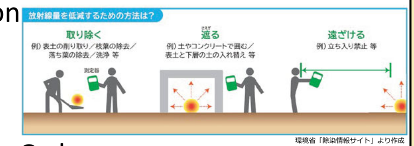
- Transition of Areas under Evacuation Orders



Chap. 10 Health Management

- Fukushima Health Management Survey
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  - Thyroid Ultrasound Examination
  - Comprehensive Health Checkup
  - Mental Health and Lifestyle Survey
  - Pregnancy and Birth Survey
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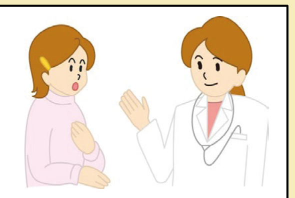

This BOOKLET compiles basic knowledge on radiation, scientific knowledge on health effects of radiation, and initiatives by relevant ministries and agencies into one page for each item.

Please select and refer to sections according to your interests.

Outline of Each Chapter

Vol. 1 Basic Knowledge and Health Effects of Radiation

Chap. 1 Basic Knowledge on Radiation

Chapter 1 explains radiation, its difference from radioactivity and radioactive materials, and the types and characteristics of radiation.
You can learn basic knowledge on familiar terms such as "radiation," "radioactivity," and "radioactive materials," and can deepen your knowledge and understanding of radiation itself.

Chap. 2 Radiation Exposure

Chapter 2 explains the mechanism of radiation exposure and measurement and calculation methods for exposure doses, and also provides explanations about radiation around us and representative radionuclides discharged upon a nuclear accident.
You can learn about radiation exposure, and on what occasion and to what extent you may be exposed to radiation. This chapter helps you understand what measuring devices and what calculation methods are used for obtaining radiation doses and exposure doses.

Chap. 3 Health Effects of Radiation

Chapter 3 explains radiation effects on the human body and mechanism of generating effects.
You can understand the health effects of radiation based on scientific grounds, including data on the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, atomic bomb survivors, and the Chernobyl NPS Accident.
You can also understand the relation between types of exposure (affected body parts, exposure dose and period) and health effects and psychological effects due to worries over radiation.

Chap. 4 Concept of Radiological Protection

Chapter 4 explains the framework of radiological protection, dose limits and dose reduction.
You can obtain knowledge on principles for protecting human health against radiation effects and methods for reducing exposure doses. Please refer to this chapter when you want to understand the concept of dose limits that served as the basis for standards for distribution restrictions for foods and designation of Areas under Evacuation Orders after the accident at TEPCO's Fukushima Daiichi NPS or the concept of radiological protection.

Chap. 5 Assessments by International Organizations

Chapter 5 outlines the assessments on radiation exposure made by the World Health Organization (WHO) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) after the accident at TEPCO's Fukushima Daiichi NPS.
You can grasp an outline of how the status and effects of radiation exposure due to the accident are assessed internationally, including the latest reports by international organizations.

Vol. 2 Accident at TEPCO's Fukushima Daiichi NPS and Thereafter (Initiatives by Ministries and Agencies)

Chap. 6 Situation concerning the Accident

Chapter 6 explains the accident at TEPCO's Fukushima Daiichi NPS, responses immediately after the accident, and efforts for decommissioning.
You can understand what happened at the NPS at the time of the accident, and the current status of the NPS. In particular it goes into details about management of decommissioning, contaminated water and treated water.

Chap. 7 Environmental Radiation Monitoring

Chapter 7 explains environmental radiation monitoring being conducted after the accident at TEPCO's Fukushima Daiichi NPS and the results thereof.
You can understand how impacts of the accident spread and the status of contamination in the surrounding environment near the NPS, and changes over time after the accident.

Chap. 8 Radioactive Materials in Foods

Chapter 8 explains the standard limits for radioactive materials in foods, results of inspections, and efforts for reducing radioactive concentrations in foods.
You can understand the framework to ensure the safety of foods distributed on the market and concrete measures being taken after the accident at TEPCO's Fukushima Daiichi NPS, and inspection results regarding to what extent there have been foods with radioactive concentrations exceeding the standard limits after the accident up to the present.

Chap. 9 Efforts toward Recovery from the Accident

Chapter 9 explains efforts toward recovery from the accident, such as measures against environmental contamination by radioactive materials discharged due to the accident at TEPCO's Fukushima Daiichi NPS and transition of Areas under Evacuation Orders.
You can understand how to recover areas contaminated with radioactive materials, how to treat waste, and what measures are being taken at present in Areas under Evacuation Orders and surrounding areas.

Chap. 10 Health Management

Chapter 10 outlines the Fukushima Health Management Survey and other surveys and examinations that are conducted for the purpose of promoting the health of the residents of Fukushima Prefecture and ensuring their safety in light of the effects of radiation due to the accident at TEPCO's Fukushima Daiichi NPS.
You can understand Fukushima Prefecture's efforts for health management in order to promote and maintain residents' good health toward the future.

Vol. 1 Basic Knowledge and Health Effects of Radiation
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Chapter 3 Health Effects of Radiation

3.6 Heritable Effects

3.7 Cancer and Leukemia

Chapter 5 Assessments by International Organizations

5.5 WHO Reports

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Chapter 7 Environmental Radiation Monitoring

Chapter 6

Situation concerning the Accident

Chapter 6 explains the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, responses immediately after the accident, and efforts for decommissioning.

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Fukushima Daiichi Nuclear Power Station (NPS) Accident

Damage due to the Great East Japan Earthquake

- A 9.0-magnitude earthquake occurred off the coast of Sanriku at 2:46 p.m. on Friday, March 11, 2011. The earthquake and subsequent tsunami caused severe damage mainly to the Tohoku region.
- The earthquake was the largest ever recorded in Japan and the fourth biggest in the world since 1900.

Human damage	
Dead	15,900
Missing	2,520
Injured	6,242

(Numbers of dead and missing people: surveyed by the National Police Agency as of the end of October 2023; Number of injured people: surveyed by the Fire and Disaster Management Agency as of March 1, 2023)

Damage to buildings	
Completely destroyed	122,039
Half destroyed	283,698
Partially destroyed	750,020

(Surveyed by the Fire and Disaster Management Agency; as of March 1, 2023)

Affected people support	
Evacuees nationwide	29,733

(Surveyed by the Reconstruction Agency; as of November 1, 2023)

A large earthquake centered off the coast of Sanriku occurred, at 2:46 p.m. on Friday, March 11, 2011. The seismic intensity of 7 on the Japanese earthquake scale was measured in Kurihara City, Miyagi Prefecture. This 9.0-magnitude earthquake was the biggest recorded in Japan since 1923 and the highest level in the world, equivalent to the 2010 Chili Earthquake (M8.8).

Included in this reference material on March 31, 2013
Updated on March 31, 2024

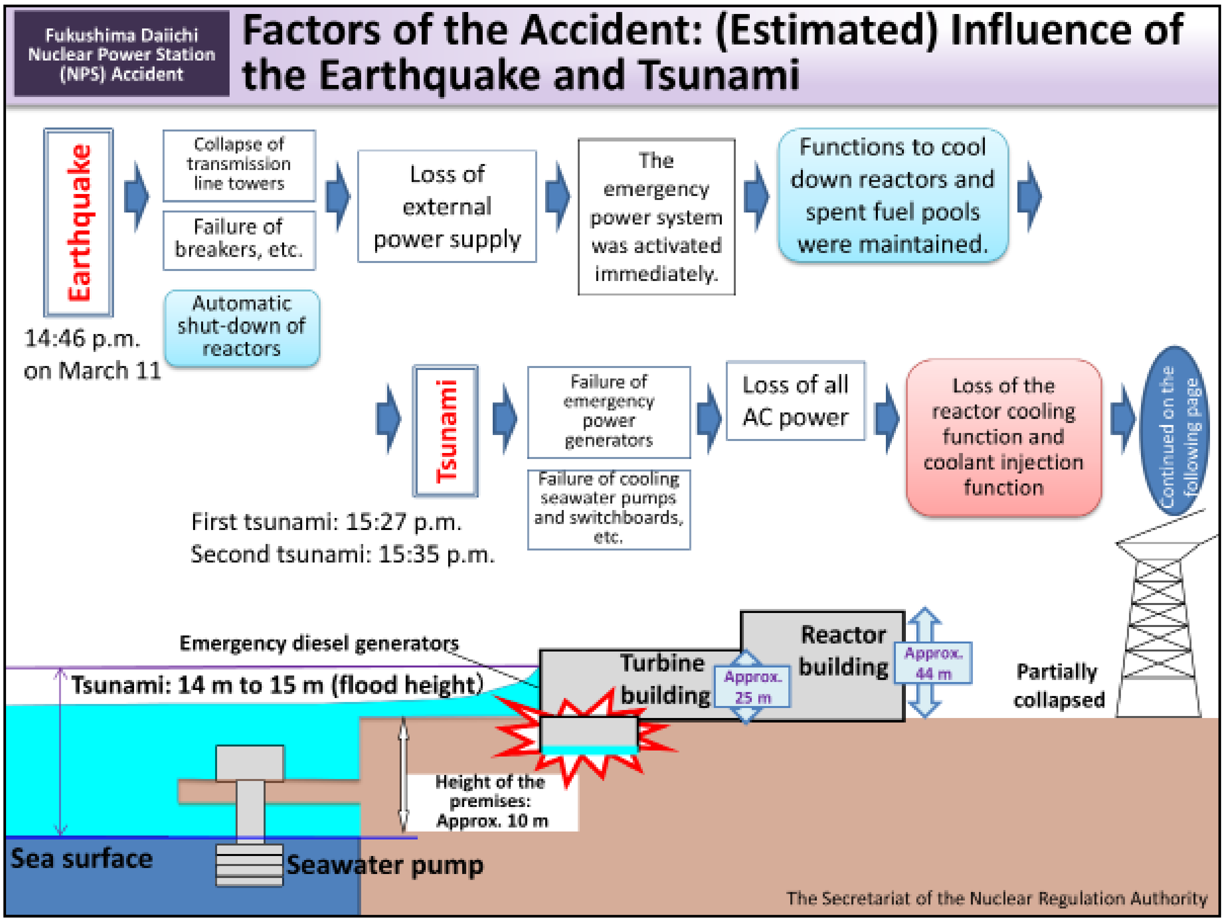
Fukushima Daiichi Nuclear Power Station (NPS) Accident

Accident at the Nuclear Power Station

Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS Unit 3 (shot from the air)
(Shot on March 16, 2011; Provided by TEPCO)

Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS Unit 1, 2 and 3, which were in operation at the time of the earthquake, lost all AC power due to the earthquake and subsequent tsunami. This led to the stop of the cooling system and loss of means to cool down nuclear fuels, eventually resulting in the melt of nuclear fuel. In the process of the melt, hydrogen gas was generated, and hydrogen gas accumulated in reactor buildings caused an explosion at Unit 1 on March 12 and at Unit 3 on March 14. Additionally, at Unit 4 adjacent to Unit 3, a hydrogen explosion occurred due to hydrogen gas that is considered to have flowed into it from Unit 3.

Included in this reference material on March 31, 2013
Updated on March 31, 2022



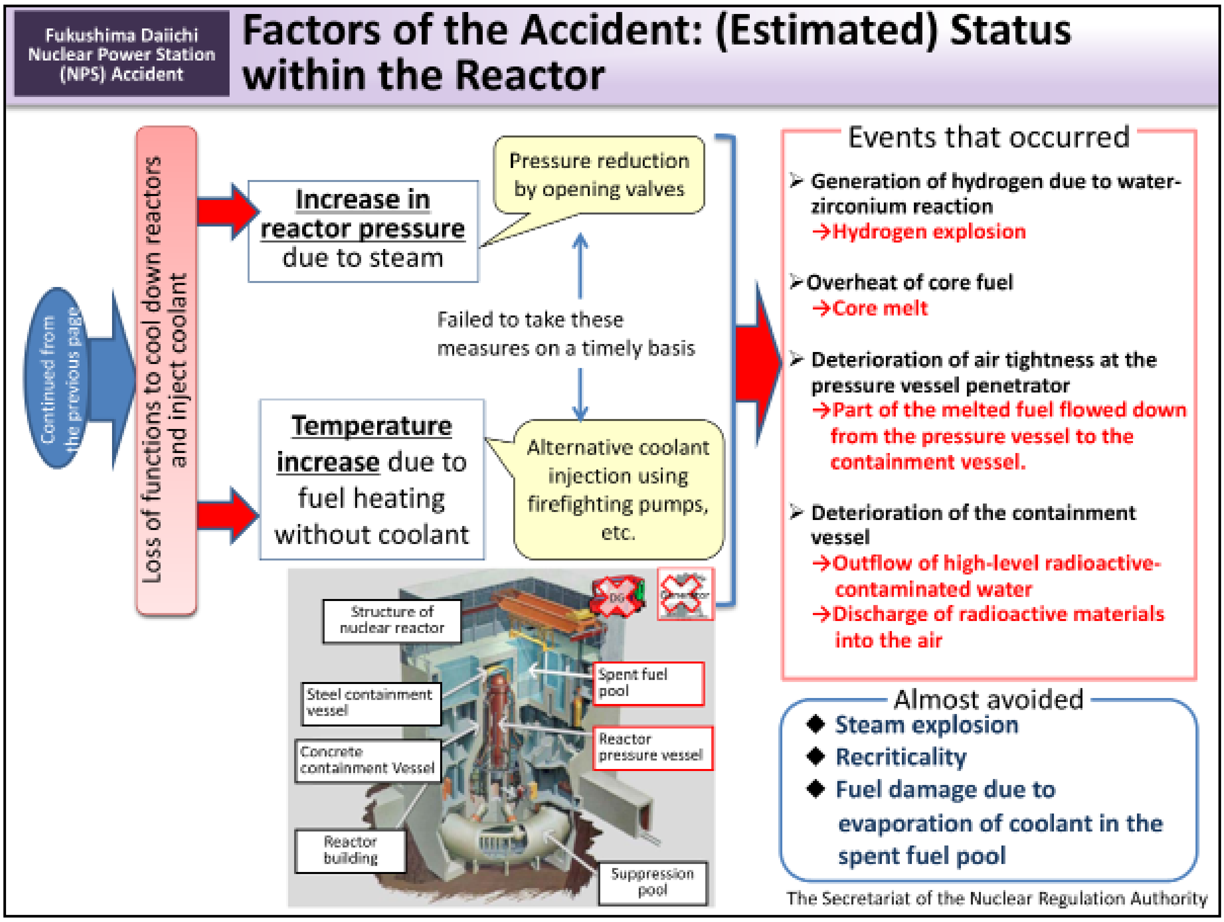
Immediately after the earthquake, at Units 1, 2 and 3 at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, which were in operation, all reactors were shut down automatically.

Even after reactors are shut down, it is necessary to remove the decay heat of core fuel. At the NPS, after external electrical power supply was lost due to the collapse of transmission line towers, etc., emergency diesel generators were automatically activated and procedures for normal cold shutdown were commenced.

However, the subsequent tsunamis hit the NPS and flooded those emergency diesel generators, switchboards and other equipment. All Units except for Unit 6 lost all AC power and cooling seawater pumps stopped functioning. Unit 1 thus lost all functions to cool down the reactor. While Units 2 and 3 continued cooling reactors for some time using the Reactor Core Isolation Cooling System (RCIC) and the High Pressure Coolant Injection System (HPCI), respectively, which can work without AC power, these systems also stopped soon and both Units eventually lost the means to remove the decay heat of core fuel.

Under such circumstances, NPS staff worked to activate alternative coolant injection routes using fire pumps or other equipment at Units 1, 2 and 3, but partly due to the possibility of another tsunami hitting, until those alternative measures were commenced, reactor cores were left uncooled. Coolant injection is considered to have been suspended for around 14 hours at Unit 1 and for around 6.5 hours at Units 2 and 3. Additionally, many hidden bypasses in the alternative coolant injection system made it difficult to supply injected water effectively to the reactor cores for cooling, and the reactors went into meltdown.

Included in this reference material on March 31, 2013
Updated on March 31, 2022



As coolant injection to the reactor core was suspended, the water level in the reactor declined and the fuel was exposed. This caused overheating of core fuel, triggered core melt and damaged a part of the pressure vessel. Melted fuel leaked from the pressure vessel into the inside of the containment vessel, and at the same time, cesium and other radioactive materials discharged from the fuel assembly was discharged within the containment vessel. Additionally, under high temperature due to core damage, steam and zirconium of the fuel cladding reacted to generate hydrogen, which was discharged within the containment vessel from the damaged part of the pressure vessel together with steam.

In the meantime, core damage increased the temperature and pressure in the containment vessel and deteriorated its confinement function, causing gaps in such parts as the penetrator that extends to the outside of the containment vessel. Radioactive materials discharged from such gaps to the outside of the containment vessel and diffused into the environment. Hydrogen generated due to the reaction of the steam and metal of the fuel cladding leaked through the gaps into the reactor building and accumulated there, and led to a hydrogen explosion.

Coolant injected into the reactor leaked from the pressure vessel and containment vessel and high-level radioactive-contaminated water accumulated underground below the reactor building and turbine building and partially flowed out into the ocean.

The damage to the pressure vessel and deterioration of the confinement function of the containment vessel caused a leak of steam containing radioactive materials. In addition, radioactive materials were also discharged into the air due to containment vessel vent operations, etc.

In this manner, radioactive materials were discharged into the environment in the forms of outflow of high-level contaminated water into the ocean and discharge of radioactive materials into the air.

Included in this reference material on March 31, 2013
Updated on March 31, 2022

Outline of the Accident

Responses Immediately after the Accident

Time	Event	Responses by Tokyo Electric Power Company (TEPCO)	Responses by the national government (Nuclear and Industrial Safety Agency)
March 11 14:46	The Great East Japan Earthquake occurred. (Seismic intensity 6 upper at Fukushima Daiichi Nuclear Power Station (NPS))	Fukushima Daiichi NPS Unit 1, Unit 2 and Unit 3 are automatically shut down by earth quake. Unit 4, Unit 5 and Unit 6 were under suspension due to periodic inspection.	The government established the Headquarters for Emergency Disaster Control, assembled officials at the Emergency Response Center, and dispatched officials to disaster-stricken areas by helicopter.
15:15			The Nuclear and Industrial Safety Agency held a press conference and provided information online.
15:27 15:35	The first tsunami (4m in height) arrived. The second tsunami (15m in height) arrived.		
15:42		Report under Article 10 of the Act on Special Measures Concerning Nuclear Emergency (Emergency generators activated at Units 1 to 5, which had lost all AC power, were damaged due to the tsunami.)	The government established the Nuclear Accident Vigilance Headquarters.
16:36	Aftershocks with seismic intensity 5 upper or less occurred several times.	TEPCO judged that the events fall under Article 15 of the Act on Special Measures Concerning Nuclear Emergency.	
19:03			The government issued a Declaration of a Nuclear Emergency Situation and established the Nuclear Emergency Response Headquarters.
21:23			The government issued an evacuation order to residents within a 3-km radius of the NPS and ordered those within a 10-km radius to shelter indoors.
March 12 5:44			The government issued an evacuation order to residents within a 10-km radius of the NPS.
18:25			The government issued an evacuation order to residents within a 20-km radius of the NPS.

From the report by the Aomori Prefecture Nuclear Safety Measure Verification Committee
Prepared by the Nuclear and Industrial Safety Agency

The Secretariat of the Nuclear Regulation Authority

As the emergency core cooling system stopped at Unit 1 and Unit 2 of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, the government issued, based on the Act on Special Measures Concerning Nuclear Emergency, a Declaration of a Nuclear Emergency Situation and established the Nuclear Emergency Response Headquarters at 19:03 p.m. on March 11, 2011.

At 21:23 p.m. on the same day, based on the same Act, the government issued an evacuation order to residents within a 3-km radius of the NPS and ordered those within a 10-km radius to shelter indoors.

Thereafter, the government expanded the coverage of the evacuation order, which was targeted to residents within a 3-km radius of the NPS, to cover those within a 10-km radius. As a result, a total of 51,207 residents in four towns within a 10-km radius were placed under the evacuation order.

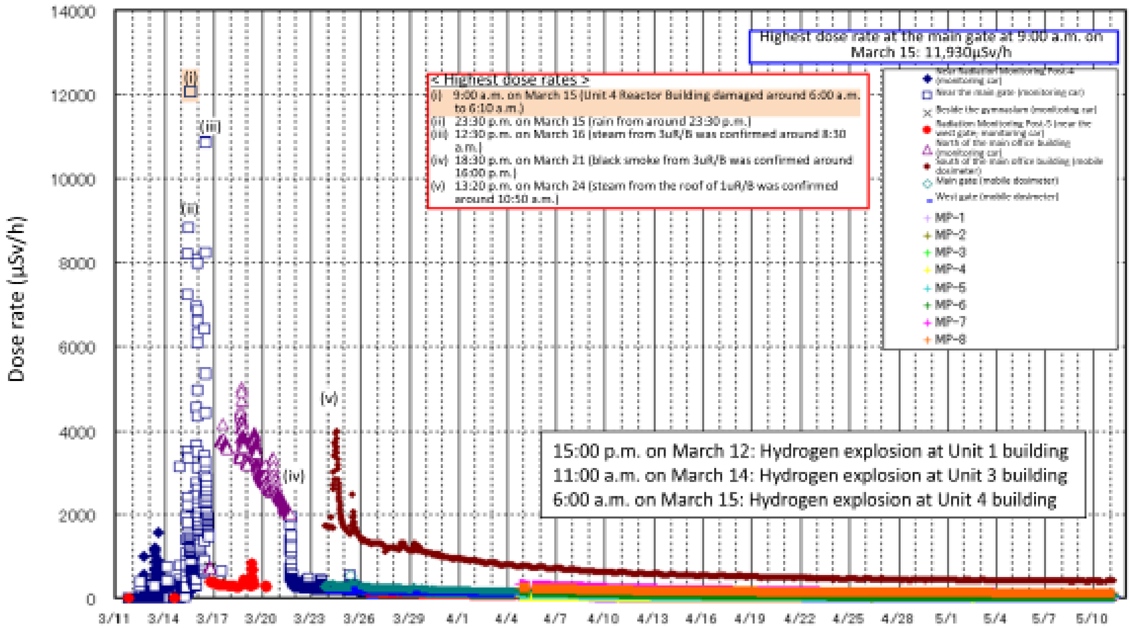
As a hydrogen explosion occurred within the reactor building at Unit 1 at 15:36 p.m. on March 12, the coverage of the evacuation order was further expanded from residents within a 10-km radius to those within a 20-km radius of the NPS.

(Related to p.109 of Vol. 2, "Designation of Areas under Evacuation Orders," and p.110 of Vol. 2, "Designation of Restricted Areas and Areas under Evacuation Orders and Removal Thereof")

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Outline of the Accident | **Ambient Dose Rates during Two Months after the Accident (Within and around of the premises of TEPCO's Fukushima Daiichi NPS)**

Hydrogen explosions occurred at buildings, etc. at Unit 1 to Unit 4 and the highest dose rates were measured in the morning of March 15.



Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety, June 2011
Nuclear Emergency Response Headquarters, Attachment V-9

μSv/h: micro sievert per hour, u: unit, R/B: Reactor Building

The Secretariat of the Nuclear Regulation Authority

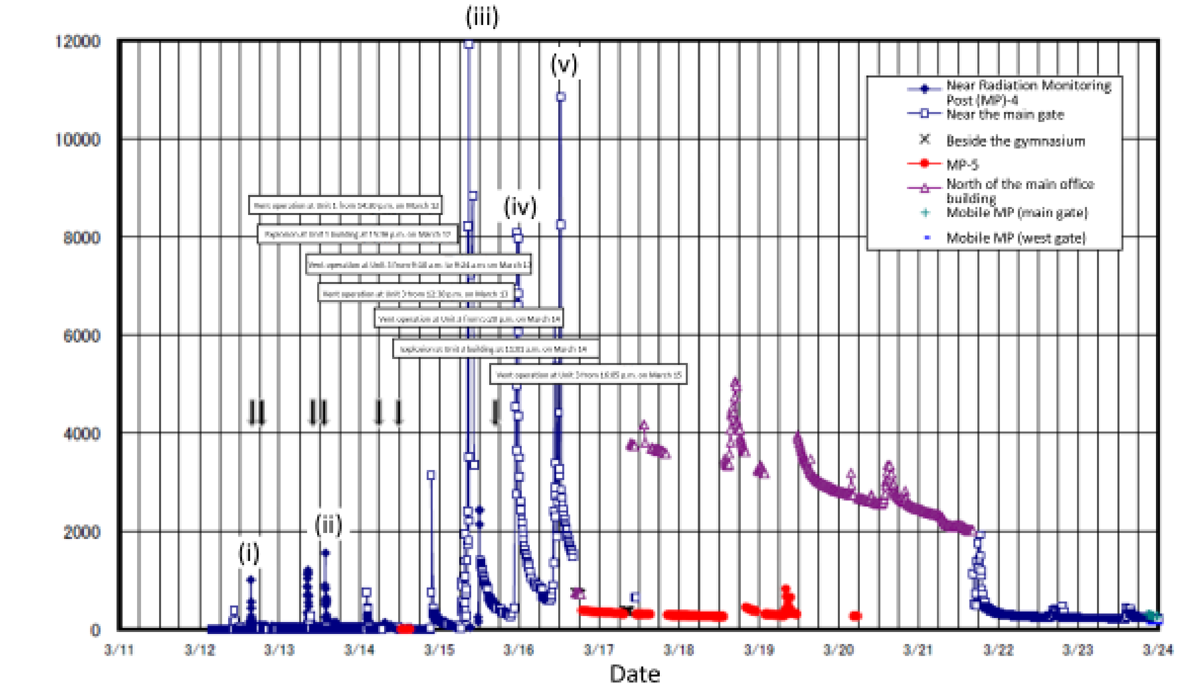
In the early morning of March 12, 2011, monitoring cars measured higher ambient dose rates within the premises of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and the discharge of radioactive materials was first confirmed after the earthquake. At Unit 1, after an abnormal pressure rise in the containment vessel was observed, the pressure declined slightly. Therefore, it is considered that radioactive materials discharged from the containment vessel at Unit 1 and were discharged into the air. Thereafter, temporary rises of ambient dose rates were observed several times after the vent operations and explosions at the buildings. The highest ambient dose rate was measured at 9:00 a.m. on March 15. A monitoring car near the main gate measured the highest rate of approx. 12 mSv/h.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Outline of the Accident

Ambient Dose Rates during Two Weeks after the Accident (Within and around of the premises of TEPCO's Fukushima Daiichi NPS)

● **Changes in ambient dose rates measured by monitoring cars within and around the NPS**



Additional Report of the Japanese Government to the IAEA - The Accident at TEPCO's Fukushima Nuclear Power Stations - (Second Report)

μSv/h: micro sievert per hour

The Secretariat of the Nuclear Regulation Authority

In accordance with the progress of events, fuel melted and radioactive materials was discharged from the pressure vessel to outside of the reactor. As a result of containment vessel vent operations and damage to reactor buildings, radioactive materials were discharged from the reactor core into the air. Vent operation at Unit 1 was considered to be successful as the pressure in the containment vessel declined at 14:30 p.m. on March 12. Due to the radioactive plume discharged at that time, an ambient dose rate of approx. 1 mSv/h was detected [(i) in the figure]. On March 13, the following day, the ambient dose rate clearly increased again [(ii) in the figure]. This is considered to have been caused by vent operation at Unit 3 conducted after the water level in the reactor declined and the fuel was exposed from cooling water. At 9:00 a.m. on March 15, the highest rate of approx. 12 mSv/h was observed [(iii) in the figure]. Early in the morning at around 6:00 a.m. of that day, the pressure of the pressure suppression chamber declined at Unit 2 with the sound of an explosion. Therefore, the high dose rate on March 15 is considered to have been caused by the discharge of radioactive materials from Unit 2.

Ambient dose rate increases were also measured at 23:00 p.m. on March 15 and at 12:00 p.m. on March 16 [(iv) and (v) in the figure]. Pressure decline in the containment vessel was observed in Unit 3 and Unit 2, respectively, and these ambient dose rate increases are considered to have been caused by the discharge of radioactive materials from Unit 3 and Unit 2.

Included in this reference material on March 31, 2013
Updated on March 31, 2022

Outline of the Accident — International Nuclear and Radiological Event Scale(INES)

	Level	Accident examples
Accident	7 Major accident	Former Soviet Union: Chornobyl Nuclear Power Plant accident (1986) Japan: Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Station (NPS) accident (2011)
	6 Serious accident	Provisionally evaluated as Level 7 on April 12, 2011
	5 Accident with wider consequences	UK: Windscale Nuclear Power Plant fire accident (1957) US: Three Mile Island Nuclear Power Plant accident (1979)
	4 Accident with local consequences	Japan: JCO criticality accident (1999) France: Saint-Laurent Nuclear Power Plant accident (1980)
Abnormal incident	3 Serious incident	Spain: Fire at Vandellos Nuclear Power Plant (1989)
	2 Incident	Japan: Damage to steam generator heat exchanger tube at Unit 2, Mihama NPS (1991) Japan: Workers' radiation exposure due to an accident of scattering nuclear fuel materials at the Fuel Research Building, Oarai Research & Development Institute (2017)
	1 Anomaly	Japan: Sodium leak accident at Monju (1995) Japan: Primary coolant leak at Unit 2, Tsuruga NPS (1999) Japan: Pipe rupture in the residual heat removal system at Unit 1, Hamaoka NPS (2001) Japan: Pipe failure in the secondary system at Unit 3, Mihama NPS (2004)
Below scale	0 Below scale	(No safety significance)
	Not covered	(Events unrelated to safety)

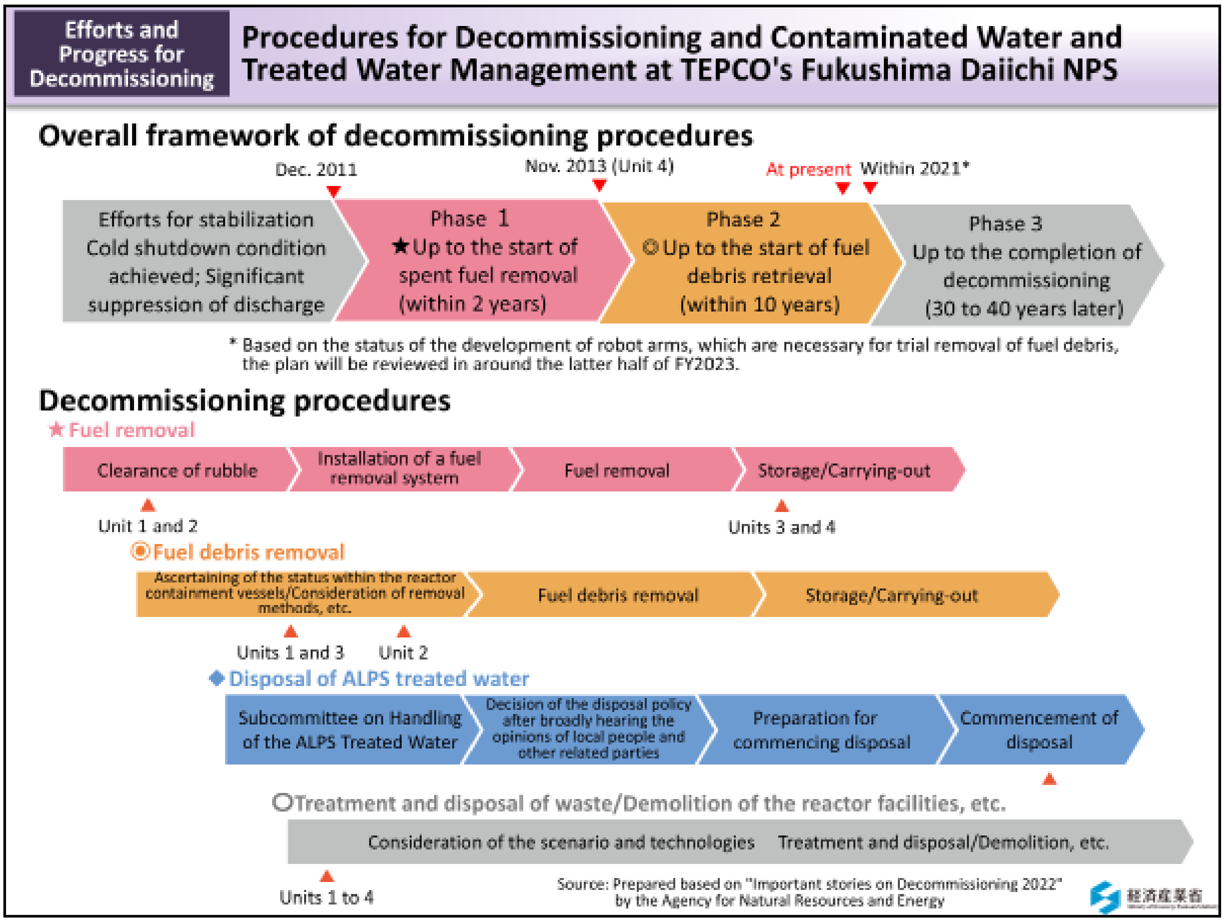
Prepared based on "The International Nuclear and Radiological Event Scale User's Manual" (IAEA) and "Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety" (June 2011; Nuclear Emergency Response Headquarters)

The International Nuclear and Radiological Event Scale (INES) is the international indicator to show the level of the seriousness in terms of safety of accidents or trouble at nuclear power plants.

The accident at TEPCO's Fukushima Daiichi NPS was evaluated as Level 7 (radiation impact converted to the amount of I-131 exceeds several tens of thousands TBq (10^{16} Bq)), equivalent to the level of the Chornobyl NPS Accident.

(Related to p.28 of Vol. 1, "International Nuclear and Radiological Event Scale")

Included in this reference material on March 31, 2013
Updated on March 31, 2024



Efforts to decommission damaged nuclear reactors have been continued at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS. Since all units achieved cold shutdown condition in December 2011, the units have all remained stable and under control up until now.

Procedures for decommissioning Fukushima Daiichi NPS are unprecedentedly challenging. The Government of Japan takes the initiative to carry out measures stably and steadily in line with the Mid- and Long-term Roadmap towards the Decommissioning of Tokyo Electric Power Company Holdings' Fukushima Daiichi NPS (Mid- and Long-term Roadmap). Specifically, efforts have been made for the removal of fuel from spent fuel pools, fuel debris removal, measures for contaminated water, disposal of the ALPS treated water, treatment and disposal of waste, and demolition of reactor facilities, etc.

In December 2019, the Mid- and Long-term Roadmap was revised and the method of removing fuel debris for the first unit was finalized. The finalized plan is to commence with trial removal of the fuel debris from Unit 2 first, and then expand the scale of the removal work in stages. For completing the decommissioning by 2041 to 2051, decommissioning procedures will continuously be implemented while placing top priority on ensuring safety.[1]

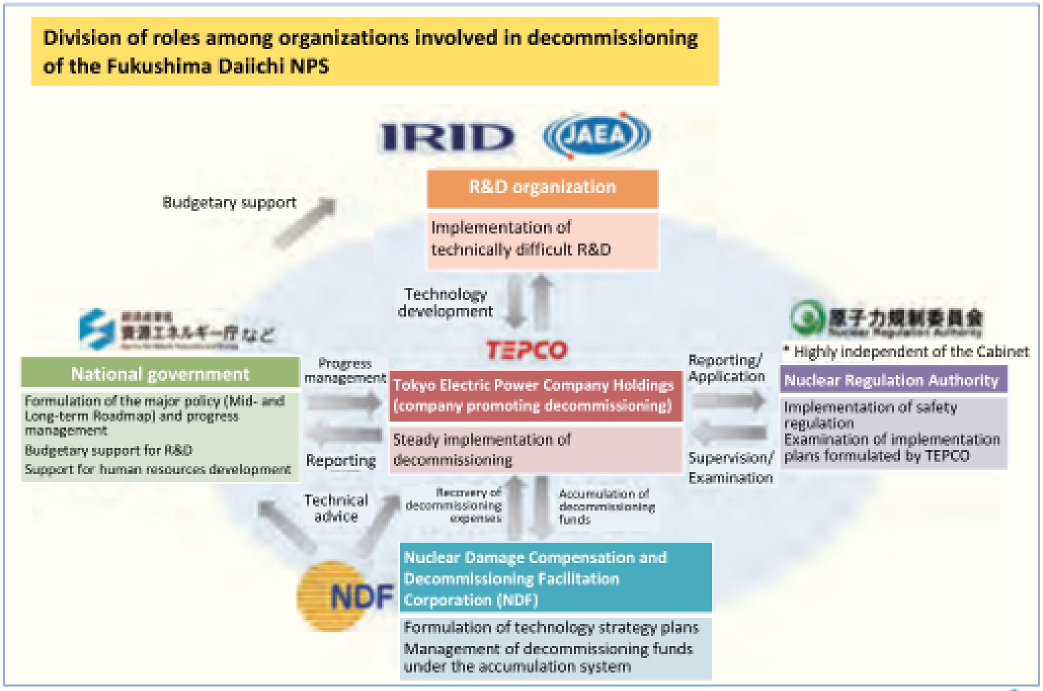
1. Based on the status of the development, etc. of robot arms, which are necessary for trial retrieval of fuel debris, the plan will be reviewed in around the latter half of FY2023.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Efforts and Progress for Decommissioning

Organizations and Tasks

Decommissioning work is being carried out in cooperation with local companies and other organizations, as well as with the collective wisdom from Japan and abroad.

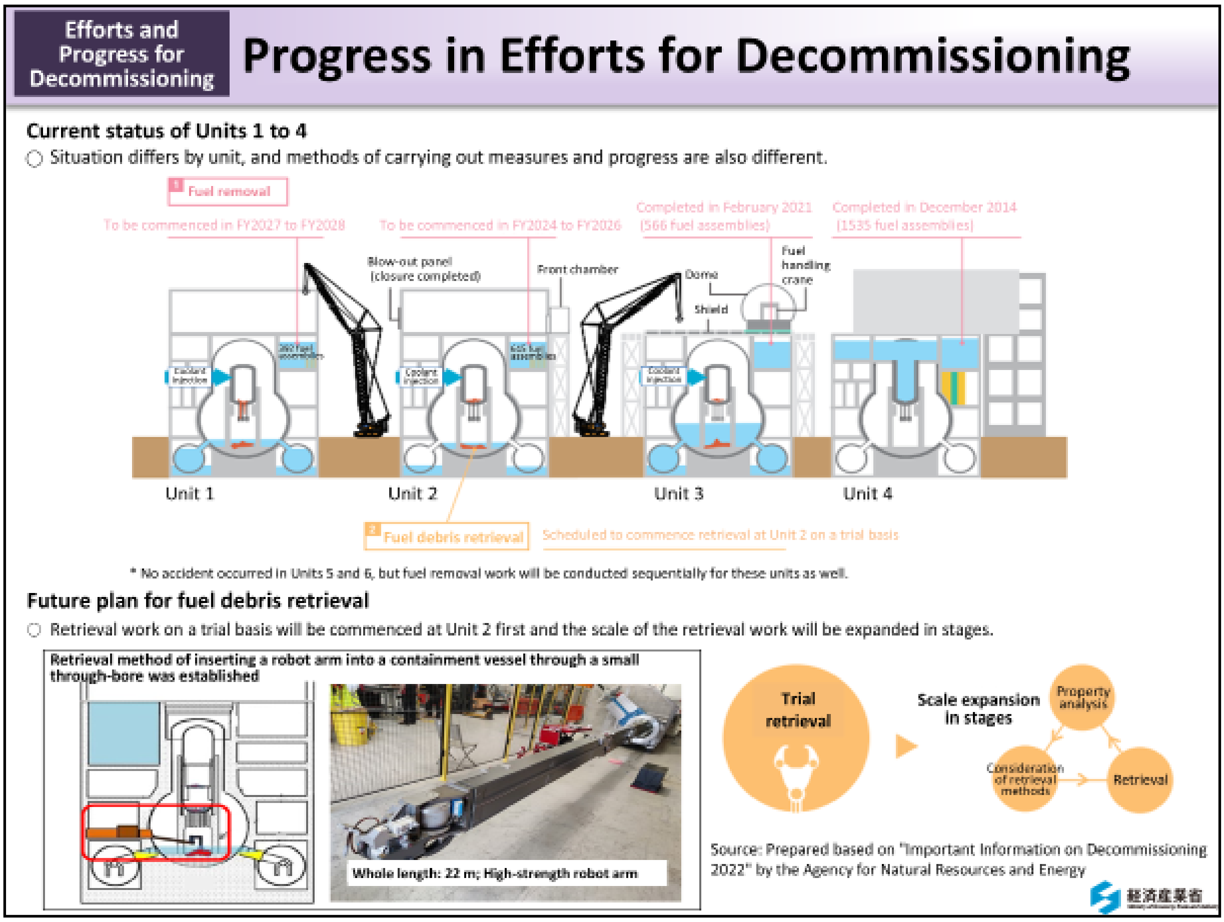


Source: Prepared based on "Important Information on Decommissioning 2022" by the Agency for Natural Resources and Energy

In proceeding with decommissioning, the national government first established a policy (Mid-and-Long-Term Roadmap towards the Decommissioning of the Tokyo Electric Power Company Holdings' Fukushima Daiichi NPS), and a system has been developed to ensure that TEPCO will steadily implement decommissioning under supervision and examination by the Nuclear Regulation Authority. In addition, the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) provides technical advice to TEPCO and the national government, and manages decommissioning funds under an accumulation system.

Decommissioning is an unprecedented challenge around the world. To consolidate the wisdom from Japan and abroad, in addition to the national government and TEPCO, various universities, the International Research Institute for Nuclear Decommissioning (IRID), the Japan Atomic Energy Agency (JAEA), other R&D organizations, and foreign companies are working together. Additionally, cooperation has been sought from local companies and residents in Fukushima with the aim of achieving revitalization of the local community based on technological capabilities, etc. accumulated through decommissioning work and ensuring well-balanced progress of decommissioning and reconstruction of Fukushima.

Included in this reference material on March 31, 2022
Updated on March 31, 2023



< Fuel removal from the spent fuel pool >

Removal of all fuel assemblies from the spent fuel pool was completed at Unit 4 in December 2014 and at Unit 3 in February 2021, and the risk of discharge of radioactive materials caused by the breaking down of spent fuel due to failure to cool it down was significantly reduced.

At present, at Units 1 and 2, preparatory work is being carried out while placing top priority on ensuring safety, such as the installation of large covers for further suppressing the scattering of dust at the time of clearing rubble at Unit 1 and the installation of a working platform for removing fuel at Unit 2.

< Fuel debris retrieval >

The retrieval works are scheduled to be commenced at Unit 2 first on a trial basis, and the scale will be sequentially expanded in stages.[1]

Investigations of the inside of containment vessels by using robots that were developed based on cutting-edge technologies have been conducted so far. Efforts will be continued to develop technologies necessary for those investigations and fuel debris retrieval (such as robot arms), and systems to analyze property of fuel debris and to confine radioactive materials.

1. Based on the status of the development, etc. of robot arms, which are necessary for trial retrieval of fuel debris, the plan will be reviewed in around the latter half of FY2023.

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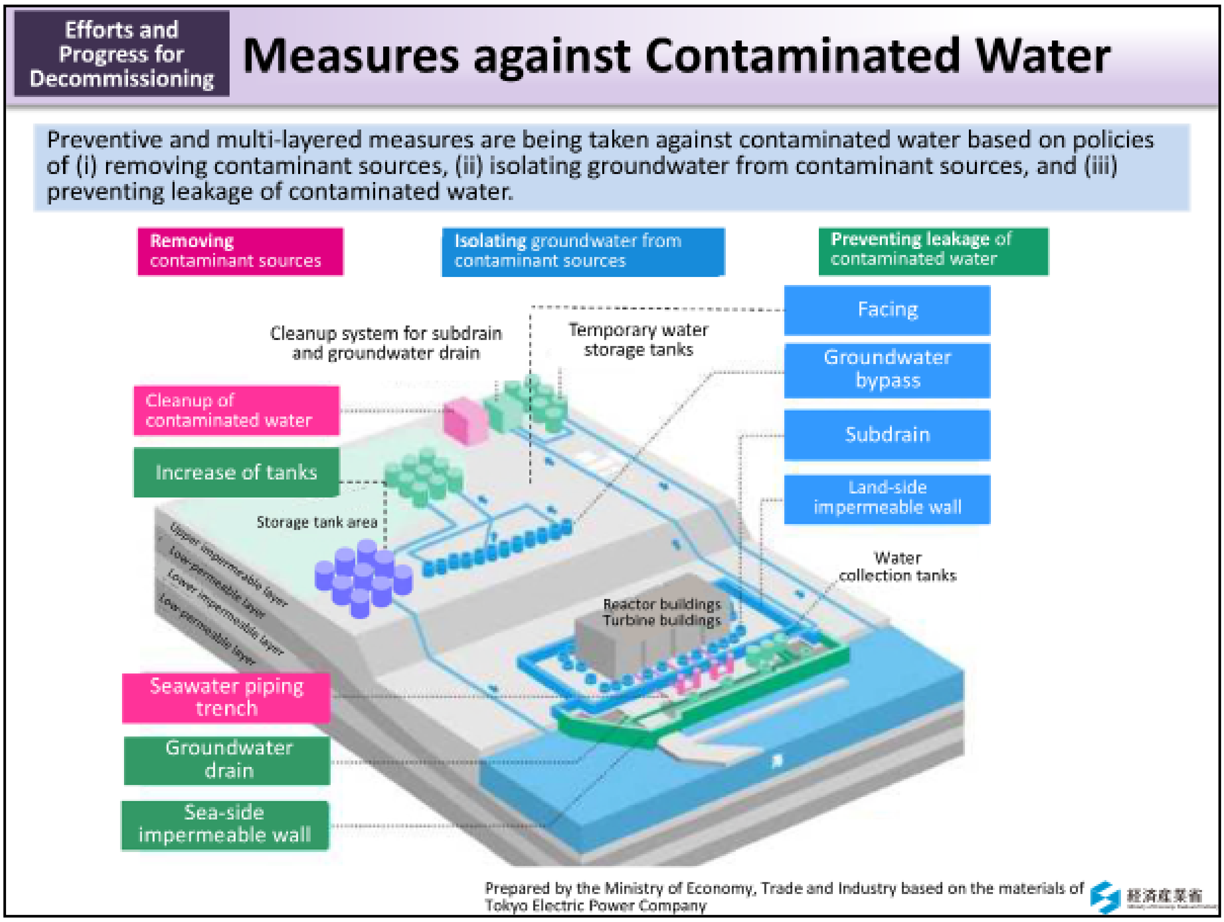
Updated on March 31, 2023



Water contaminated with radioactive materials has been treated based on the following three basic policies.

< Basic Policy 1: Removing contaminant sources >

(i) Clean up contaminated water by removing 62 types of radionuclides therefrom

(ii) Remove highly contaminated water that remains in the trench, etc.

< Basic Policy 2: Isolating water from contaminant sources >

(i) Pump up groundwater on the mountain side of the buildings to suppress inflow of groundwater around the buildings

(ii) Pump up groundwater using the well near the buildings (subdrain) to lower the groundwater level, thereby suppressing inflow of groundwater into the buildings

(iii) Construct a frozen soil wall around the buildings to suppress inflow of groundwater into the buildings

(iv) Suppress infiltration of rainwater into soil by paving the surface (facing)

< Basic Policy 3: Preventing leakage of contaminated water >

(i) Construct a sea-side impermeable wall made of steel pipes to reduce outflow of groundwater containing radioactive materials into the sea

(ii) Construct a groundwater drain in the area between the sea-side impermeable wall and the land-side impermeable wall and pump up groundwater to reduce the outflow of groundwater into the sea

(iii) In order to ensure safe storage of water after purification using ALPS and other equipment, promote storage in welded tanks with lower leakage risks

These efforts have brought about the following outcomes:

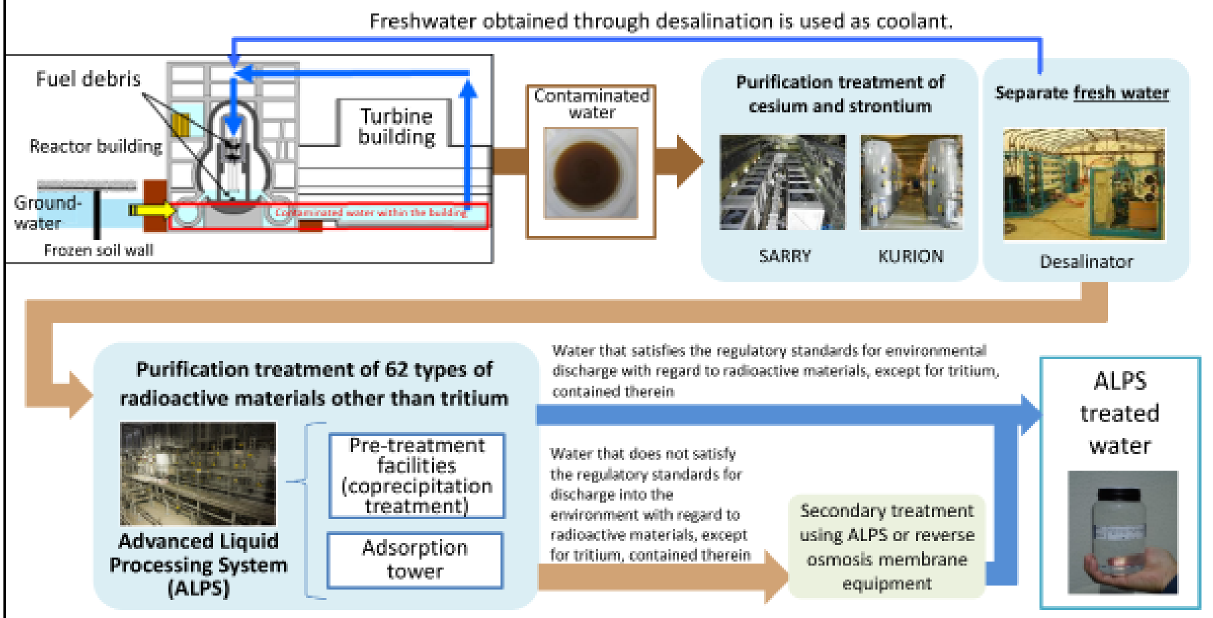
- The amount of newly generated contaminated water decreased from approx. 540 m^3/day in May 2014 to approx. 90 m^3/day in FY2022.
- Treatment of the accumulated water in the buildings, except for reactor buildings, etc. for Unit 1 to Unit 3, was completed and the goal set in the Mid- and Long-term Roadmap has been achieved.
- Concentrations of radioactive materials in the port decreased significantly.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Efforts and Progress for Decommissioning

ALPS Treated Water – Purification of Contaminated Water –

- Contaminated water with radioactive materials is being generated after the accident at TEPCO's Fukushima Daiichi NPS. "ALPS treated water" refers to the water that has been treated by the Advanced Liquid Processing System (ALPS) and other equipment and has been purified to a level where contained radioactive materials, except for tritium, satisfy the regulatory standards for discharge into the environment.



[Source] Prepared based on "Fukushima Daiichi Nuclear Power Station: Contaminated water management: What is 'slurry'? Why is it generated? How is it stored?" by the Agency for Natural Resources and Energy (https://www.enecho.meti.go.jp/en/category/special/article/detail_157.html)

Contaminated water with radioactive materials is being generated after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS. "ALPS treated water" refers to the water that has been treated by the Advanced Liquid Processing System (ALPS) and other equipment and has been purified to a level where contaminated radioactive materials, except for tritium, satisfy the regulatory standards for discharge into the environment.

At TEPCO's Fukushima Daiichi NPS, as water is being injected continuously in order to cool melted and solidified fuel left within the reactor (fuel debris) and due to the inflow of rainwater and groundwater into the reactor building, water containing radioactive materials at high concentrations continues to be generated.

For such contaminated water, purification is conducted to remove radioactive materials using multiple types of equipment for the purpose of reducing the risks posed thereby. First, cesium and strontium are purified by the use of devices called SARRY and KURION. Then, the water goes through a desalination system and fresh water is separated and later used for cooling the reactor. The concentrated water is purified using ALPS to a level where the targeted 62 types of radioactive materials, except for tritium, satisfy their regulatory standards. Radioactive materials such as cesium, strontium, iodine, and cobalt are purified by ALPS through co-precipitation treatment using solutions and adsorption on activated carbon and adsorbents. Almost all radioactive materials are removed through repeated treatment by ALPS, but tritium, which is a radioisotope of hydrogen, exists as a part of the water molecule and cannot be removed through treatment by ALPS and other equipment.

Water treated in this manner has been stored in tanks installed within the premises of TEPCO's Fukushima Daiichi NPS. However, as of December 2024, approximately 70% of the water stored in tanks still contained radioactive materials at concentrations exceeding the regulatory standards, in addition to tritium, due to such reasons as failures in purification equipment that occurred in the past and emergency purification treatment prioritizing the treatment amount in order to promptly reduce the impact of contaminated water on the surrounding areas. For such approximately 70% of the stored water, further treatment is to be conducted using ALPS or using reverse osmosis membrane equipment until it meets the definition of "ALPS treated water" which satisfies the regulatory standards for discharge into the environment other than tritium. (Related to p.14 of Vol. 2, "Treatment Method for Water Stored in Tanks")

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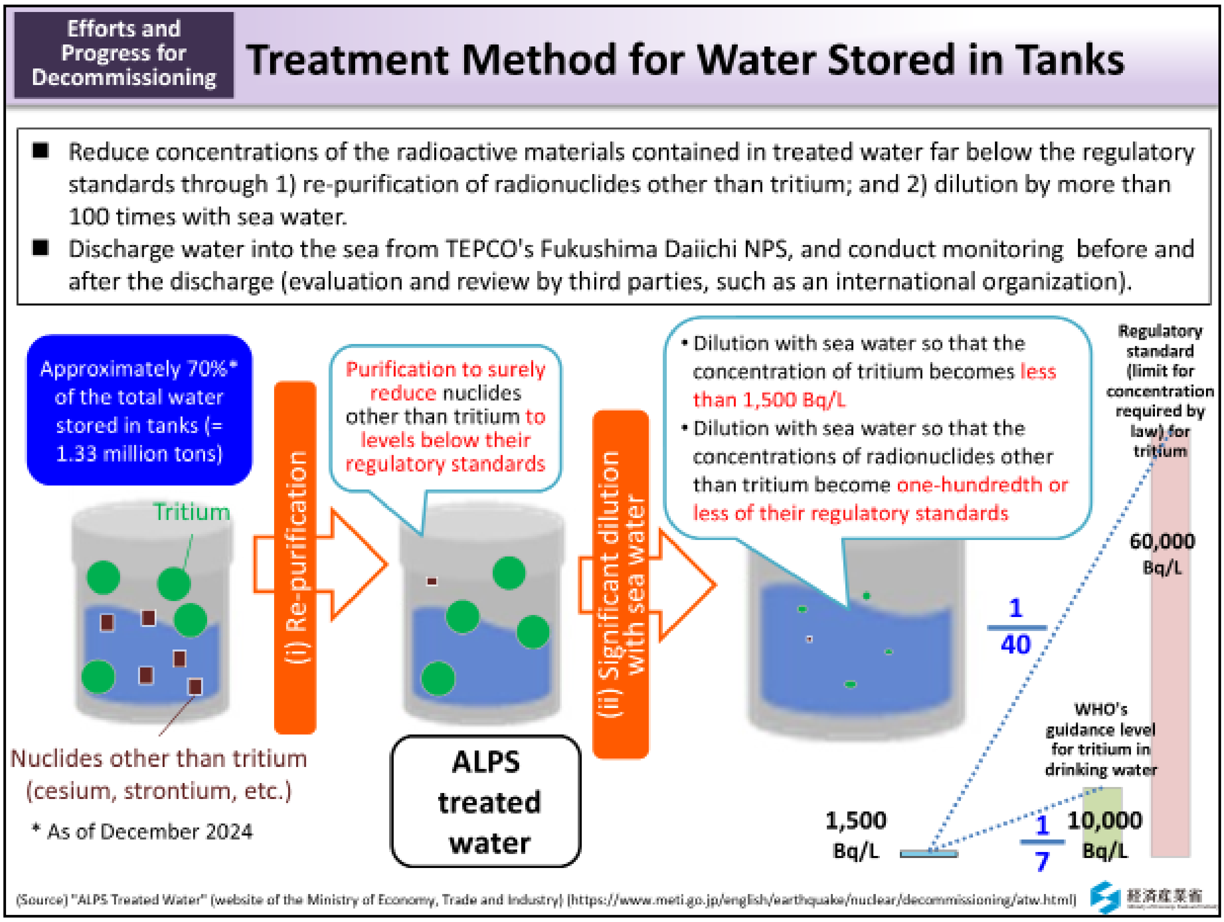


On April 13, 2021, the Government of Japan defined “ALPS treated water” as water wherein radionuclides other than tritium satisfy “their regulatory standards for discharge into the environment” and announced its basic policy to discharge ALPS treated water into the sea. On August 22, 2023, prospects for the day for initiating the discharge into the sea were presented, and the discharge was commenced on August 24, 2023. The basic policy provides that ALPS treated water is to be discharged into the sea after diluting it by more than 100 times with sea water to reduce the concentration of tritium contained therein to less than 1,500 Bq/L. This value of 1,500 Bq/L is one-fortieth of the regulatory standard (limit for concentration required by law) for tritium that is applied to NPSs under operation and is around one-seventh of the WHO’s guidance level for tritium in drinking water (Guidelines for Drinking-Water Quality). Through this dilution, nuclides other than tritium are also diluted to below one hundredth of the regulatory standards for discharge into the environment (the sum of ratios of concentrations required by law). (Related to p.15 of Vol. 2, “Regulatory Standards for Discharging Radioactive Materials into the Environment”)

Water treated by ALPS and other equipment has been stored in tanks installed within the premises of Tokyo Electric Power Company (TEPCO)’s Fukushima Daiichi NPS after the accident. However, as of December 2024, approximately 70% of the water stored in tanks still contained radioactive materials at concentrations exceeding the regulatory standards, in addition to tritium. Such water does not meet the definition of “ALPS treated water.” This is because in around 2013, when the operation of ALPS commenced, (i) its purification capacity was inferior, and (ii) as an enormous amount of contaminated water was generated, the priority was placed on first satisfying the regulatory standards for the storage within the NPS premises in order to reduce radiation risks as promptly as possible.

Accordingly, in line with the basic policy, before discharging the water stored in tanks into the sea, purification by using ALPS or reverse osmosis membrane equipment is to be conducted again (secondary treatment) to satisfy the regulatory standards for environmental discharge, which are stricter than the regulatory standards for the storage within the NPS premises. The performance test on secondary treatment, which Tokyo Electric Power Company Holdings conducted from September 2020, confirmed that nuclides other than tritium can be purified to levels below the regulatory standards for environmental discharge.

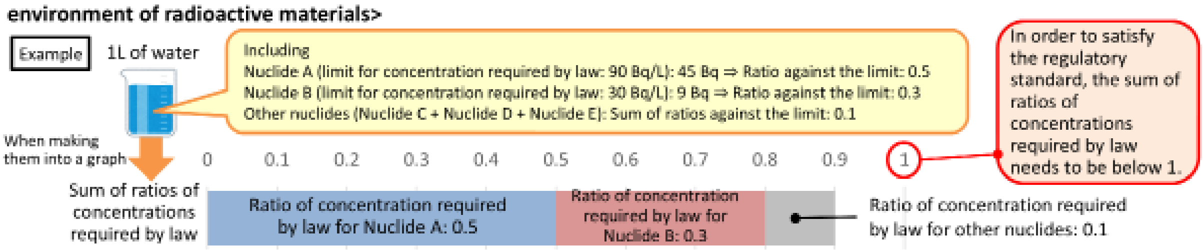
Included in this reference material on March 31, 2022
Updated on March 31, 2025

Efforts and Progress for Decommissioning

Regulatory Standards for Discharging Radioactive Materials into the Environment

- Whether the regulatory standard is satisfied or not is evaluated based on the sum of radiation effects caused by all types of contained nuclides, irrespective of whether the reactor is an operating one or a damaged one (evaluations are based on the sum of the values converted to the effects on human beings, not simply based on types or amounts of nuclides).
- Contaminated water at TEPCO's Fukushima Daiichi NPS contains radioactive nuclides unique to the broken-down reactors (such as cesium and strontium), but these are surely removed to levels below the regulatory standards by the use of the Advanced Liquid Processing System (ALPS) and other equipment.

< Concept of the sum of ratios of concentrations required by law, the regulatory standard for discharge into the environment of radioactive materials>



[Reference] Results of the performance test regarding re-purification by the use of ALPS and other equipment (sum of ratios of concentrations required by law and ratios against the limits for major nuclides)

	Cobalt 60	Cesium 137	Strontium 90	Iodine 129	Other nuclides	Sum for nuclides other than tritium (sum of ratios of concentrations required by law)
Ratio against the limit for concentration required by law	0.0017	0.0021	0.0012	0.13	0.215	0.35

Dilution by more than 100 times so that the sum of the ratios of concentrations required by law for all radioactive materials including tritium becomes less than 1

(Source) Prepared based on "First priority is given to safety and security; Measures related to contaminated water in Fukushima (iv): Regulatory standards for radioactive materials" (https://www.enecho.meti.go.jp/about/special/johoteikyo/osensuitaisaku04.html) (in Japanese) and "Safe and secured disposal of treated water for reconstruction and decommissioning (II): Secondary treatment and other nuclides contained in treated water" (https://www.enecho.meti.go.jp/about/special/johoteikyo/shorisui02.html) (in Japanese) by the Agency for Natural Resources and Energy, and "Performance test regarding secondary treatment of ALPS treated water" by Tokyo Electric Power Company Holdings

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Regulatory standards for radioactive materials contained in liquid and gaseous waste that are discharged into the environment from nuclear power stations, etc. in Japan are set on the basis that an annual public exposure dose additionally caused by discharged radioactive materials (effects on human bodies) will not exceed 1 mSv, according to the recommendations of the International Commission on Radiological Protection (ICRP). More specifically, the maximum concentration for a radioactive material is set so that, supposing that a person continues to drink 2L of water containing that type of radioactive material every day from birth until becoming 70 years old, the resulting dose rate becomes 1 mSv per year on average. The limit thus set for each radioactive material is called the “limit for concentration required by law.”

Generally, liquid and gaseous waste discharged from a nuclear power station, etc. contains multiple radionuclides. Therefore, when effects of multiple radionuclides are supposed, the concept of *the sum of ratios of concentrations required by law* as described in Ministerial Notice is adopted in comprehensive consideration of the effects of all radionuclides contained in the waste. Concentration levels are regulated so that the sum does not exceed 1.

When disposing of ALPS treated water, whether *the sum of ratios of concentrations required by law* thus obtained is below 1 is to be checked in the same manner as for other nuclear power stations, etc. currently under operation. At Tokyo Electric Power Company (TEPCO)’s Fukushima Daiichi NPS, treatment using ALPS and other equipment is conducted to reduce concentrations of radioactive materials other than tritium, including those unique to the damaged reactors (such as cesium and strontium), so that their concentrations do not exceed the regulatory standards.

Also with regard to tritium, which is difficult to remove by ALPS or other equipment, dilution for reducing its concentration (by 100 times or more with sea water) is conducted in order to ensure that the sum of ratios of concentrations required by law for all radioactive materials, including tritium, remains below 1. Through the dilution, concentrations of nuclides contained in ALPS treated water other than tritium, which are already reduced to below their regulatory standards, are also reduced by 100 times or more and safety can be further ensured.

Annual radiation effects when discharging ALPS treated water into the sea after dilution were assessed to be approx. 1/1,000,000 to approx. 1/70,000 of the exposure doses (2.1 mSv/y) of Japanese people from natural radiation (assessment results as of February 2023). (Related to p.18 of Vol. 2, “Assessment of the Radiological Impact of Discharge of ALPS Treated Water into the Sea”)

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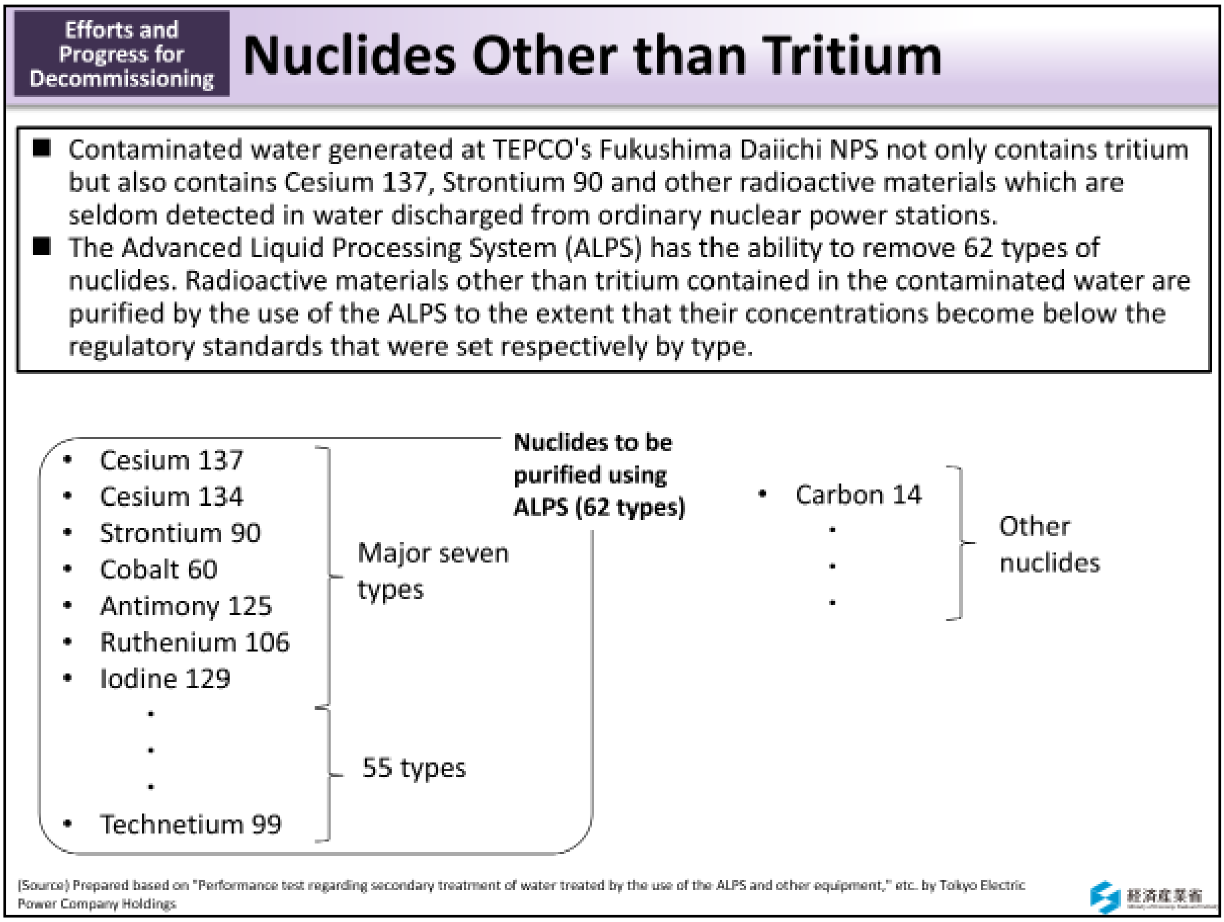

Contaminated water generated at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS contains not only tritium but also Cesium 137, Strontium 90, Iodine 129, and other radioactive materials. These types of radioactive materials normally remain in nuclear fuel rods at ordinary nuclear power stations and are seldom detected in water discharged therefrom. (Related to p.30 of Vol. 1, "Products in Nuclear Reactors")

Regarding these radioactive materials, purification using the Advanced Liquid Processing System (ALPS) and other equipment is conducted prior to discharge into the sea to reduce their concentrations to levels below their regulatory standards, and then, dilution by 100 times or more is conducted together with tritium. Through these procedures, concentrations of radioactive materials that were contained in contaminated water are reduced to less than 1/100 of the regulatory standards when the water is actually discharged.

In ALPS treated water after purification using ALPS and other equipment but before dilution, concentrations of many of the contained nuclides other than tritium are reduced to levels below detection limits. There remains the possibility that Cesium 134/137, Cobalt 60, Ruthenium 106, Antimony 125, Strontium 90, Iodine 129, Technetium 99, Carbon 14, etc., may be detected but at concentrations below the regulatory standards.

Regulatory standards for radioactive materials contained in liquid and gaseous waste that are discharged into the environment from nuclear power stations, etc. in Japan are set based on the total effects by all radioactive materials contained in waste, not based on the types of contained nuclides, and even if some types of these nuclides are detected, they do not necessarily have effects on human bodies and the environment. Incidentally, other nuclear power stations and reprocessing facilities inside and outside Japan also discharge waste containing radioactive materials into the sea or rivers or into the air through ventilation, etc. in compliance with the laws and regulations of respective countries.

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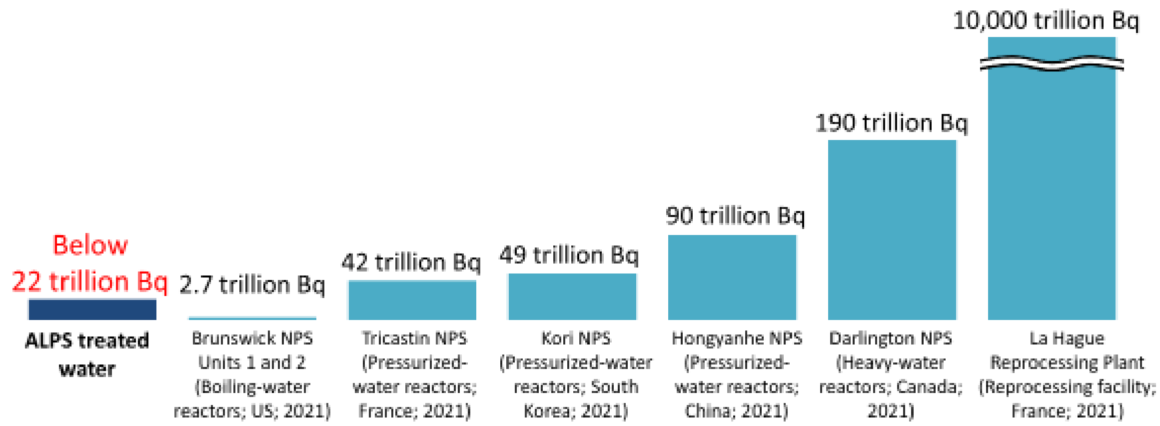
Efforts and Progress for Decommissioning

Annual Discharge Amounts of Tritium - International Comparison -

- The total amount of tritium at the time of discharge of ALPS treated water is below 22 trillion Bq per year (operational target value prior to the accident).
- Tritium is discharged as liquid waste into the sea or rivers or as gaseous waste into the air also at other nuclear power stations and reprocessing facilities inside and outside Japan in compliance with the laws and regulations of respective countries.



Annual discharge amounts of tritium (liquid) from ALPS treated water and at nuclear facilities around the world

(Source) Prepared based on "ALPS Treated Water" on the website of the Ministry of Economy, Trade and Industry (https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/atw.html)

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For discharging ALPS treated water into the sea, the Government of Japan has published the policy of maintaining the annual total discharge of tritium at a level below the operational target value that was adopted at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS prior to the accident (22 trillion Bq per year).

Tritium is also generated at other nuclear power stations and reprocessing facilities inside and outside Japan and is discharged as liquid waste into the sea or rivers or into the air through ventilation, etc. in compliance with laws and regulations of respective countries.

As shown in the graph above, the limit for the total annual discharge of tritium upon discharge of ALPS treated water, 22 trillion Bq or lower, is at a low level, compared with the amounts discharged from many of the nuclear power stations, etc. outside Japan.

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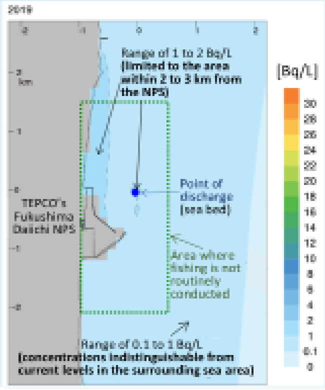
Efforts and Progress for Decommissioning

Assessment of the Radiological Impact of Discharge of ALPS Treated Water into the Sea

- When discharging ALPS treated water into the sea, dilution is to be surely conducted and the diffusion and potential radiological impacts on humans and the marine environment are to be scientifically assessed.
- The content of the assessment is to be reviewed as necessary based on the opinions of the IAEA and the Nuclear Regulation Authority.

Results of the dispersion simulation

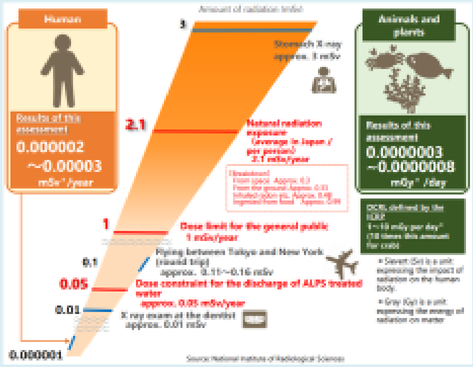
- The surrounding sea area where the tritium concentration was assessed to increase from the current level (0.1 to 1 Bq/L) is limited to the area within 2 to 3 km from the NPS.
- Even in this sea area, the sea water sufficiently satisfies the regulatory standard for tritium in Japan and the WHO's guideline for drinking-water quality.



Around the NPS [Enlarged]
(Largest value in scale at 30Bq/L)

Assessment of the public's exposure

- The impact on humans is assessed to be approx. 1/1,000,000 to 1/70,000 of the exposure doses (2.1 mSv/year) of Japanese people from natural radiation.



- Based on the discharge results and meteorological and oceanographic data for the one-year period from the commencement of discharge on August 24, 2023, to August 25, 2024, the impact on humans was assessed to be approx. 1/400,000 to 1/100,000 of that.

(Source) Prepared based on the " Report of Assessment of Radiological Impact on Public and Environment Regarding the Discharge of ALPS Treated Water into the Sea (Construction stage) " (May 2023) by Tokyo Electric Power Company Holdings, https://www.tepco.co.jp/en/decommission/progress/watertreatment/images/ria_202112e.pdf, etc.

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Following the basic policy, which the Government of Japan announced in April 2021, Tokyo Electric Power Company Holdings conducted assessment on the radiological environmental impact when discharging ALPS treated water into the sea in accordance with internationally recognized methods (as found in the International Atomic Energy Agency (IAEA) Safety Standard documents and International Commission on Radiological Protection (ICRP) recommendations). The assessment was revised based on opinions received from Japan and abroad through a public comment procedure, observations in IAEA reviews and discussions with Nuclear Regulation Authority. The assessment result indicated that the impact on humans and the environment is minimal.

■ Results of the dispersion simulation in the sea (using the atmospheric and hydrographic data for 2019; annual average)

- The area where the concentration of tritium was assessed to be higher than that in seawater (0.1 to 1 Bq/L) in the current surrounding sea area is limited to the area within 2 to 3 km around the NPS.
- Tritium concentration assessed to be around 30 Bq/L was observed in some areas near the discharge outlet, but the concentration decreased rapidly in the vicinity of those areas. Even the tritium concentration of 30 Bq/L is sufficiently lower than 10,000 Bq/L, which is the standard level specified in the WHO Guidelines for Drinking Water Quality.

■ Results of radiological impact assessment on humans and the environment (assessment results as of February 2023)

- The impact on humans was assessed to be approx. 1/1,000,000 to 1/70,000 of the exposure doses (2.1 mSv/y) of Japanese people from natural radiation.
- The impact on plants and animals (flatfish, crabs, and brown algae) was assessed to be approx. 1/3,000,000 to 1/1,000,000 of the standard values at which impact could occur in living organisms as specified by ICRP. (Result of the assessment regarding crabs was approx. 1/30,000,000 to 1/10,000,000)

The operation stage began with the discharge into the sea in August 2023, and one year has passed in August 2024. Therefore, Tokyo Electric Power Company Holdings conducted radiological environmental impact assessment based on the discharge results and meteorological and oceanographic data for the one-year period from the commencement of discharge on August 24, 2023, to August 25, 2024. As was the case with the assessment conducted before the discharge of ALPS treated water, the assessment results indicated that the impact on humans and the environment is minimal.

■ Results of radiological impact assessment on humans and the environment (assessment results for the one-year period from the commencement of discharge on August 24, 2023, to August 25, 2024)

- The impact on humans was assessed to be approx. 1/400,000 to 1/100,000 of the exposure doses (2.1 mSv/y) of Japanese people from natural radiation.
- The impact on plants and animals (flatfish, crabs, and brown algae) was assessed to be approx. 1/1,000,000 of the standard values at which impact could occur in living organisms as specified by ICRP. (Result of the assessment regarding crabs was approx. 1/11,000,000)

(Source)
Prepared based on

- "Report of Assessment of Radiological Impact on Public and Environment Regarding the Discharge of ALPS Treated Water into the Sea (Construction stage)" (February 2023) by Tokyo Electric Power Company Holdings, Inc.
https://www.tepco.co.jp/en/decommission/progress/watertreatment/images/ria_202112e.pdf
- "Radiological Environmental Impact Assessment Report Regarding the Discharge of ALPS Treated Water into the Sea (Operation stage)" (December 2024) by Tokyo Electric Power Company Holdings, Inc.
https://www.tepco.co.jp/en/hd/newsroom/announcements/archives/2024/pdf/241209e0103.pdf

Included in this reference material on March 31, 2022
Updated on March 31, 2025

Efforts and Progress for Decommissioning

Sea Area Monitoring in Relation to ALPS Treated Water

- Since 2022, before commencing the discharge, relevant ministries and agencies, the nuclear operator, and others have conducted sea area monitoring in relation to ALPS treated water.
- The reliability of the analyses is being ensured with the assistance of the IAEA.
- As of December 2024, it was confirmed that tritium concentrations were sufficiently low and would have no adverse impact on human health and the environment.

< Monitoring of sea water, marine biota and fishery products regarding ALPS treated water >

Extract of monitoring plan for FY2024

[Sea water (conducted by the Ministry of the Environment and the Nuclear Regulation Authority)]

(i) Precise analysis of tritium
- Conduct analysis basically four times a year

(ii) Rapid analysis of tritium
- Conduct analysis twice during the discharge, and once a month while suspending the discharge
- Conduct analysis twice a year at six locations at the beach near the outlet

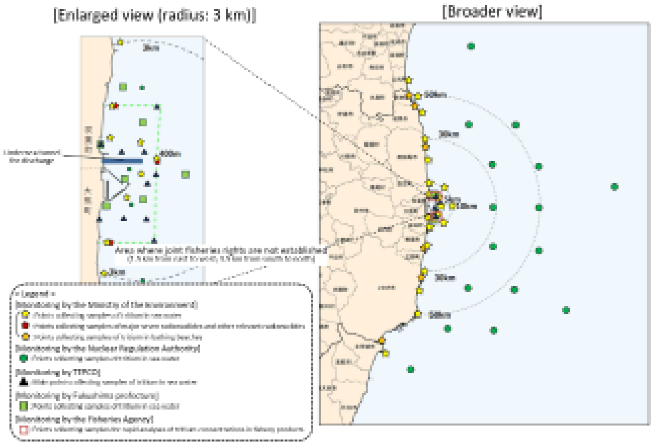
(iii) Analysis of radionuclides other than tritium
- Conduct analysis basically four times a year

[Marine biota (conducted by the Ministry of the Environment)]

(i) Fish
- Conduct analysis for fish collected at three locations closest to the outlet in the sea area where fisheries are conducted ordinarily
- Analyze the concentrations of tritium and Carbon-14 four times a year

(ii) Seaweeds
- Conduct analysis for seaweeds collected at two locations close to the outlet
- Analyze the concentrations of Iodline-129 two times a year

[Fisheries products (conducted by the Fisheries Agency)]
- Measure the concentration of tritium for approx. 450 samples per year



Points collecting samples for sea area monitoring by the relevant organizations

(Source) Prepared based on "Comprehensive Radiation Monitoring Plan (revised on March 21, 2024)" (Monitoring Coordination Meeting) (https://radioactivity.nra.go.jp/cont/en/plan/meetings/274_20240321.pdf), and "Status of Monitoring by MOE" (MOE's website) (https://www.env.go.jp/content/000250315.pdf) (in Japanese), and "Sea Area Monitoring regarding ALPS Treated Water" (NRA) (https://www.nra.go.jp/data/000457798.pdf) (in Japanese)

From the perspective of securing safety and thoroughly ensuring measures against reputational damage upon the discharge of ALPS treated water, the national government and other relevant organizations have been conducting sea area monitoring. The monitoring has been conducted while ensuring the reliability of the relevant organizations' analytical abilities with the assistance of the IAEA.

In FY2022 before commencing the discharge, monitoring was started, and at present, precise analyses and rapid analyses are being conducted.

When monitoring detects any incident, such as a radioactive concentration exceeding the discharge suspension level, TEPCO is committed to making responses appropriately, including the immediate suspension of the discharge based on the Implementation Plan it had formulated.

Results of monitoring concerning tritium, etc. conducted by relevant ministries and agencies are published on the webpage titled "ALPS Treated Water Marine Monitoring Information. The government of Japan will continue making efforts to provide information domestically and internationally in a transparent and easy-to-understand manner.

ALPS Treated Water Marine Monitoring Information
https://shorisui-monitoring.env.go.jp/en/

(Source)
Prepared based on
- "Comprehensive Radiation Monitoring Plan (revised on March 21, 2024)" (Monitoring Coordination Meeting)
https://radioactivity.nra.go.jp/cont/en/plan/meetings/274_20240321.pdf,
- "Status of Monitoring by MOE" (MOE)
https://www.env.go.jp/content/000250315.pdf(in Japanese),
- "Sea Area Monitoring regarding ALPS treated water" (NRA)
https://www.nra.go.jp/data/000457798.pdf (in Japanese)

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Efforts and Progress for Decommissioning

Sea Area Monitoring in Relation to ALPS Treated Water (Announcement of Monitoring Results)

- Since FY2022, before commencing the discharge, relevant ministries and agencies, local governments, the nuclear operator, and others have conducted sea area monitoring in relation to ALPS treated water. Immediately after commencing the discharge in August 2023, they strengthened and expanded the structure for sea area monitoring by such means as increasing analysis frequencies and locations.
- The results of the monitoring are published on the websites of relevant organizations, etc.
- As of December 2024, it was confirmed through sea area monitoring that tritium concentrations were sufficiently low compared to the regulatory standards (limit for concentration required by law) and would have no adverse impact on human health and the environment.

<MOE ALPS Treated Water Marine Monitoring Information>

https://shorisui-monitoring.env.go.jp/en/

Results of the monitoring regarding tritium, etc. conducted by other relevant ministries and agencies are published, together with those by the MOE.

(Source) "ALPS Treated Water Marine Monitoring Information" (MOE's website) (https://shorisui-monitoring.env.go.jp/en/)

<NRA Sea Area Monitoring in Relation to ALPS Treated Water>

https://radioactivity.nra.go.jp/en/results/sea

Results of the monitoring conducted by the Nuclear Regulation Authority are published.

<Fisheries Agency Results of the monitoring on radioactivity level in fishery products>

https://www.jfa.maff.go.jp/e/inspection/index.html

Results of the tritium monitoring conducted on fishery products landed on Japan's Pacific coast from Hokkaido prefecture to Chiba prefecture are published.

<Information held by other relevant organizations >

MOE's website "ALPS Treated Water Marine Monitoring Information" contains links to information on monitoring by other relevant organizations (Ministry of Foreign Affairs; Ministry of Economy, Trade and Industry; International Atomic Energy Agency (IAEA); Japan Atomic Energy Agency; and TEPCO).

From the perspective of securing safety and thoroughly ensuring measures against reputational damage upon the discharge of ALPS treated water, the national government and other relevant organizations have been conducting sea area monitoring. The results of the monitoring regarding tritium, etc. conducted by relevant ministries and agencies are published on their webpages, etc.

The MOE's website, "ALPS Treated Water Marine Monitoring Information," contains results of the monitoring regarding tritium, etc. conducted by other relevant organizations, together with those by the MOE.

Results of the monitoring conducted so far show that tritium concentrations, etc. were sufficiently low compared to the regulatory standards (limit for concentration required by law) and would have no adverse impact on human health and the environment.

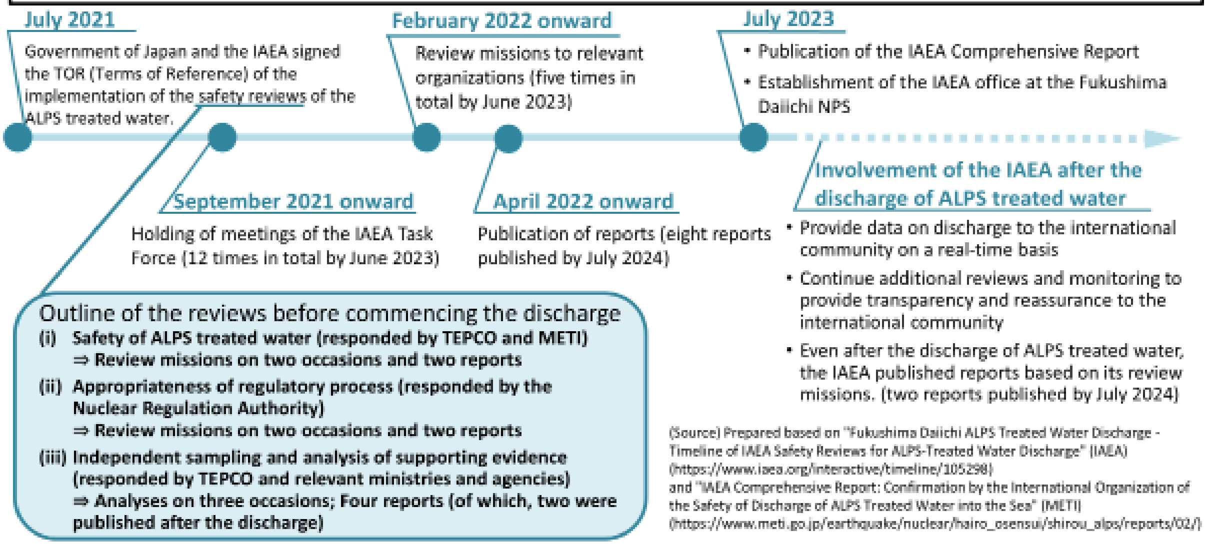
"ALPS Treated Water Marine Monitoring Information" (MOE)
https://shorisui-monitoring.env.go.jp/en/
"ALPS Treated Water Marine Monitoring" (NRA)
https://radioactivity.nra.go.jp/en/results/sea
"Results of the monitoring on radioactivity level in fishery products" (Fisheries Agency)
https://www.jfa.maff.go.jp/e/inspection/index.html

Included in this reference material on March 31, 2025

Efforts and Progress for Decommissioning

Involvement of the IAEA in Discharge of "ALPS Treated Water"

- The IAEA conducts reviews as a third party in its professional capacity as an authoritative UN-related agency with specialized knowledge in the field of nuclear energy.
- On July 4th, 2023, the IAEA published its comprehensive report stating that discharges of the ALPS treated water to the sea are "consistent with relevant international safety standards" and "would have a negligible radiological impact on people and the environment."
- The IAEA will get involved in securing the safety of discharge of ALPS treated water over years even during and after discharge, not limited to reviews prior to discharge.



(Source) Prepared based on "Fukushima Daiichi ALPS Treated Water Discharge - Timeline of IAEA Safety Reviews for ALPS-Treated Water Discharge" (IAEA) (https://www.iaea.org/interactive/timeline/105298) and "IAEA Comprehensive Report: Confirmation by the International Organization of the Safety of Discharge of ALPS Treated Water into the Sea" (METI) (https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/shirou_alps/reports/02/)

The government of Japan has asked the IAEA for support to review Japan's plans and activities for the discharge of ALPS treated water so that the treated water can be discharged in a safe and highly-transparent manner in compliance with the IAEA international safety standards. Accepting this request of the government of Japan, the IAEA will conduct technical reviews as to whether ALPS treated water is discharged in compliance with the IAEA international safety standards over the coming several decades. In order to sufficiently secure key elements regarding safety, the reviews consist of the following three major items.

1. Intensively evaluate the property of ALPS treated water and discharge plans, especially focused on safety
2. Check responses of the Nuclear Regulation Authority, which is responsible for nuclear safety regulations
3. Corroborate the data published by the government of Japan by independently conducting monitoring of radioactive materials in ALPS treated water and the environment

From February 2022 to June 2023, the IAEA conducted multiple review missions and published reports for the purpose of publicizing the progress. Based on the observations by the Task Force, TEPCO revised the Implementation Plan and reports on the assessment of radiological impacts on humans and the environment to further improve the content thereof.

In July 2023, the IAEA published its comprehensive report, which concludes that discharges of the ALPS treated water into the sea are "consistent with relevant international safety standards" and "would have a negligible radiological impact on people and the environment" (p.22 of Vol. 2, "IAEA Comprehensive Report on the Safety of 'ALPS Treated Water'"). This report states as follows.

- The IAEA will maintain an onsite presence at Fukushima Daiichi NPS throughout its review and will provide real-time and near real-time monitoring data on discharges to the international community.
- Additional review and monitoring activities will be continued to provide additional transparency and reassurance to the international community.

The report presents the IAEA's commitment to engaging with Japan on the discharge of ALPS treated water not only before, but also during, and after the treated water discharges occur, aiming to secure the safety of discharge over years.

In January 2024, the IAEA published a report on its first review mission to Japan after the start of ALPS treated water discharge. In the report, the IAEA concludes as follows.

- In its reviews and observations, the Task Force did not identify anything that is inconsistent with the requirements in the relevant international safety standards.
- A robust regulatory infrastructure is in place to provide operational safety oversight of the discharge of ALPS treated water, and the Task Force was able to witness first-hand the onsite presence of the NRA and their activities in this regard.
- The Task Force confirmed that the equipment and facilities are installed and operated in a manner that is consistent with the Implementation Plan and the relevant international safety standards.
- The Task Force reiterated the finding from the IAEA's Comprehensive Report that optimization of protection of the discharge of ALPS treated water needs to be considered moving forward as part of the overall decommissioning of the FDNPS site. However, the Task Force fully recognized that the discharges are in the early stages and that further time and operational experience are required before progress can be made on this issue.

The IAEA's reports are published on the following website:
IAEA Fukushima Daiichi ALPS Treated Water Discharge - Reports
https://www.iaea.org/topics/response/fukushima-daiichi-nuclear-accident/fukushima-daiichi-alps-treated-water-discharge/reports

(Source)
Prepared based on
- "The IAEA confirmed the safety of discharge of ALPS treated water into the sea" (July 2023)
https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/shirou_alps/reports/02/ (in Japanese)
- "The IAEA Published a Report on Its February Review Mission of Safety Aspects of Handling of ALPS Treated Water at Fukushima Daiichi Nuclear Power Station" (April 2022)
https://www.meti.go.jp/english/press/2022/0429_001.html

Included in this reference material on March 31, 2024
Updated on March 31, 2025

Efforts and Progress for Decommissioning

IAEA Comprehensive Report on the Safety of "ALPS Treated Water"

- The IAEA conducted technical reviews (on five occasions) before discharge in order to evaluate whether the discharge of ALPS treated water into the sea complies with the international safety standards.
- In those reviews, TEPCO's assessment of radiological environmental impacts was verified and data were corroborated through comparison among analytical laboratories (Interlaboratory Comparison (ILC)) with the participation of third-party analytical laboratories* in addition to the IAEA.
- The comprehensive report published in July 2023 evaluates that "discharges of the ALPS treated water to the sea would have a negligible radiological impact on people and the environment."

* Analytical laboratories of South Korea, France, the United States, and Switzerland participated.

Reviewed items	Major results
Radiological impacts on humans and the environment	• Assessment of radiological impacts on the environment is being conducted in compliance with international standards. • International waters are not affected by the discharge of ALPS treated water, and the cross-border impact is negligible.
Integrity of facilities and process for controlling discharge	• The system and process for controlling discharge are robust. • Emergency isolation valves and radiation detectors are incorporated in the system in a redundant manner.
Regulatory management and approval	• The Nuclear Regulation Authority has established and is enforcing appropriate legal and regulatory safety frameworks as an independent regulatory organization.
Analysis/source and environmental monitoring	• Monitoring activities by the government of Japan and TEPCO are in compliance with the international safety standards. • TEPCO has the ability to undertake accurate and precise analyses and has a sustainable and robust analytical system in place.

(Source) Prepared based on METI's website "Let's get to know and understand about ALPS treated water."
https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/english/shirou_alps.html

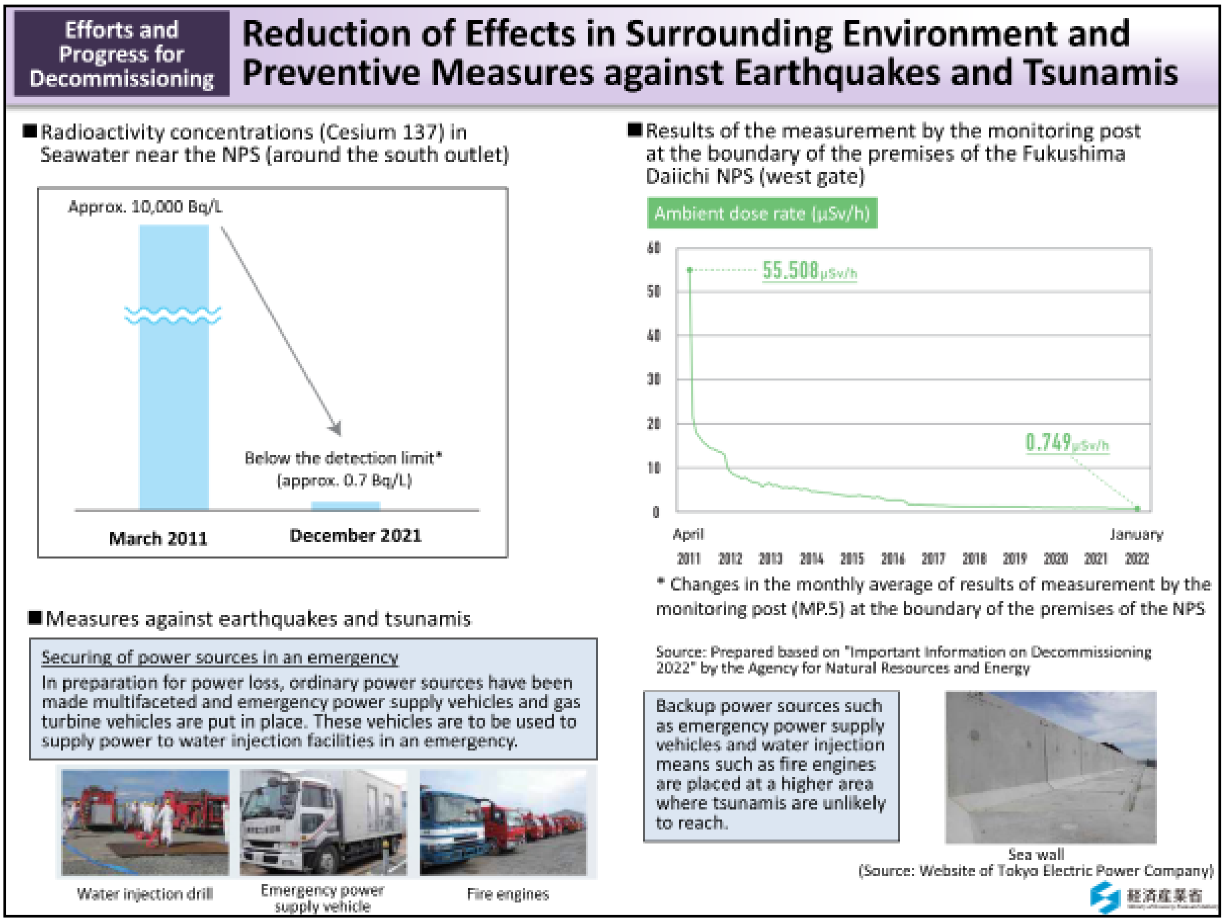
In response to the request of the government of Japan, the IAEA conducted reviews in and after February 2022 from the viewpoints of (i) safety of ALPS treated water, (ii) appropriateness of the regulatory process, and (iii) independent sampling and analysis of supporting evidence. The results of the reviews were published as reports in and after April 2022, and the comprehensive report summarizing the reviews was published on July 4, 2023. International experts from 11 countries participated in the reviews, in addition to the experts of the IAEA.

In the review concerning (i), data provided by TEPCO and the Ministry of Economy, Trade and Industry (METI) concerning eight technical matters, including TEPCO's radiological environmental impacts assessment, were verified. In the review concerning (ii), the details of the examinations and inspections being conducted by the Nuclear Regulation Authority were checked. In the review concerning (iii), the IAEA conducted independent monitoring of radioactive materials in ALPS treated water and the environment and verified data published by the Japan side.

The comprehensive report summarizing the results of these reviews concludes that the approach to and activities for the discharge of ALPS treated water taken by TEPCO, the Nuclear Regulation Authority, and the government of Japan are consistent with relevant international safety standards. Additionally, it concludes that discharges of the ALPS treated water to the sea would have a negligible radiological impact on people and the environment. On the other hand, the report points out the necessity to assess the consistency of activities during the operation of the ALPS treated water discharges with relevant international safety standards at various times. Given these, the IAEA presents its commitment to being involved even after the commencement of ALPS treated water discharges to secure the safety thereof.

(Source)
Prepared based on
- IAEA, "IAEA COMPREHENSIVE REPORT ON THE SAFETY REVIEW OF THE ALPS-TREATED WATER AT THE FUKUSHIMA DAIICHI NUCLEAR POWER STATION" (July 2023) https://www.iaea.org/sites/default/files/iaea_comprehensive_alps_report.pdf
- METI's website "Let's get to know and understand about ALPS treated water." https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/english/shirou_alps.html

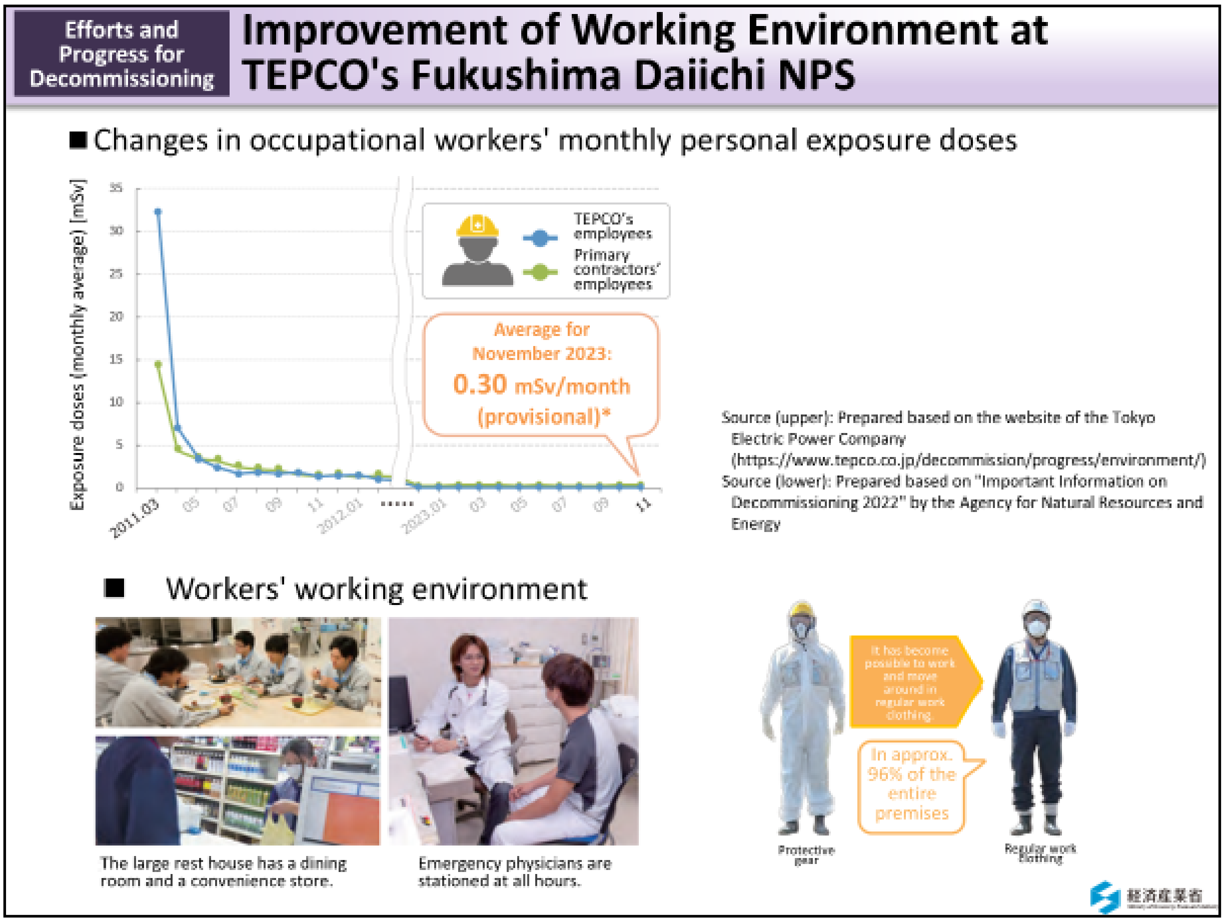
Included in this reference material on March 31, 2024



During work, the monitoring of changes in radiation doses at work sites and the monitoring of water and air at the boundary of the premises of the NPS have simultaneously been conducted regularly. In preparation for any event of an abnormal increase in ambient dose rates or concentrations of radioactive materials in dust, a system for promptly reporting the incident has been put in place.

As measures against earthquakes and tsunamis, computer analysis has confirmed that important buildings will not collapse even in the event of an earthquake of the same magnitude as the Great East Japan Earthquake. In addition, a sea wall against a Chishima-trench Tsunami was installed in September 2020. Additionally, a sea wall against a Japan-trench Tsunami, which is expected to be larger, is being constructed at present. While the work to block the openings of the buildings to prevent the inflow of seawater in the event of a tsunami has been completed, backup power sources such as emergency power supply vehicles have been provided and water injection means such as fire engines are placed at a higher area where tsunamis are unlikely to reach.

Included in this reference material on February 28, 2018
Updated on March 31, 2023



In order to improve safety and workability by reducing workers' load, efforts to improve the working environment for such work as rubble removal and covering of slopes and sites, etc. with mortar have been made at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS. As a result, areas where workers can work in regular work clothing expanded to approx. 96% of the entire premises in June 2018.

Furthermore, in November 2018 onward, it became possible for residents to attend a tour of the NPS and observe Units 1 to 4 from a height in ordinary clothing without wearing a mask.

Along with efforts to improve the working environment, etc., reduction of exposure doses has been implemented. The average exposure dose in November 2023 was 0.30 mSv/month, which is sufficiently low compared to the value of 1.67 mSv/month, calculated from the dose limit of 100 mSv per 5 years (p.171 of Vol. 1, "Application of Dose Limits"). Not only radiation control but also comprehensive occupational health management, including countermeasures against heatstroke and infectious diseases, are conducted to ensure the health and safety of workers. Additionally, long-term health management has also been implemented for emergency workers, etc.

In May 2015, a large rest house was opened, and workers are served hot meals prepared at the food service center and can take a shower and buy things at a convenience store. They can thus work under normal working conditions, except for a certain zone, at present.

The facility that manages access to and from the Fukushima Daiichi NPS is equipped to provide emergency medical care 24 hours a day in case of any accident. A heliport has also been constructed so as to ensure prompt transportations to external medical facilities in an emergency.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Chapter 7

Environmental Radiation Monitoring

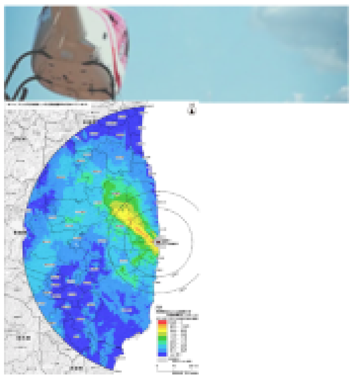
Chapter 7 explains environmental radiation monitoring being conducted after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and the results thereof.

You can understand how impacts of the accident spread and the status of contamination in the surrounding environment near the NPS, and changes over time after the accident.

Spatiotemporal Distribution of Ambient Dose Rates

Comprehensive Radiation Monitoring Plan and Information Disclosure

Radiation dose measurement map
Results of radiation monitoring nationwide 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.

Prepared based on Nuclear Regulation Authority; Monitoring information of environmental radioactivity level: https://radioactivity.nra.go.jp/ja/ (in Japanese)
Comprehensive Radiation Monitoring Plan: https://radioactivity.nra.go.jp/en/plan/meetings

The Monitoring Coordination Meeting established in the Nuclear Emergency Response Headquarters formulated Comprehensive Radiation Monitoring Plan to ensure detailed monitoring of large amounts of radioactive materials released into the environment due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS. Based on this plan, relevant organizations and nuclear operators are collaboratively conducting monitoring, respectively focusing on the following.

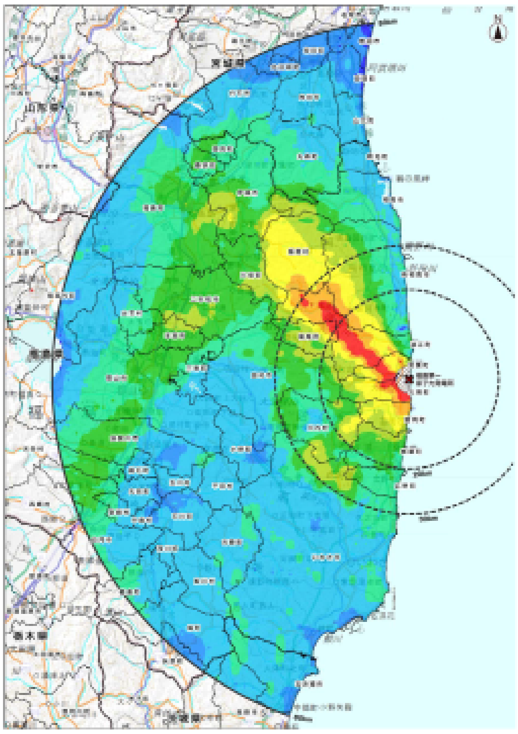
1) General environment (soil, water, and atmosphere, etc.), water environment, sea areas, etc.
2) Schools, etc.
3) Ports, airports, and sewage, etc.
4) Wild fauna and flora, and waste
5) Cultivated soil, forests, and pasture grass, etc.
6) Tap water
7) Foodstuffs (agricultural products, forestry products, livestock products, and fishery products)

Monitoring results are released on the websites of the respective organizations and are updated as needed.

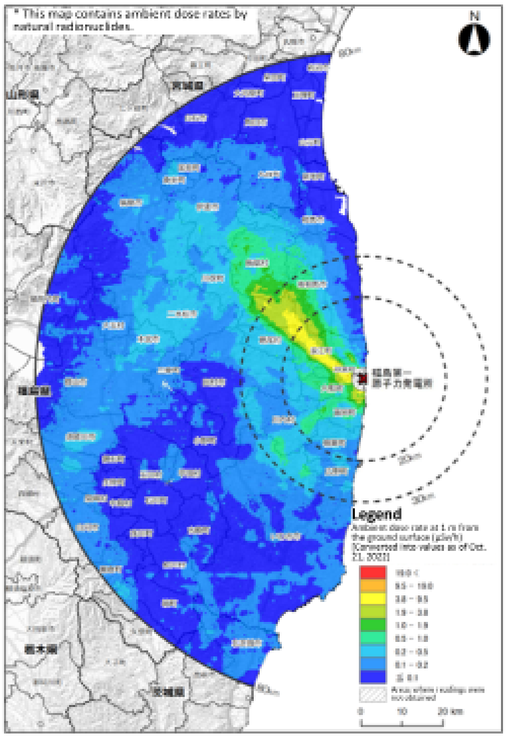
Included in this reference material on February 28, 2018
Updated on March 31, 2024

Spatiotemporal Distribution of Ambient Dose Rates

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



* Converted into values as of October 21, 2022
Released by the Nuclear Regulation Authority on Mar. 10, 2023

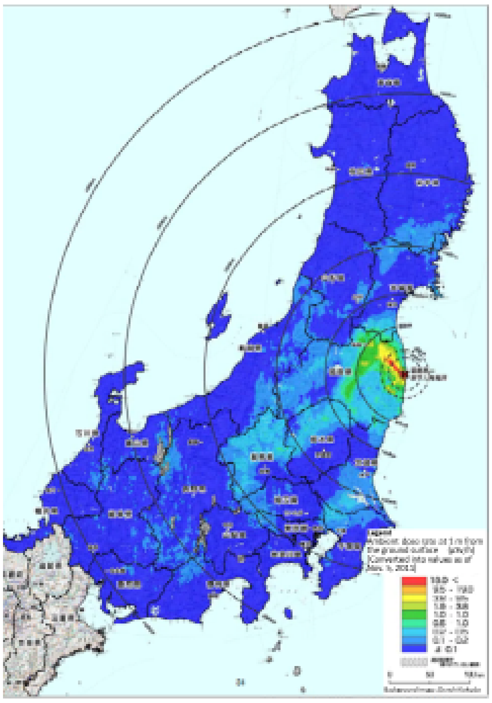
In order to ascertain the changes in the effect of radioactive materials, the airborne monitoring survey has been conducted continuously within the 80-km zone of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, and the distribution of ambient dose rates and deposition of radioactive cesium have been surveyed. Additionally, the effect of radioactive materials outside the 80-km zone has also been ascertained through the airborne monitoring survey.

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.

Included in this reference material on March 31, 2014
Updated on March 31, 2024

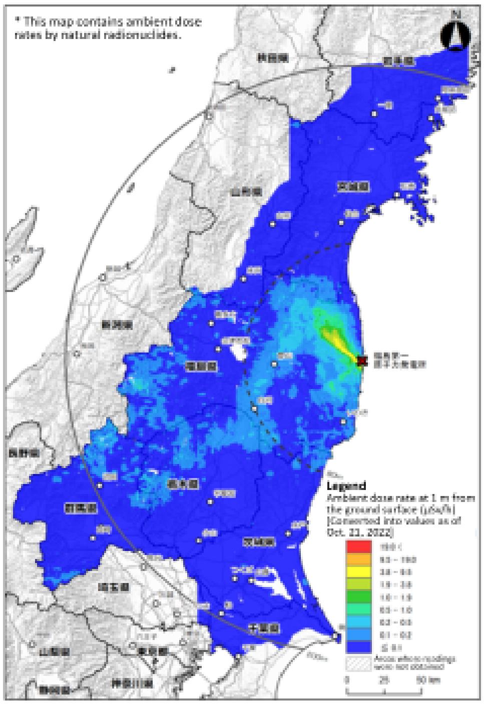
Spatiotemporal Distribution of Ambient Dose Rates

Distribution of Ambient Dose Rates in Fukushima Prefecture and Neighboring Prefectures



* Converted into values as of Nov. 5, 2011

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



* Converted into values as of Oct. 21, 2022

Released by the Nuclear Regulation Authority on Mar. 10, 2023

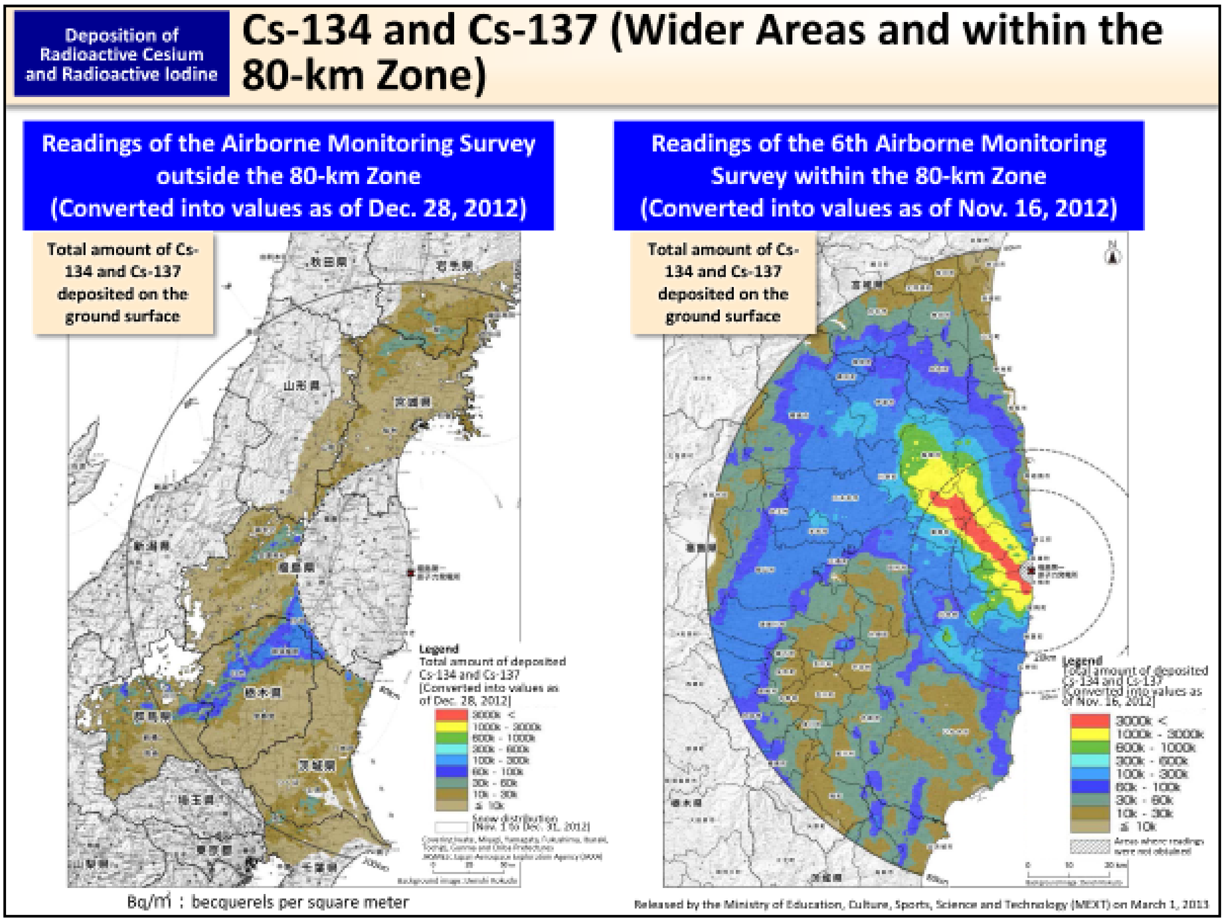
An airborne monitoring survey was conducted within the 80-km zone of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and outside this zone, mainly in the western area of Fukushima Prefecture, and in Ibaraki, Gunma, Tochigi and Miyagi Prefectures.

The left figure shows the airborne monitoring survey results as of November 2011, seven months after the accident, and the right figure shows those as of October 2022.

Readings of the Airborne Monitoring Survey in Fukushima Prefecture and Neighboring Prefectures (March 10, 2023)

https://radioactivity.nra.go.jp/cont/ja/results/airborne/air-dose/2023_18thAirbome_monitoring_press_japanese_R08.pdf (in Japanese)

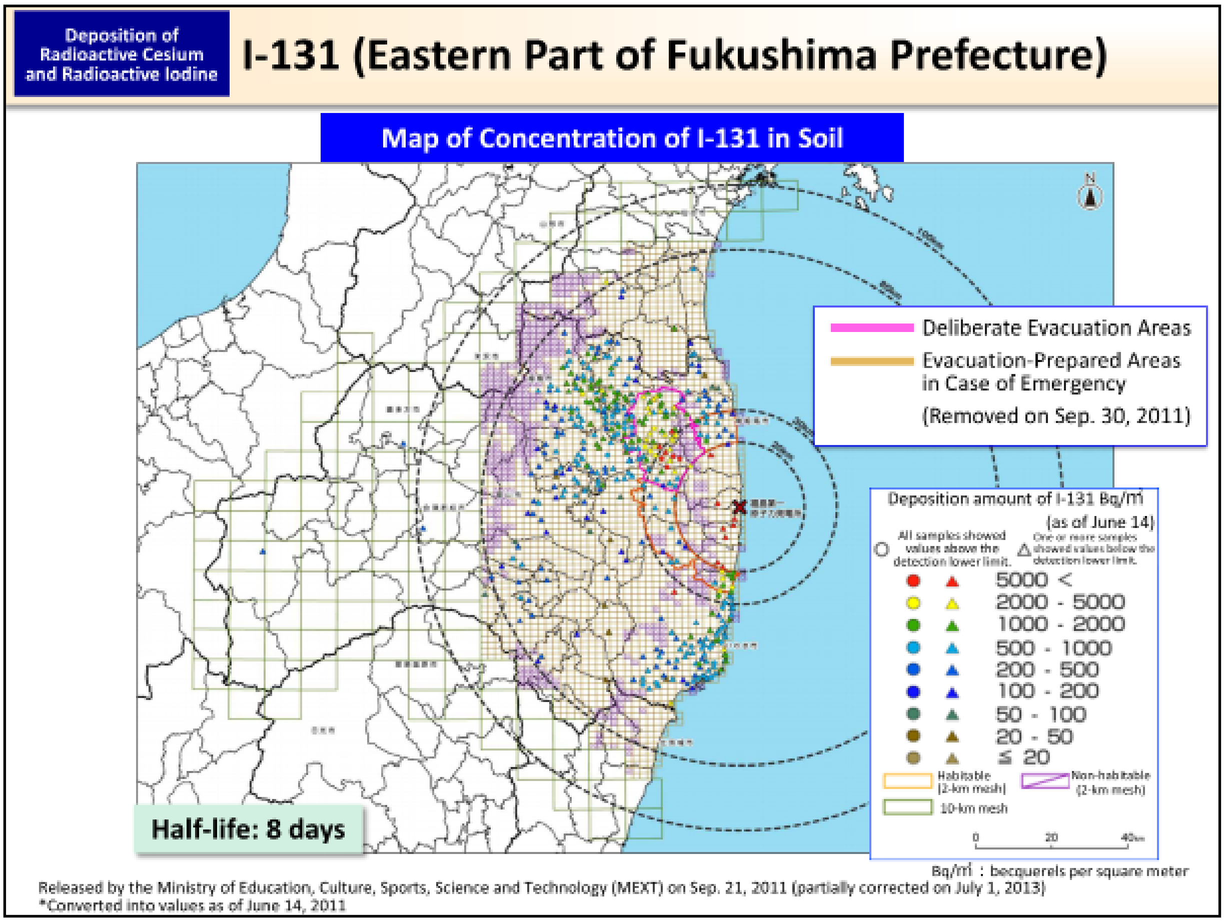
Included in this reference material on March 31, 2013
Updated on March 31, 2024



These maps show deposition of radioactive cesium on the soil surface in Fukushima and neighboring prefectures based on the readings of the airborne monitoring survey.

The survey was conducted in October to December 2012 for the purpose of ascertaining the changes in the situation regarding the effect of radioactive materials including influence of rainfall or other natural environments. When creating these maps, values were all converted into those as of the last day of the relevant airborne monitoring survey, November 16, 2012, and December 28, 2012, respectively.

Included in this reference material on March 31, 2013
Updated on March 31, 2019



In the soil survey conducted by the national government in June 2011, three months after the accident, analysis of I-131 was conducted for soil samples collected within the 100-km zone of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS.

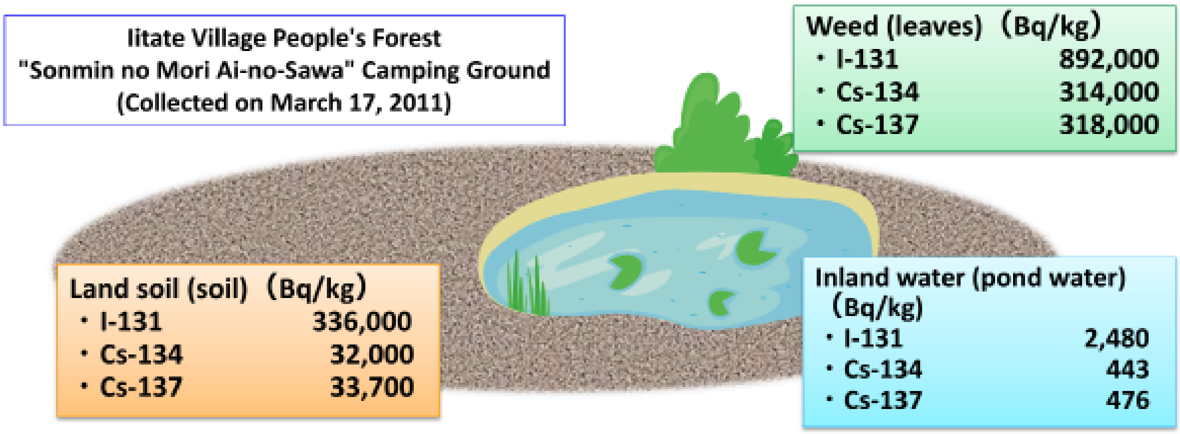
Areas showing high deposition amounts of iodine extended to the northwest of the NPS, in the same manner as in the case of cesium, and there are areas where the ratio of iodine against cesium is large in the southern areas of the NPS. I-131 and Cs-137 were thus deposited at different ratios in different areas probably because the ratio between I-131 and Cs-137 in radioactive plumes differed depending on the time when they were discharged. There is also the possibility that the ratio of I-131 against Cs-137 was relatively larger in plumes that flowed down to the south or that deposition was not even and a larger amount of Cs-137 was deposited in the north due to rainfall, resulting in increased concentrations of Cs-137 in soil in the north.[1]

1. "Concerning the Preparation of Distribution Map of Radiation Doses, etc. (Part 1)" (2012) by the Emergency Operation Center, Ministry of Education, Culture, Sports, Science and Technology

Included in this reference material on March 31, 2013
Updated on March 31, 2020

Deposition of Radioactive Cesium and Radioactive Iodine

Environmental Samples Collected in Fukushima Prefecture (Immediately after the TEPCO's Fukushima Daiichi NPS Accident)



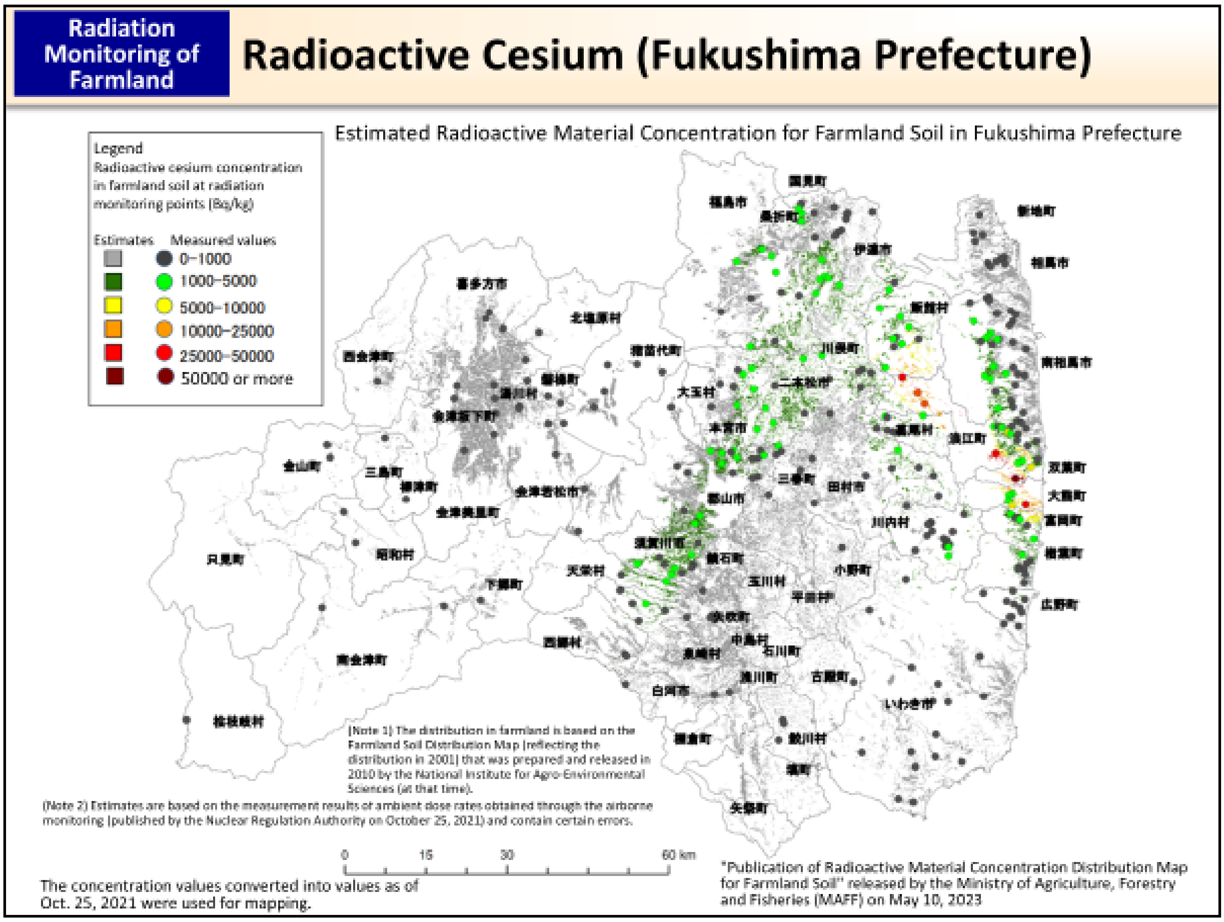
Sampling location	Date	Weed (leaves) Bq/kg			Land soil (soil) Bq/kg		
		I-131	Cs-134	Cs-137	I-131	Cs-134	Cs-137
Towa branch municipal office, Nihonmatsu City	March 17	152,000	107,000	110,000	35,800	5,440	6,230
Swordsmanship dojo, Iitate Village	March 16	1,150,000	546,000	549,000	151,000	22,600	25,100
Ruins of Onami castle, Fukushima City	March 17	429,000	283,000	292,000	156,000	16,700	18,000

Bq/kg: becquerels per kilogram

Prepared based on "Measurement Readings for Environmental Samples" on June 7, 2011, by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Through radiation monitoring of environmental samples conducted immediately after the accident, high level concentrations of radioactive iodine and radioactive cesium were detected from soil and plants.

Included in this reference material on March 31, 2013
Updated on March 31, 2019



In order to promote future agricultural activities at farmland in Fukushima Prefecture, which was severely affected by radioactive materials due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, measurements of radioactive materials in farmland soil have been conducted continuously. The above map shows estimated radioactive cesium concentrations in farmland soil based on the results of the measurement conducted at 319 locations in Fukushima Prefecture in FY2021 (values are converted into those as of October 25, 2021).

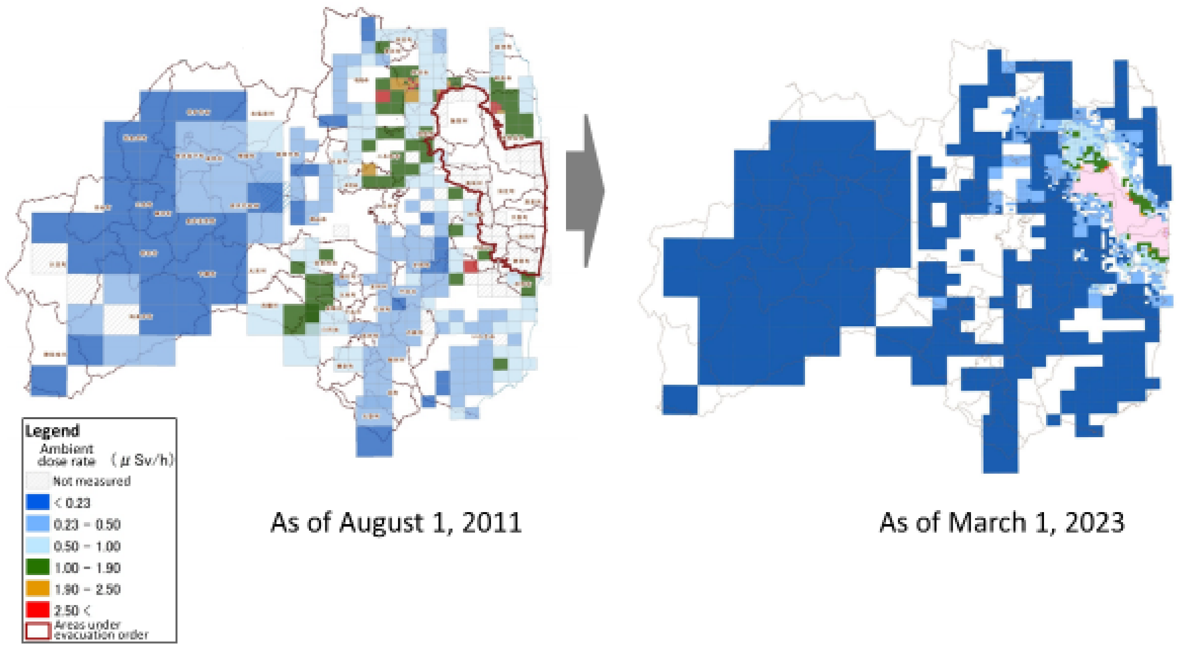
In this farmland soil survey, soil to a depth of approx. 15 cm from the ground surface or a depth to be plowed was collected as samples in consideration of the depth of soil wherein radioactive materials are turned over in cultivation and in which crops take root.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radiation Monitoring of Forest

Changes in Ambient Dose Rates in Forests

The average ambient dose rate for 362 locations as of March 2023 is approximately 19% of the average as of August 2011.



Prepared based on "Current State and Forecast of Radioactive Materials in Forests" by Fukushima Prefecture

Fukushima Prefecture has been conducting monitoring of ambient dose rates in forests within the prefecture every year since FY2011. The monitoring targeted 362 locations in FY2011 but gradually expanded the coverage to target 1,300 locations in FY2022.

For the 362 locations, where monitoring has been continued from the beginning, the average ambient dose rate was 0.17 μSv/h as of March 2023, approximately 19% of the average as of August 2011 (0.91 μSv/h). The ambient dose rate in forests has decreased almost the same as the decrease in dose rate due to physical attenuation.

Measurement results by region as of March 2023 (minimum value - maximum value) are as follows.

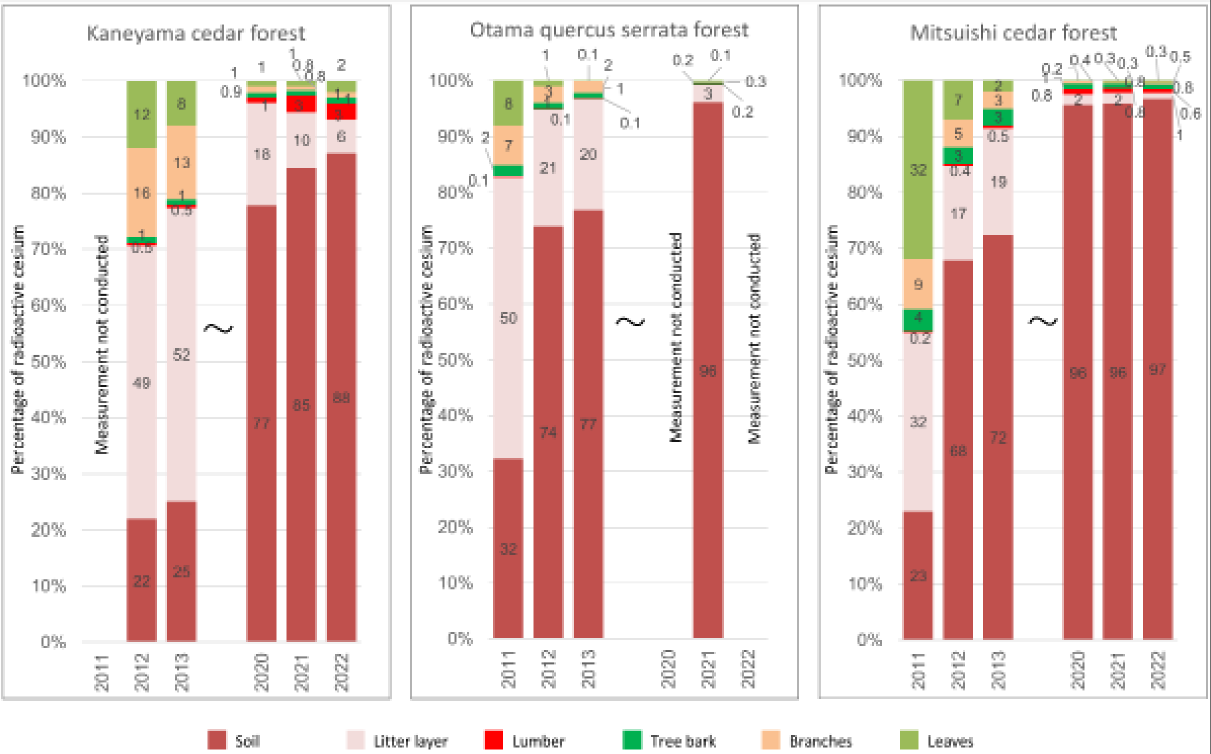
- Ken-poku (northern pref.) (361 locations): 0.04 - 1.09 μSv/h
- Ken-chu (central pref.) (122 locations): 0.04 - 0.42 μSv/h
- Ken-nan (southern pref.) (38 locations): 0.04 - 0.20 μSv/h
- Aizu (33 locations): 0.03 - 0.08 μSv/h
- Minamiaizu (22 locations): 0.03 - 0.08 μSv/h
- Soso (653 locations): 0.08 - 2.62 μSv/h
- Iwaki (71 locations): 0.04 - 0.84 μSv/h

(Related to p.186 of Vol. 1, “Distribution of Radioactive Materials in Forests”)

Included in this reference material on March 31, 2019
Updated on March 31, 2024

Radiation Monitoring of Forest

Changes in Radioactive Cesium Distribution in Forests



Prepared based on the "Result of FY2022 Survey on Radioactive Cesium Distribution in Forests" (Forestry Agency)

Regarding radioactive cesium in the surveyed forests, in the first one year after the accident from 2011 to 2012, the percentage of radioactive cesium found in leaves, branches and litter layers decreased significantly, while that found in soil increased significantly. This is considered to be because radioactive cesium deposited on leaves and branches, etc. of trees gradually transferred to the litter layer on the ground due to rain or leaf fall and then transferred to soil due to the decomposition of the litter layer. The percentage of radioactive cesium in soil is continuously increasing, and over 90% of the radioactive cesium in forests is found in soil or the litter layer as of 2022, mostly found in the soil surface layer at a depth between 0 cm and 5 cm.

The percentage of radioactive cesium found in the litter layer is high in the Kaneyama cedar forest and is low in other forests. Each forest thus shows different tendencies. The survey will be continued into the future.

(Related to p.186 of Vol. 1, “Distribution of Radioactive Materials in Forests”)

Included in this reference material on January 18, 2016
Updated on March 31, 2024

Radiation Monitoring of Forest

Readings of the Monitoring of Radioactive Cesium in Mountain Streams (2012)

Category	Snowmelt season (March 1 - April 30)		Rainy season (May 1 - July 31)		Autumn season (Aug. 1 - Oct. 31)
Total number of samples	118	(342)	184	(264)	175
Samples wherein Cs was not detected[1]	111	(333)	181	(260)	169
Samples wherein Cs was detected[2]	7	(9)	3	(4)	6
Concentration of Cs in samples wherein Cs was detected[3]: (minimum - maximum) (Bq/L)	1.1 - 5.9	(1.0 - 5.9)	1.0 - 13.1	(1.0 - 13.1)	1.1 - 6.8
Percentage of samples wherein Cs was not detected	94.4%	(97.4%)	98.4%	(98.5%)	96.6%

Source: Prepared based on the Readings of the Monitoring of Radioactive Cesium in Mountain Streams (press releases by the Forestry and Forest Products Research Institute on June 12, Sep. 21 and Dec. 20, 2012)

Forestry Agency

Water samples collected from streams from forests in Fukushima Prefecture were inspected but radioactive cesium was not detected in most of them. Radioactive cesium was detected only in some of the samples, such as those collected on days with rainfall. These samples contained suspended solids with insoluble particles. Measurement was conducted again after filtering them and radioactive cesium was not detected in any of those filtered samples.

This suggests that radioactive cesium was detected mainly due to temporary increases in suspended solids, which are often observed when forest streams increase after rainfall.

1. Detection lower limits for both Cs-134 and Cs-137 are 1 Bq/L.
2. Samples wherein radioactive cesium was detected all contained suspended solids. As a result of the second measurement of those samples after filtering, radioactive cesium was not detected in any of them.
3. Concentration of radioactive cesium is the total of Cs-134 and Cs-137 concentrations.
4. Monitoring points were as follows:
   Snowmelt season: Date City, Iitate Village, (Nihonmatsu City, Aizuwakamatsu City, Koriyama City and Hirono Town)
   Rainy season: Date City, Iitate Village, (Nihonmatsu City)
   Autumn season: Date City, Iitate Village
5. Values in the table are the readings for Date City and Iitate Village throughout these seasons. Values in the parentheses for the snowmelt season and rainy season contain the readings for the cities and the town in the parentheses indicated in 4. above.

Included in this reference material on January 18, 2016

Radiation Monitoring in Well Water

Results of Well Water Inspection in Fukushima Prefecture

	Aizu District (western part of Fukushima Prefecture)	Nakadori District (central part of Fukushima Prefecture)	Hamadori District (eastern part of Fukushima Prefecture)
	Aizuwakamatsu City, Kitakata City, Nishiaizu Town, Bandai Town, Inawashiro Town, Aizubange Town, Yanaizu Town, Mishima Town, Kaneyama Town, Aizumisato Town, Kitashiobara Village, Showa Village, Shimogo Town, Tadami Town, Hinoemata Village	Fukushima City, Nihonmatsu City, Date City, Motomiya City, Koori Town, Kunimi Town, Kawamata Town, Otama Village, Sukagawa City, Tamura City, Ishikawa Town, Asakawa Town, Furudono Town, Miharu Town, Ono Town, Tenei Village, Tamakawa Village, Hirata Village, Shirakawa City, Yabuki Town, Tanagura Town, Yamatsuri Town, Hanawa Town, Nishigo Village, Izumizaki Village, Nakajima Village, Samegawa Village	Soma City, Minamisoma City, Hirono Town, Naraha Town, Kawauchi Village, Katsurao Village, Iitate Village, Iwaki City
2011 ≀ 2023 (up to Dec.28)	All ND	All ND	All ND

Measurement readings of radioactive materials in well water
ND (not detected; below the detection lower limit): The detection lower limits for radioactive cesium and radioactive iodine were both 5 Bq/kg in 2011 and have been 1 Bq/kg since 2012.
* All municipalities indicated above participate in the Fukushima Prefecture Monitoring Program for Radioactive Materials in Drinking Water. Some of the other municipalities conduct their own inspection.

Source: Prepared based on the "Results of drinking water monitoring inspections and related information (Dec. 28, 2023)" (in Japanese) of the Fukushima Revitalization Information Portal Site

Fukushima Prefecture's reconstruction information portal site, "Fukushima Revitalization Information Portal Site," publicizes the results of the drinking well water inspection, which has been conducted since 2011, the year when the nuclear accident occurred. Based on the inspection system established under the Fukushima Prefecture Monitoring Program for Radioactive Materials in Drinking Water, the inspection has been conducted for municipalities upon their requests.

Fukushima Revitalization Information Portal Site: "Results of drinking water monitoring inspections and related information"

https://www.pref.fukushima.lg.jp/site/portal/ps-drinkingwater-monitoring.html (in Japanese)

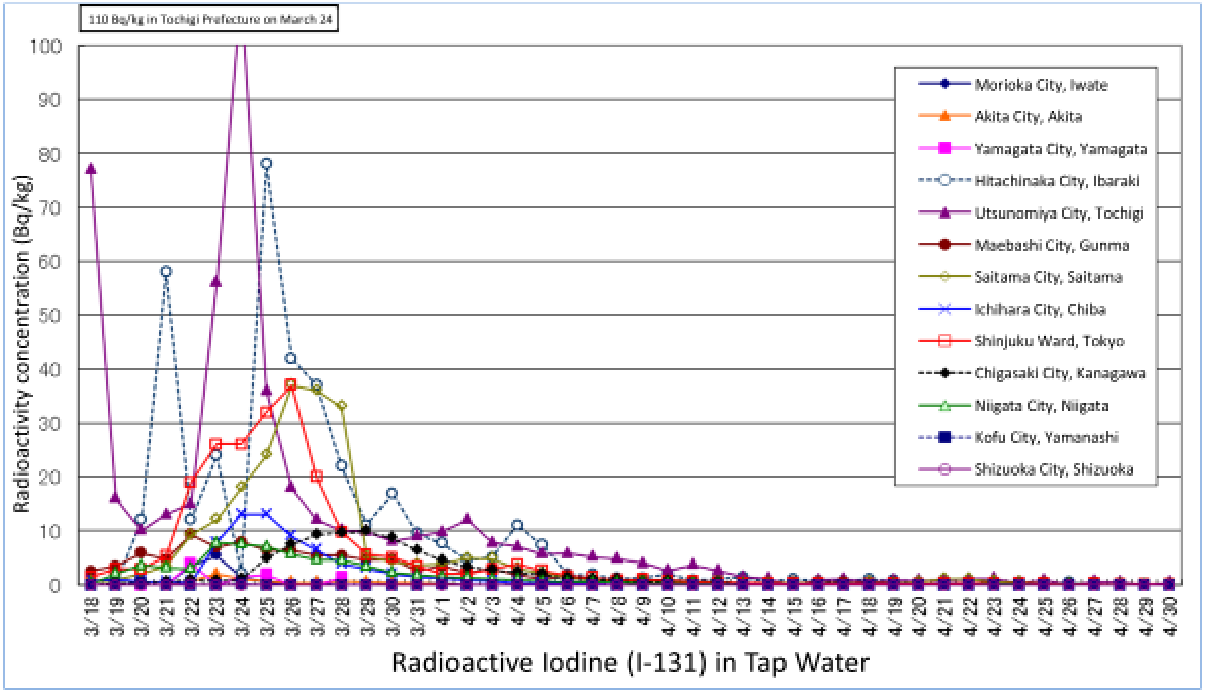
The national standard for drinking water including well water is 10 Bq/kg, but radioactive materials have never been detected from well water in the inspection conducted so far. Inspection results have been all "ND" (not detected; below the detection limit).

The detection lower limits for radioactive cesium and radioactive iodine were both 5 Bq/kg or lower in 2011 and are 1 Bq/kg or lower at present.

Included in this reference material on March 31, 2017
Updated on March 31, 2024

Radiation Monitoring of Clean Water

Radioactive Iodine (I-131) (the Tokyo Metropolis and 12 Prefectures)



Bq/kg: becquerels per kilogram

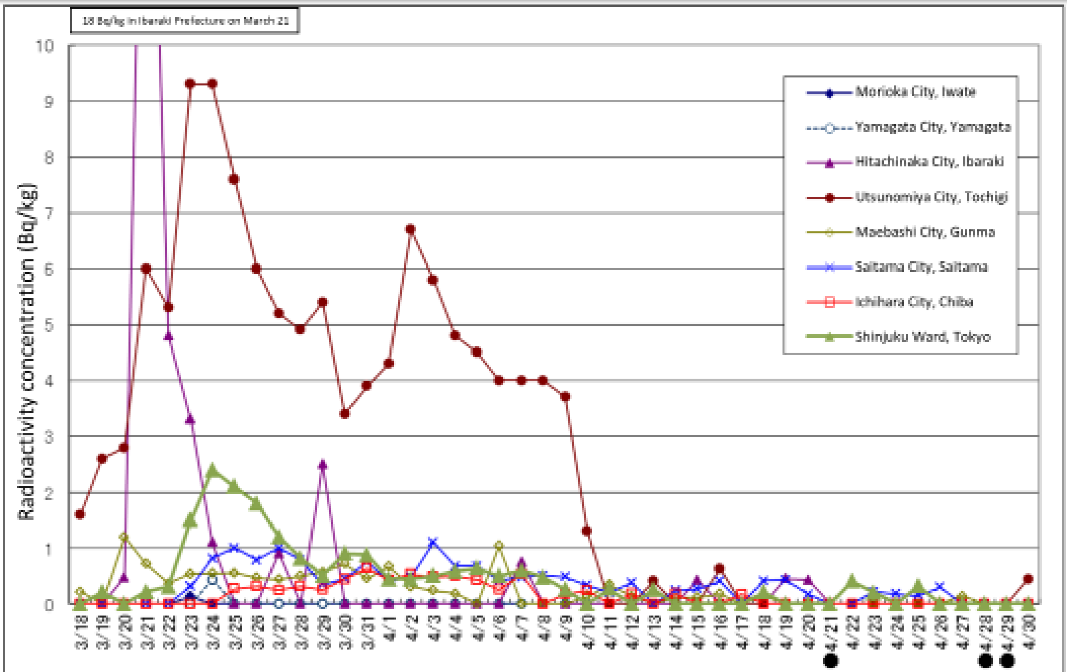
* In the figure above, values below the detection lower limit are treated as 0 for convenience.
* Only prefectures where radioactive iodine was detected in the measurement are indicated in the figure.

Interim Report on Measures for Radioactive Materials in Tap Water
Prepared based on the reference material for the Ministry of Health, Labour and Welfare (MHLW)'s Study Meeting on Measures for Radioactive Materials in Tap Water (June 2011)

As a result of the inspection of radioactive materials in tap water conducted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), radioactive iodine was detected in the Tokyo Metropolis and 12 prefectures out of 47 prefectures nationwide. Highest concentrations were detected at the respective locations from March 18 to 29, 2011, but I-131 concentrations turned to decrease in many locations in the latter half of March 2011. In and after April 2011, only small amounts of I-131 were detected at some of these locations.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radioactive Cesium (Cs-134 + Cs-137) (the Tokyo Metropolis and 7 Prefectures)



Radioactive Cesium (Cs-134 + Cs-137) in Tap Water

* In the figure above, values below the detection lower limit are treated as 0 for convenience.
* Only prefectures where radioactive cesium was detected in the measurement are indicated in the figure.
* ● is marked on dates when the readings were ND (not detected; below the detection lower limit).

Bq/kg: becquerels per kilogram

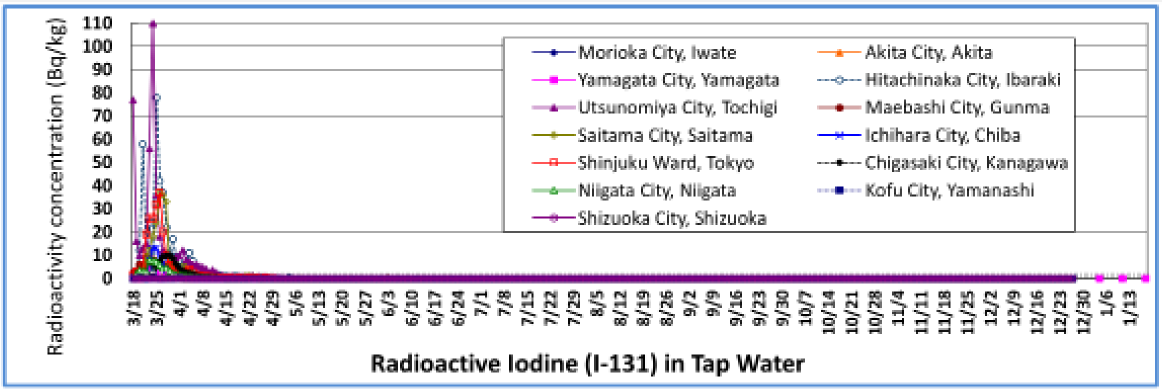
Interim Report on Measures for Radioactive Materials in Tap Water
Prepared based on the reference material for the Ministry of Health, Labour and Welfare (MHLW)'s Study Meeting on Measures for Radioactive Materials in Tap Water (June 2011)

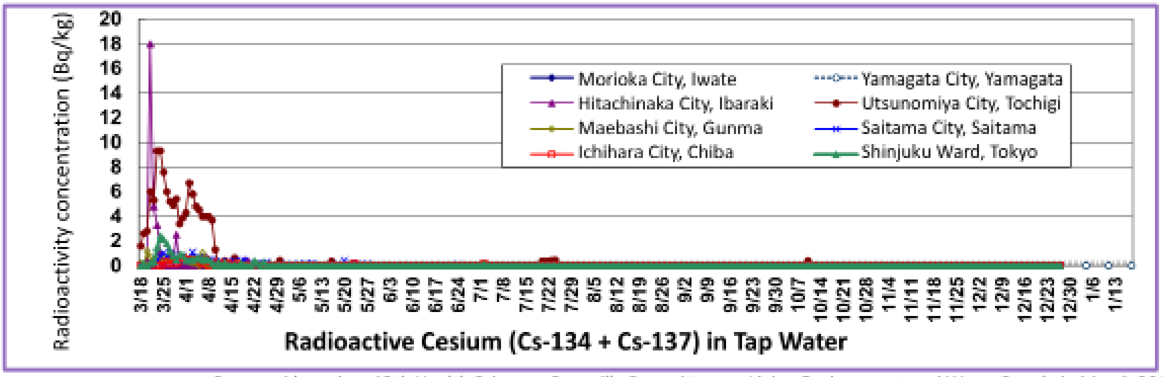
As a result of the inspection of radioactive materials in tap water conducted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), radioactive cesium was detected in the Tokyo Metropolis and 7 prefectures out of 47 prefectures nationwide. Highest concentrations were detected at the respective locations from March 20 to early April 2011, but radioactive cesium concentrations were relatively smaller than radioactive iodine concentrations. In and after April 2011, only small amounts of radioactive cesium were detected at some of these locations.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radiation Monitoring of Clean Water

Results of Radiation Monitoring of Tap Water (until Jan. 2012)





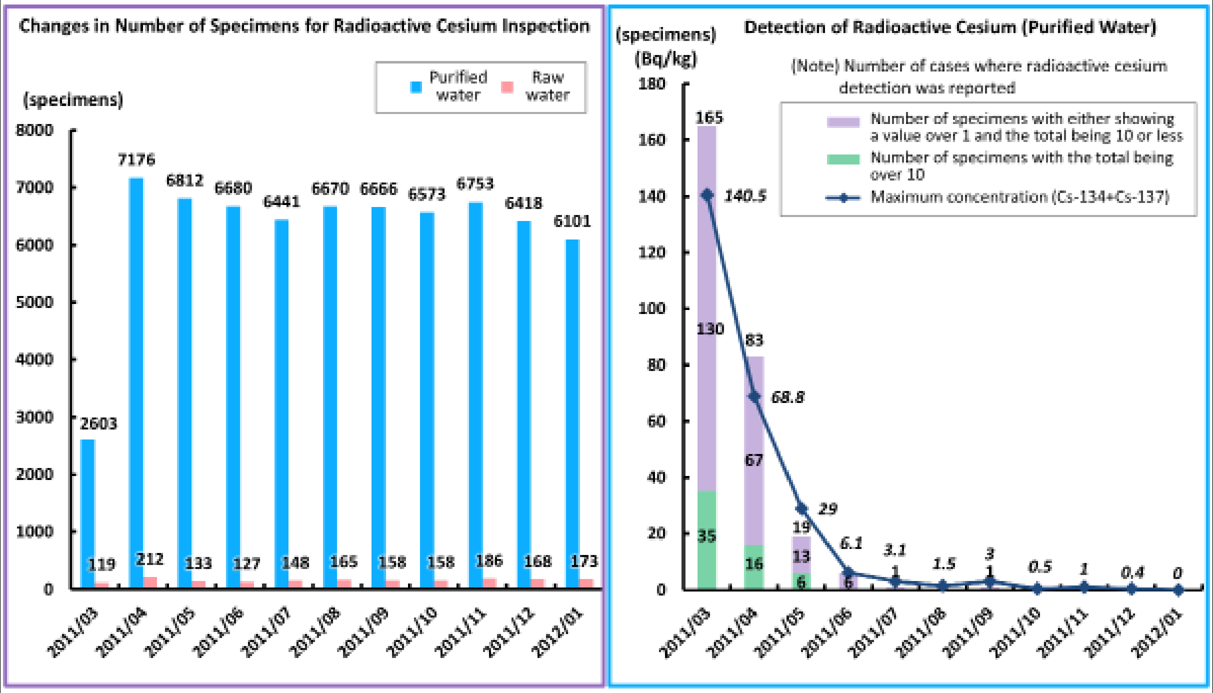
Prepared based on 12th Health Sciences Council's Committee on Living Environment and Water Supply in March 2012

The tap water monitoring showed that radioactive cesium has seldom been detected since May 2011, not to mention short-half-life radioactive iodine.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Inspections by Water Suppliers

Radiation Monitoring of Clean Water

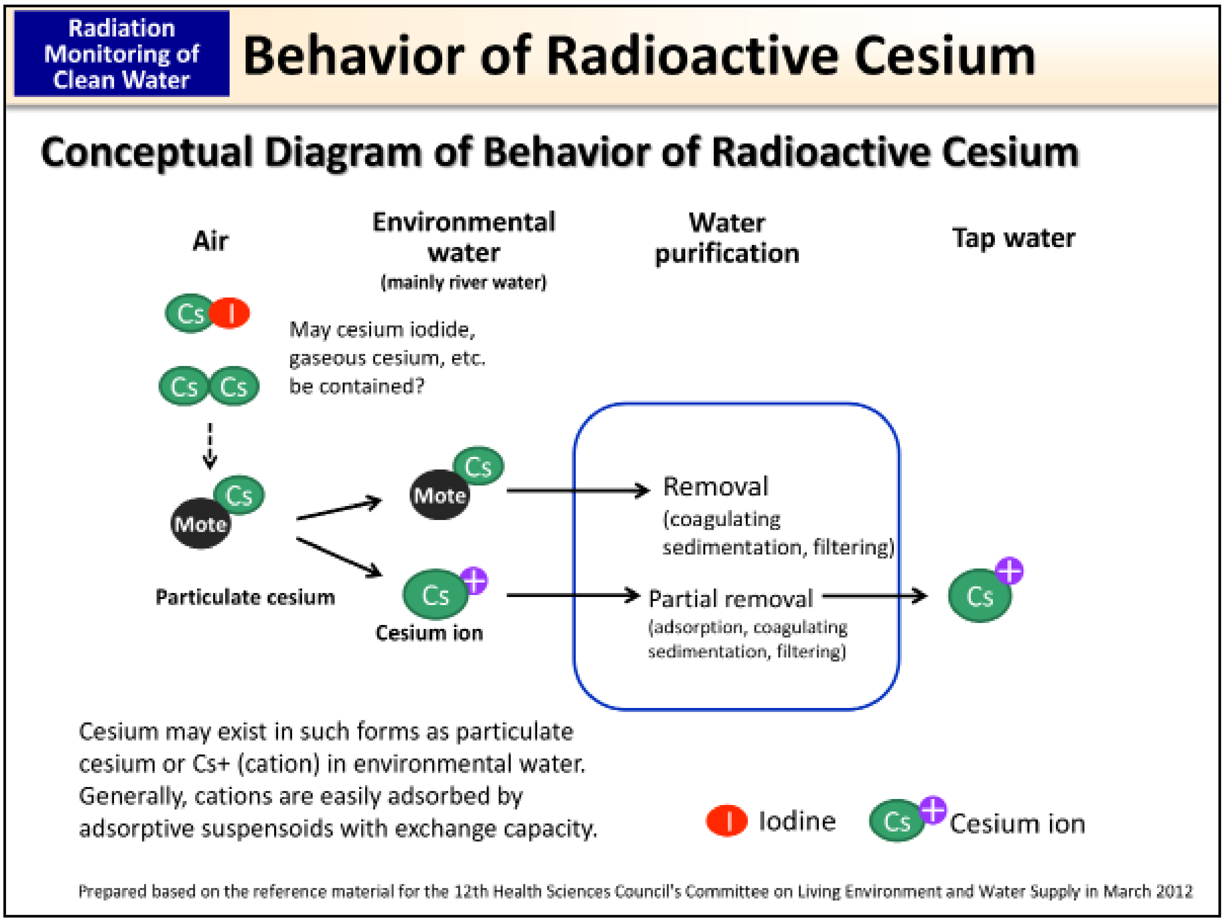


Bq/kg: becquerels per kilogram

Prepared based on 12th Health Sciences Council's Committee on Living Environment and Water Supply in March 2012

Water suppliers conduct inspections of radioactive cesium for approx. 6,000 to 7,000 specimens of purified water and over 100 specimens of raw water per month. The maximum monthly value of radioactive cesium concentration was 140.5 Bq/kg detected in March 2011, but the value declined gradually thereafter and there has been no report of radioactive cesium detection at a level exceeding 10 Bq/kg since June 2011.

Included in this reference material on March 31, 2013

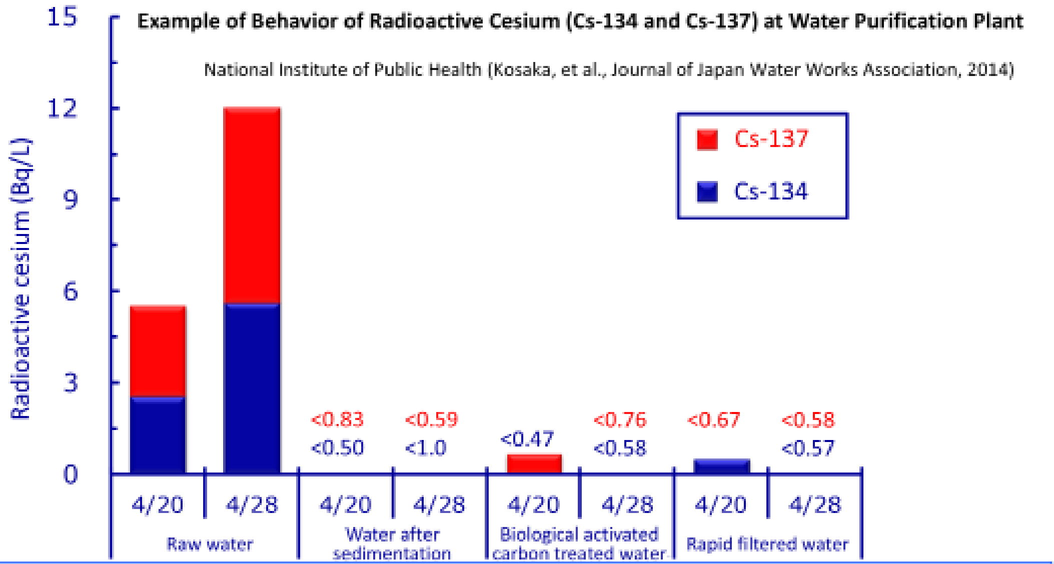


Radioactive cesium discharged due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS consists of Cs-134 and Cs-137 in equal proportion (1:1) and has also been detected at the same rate in the environment immediately after the accident. Radioactive cesium was in the form of particles or gas immediately after discharge from the NPS, but it is considered to have fallen down onto the ground surface and to have been adsorbed into soil and dust, etc. In water, radioactive cesium is adsorbed into dust and tends to behave in the same manner as soil or other suspensoids, and therefore, is highly likely to be reduced by removing suspensoids in water.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Control of Radioactive Cesium

Most of the radioactive cesium that reaches sources of tap water is adsorbed into suspensoids such as soil and flows out. Therefore, radioactive cesium can be controlled through strict turbidity management.



Zeolite, ion exchangers, nanofiltration membranes and reverse osmosis membranes are professionally used for removing radioactive materials, but these cannot be used for ordinary water purification due to high cost, required facilities and inefficiency (in particular, the use of nanofiltration membranes and reverse osmosis membranes is power consuming).

Bq/L: becquerels per liter

Prepared based on the reference material for the 12th Health Sciences Council's Committee on Living Environment and Water Supply in March 2012

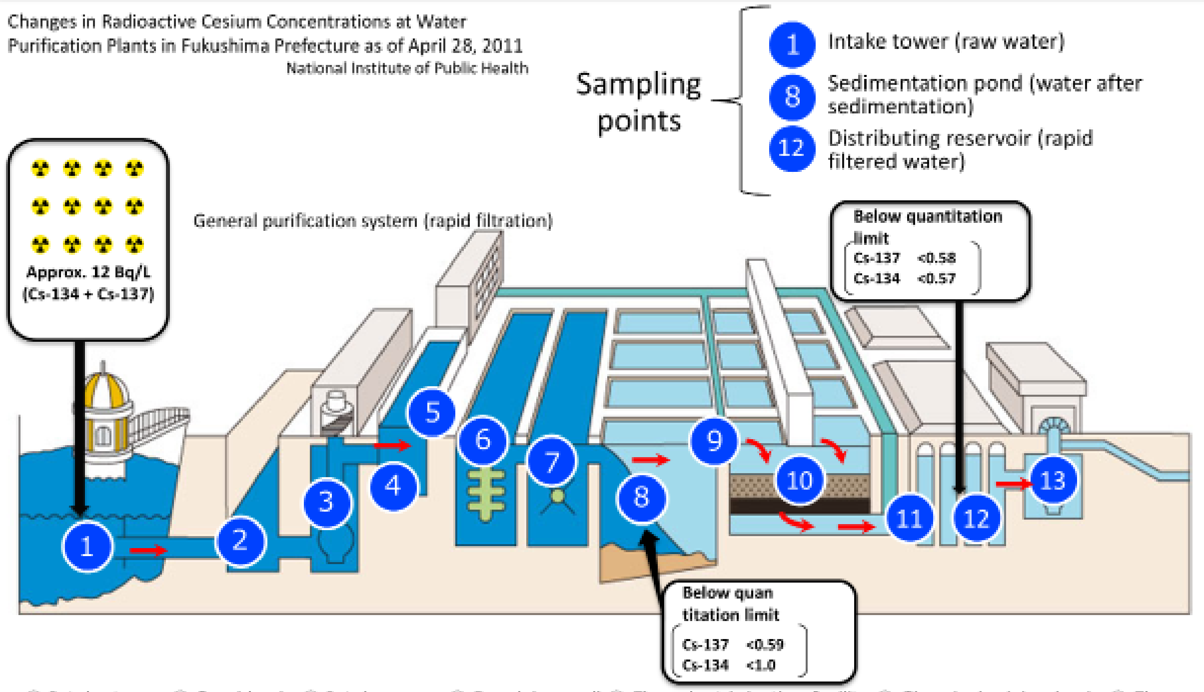
As of April 2011, radioactive cesium concentrations in raw water, water after sedimentation, biological activated carbon treated water, and rapid filtered water were measured at water purification plants in Fukushima Prefecture. As a result, it was confirmed that low-concentrated radioactive cesium detected in raw water had decreased through adsorption into soil in the process of sedimentation.

A survey of water purification processes revealed that radioactive cesium had been almost entirely removed together with suspensoids through coagulating sedimentation, sand filtration and the use of powdered activated carbon. At present, radioactive cesium is not detected in almost all purified water. These results showed that radioactive cesium can be controlled through strict turbidity management.

Included in this reference material on March 31, 2013

Radiation Monitoring of Clean Water

Waterworks System



① Intake tower ② Sand basin ③ Intake pump ④ Receiving well ⑤ Flocculant injection facility ⑥ Chemical mixing basin ⑦ Floc forming basin ⑧ Sedimentation pond ⑨, ⑪ Chlorine injection facility ⑩ Filter basin ⑫ Distributing reservoir ⑬ Water pump

Bq/L: becquerels per liter

Prepared based on the reference material for the 12th Health Sciences Council's Committee on Living Environment and Water Supply in March 2012

This figure shows the rapid filtration method, which is generally used in Japan. In this method, chemicals are injected into raw water taken from a river or dam to cause sedimentation of mud and small particles and make them into big chunks called "floc." Tap water is created by filtering the clear upper portion of such water.

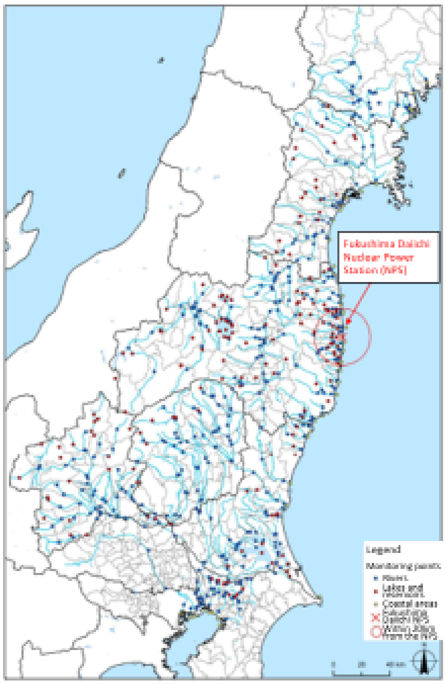
Cesium has the property to be easily adsorbed into soil and mud (p.40 of Vol. 2, "Behavior of Radioactive Cesium"). Therefore, when water is separated from floc, cesium tends to gather around the floc, which is a chunk of soil and mud. Additionally, tap water is created using the clear upper portion of the water in plant basins. Therefore, this mechanism leaves little chance for cesium to be mixed into tap water.

In the pattern diagram above, radioactive cesium concentrations (Bq/L) actually measured at a water purification plant in Fukushima Prefecture as of April 28, 2011, are indicated at points where measurement was conducted. Radioactive cesium concentration, which was initially approx. 12 Bq/L at the intake tower, decreased to below the quantitation limit in the end when being pumped out from the distribution reservoir. As 1 liter of water weighs approx. 1 kg, it can be found that the concentration was far below 200 Bq/kg, which was the allowable limit for radioactive cesium in tap water publicized by the Ministry of Health, Labour and Welfare (MHLW) in March 2011, and also far below 10 Bq/kg, which is specified in the new standards for radioactive materials in tap water publicized in March 2012 (p.55 of Vol. 2, "Standard Limits Applied from April 2012").

Included in this reference material on March 31, 2015
Updated on March 31, 2019

Radiation Monitoring of Public Water Areas

Radioactive Material Monitoring in and around Fukushima Prefecture (Public Water Areas)



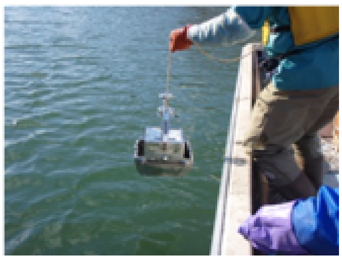
[Coverage]
Whole Area of Fukushima, Miyagi, Ibaraki, Tochigi and Gunma Prefectures, and part of Iwate and Chiba Prefectures, etc.

[Monitoring points]
602 locations

[Radionuclide analyses]
- Samples
  Water, sediments and Surrounding environment (soil)
- Analyzed radionuclides
  Radioactive cesium, Radioactive strontium (only for some water and sediment samples), etc.

[Frequencies]
Twice to 10 times a year depending on the contamination status, etc.

(River: water sampling)



(Lake: sediments sampling)

Prepared based on the Results of the FY2022 Radioactive Material Monitoring in the Water Environment (Public Water Areas) (Summary) by the Ministry of the Environment
https://www.env.go.jp/jishin/monitoring/results_r-pw-r04.html (in Japanese)

Radioactive material monitoring was conducted at rivers, lakes and coastal areas in Miyagi, Ibaraki and other Prefectures, centered on Fukushima Prefecture, where contamination with radioactive materials was suspected.

In FY2022, monitoring covered 602 locations and analysis was conducted for radioactive cesium and strontium in water, etc.

Monitoring results of radioactive cesium concentrations in water are as follows. Monitoring results for sediments (mud of the bottom of rivers, lakes, etc.) are shown in p.44 of Vol. 2, “Radioactive Material Monitoring in the Water Environment (River Sediments)” through to p.46 of Vol. 2, “Radioactive Material Monitoring in the Water Environment (Coastal Area Sediments).”

[Monitoring results of radioactive cesium concentrations in water]

River water samples (2,010 samples): Radioactive cesium concentrations were all below the detection limit.

Lake/reservoir water samples (1,378 samples): Radioactive cesium concentrations were all below the detection limit except for those in 9 samples collected at 2 locations in the Hamadori District.

Coastal samples (534 samples): Radioactive cesium concentrations were all below the detection limit.

- At all locations where radioactive cesium was detected, amounts of suspended solids (SS) and turbidity were relatively large.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radiation Monitoring of Public Water Areas

Radioactive Material Monitoring in the Water Environment (River Sediments)

Distribution of Radioactive Cesium Concentrations in River Sediments (FY2022)

[Number of collected samples]

Radioactive cesium concentrations [Bq/kg(dry)]	Iwate Prefecture	Miyagi Prefecture	Fukushima Prefecture, Hamadori District	Fukushima Prefecture, Nakadori District	Fukushima Prefecture, Aizu District	Ibaraki Prefecture	Tochigi Prefecture	Gunma Prefecture	Chiba Prefecture	Saitama Prefecture	Tokyo Metropolis	Total	Percentage
Less than 1,000	80	196	305	324	164	212	278	214	199	8	8	1,988	98.9%
1,000 or more but less than 2,000	0	0	18	0	0	0	0	0	1	0	0	19	0.9%
2,000 or more but less than 3,000	0	0	3	0	0	0	0	0	0	0	0	3	0.1%
3,000 or more but less than 4,000	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
4,000 or more but less than 5,000	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
5,000 or more but less than 10,000	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
10,000 or more	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Total	80	196	326	324	164	212	278	214	200	8	8	2,010	100.0%

Prepared based on the FY2022 Radioactive Material Monitoring in the Water Environment (Environmental Management Bureau, Ministry of the Environment)

Radioactive cesium concentrations in river sediments were measured in FY2022 as in the previous year.

A total of 2,010 samples, including 814 samples collected in Fukushima Prefecture and others collected in Iwate, Miyagi, Ibaraki, Tochigi, Gunma, Chiba and Saitama Prefectures and the Tokyo Metropolis, were surveyed.

The survey results showed that concentrations of radioactive cesium detected in approx. 99% of these samples were less than 1,000 Bq/kg (dry).

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radiation Monitoring of Public Water Areas

Radioactive Material Monitoring in the Water Environment (Lake and Reservoir Sediments)

Distribution of Radioactive Cesium Concentrations in Lake and Reservoir Sediments (FY2022)

[Number of collected samples]

Radioactive cesium concentrations [Bq/kg(dry)]	Miyagi Prefecture	Fukushima Prefecture, Hamadori District	Fukushima Prefecture, Nakadori District	Fukushima Prefecture, Aizu District	Ibaraki Prefecture	Tochigi Prefecture	Gunma Prefecture	Chiba Prefecture	Total	Percentage
Less than 1,000	76	93	54	154	76	31	85	28	597	71.7%
1,000 or more but less than 2,000	0	40	13	11	0	1	9	4	78	9.4%
2,000 or more but less than 3,000	0	17	4	15	0	0	2	0	38	4.6%
3,000 or more but less than 4,000	0	21	6	11	0	0	0	0	38	4.6%
4,000 or more but less than 5,000	0	9	1	1	0	0	0	0	11	1.3%
5,000 or more but less than 10,000	0	28	1	2	0	0	0	0	31	3.7%
10,000 or more	0	40	0	0	0	0	0	0	40	4.8%
Total	76	248	79	194	76	32	96	32	833	100.0%

Prepared based on the FY2022 Radioactive Material Monitoring in the Water Environment (Environmental Management Bureau, Ministry of the Environment)

Radioactive cesium concentrations in lake and reservoir sediments were measured in FY2022 as in the previous year.

A total of 833 samples, including 521 samples collected in Fukushima Prefecture and others collected in Miyagi, Ibaraki, Tochigi, Gunma and Chiba Prefectures, were surveyed.

The survey results showed that concentrations of radioactive cesium detected in approx. 72% of these samples were less than 1,000 Bq/kg (dry).

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Radiation Monitoring of Public Water Areas

Radioactive Material Monitoring in the Water Environment (Coastal Area Sediments)

Distribution of Radioactive Cesium Concentrations in Coastal Area Sediments (FY2022)

[Number of collected samples]

Radioactive cesium concentrations [Bq/kg(dry)]	Iwate Prefecture	Miyagi Prefecture	Fukushima Prefecture	Ibaraki Prefecture	Chiba Prefecture	Tokyo Metropolis	Total	Percentage
Less than 1,000	4	52	150	20	23	18	267	100.0%
1,000 or more but less than 2,000	0	0	0	0	0	0	0	0.0%
2,000 or more but less than 3,000	0	0	0	0	0	0	0	0.0%
3,000 or more but less than 4,000	0	0	0	0	0	0	0	0.0%
4,000 or more but less than 5,000	0	0	0	0	0	0	0	0.0%
5,000 or more but less than 10,000	0	0	0	0	0	0	0	0.0%
10,000 or more	0	0	0	0	0	0	0	0.0%
Total	4	52	150	20	23	18	267	100.0%

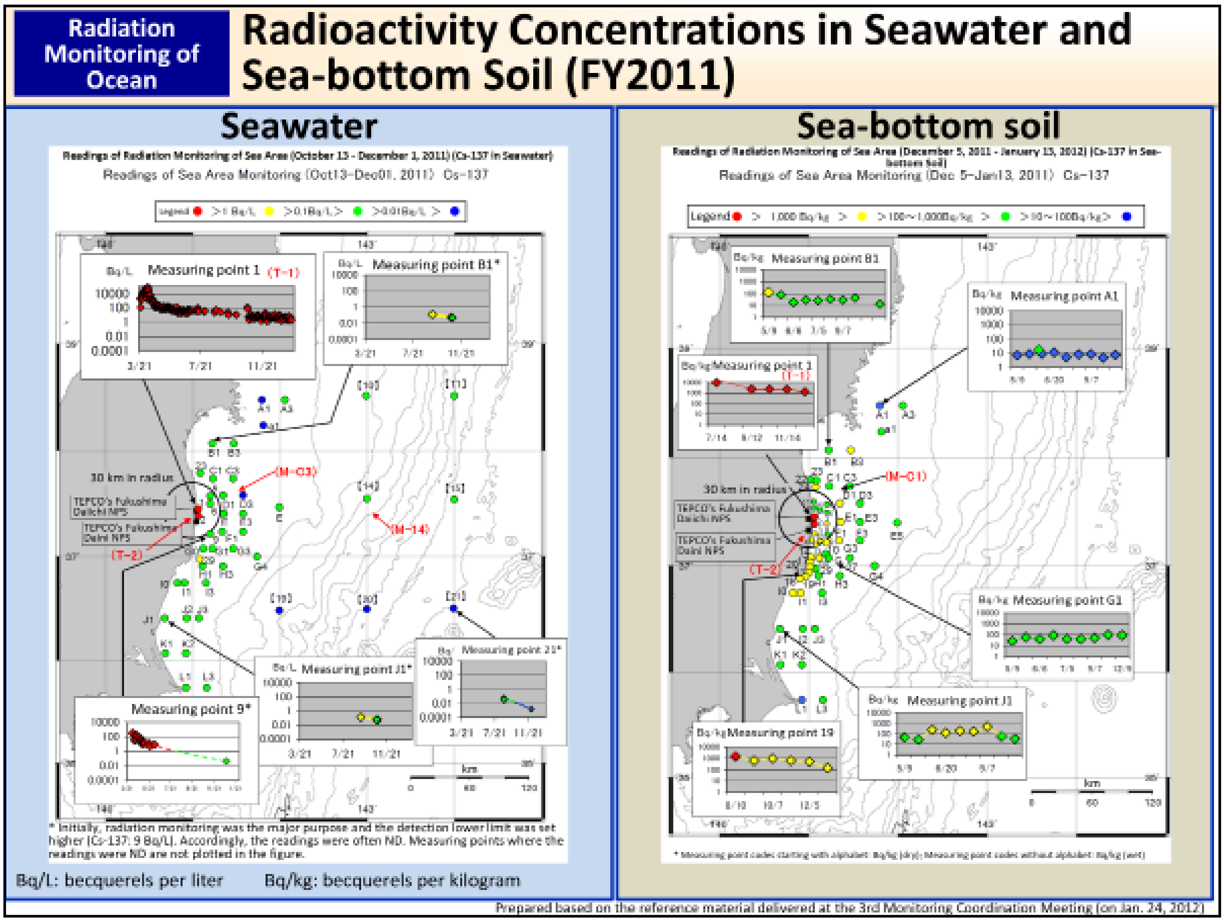
Prepared based on the FY2022 Radioactive Material Monitoring in the Water Environment (Environmental Management Bureau, Ministry of the Environment)

Radioactive cesium concentrations in sediments in coastal areas were measured in FY2022 as in the previous year.

A total of 267 sediment samples collected in coastal areas, including 150 samples collected in Fukushima Prefecture and others collected in Iwate, Miyagi, Ibaraki, Chiba Prefectures and the Tokyo Metropolis, were surveyed.

The survey results showed that concentrations of radioactive cesium detected in all of these samples were less than 1,000 Bq/kg (dry).

Included in this reference material on March 31, 2013
Updated on March 31, 2024



Since October 2011, radiation monitoring of radioactive cesium (Cs-137) in seawater and sea-bottom soil has been conducted jointly by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) (until the establishment of the Secretariat of the Nuclear Regulation Authority), Secretariat of the Nuclear Regulation Authority, Fisheries Agency, Japan Coast Guard, Ministry of the Environment (MOE), Fukushima Prefecture and Tokyo Electric Power Company (TEPCO). With regard to samples collected near outlets (at Measuring Points T-1 and T-2), analysis has been conducted not only for radioactive cesium, but also for radioactive iodine (only for seawater samples), radioactive strontium, plutonium, and tritium (only for seawater samples).

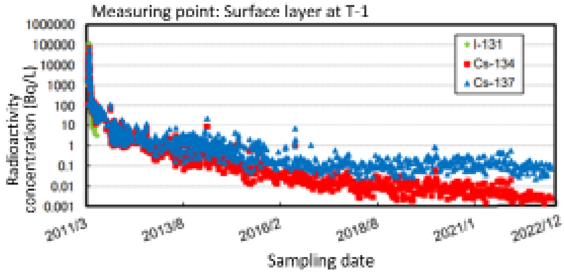
The figures show the results of radiation monitoring of the sea area immediately after the accident.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Radiation Monitoring of Ocean

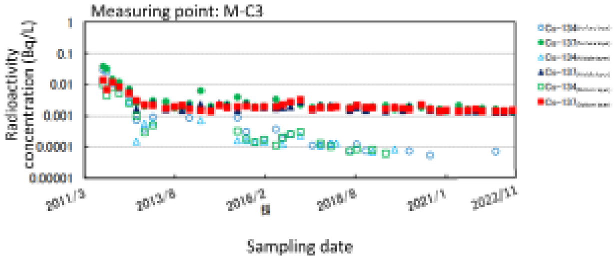
Changes in Radioactivity Concentrations in Seawater

Changes in Radioactivity Concentrations in Seawater in Coastal Areas Near Fukushima Prefecture

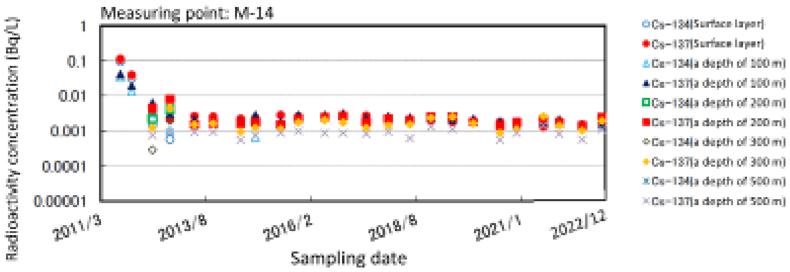


Changes in Radioactivity Concentrations in Seawater Offshore of Fukushima Prefecture

Surface layer: Water surface to a depth of approx. 2 m; Middle layer: Depth of 50 m to 100 m; Bottom layer: Sea bottom to up to approx. 40 m from the bottom



Changes in Radioactivity Concentrations in Seawater in the Open Sea



* For measuring points, see p. 47 of Vol. 2, "Radioactivity Concentrations in Seawater and Sea-bottom Soil (FY2011)."

Readings of Sea Area Monitoring by the Nuclear Regulation Authority: https://radioactivity.nra.go.jp/en/results/sea

Soil with radioactive cesium is transported to coastal areas via rivers.

Radioactivity concentrations in seawater samples collected near Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS rose to 100,000 Bq/L immediately after the accident, but dropped to one-thousandth (100 Bq/L) in one and a half months as a result of dilution and dispersion. The concentrations further decreased to 10 Bq/L in one and a half years and are 1 Bq/L or less at present.

In six months after the accident, soil containing radioactive cesium was transported from the coastal areas to 30 km offshore, but the concentration detected at Measuring Point M-C3 was 0.05 Bq/L or one-200th of the concentrations detected in the coastal areas. Generally, it is considered that radioactivity concentrations become higher at the sea bottom due to settling of part of radioactive cesium, but in 2012, radioactivity concentrations were as low as 0.008 Bq/L in samples collected from bottom layers, and radioactivity concentrations detected in samples collected from surface and middle layers also decreased.

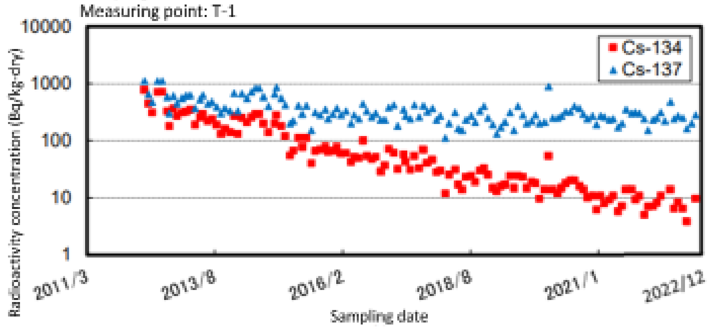
At Measuring Point M-14 in the open sea, 180 km away from the land, radioactivity concentrations detected in surface layers were 0.1 Bq/L, the same level of concentrations detected 30 km offshore, in six months after the accident. The concentrations further showed a two-digit decrease to 0.001 Bq/L in two years after the accident.

(Related to p.188 of Vol. 1, "Distribution of Radioactive Cesium in the Ocean")

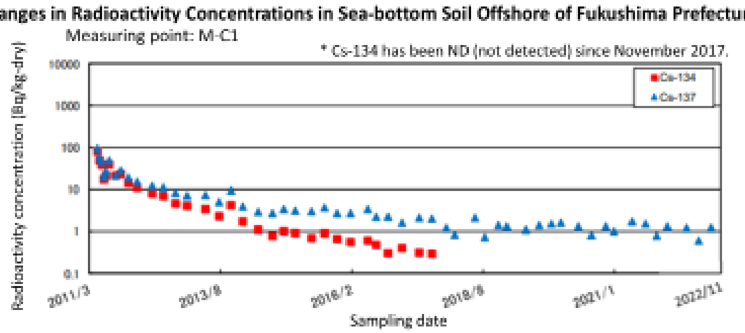
Included in this reference material on March 31, 2014
Updated on March 31, 2024

Changes in Radioactivity Concentrations in Sea-bottom Soil

Changes in Radioactivity Concentrations in Sea-bottom Soil in Coastal Areas in and around Fukushima Prefecture



Changes in Radioactivity Concentrations in Sea-bottom Soil Offshore of Fukushima Prefecture



* For measuring points, see p.47 of Vol. 2, "Radioactivity Concentrations in Seawater and Sea-bottom Soil (FY2011)."

Readings of Sea Area Monitoring by the Nuclear Regulation Authority: https://radioactivity.nra.go.jp/en/results/sea

As a result of measuring dried sea-bottom soil samples collected in the coastal areas near Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, the concentrations of Cs-134 and Cs-137 were initially 1,000 Bq/kg but decreased in two years after the accident to 200 Bq/kg (down by 80%) and 500 Bq/kg (down by 50%), respectively. (Measuring Point T-1)

Radioactivity concentrations detected from sea-bottom soil samples collected 40 km offshore (Measuring Point M-C1) rose to 100 Bq/kg immediately after the accident but decreased to 10 Bq/kg a year later.

(Related to p.188 of Vol. 1, "Distribution of Radioactive Cesium in the Ocean")

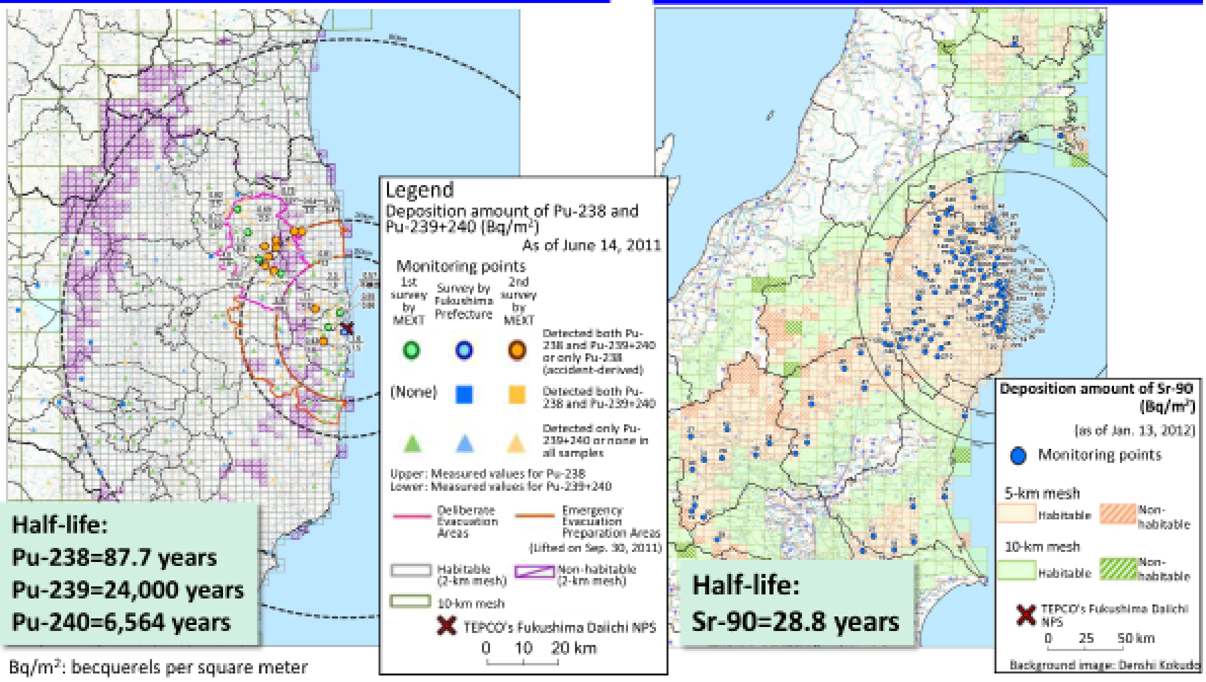
Included in this reference material on March 31, 2014
Updated on March 31, 2024

Deposition of Other Radioactive Materials

Plutonium and Strontium (Eastern Part of Fukushima Prefecture, Wider Areas)

Deposition Amount of Pu-238 and Pu-239+240 (as of June 14, 2011)

Deposition Amount of Sr-90 (as of Jan. 13, 2012)



Bq/m²: becquerels per square meter

Left: Released by MEXT on Aug. 21, 2012 (partially corrected on July 1, 2013)
Right: Released by MEXT on Sep. 12, 2012 (partially corrected on Sep. 19, 2012 and July 1, 2013)

In the soil surveys conducted by the national government in June 2011 and January 2012, soil samples were collected within the 100-km zone of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and in the western part of Fukushima Prefecture outside this zone.

The amounts of deposited Pu-238 and Pu-239+240 detected in the surveys were found to be within their ranges in past measurements conducted from FY1999 to FY2009, before the accident, covering the whole nation. It means that the amounts were within the fluctuations due to past nuclear bomb tests in the atmosphere, except for the amount of Pu-238 detected in a sample collected at one location (p.185 of Vol. 1, "Effects of Nuclear Test Fallout (Japan)").

In the current surveys, the amount of Pu-238 detected in a sample collected at one location exceeded the maximum deposition amount before the accident, and was around 1.4 times the maximum level before the accident. In order to determine whether the detected plutonium has derived from the TEPCO's Fukushima Daiichi NPS Accident, a comparison was made between the ratios between Pu-238 and Pu-239+240 detected in the current surveys and the ratios between deposited Pu-238 and Pu-239+240 measured nationwide for 11 years from FY1999 to FY2009. Locations where the detected Pu-238 and Pu-239+240 are highly likely to be accident-derived are marked with ◯ on the map.

Sr-90 was also detected in the current surveys, but measured values for all samples were within the fluctuations due to past nuclear tests in the atmosphere in comparison with the readings of the nationwide measurements conducted from FY1999 to FY2009 before the accident at TEPCO's Fukushima Daiichi NPS. It was also confirmed that the deposition amounts of detected Sr-90 were around one-thousandth of those of Cs-137 at many of the monitoring points in the current surveys. Only occasionally, the deposition amounts of Sr-90 showed some fluctuations, being around one-tenth of those of Cs-137.

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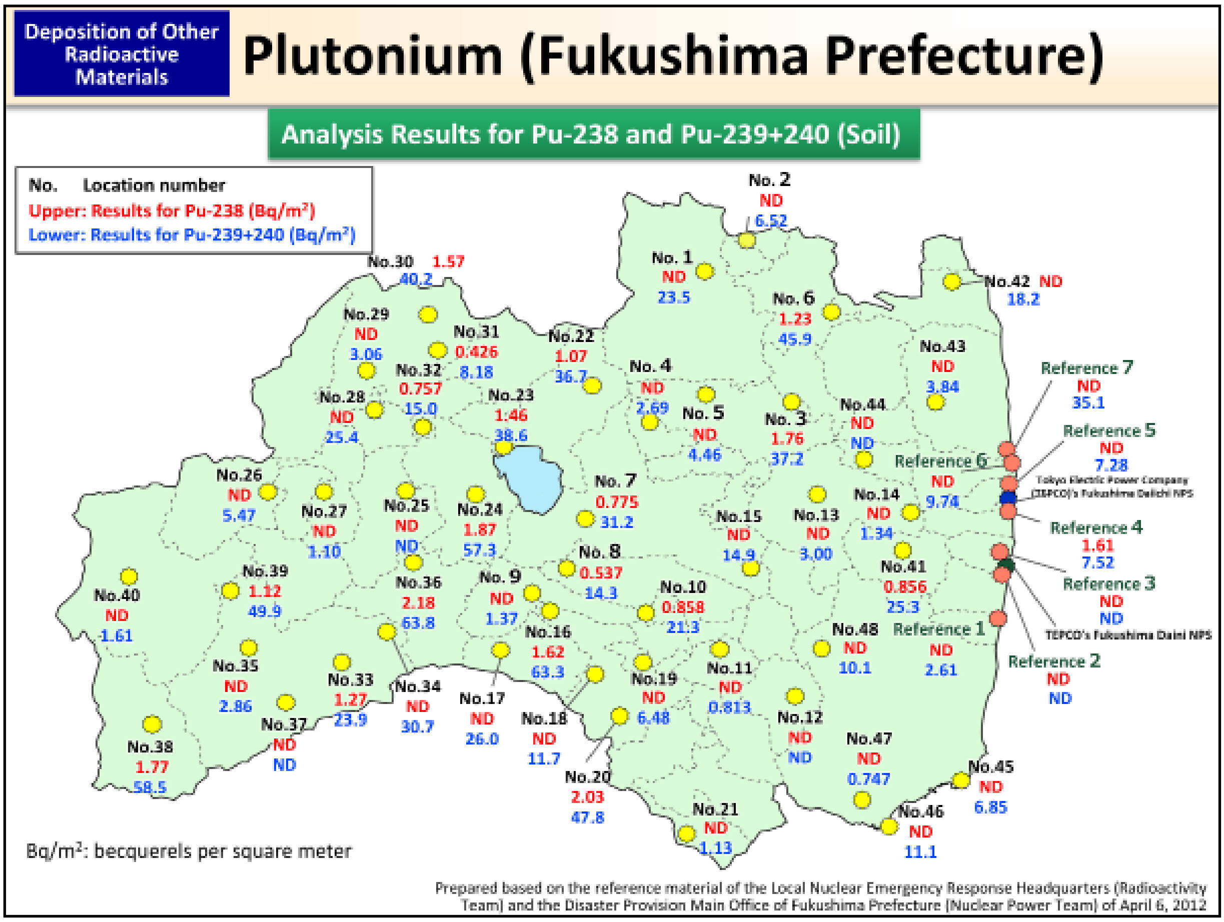
Updated on March 31, 2021



Based on the Plan for the Radiation Monitoring of Soil in Fukushima Prefecture, nuclide analysis for Pu-238 and Pu-239+240 was conducted for soil samples collected in Fukushima Prefecture from August 10 to October 13, 2011.

Deposition amounts of plutonium detected within the prefecture in the current monitoring were all within the ranges in past monitoring in the prefecture for ten years before the Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS Accident. At one location (Ottozawa, Okuma Town; Reference 4) out of seven reference monitoring points around TEPCO's Fukushima Daiichi NPS, the result fell outside the range of values before the accident, suggesting the influence of the accident at TEPCO's Fukushima Daiichi NPS.

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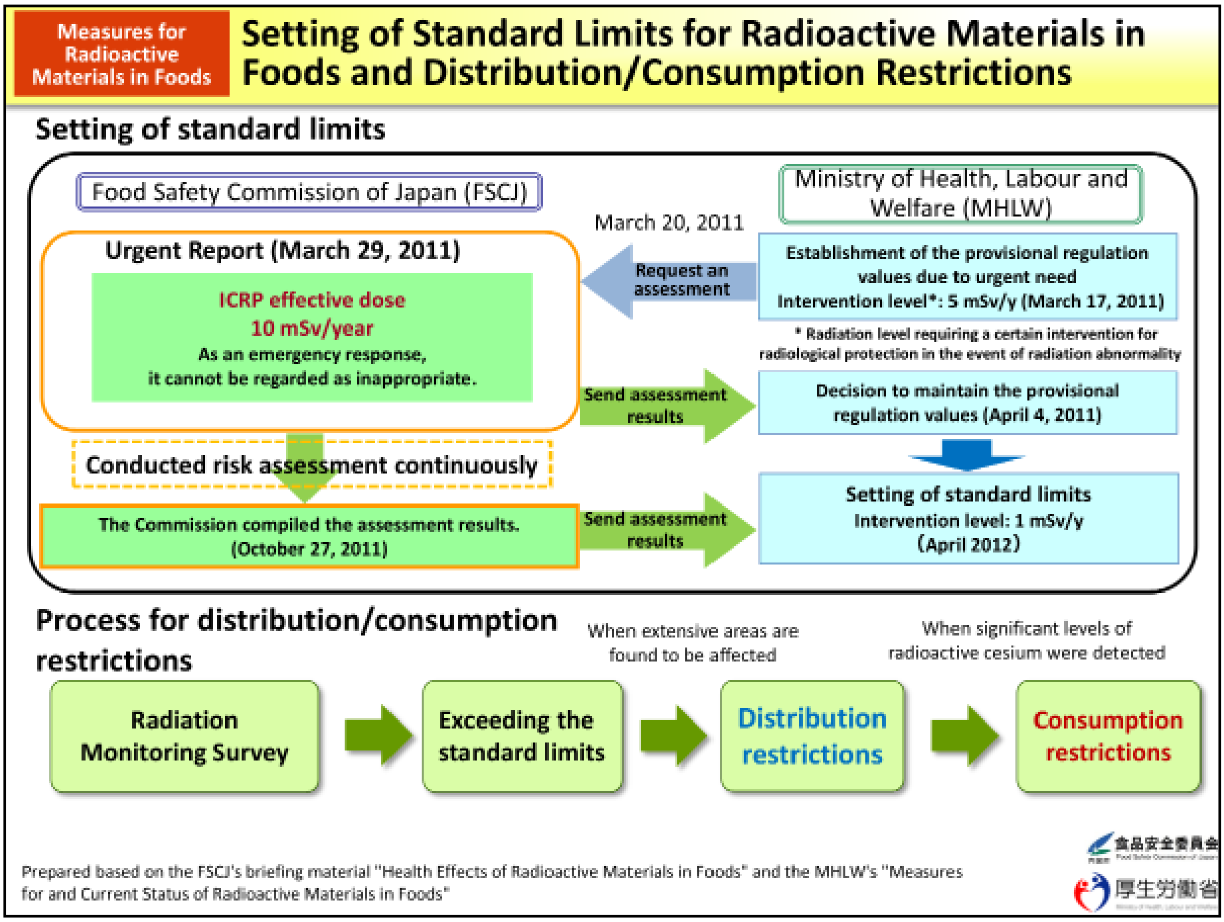
Updated on March 31, 2019

Chapter 8

Radioactive Materials in Foods

Chapter 8 explains the standard limits for radioactive materials in foods, results of inspections, and efforts for reducing radioactive concentrations in foods.

You can understand the framework to ensure the safety of foods distributed on the market and concrete measures being taken after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, and inspection results regarding to what extent there have been foods with radioactive concentrations exceeding the standard limits after the accident up to the present.



Generally, health effects caused by consumption of hazardous materials in foods are assessed by the Food Safety Commission of Japan (FSCJ), a risk assessment organization, which implements science-based risk assessments in an objective, neutral and fair manner. Based on the FSCJ's risk assessment, risk management organizations, such as the Ministry of Health, Labour and Welfare (MHLW) and the Ministry of Agriculture, Forestry and Fisheries (MAFF), formulate and implement risk management policies by establishing regulation values for each type of food.

However, under an emergency situation immediately after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, on March 17, 2011, the MHLW set the provisional regulation values for radioactive materials in foods mainly based on the guideline values given by the Nuclear Safety Commission. Then, the FSCJ held a total of five meetings, compiled the "Urgent Report on Radioactive Materials," and sent it to the MHLW on March 29, 2011. Based on this Urgent Report, the ministry decided to maintain the provisional regulation values as an interim measure.

In October 2011, the FSCJ notified the MHLW of the results of the risk assessment, and the MHLW reviewed the provisional regulation values and set the current standard limits by reducing the intervention level to 1 mSv/year in order to further ensure security and safety and deal with the situation on a long-term basis. The new regulation was adopted on April 1, 2012.

Local governments conduct inspections of radioactive materials in foods based on their respective plans formulated in line with the guideline established by the Nuclear Emergency Response Headquarters. When any item with radioactivity concentration exceeding the standard values is found through an inspection, the relevant item is collected and disposed of. When extensive areas are found to be affected, the Director General of the Nuclear Emergency Response Headquarters (Prime Minister) issues distribution restrictions by designating the regions and the items.

When significant levels of radioactive materials are detected from a food item, consumption restrictions are promptly issued irrespective of the number of inspected samples of that item.

(Related to p.174 of Vol. 1, "Indices Concerning Radioactive Materials in Foods," and p.55 of Vol. 2, "Standard Limits Applied from April 2012")

Source

- Prepared based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023), Nuclear Emergency Response Headquarters

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Measures for Radioactive Materials in Foods

Publication of the Inspection Results Concerning Radioactive Materials in Foods

The national government proposes food items to be inspected and inspection frequencies, and respective prefectural governments formulate their inspection plans and carry out inspections accordingly.
Inspection results are publicized by the Ministry of Health, Labour and Welfare and respective local governments.

"Measures for Radioactive Materials in Foods," Ministry of Health, Labour and Welfare
https://www.mhlw.go.jp/shinsai_jouhou/shokuhin.html (in Japanese)
Database of radioactive substances in food
https://www.radioactivity-db.niph.go.jp/ (in Japanese)

In response to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS on March 11, 2011, the provisional regulation values concerning radioactive materials were established on March 17, 2011, based on the Food Sanitation Act (Act No. 233 of 1947). Then, the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" was compiled on April 4.

The "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" has been revised in light of the inspection results and accumulated knowledge on countermeasures to reduce radioactive materials (the latest revision was made on March 30, 2023).

Inspection results and information on distribution restrictions and consumption restrictions are positively publicized through websites of the national government and local governments.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Measures for Radioactive Materials in Foods

Standard Limits Applied from April 2012

○ Immediately after the accident, foods in conformity to the provisional regulation values were generally assessed to have no ill effects and their safety was guaranteed. However, the annual dose limit was reduced to 1 mSv from 5 mSv, which had been permitted under the provisional regulation values, and current standard limits were set based thereon from the perspective of further ensuring security and safety of foods.

○ **Provisional regulation values for radioactive cesium***1

Category	Regulation value
Drinking water	200
Milk and dairy products	200
Vegetables	500
Cereals	500
Meat, eggs, fish and others	500

*1 The regulation values were set also taking into consideration radioactive strontium.

○ **Present standard limits concerning radioactive cesium***2

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

(Unit: Bq/kg)

*2 The standard limits were set also taking into consideration Sr-90 and radioactive plutonium, etc.

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

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Even based on the provisional regulation values applied up to March 2012, safety of foods in conformity thereto was guaranteed in terms of the effects on human health. However, from the perspective of further ensuring the security and safety of foods, the current standard limits were established and have been applied since April 1, 2012.

First of all, the provisional regulation values for radioactive cesium and strontium were based on the premise that the annual radiation dose from foods does not exceed 5 mSv.

The present standard limits are set so that the annual radiation dose from foods should not exceed 1 mSv (p.59 of Vol. 2, "Approach for the Establishment of the Standard Limits ◆ Grounds for the Standard Limits"). Additionally, foods were classified into five categories for the provisional regulation values, but were newly classified into four for the present standard limits (for details, see p.56 of Vol. 2, "Food Categories [Reference]").

(Related to p.174 of Vol. 1, "Indices Concerning Radioactive Materials in Foods," p.61 of Vol. 2, "Approach for the Calculation of the Standard Limits (1/2)," and p.62 of Vol. 2, "Approach for the Calculation of the Standard Limits (2/2)")

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Measures for Radioactive Materials in Foods

Food Categories [Reference]

- **Basic idea**
  Drinking water, infant foods and milk, for which special consideration is required, are separately classified into three different categories, while the others are all classified into a single category as general foods. In this manner, all foods and drinks are classified into four categories.

Food category	Reasons to establish the limits	Range of foods
Drinking water	1. Water is essential for human life and there is no substitution for water, and its consumption is large. 2. WHO's guidance level for radioactive cesium in drinking water is 10Bq/kg. 3. Strict management is possible for radioactive materials in tap water.	○ Drinking water, water used for cooking and tea drinks, which is a substitute for water
Infant foods	○ The Food Safety Commission pointed out that "the susceptibility to radiation may be higher in childhood than in adulthood."	○ Foods approved to be labeled as "fit for infants" based on Article 26, paragraph (1) of the Health Promotion Act (Act No. 103 of 2002) ○ Foods and drinks sold as intended for infants
Milk	1. Children consume a lot. 2. The Food Safety Commission pointed out that "the susceptibility to radiation may be higher in childhood than in adulthood."	○ Milk (cow milk, low-fat milk, processed milk, etc.) and milk drinks specified in the Ministerial Order concerning the Ingredient Standards for Milk and Dairy Products (Order of the Ministry of Health and Welfare No. 52 of 1951)
General foods	For the following grounds, foods other than given above are categorized as "general foods." 1. Can minimize the influence of individual differences in eating habits (deviation of the foods to be consumed) 2. Easy to understand for the general public 3. Consistent with international views, such as those of the Codex Alimentarius Commission	○ Foods other than given above

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

Standard limits concerning radioactive materials in foods are established respectively for the four food categories.

For "drinking water," the standard limit was set at 10 Bq/kg due to the following three grounds: (i) Water is essential for human life and there is no substitution for water, and its consumption is large; (ii) WHO's guidance level for radioactive cesium in drinking water is 10Bq/kg; and (iii) Strict management is possible for radioactive materials in tap water (p.42 of Vol. 2, "Waterworks System").

For "milk," the standard limit was set at 50 Bq/kg because (i) children consume a lot and (ii) the Food Safety Commission pointed out that "the susceptibility to radiation may be higher in childhood than in adulthood."

For "infant foods," the standard limit is the same as that for milk at 50 Bq/kg as the Food Safety Commission pointed out that "the susceptibility to radiation may be higher in childhood than in adulthood."

As reasons to set the limit at 100 Bq/kg for "general foods," the following three points are cited: Setting the value in this manner (i) can minimize the influence of individual differences in eating habits (deviation of the foods to be consumed), and is (ii) easy to understand for the general public and (iii) consistent with international views, such as those of the Codex Alimentarius Commission (an intergovernmental body created for the purpose of protecting consumers' health and ensuring fair-trade practices in the food trade, etc. that establishes international standards for foods).

(Related to p.174 of Vol. 1, "Indices Concerning Radioactive Materials in Foods")

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Measures for Radioactive Materials in Foods

Outline of the Results of the Food-related Health Risk Assessment

(Food Safety Commission of Japan (FSCJ), on October 27, 2011)

- Potential effects of radiation are found **when the lifetime additional effective cumulative dose exceeds around 100 mSv.** However, radiation dose accumulated in ordinary daily life such as from natural radiation and X-ray exams, etc. is excluded.

- In one's lifetime, **the susceptibility to radiation may be higher in childhood than in adulthood.**(thyroid gland cancer and leukemia)
  - Risks of leukemia increased in children under the age of five at the time of the accident. (Noshchenko et al. 2010; Data relating to the nuclear accident at Chornobyl)
  - Risks of thyroid gland cancer are higher for children younger at the time of radiation exposure. (Zablotska et al. 2011; Data relating to the nuclear accident at Chornobyl)

  << However, both data contain uncertain points in the estimation of radiation doses, etc. >>

- **It is difficult to identify health effects concerning radiation exposure below 100 mSv.**
  - Inaccuracy in estimation of the amount of exposure
  - Effects of radiation and effects caused by other factors are unlikely to be distinguished.
  - Study population for epidemiological data serving as grounds is not large enough.

Based on currently available scientific knowledge, the FSCJ discussed additional radiation exposure through contaminated food consumption, and concluded that health effects could be found when the lifetime additional effective dose exceeds around 100 mSv, excluding radiation exposure from everyday life.

Although there are some unclear points in the estimation of radiation doses, etc., on the basis of findings of health effects after the Chornobyl NPS Accident concerning risks of thyroid gland cancer and leukemia, it is likely that the susceptibility to radiation is higher in childhood than in adulthood (p.115 of Vol. 1, “Difference in Radiosensitivity by Age”).

On the other hand, if any health effects may occur by exposure to radiation below 100 mSv, it would be very small. As effects of radiation and effects caused by other factors are unlikely to be clearly distinguished and the epidemiological data, due to the small study population, is insufficient to prove the health effects of additional exposure, such as a causal association with cancer, the FSCJ has concluded that it is difficult to identify health effects from the extra cumulative exposure to radiation doses below 100 mSv.

The lifetime additional effective cumulative dose of “around 100 mSv” is not a threshold meaning that radiation exposure below this level causes no health effects nor that radiation exposure above this level surely causes health effects. This is the dose value which risk management organizations should consider for appropriate management of foods.
(Related to p.100 of Vol. 1, “Risks of Cancer Death from Low-Dose Exposure”)

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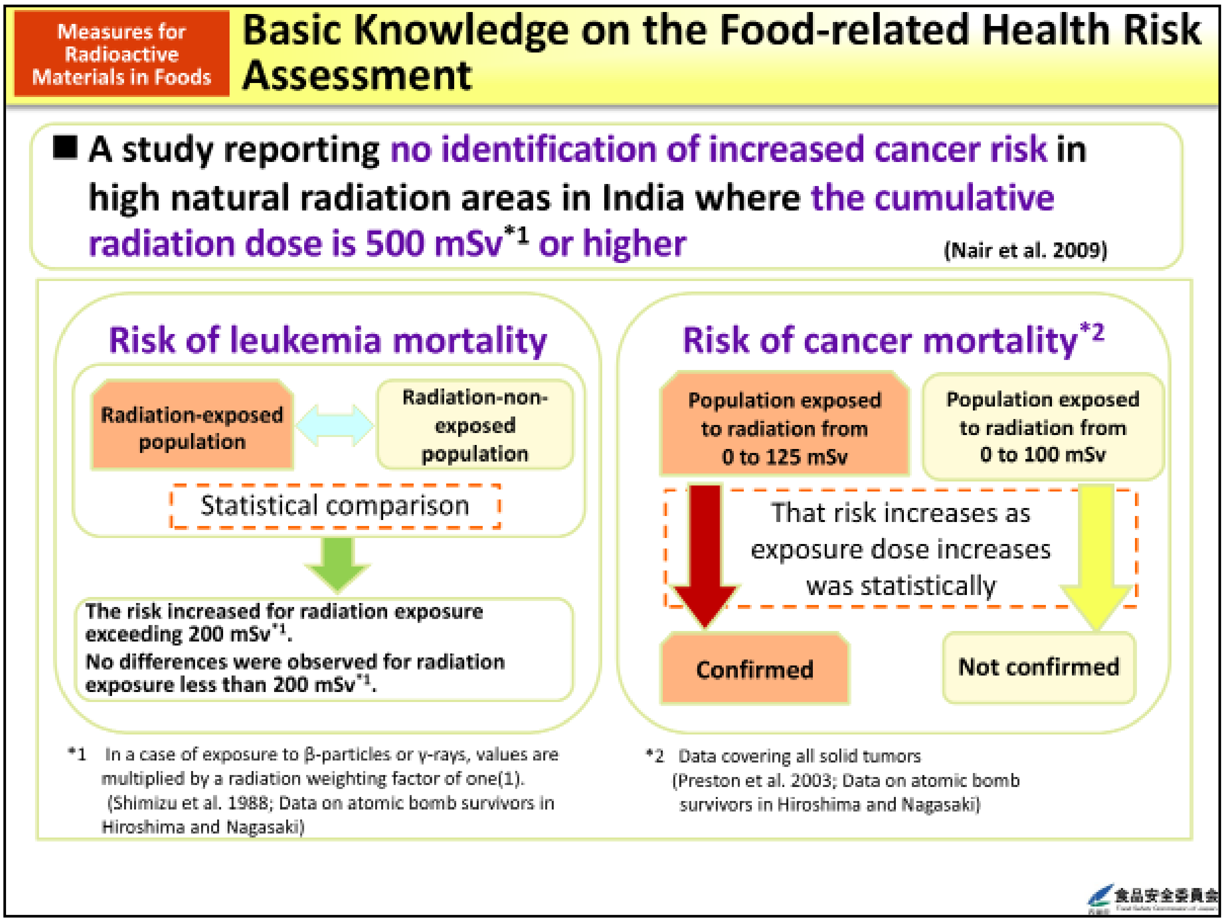

This figure shows epidemiological data on which the Food-related Health Risk Assessment was based.

There was a study report that the increased cancer risk by radiation was not observed among persons exposed to radiation exceeding 500 mSv in total in areas in India where natural radiation doses are high (p.124 of Vol. 1, “Effects of Long-Term Low-Dose Exposure”).

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 (p.119 of Vol. 1, “Risks of Developing Leukemia”).

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 mortality risk. Based on these data, the result of the Food-related Health Risk Assessment was derived.

Included in this reference material on March 31, 2013

Measures for Radioactive Materials in Foods

Approach for the Establishment of the Standard Limits ◆ Grounds for the Standard Limits

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

A. (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"

The standard limits concerning radioactive materials in foods were set based on the annual permissible dose of 1 mSv, which is adopted as an indicator by the Codex Alimentarius Commission, which establishes international specifications for foods. Originally, the International Commission on Radiological Protection (ICRP) publicized the idea that stricter requirements below 1 mSv/year would not achieve any significant additional dose reduction. Based on this idea, the Codex Alimentarius Commission specifies indicators.

Additionally, the standard limits are based on the principle of ALARA (As Low As Reasonably Achievable) (p.169 of Vol. 1, "Optimization of Radiological Protection"). Radiation monitoring surveys have shown considerable decreases in radioactivity concentrations measured in many of the food samples. Therefore, it was found that the reduction of the standard limit for radioactive cesium concentrations in general foods to 100 Bq/kg would not cause any problem for the dietary patterns of the Japanese people.
(Related to p.61 of Vol. 2, "Approach for the Calculation of the Standard Limits (1/2)")

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Measures for Radioactive Materials in Foods

Radionuclides Taken into Consideration

Q. Why are the standard limits set only for radioactive cesium?

○ **The standard limits were set in consideration of all radionuclides whose half-life is one year or longer out of the radionuclides that are supposed to have been released due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS based on the assessment by the Nuclear and Industrial Safety Agency.**

Regulated radionuclides	(Physical) half-life
Cesium 134	2.1 years
Cesium 137	30 years
Strontium 90	29 years
Plutonium	14 years -
Ruthenium 106	374 days

* The standard limits are not set for radioactive iodine, which has a half-life as short as 8 days and is no longer detected, nor for uranium that exists within the premises of TEPCO's Fukushima Daiichi NPS at the same level as naturally occurring uranium.

○ **However, as measurements of radionuclides other than radioactive cesium take time, the standard limits are not set for each of them but are calculated and set so that the total dose from other radionuclides does not exceed 1 mSv if only the standard limits for radioactive cesium are met.**

* The maximum doses from radionuclides other than radioactive cesium that people may receive from foods can be calculated by age group based on such data as radioactivity concentrations in soil and easiness of transition of radioactive materials from soil to agricultural products. For example, for people aged 19 years or over, doses from radionuclides other than radioactive cesium account for approx. 12% of the total.

A. While also taking into consideration effects of other radionuclides in calculation, cesium that accounts for the largest percentage and is most easily measured is used as the indicator.

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 grounds why the standard limits are set only for radioactive cesium out of diverse radioactive materials.

All radionuclides whose half-life is one year or longer are taken into consideration, out of the radionuclides that are supposed to have been released due to the accident at TEPCO's Fukushima Daiichi NPS. Radionuclides shown in the table above, such as strontium 90, plutonium, and ruthenium 106, are taken into account in calculation, in addition to radioactive cesium. However, as the standard limits are intended for long-term regulations of radioactive materials in foods, only radionuclides with a relatively long half-life whose long-term influence needs to be taken into account are covered. For example, the standard limits are not set for radioactive iodine. Even if measurements are conducted for these other radionuclides by setting specific standard limits for each of them, it takes time to obtain measurement results. On the other hand, it is easy to measure radioactive cesium. Therefore, the standard limits are calculated and set so that the total dose from other radionuclides does not exceed 1 mSv if only the standard limits for radioactive cesium are met.

Specifically, effects of the radionuclides shown in the table above, such as radioactive cesium, strontium 90 and plutonium, were ascertained through surveys of soil, etc. For example, assuming the entirety of the effects caused by the consumption of foods containing radioactive materials released from TEPCO's Fukushima Daiichi NPS as 100, the effects of radioactive cesium account for around 88 in the case of people aged 19 years or over. On the other hand, the effects of the other radionuclides were found to account for around 12. In this manner, the standard limits were established also taking into consideration the effects of radionuclides other than radioactive cesium.

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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.55 of Vol. 2, "Standard Limits Applied from April 2012," and p.62 of Vol. 2, "Approach for the Calculation of the Standard Limits (2/2)")

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Measures for Radioactive Materials in Foods

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

3. Calculation of the upper limits by age group

Intervention level: 1 mSv/y

Age groups are divided more finely than for the provisional regulation values

Subtract permissible dose for drinking water (approx. 0.1 mSv)

Permissible dose to be allocated to general foods (approx. 0.9 mSv) determined

The upper limit is calculated in consideration of the amount of consumption and the conversion factor (effective dose coefficient) by age group.

* Effects of radionuclides other than cesium are also taken into account.

Age group	Gender	Upper limit (Bq/kg)
Under 1 year old	Total average	460
1 to 6 years old	Male	310
	Female	320
7 to 12 years old	Male	190
	Female	210
13 to 18 years old	Male	**120**
	Female	150
19 years old or older	Male	130
	Female	160
Pregnant women	Female	160
Minimum value		**120**

Standard limit 100 Bq/kg

The standard limit is set based on the strictest upper limit (the minimum value) out of those for all age groups.
- **The standard limit results in reflecting requirements for all age groups.**
- **The standard limit secures an extra margin of safety from the upper limit especially for infants.**

4. Standard limits for milk and infant foods

These categories are established in consideration of young children. Therefore, the standard limits should be stricter so that consumption of these foods would not cause any harmful effects even if all of them contain radioactive materials up to the upper limits.
→**The standard limits for milk and infant foods are both set to be 50 Bq/kg**, namely half of the 100 Bq/kg for general foods.

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

The basic approach to set the standard limits is to figure out dose limits for each age group.

The annual permissible dose allocated to general foods is approx. 0.9 mSv/year, subtracting that for drinking water from the total.

The table above shows the upper limits for radioactive cesium concentrations (Bq/kg) by age group, which were derived based on the annual consumption and the committed effective dose coefficients for each age group. These limits also take into consideration the influence of radionuclides other than radioactive cesium (p.60 of Vol. 2, "Radionuclides Taken into Consideration").

As a result, the upper limit set for males aged between 13 and 18, 120 Bq/kg, was the strictest of all age groups.

To further ensure safety for all age groups, the standard limit was set at 100 Bq/kg, below the highest upper limit of 120 Bq/kg.

To further ensure the safety of children, the standard limit for milk and infant foods was set to be 50 Bq/kg, which is half of that for general foods. This limit was set so that no negative influence appears, even assuming that milk and all infant foods contain radionuclides up to the maximum permissible limit.

(Related to p.55 of Vol. 2, "Standard Limits Applied from April 2012," and p.61 of Vol. 2, "Approach for the Calculation of the Standard Limits (1/2)")

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Measures for Radioactive Materials in Foods

Approach for Applying Standard Limits for Drinks and Dried Foods [Reference]

Food category	Standard limits for radioactive materials
Drinks	
Green tea and blend tea partially containing green tea	10 Bq/kg The standard limit for drinking water is applied.
Green tea, etc. with sugar, *matcha* tea, flavoring, vitamin C, etc.	
Barley tea	100 Bq/kg The standard limit for general foods is applied to barley as ingredient.
Tea other than green tea and barley tea, such as black tea, oolong tea, herbal tea, du zhong tea, and houttuynia cordata tea; and coffee.	100 Bq/kg The standard limit for general foods is applied to the products in drinkable form.
Products falling under milk (cow milk, low-fat milk, processed milk, etc.) and milk drinks specified in the Ministerial Order on Milk and Milk Products Concerning Compositional Standards, etc.(Order of the Ministry of Health and Welfare No. 52 of 1951)	50 Bq/kg The standard limit for milk is applied.
Matcha tea and other powdered tea (tea made by grinding tea leaves)	100 Bq/kg The standard limit for general foods is applied to the products in powder form.
Powdered drinks that are served in diluted form	100 Bq/kg The standard limit for general foods is applied to the final products.
Bottled drinks containing *matcha* tea but not containing green tea extract	
Dried foods	
Concentrated foods, including condensed soups, sauces, and dips	100 Bq/kg The standard limit for general foods is applied to the final products.
Dried foods including freeze-dried foods, powdered soups, and instant miso soups	

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

The table shows part of the standard limits for radioactive materials applied to drinks, condensed foods, and dried foods such as powdered soups that are served by dissolving them in cold or hot water. The details of each category are as follows.

- Green tea: Non-fermented tea that is made from leaves of tea plants, including *sencha* (ordinary green tea) and its equivalents—*gyokuro* (refined green tea), roasted green tea, brown rice tea (green tea with roasted brown rice)
- *Matcha* tea and other powdered tea (tea made by grinding tea leaves): This type of tea is ingested in powder form, not as liquid tea obtained by brewing tea leaves and is used as an ingredient for foods like ice cream. Therefore, the standard limit for general foods is applied to this type of tea in powder form.
- Dried foods: For some dried foods, the standard limit for general foods is applied to foods both in dried form and in edible form (reconstituted form). "Dried foods" refers to dried mushrooms, vegetables, and seafood, including sea weeds.
- Dried mushrooms: Dried mushrooms listed in the Japan Standard Commodity Classification (JSCC), including *shiitake* mushrooms (*Lentinula edodes*), and *kikurage* mushrooms (*Auricularia polytricha*).
- Dried vegetables: Dried vegetables listed in the JSCC, including gourd shavings, Japanese radish, fiddleheads (*Osmunda japonica*), brackens (*Pteridium aquilinum*), and taro stems. Products in flake form and in powder form are excluded.
- Dried seaweeds: Processed seaweeds listed in the JSCC, including dried kelp, dried *wakame* (*Undaria pinnatifida*) products, dried *hijiki* (*Sargassum fusiforme*), dried *arame* (*Eisenia bicyclis*), agar.
- Dried seafoods: Open-air dried seafoods listed in the JSCC, including fully dried herring fillets, cod fillets, and shark fins; as well as dried boiled-seafoods listed in the JSCC, including abalone and sea cucumbers.
- Dried shiitake mushrooms: Basically, tests are conducted using ground samples to which an adequate amount of water is added. The amount of added water is based on the data (weight change rate)— made public in the Standard Tables of Food Composition in Japan—of the water taken into dried mushrooms as the result of reconstitution. As water used for reconstitution is often used as soup stock in Japan, the amount of radioactive materials migrating from dried mushrooms into the water needs to be determined. This method is equivalent to the testing being conducted by considering the amount of radioactive materials migrating from the samples into the water.
- Concentrated fruit juice: For fruit juice that is distributed in concentrated form for the purpose of transportation and that is surely reprocessed into diluted form at processing facilities before being sold for unspecified persons, the standard limit is basically applied to the products obtained by being diluted to the state of original fruit juice, based on the concentration factor. This is because such concentrated fruit juice is unlikely to be served for human consumption as is.

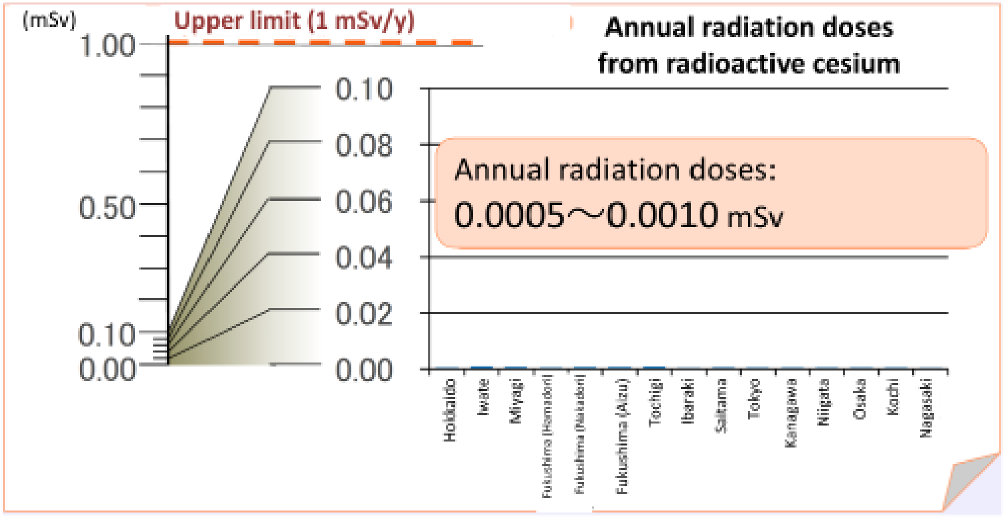
These standard limits are compiled in the "Q&As on the Setting of Standard Limits for Radioactive Materials in Foods" by the Ministry of Health, Labour and Welfare. (in Japanese)

Included in this reference material on March 31, 2019

Measures for Radioactive Materials in Foods

Survey of Distributed Foods (Market Basket Survey)

- **A survey was conducted by purchasing foods distributed nationwide and precisely measuring radioactive cesium contained therein.**
  Foods were purchased based on average food consumption by region (based on the National Health and Nutrition Survey) and purchased foods were mixed for measurement.
  - ◆Purchased foods were simply cooked in line with ordinary dietary circumstances and measurement was conducted.
  - ◆Regarding fresh foods, those produced in the relevant region or the neighboring areas were chosen if possible.
- **Based on the measurement results, radiation doses that people would intake from foods in a year were calculated (surveyed in February and March 2023).**



Measured effective doses were around 0.1% of 1 mSv/y, based on which the standard limits were established.

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

Since FY2011, the amount of radioactive materials contained in the average diet has been surveyed using the market basket method.

From February to March 2023, the Ministry of Health, Labour and Welfare conducted a survey by purchasing distributed foods in 15 areas across Japan and measuring radioactive cesium contained therein to estimate annual radiation doses received from radioactive cesium in foods.

Annual radiation doses received from radioactive cesium in foods were estimated to be 0.0005 to 0.0010 mSv, being around 0.1% of the annual permissible dose of 1 mSv/y, based on which the current standard limits were established. Thus, annual radiation doses received from foods were confirmed to be extremely small.

Market basket survey:

One of the survey methods for estimating daily consumption of various chemical substances

Source

- Ministry of Health, Labour and Welfare's website (https://www.mhlw.go.jp/shinsai_jouhou/market_basket.html, in Japanese)

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Measures for Radioactive Materials in Foods

Prefectures and Food Items to be Inspected (Items for which Cultivation/Feeding Management is Difficult and Log-grown Mushrooms)

Food items for which cultivation/feeding management is difficult and relevant prefectures to be inspected

		Aomori	Iwate	Akita	Miyagi	Yamagata	Fukushima	Ibaraki	Tochigi	Gunma	Chiba	Saitama	Tokyo	Kanagawa	Niigata	Yamanashi	Nagano	Shizuoka
Items with radioactivity concentrations exceeding the standard limits	Wild mushrooms and wild plants	□	○	○	○	○	○	□	□	●	□	□	□	□	○	○	○	○
	Wild bird and animal meat	□	○	□	○	●	○	●	□	○	□	□	□	□	●	□	□	□
Items with radioactivity concentrations between half of the standard limits and the standard limits	Wild mushrooms and wild plants	□	□	□	□	□	□	□	●	●	□	□	□	□	□	□	□	□
	Wild bird and animal meat	□	●	□	●	□	□	□	□	●	□	□	□	□	□	□	●	□
Marine fish		-	-	-	-	-	□	-	×	×	-	×	-	-	-	×	×	-
Inland water fish		-	-	-	□	-	○	-	-	○	□	-	-	-	-	-	-	-

Log-grown mushrooms to be inspected and relevant prefectures to be inspected

	Aomori	Iwate	Akita	Miyagi	Yamagata	Fukushima	Ibaraki	Tochigi	Gunma	Chiba	Saitama	Tokyo	Kanagawa	Niigata	Yamanashi	Nagano	Shizuoka
Log-grown mushrooms	▲	●	▲	▲	▲	▲	▲	●	●	▲	▲	▲	▲	▲	▲	▲	▲

Classification based on inspection results for the latest one year (from April 1, 2022, to February 28, 2023)

○: Items wherein radioactivity concentrations exceeding the standard limits were detected (for fishery products, those wherein radioactivity concentrations exceeding half of the standard limits were detected)

●: Items wherein radioactivity concentrations exceeding half of the standard limits were detected (excluding those wherein radioactivity concentrations exceeding the standard limits were detected)

□: Items requiring inspections in consideration of the difficulties in management (wild mushrooms and wild plants), the mobility (wild bird and animal meat), or the status of distribution restrictions (marine fish)

▲: Items requiring cultivation management and monitoring based on the influence of radioactive materials on materials used for production

−: Items that are not classified by relevant prefectures as those requiring inspections based on inspection results for the latest one year

×: Nothing applicable

Prepared based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023) by the Nuclear Emergency Response Headquarters

厚生労働省

In FY2016, more than five years after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, radioactivity concentrations had decreased as a whole and food items with radioactivity concentrations exceeding the standard limits had become limited. Therefore, the national government reviewed and made inspection methods more reasonable and efficient, centered on items whose cultivation/feeding is manageable.

Thereafter, as inspection results had been accumulated, the approach for deciding prefectures and items to be inspected and lifting distribution restrictions has been reviewed every year and inspection targets are as shown in the table above as of FY2023.

With regard to items for which cultivation/feeding management is difficult, prefectures where inspections need to be continued are specified for each item in consideration of the difficulties in management therefor.

With regard to log-grown mushrooms, prefectures where inspections need to be continued are also specified considering the influence of radionuclides on materials used for production.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Measures for Radioactive Materials in Foods

Prefectures and Food Items to be Inspected (Items whose Cultivation/Feeding is Manageable (excl. Log-grown Mushrooms))

Food items whose cultivation/feeding is manageable (excl. log-grown mushrooms) and relevant prefectures to be inspected

		Fukushima
Items with radioactivity concentrations between half of the standard limits and the standard limits	Vegetables, etc.	●
Rice		■

* Out of items requiring continued monitoring as being significantly affected by feeding management, milk is inspected in Fukushima Prefecture and beef is inspected in Iwate, Miyagi, Fukushima and Tochigi Prefectures.

Classification based on inspection results for the latest one year (from April 1, 2022, to February 28, 2023)
- ❂ : Items wherein radioactivity concentrations exceeding the standard limits were detected
- ● : Items wherein radioactivity concentrations exceeding half of the standard limits were detected (excluding those wherein radioactivity concentrations exceeding the standard limits were detected)
- ■ : Food items designated as inspection targets in the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies (March 30, 2023)" (Nuclear Emergency Response Headquarters)
- — : Items that are not classified by relevant prefectures as those requiring inspections based on inspection results for the latest one year

Prepared based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023) by the Nuclear Emergency Response Headquarters

With regard to items whose cultivation/feeding is manageable (excluding log-grown mushrooms), prefectures where inspections need to be continued are specified for each item based on inspection results for the latest three years, such as prefectures where items with radioactive cesium exceeding half of the standard limits were detected.

In other prefectures, inspections are to be conducted as needed.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Measures for Radioactive Materials in Foods

Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies

	Local governments marked with ◎ and ● (those marked with ■ and ▲ should conduct inspections correspondingly)	
	Municipalities (exceeding half of the standard limits)	Other municipalities
Exceeding half of the standard limits	3 or more samples*1	1 or more samples
Beef meat	Once every three months for each farm household*2	
Milk	Periodically for each cooler station*3	
Inland water fish Marine fish	Periodically	

*1: It is permissible to divide a prefecture into multiple zones across municipalities and conduct inspections for three or more samples in each of those zones.

*2: For farm households whose feeding management has been recognized as appropriate by the relevant local government, it would suffice to conduct inspections once every 12 months or so. However, inspections may be omitted for cattle (i) being fed by farm households where radioactive cesium has not been detected at levels exceeding half of the standard limits for the last three years, (ii) being fed only with imported feed or feed produced in fields other than those subject to voluntary suspension of distribution and use of feed, and (iii) for which the relevant prefectural government confirms that measures are being taken to prevent use of any feed produced in fields subject to voluntary suspension of distribution and use of feed and finds that inspections are not necessary.

*3: This does not apply to cooler stations, etc. (i) where the relevant local government recognizes appropriate feeding management, (ii) where what is handled is only raw milk produced in areas whose distribution restrictions were lifted more than three years ago, and (iii) where inspection results for the latest three years are all below half of the standard limits.

Classification based on the inspection results for the last one year (from April 1, 2022 to February 28, 2023)

◎ : Local governments whose inspections detected radioactive cesium concentrations exceeding the standard limits (exceeding half of the standard limits for fishery products)

● : Local governments whose inspections detected radioactive cesium concentrations exceeding half of the standard limits (excluding those categorized above)

▲ : Local governments requiring cultivation management and monitoring based on the status of the influence of radioactive materials on materials used for production

■ : Local governments designated as inspection targets in the Attachment to the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023, Nuclear Emergency Response Headquarters)

Prepared based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023) by the Nuclear Emergency Response Headquarters

厚生労働省

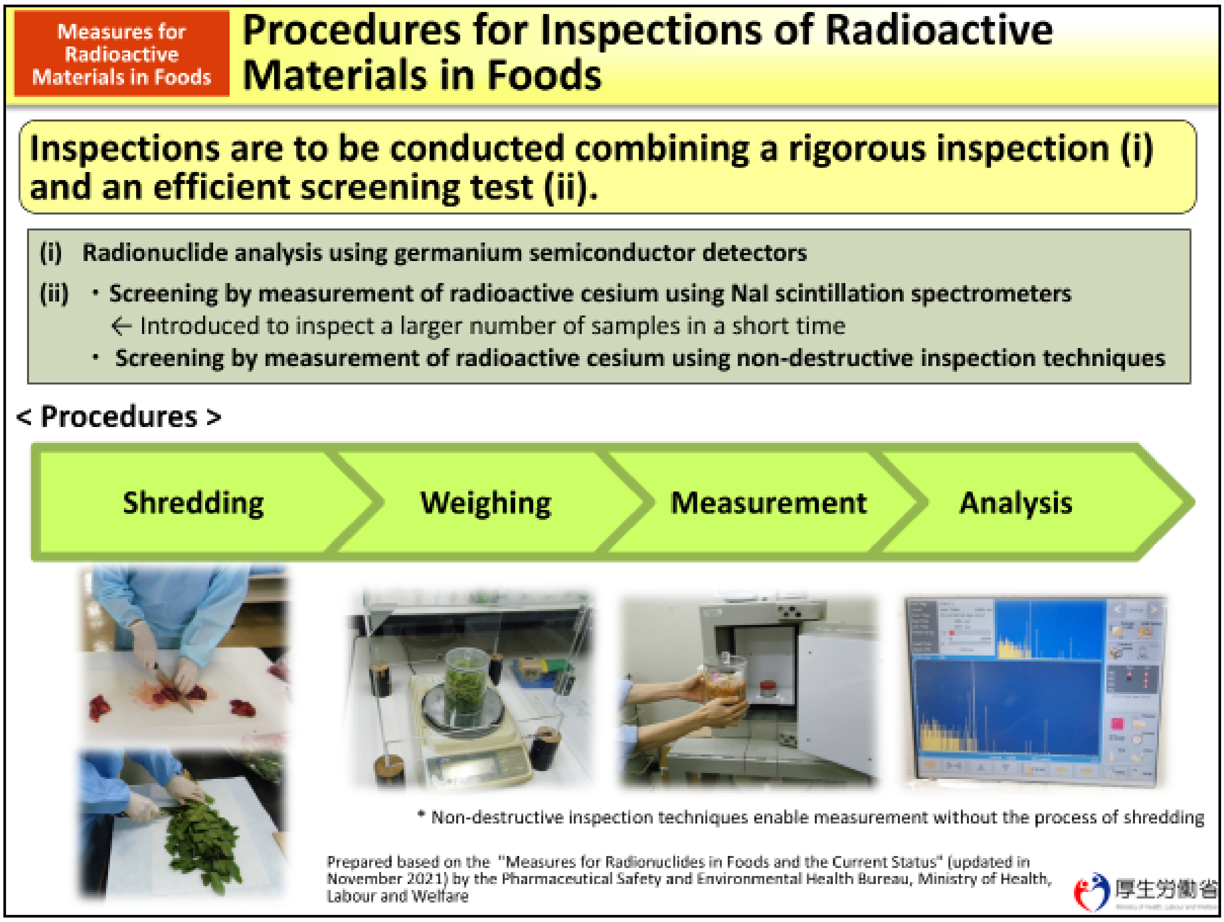
This table shows the required number of samples and frequencies of inspections for local governments whose inspections detected radioactive cesium concentrations exceeding the standard limits (those marked with ◎) and local governments whose inspections detected radioactive cesium concentrations exceeding half of the standard limits (those marked with ●).

The “Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies” (March 30, 2023) by the Nuclear Emergency Response Headquarters specifies as follows.

- Regarding local governments that have detected radioactive cesium concentrations exceeding half of the standard limits in any food under this food classification since April 2022, inspections should be conducted for three or more samples for each municipality in the areas where radioactive cesium concentrations exceeding half of the standard limits were detected, and for one or more samples for each municipality in other areas (it is permissible to divide a prefecture into multiple zones across municipalities and conduct inspections for three or more samples in each of those zones) (marked with ◎ and ○ in the table).

For the cancellation of items and areas to which restriction of distribution and/or consumption of foods concerned applies, the following conditions are presented: inspection results within the latest one month are all below the standard limits for at least three locations per municipality, in principle; and for crops such as log-cultured shiitake mushrooms, for which cultivation management is especially required to keep radioactive cesium concentrations below the standard limits, factors causing contamination exceeding the standard limits are surely removed through management, etc.

Included in this reference material on March 31, 2013
Updated on March 31, 2024



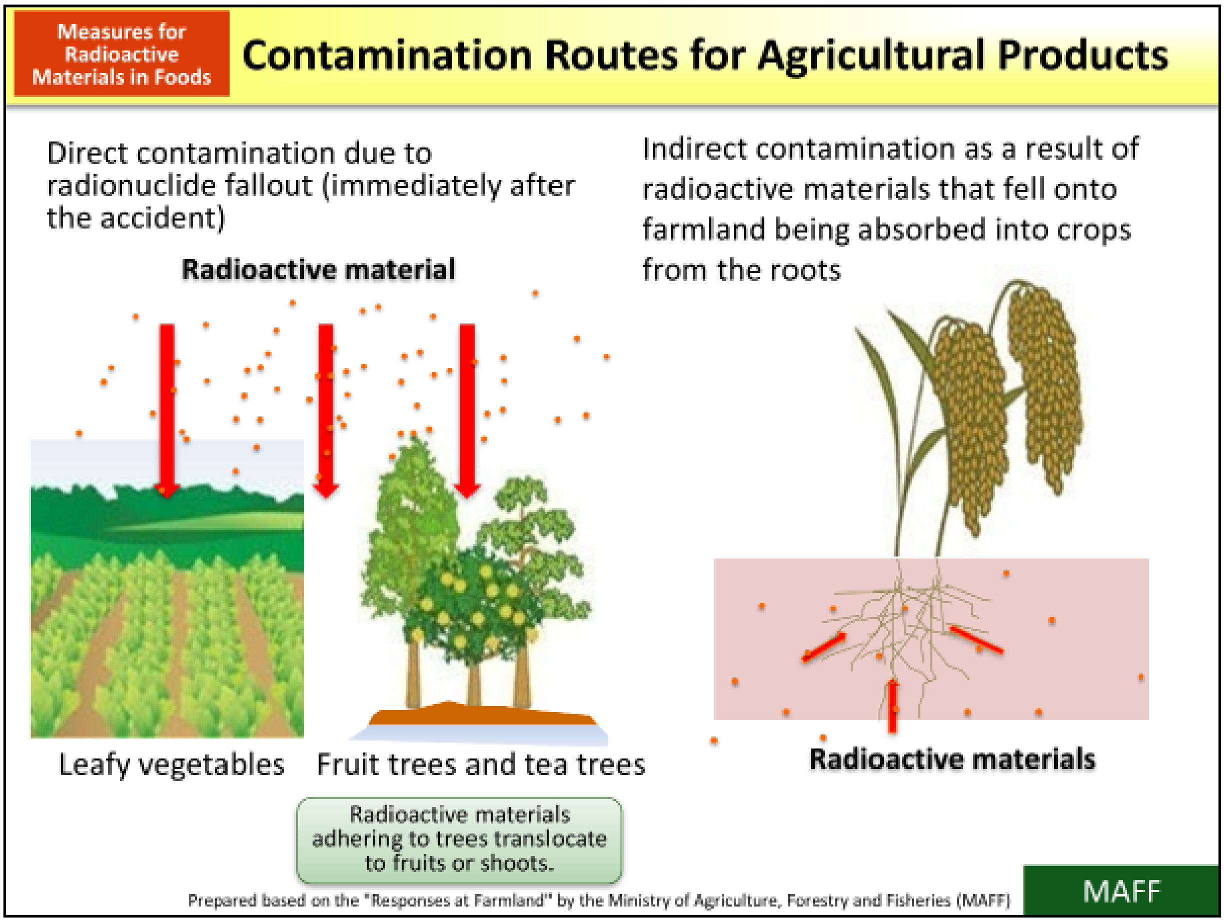
This figure shows procedures for inspections of radionuclides in foods.

There are two ways to inspect foods, i.e., a rigorous inspection and an efficient screening test.

As a rigorous inspection, radionuclide analysis is conducted using a germanium semiconductor detector. After shredding a food sample, its weight is measured accurately. Then, the shredded sample is put in a prescribed container. The container is set in a detector, which is structured like a box covered with a thick layer of lead, and the amount of radioactive cesium is measured. Lastly, measurement results are analyzed.

For an efficient screening test, a NaI (Tl) scintillation spectrometer is used. Screening using a NaI scintillation spectrometer is inferior to radionuclide analysis using a germanium semiconductor detector in terms of measurement accuracy, but can shorten the time required for inspections and is less expensive. Screening using non-destructive inspection techniques does not require shredding and mixing of samples. If the results of these screening tests suggests the existence of radioactive cesium exceeding the standard limits, an inspection is conducted again using a germanium semiconductor detector.

Included in this reference material on March 31, 2013
Updated on March 31, 2022



Contamination routes due to radioactive fallout are roughly divided into three.

(i) The figure on the left shows the route of how radioactive fallout directly adheres to crops. High radioactivity concentrations were often detected in leafy vegetables that were grown in the fields at the time of the accident. This is considered to be due to direct contamination.

(ii) The figure in the center shows the route of how radioactive materials that adhered to fruit trees and tea trees immediately after the accident penetrate into trees and translocate[1] to fruits and tea shoots.

(iii) The figure on the right shows the route of how radioactive materials that fell onto soil are absorbed into crops from the roots. Contamination of crops planted after the accident is considered to have followed this route.

(Related to p.180 of Vol. 1, “Transfer to Plants”)

1. Phenomenon wherein nutrients absorbed in a plant or metabolites produced by photosynthesis are transported from one tissue to another tissue

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Measures for Radioactive Materials in Foods

Measures for Reducing Transfer of Radioactive Materials to Crops (1/5) - 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

Radioactive materials that were released into the air and fell onto uncultivated farmland stay on topsoil.

Therefore, at farmland where high radioactivity concentrations are detected, the topsoil is scraped away to remove radioactive materials which remain in shallow depth.

In the meantime, at farmland where detected radioactivity concentrations are relatively low, topsoil is replaced with subsoil (inversion tillage) to reduce radioactivity concentrations in the soil layer where plants take root.

In this manner, efforts have been made to reduce radiation doses released from farmland and inhibit growing crops from absorbing radioactive materials.

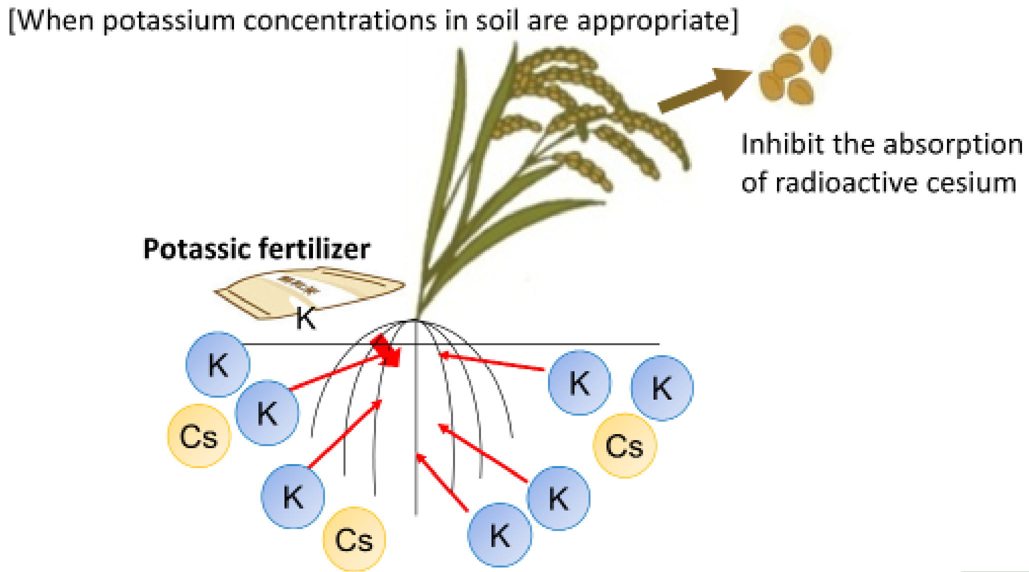
(Related to p.181 of Vol. 1, "Distribution of Radioactive Cesium in Soil")

Included in this reference material on March 31, 2013
Updated on March 31, 2017

Measures for Radioactive Materials in Foods

Measures for Reducing Transfer of Radioactive Materials to Crops (2/5) - 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.



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

MAFF

It is known that crops, such as rice, absorb more radioactive cesium when potassium concentrations in soil are lower.

Potassium and cesium have similar chemical characteristics, and when the soil contains sufficient potassium, less cesium is absorbed into crops. This is because a passage (transporter) on the root surface that lets some potassium through also lets cesium through. Recently, there is also a research report concerning rice plants that do not have such passage (unlikely to absorb cesium).

Therefore, at farmland where potassium concentrations in soil are low, a sufficient amount of potassic fertilizer is applied to increase potassium concentrations above a certain level to inhibit absorption of radioactive cesium into crops.

Included in this reference material on March 31, 2013
Updated on March 31, 2021

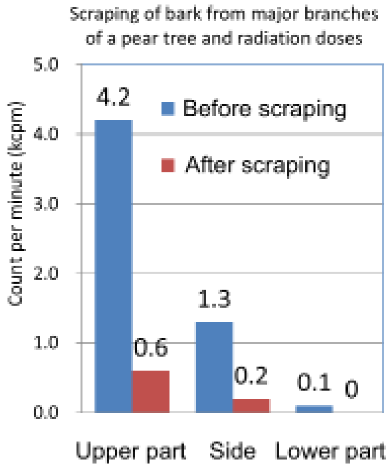
Measures for Radioactive Materials in Foods

Measures for Reducing Transfer of Radioactive Materials to Crops (3/5) - Washing of Fruit Trees and Removal of Bark -

Wash off radioactive cesium adhering to trees with high-pressure water and scrape away bark to reduce radioactive cesium concentrations

High-pressure washing of a persimmon tree

Scraping of bark from a pear tree



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

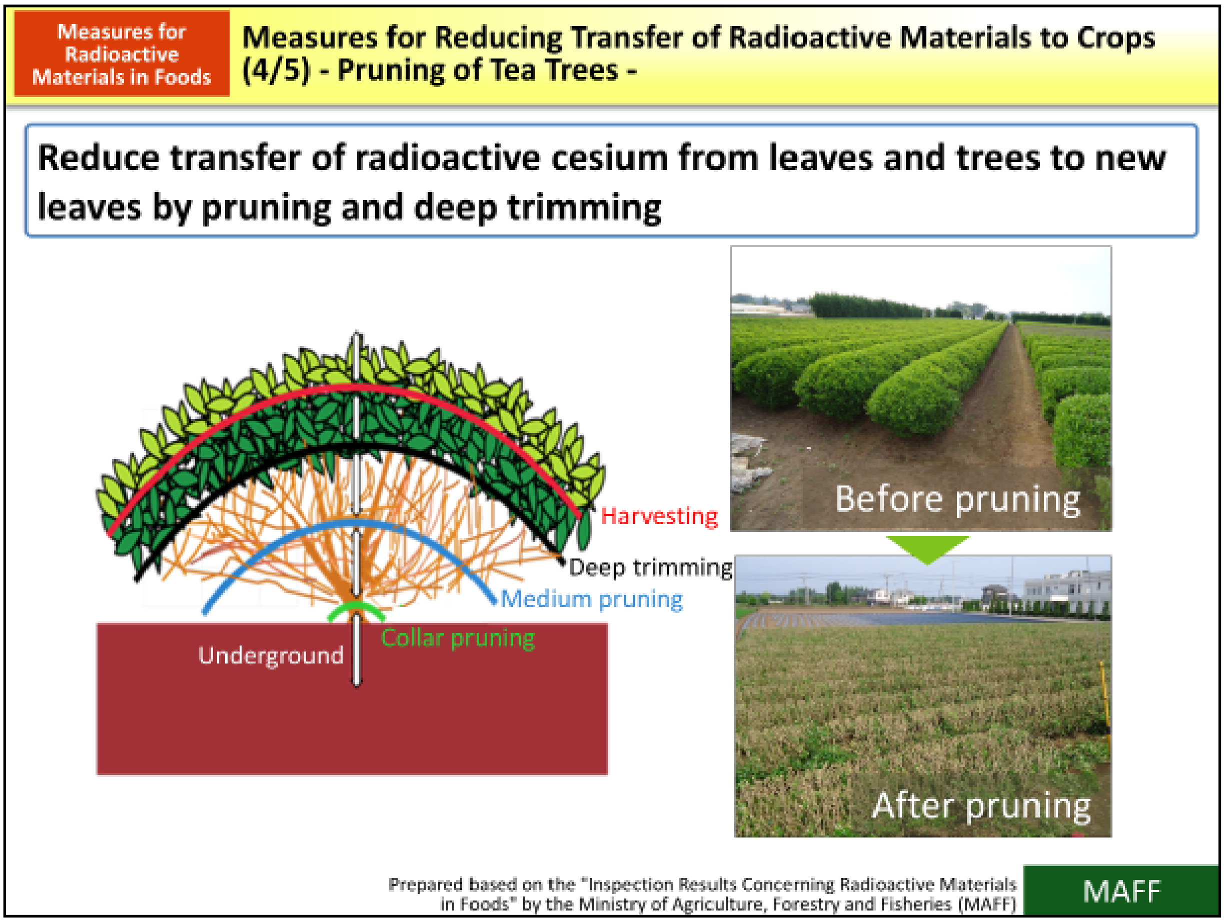
MAFF

In order to prevent translocation of radioactive materials from fruit trees to fruits, trees are washed with high-pressure water and bark is scraped off from trees to remove adhering radioactive materials.

In the case of pear trees, there is data that radiation doses from major branches are reduced by nearly 90% by scraping off the bark.

(Related to p.180 of Vol. 1, "Transfer to Plants")

Included in this reference material on March 31, 2013
Updated on March 31, 2017



In the case of tea trees, in order to prevent transfer of radioactive materials from the surface of leaves to new leaves, leaves and branches are trimmed or pruned deeper than usual to remove contaminated parts.
(Related to p.180 of Vol. 1, “Transfer to Plants”)

Included in this reference material on March 31, 2013
Updated on March 31, 2017

Regarding materials used for agricultural production, such as fertilizers, soil amendments and soils for cultivation, the reference value for radioactive cesium of 400 Bq/kg was set in order to prevent expansion of contamination of farmland soil by the use of contaminated materials.

Several local governments and other organizations have monitored radioactive cesium concentration in these materials, and provide guidance to ensure that materials containing radioactive cesium exceeding the reference value should not be used at farmland.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Rice

Changes in Inspection Results for Rice (Incl. Inspection of All Rice Bags)

inspection period	Number of samples[1]	Number of samples exceeding the standard limit	Percentage of samples exceeding the standard limit
Harvested in ～2011	26,464	592	2.2%
Harvested in 2012	Approx. 10.37 million	84	0.0008%
Harvested in 2013	Approx. 11.04 million	28	0.0003%
Harvested in 2014	Approx. 11.02 million	2	0.00002%
～	～	0	0%
Harvested in 2023 (As of January 9)	Approx. 0.08 million	0	0%

1: For rice harvested in FY2020 onward, inspection of all rice bags has been replaced with random monitoring by stages, and the number of samples decreased.

* Coverage: 17 prefectures including the Tokyo Metropolis designated as inspection targets in the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies," which compiles basic approaches concerning radioactive materials in foods

Prepared based on the "Inspection Results Concerning Radioactive Cesium Concentrations in Agricultural Products" by the Ministry of Agriculture, Forestry and Fisheries and the "Information about the Food Test" by the Fukushima Association for Securing Safety of Agricultural Products

The production and distribution of rice are managed through measures to inhibit radioactive cesium absorption by the use of potassic fertilizer (p.71 of Vol. 2, "Measures for Reducing Transfer of Radioactive Materials to Crops (2/5) - Measures to Inhibit Radioactive Cesium Absorption through Potassic Fertilization -") and inspection of all bags of harvested rice. In Fukushima Prefecture, planting has been restricted and measures to inhibit radioactive cesium absorption have been taken at Areas under Evacuation Orders, etc. and distribution of rice has been strictly controlled through inspection of all rice bags since FY2012. However, for rice harvested in FY2020 onward, inspection of all rice bags is replaced with random monitoring, except for rice harvested in former Areas under Evacuation Orders, etc[1], and the number of samples decreased significantly (p.77 of Vol. 2, "Radioactivity Inspection of All Rice Bags by Fukushima Prefecture").

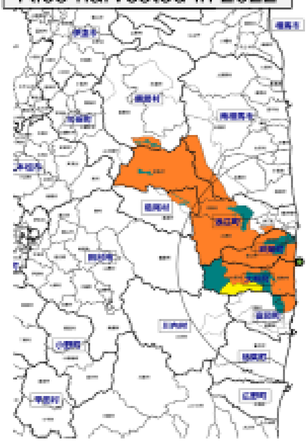
Rice containing radioactive cesium at a level exceeding the standard limit decreased year by year, and there has been none since FY2015 (as of the end of December 2023). This standard limit refers to 100 Bq/kg, which has been applied since April 2012 (in FY2011, provisional regulation values were applied, but tabulation is based on the current standard for the purpose of comparison with the results in and after 2012).

1. Former Areas under Evacuation Orders, etc.: Tamura City, Minamisoma City, Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, Namie Town, Katsurao Village, Iitate Village, and Kawamata Town (former Yamakiya Village)

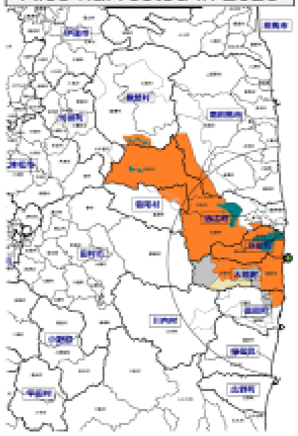
Included in this reference material on March 31, 2013
Updated on March 31, 2024

Rice — Areas Subject to Planting Restrictions for Rice to be Harvested in 2023

Rice harvested in 2022



Rice harvested in 2023



Planting restrictions
Planting and farming are not permitted.

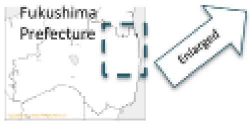
Agricultural land conservation / Test growing
Agricultural land conservation after decontamination and test growing under the management of a municipality is conducted.

Preparation for resuming planting
After formulating a management plan, demonstration for resuming planting is conducted based thereon.

Inspection and management of all rice harvested
After formulating a management plan, measures to inhibit radiation absorption are taken based thereon at all farmland. Harvested rice is all inspected (management of all harvested rice and inspection of all rice bags) and rice passing the inspection is shipped sequentially.

Inspection and management of all farm households
Measures to inhibit radioactive cesium absorption are taken thoroughly by each farm household, and after inspection (inspection of all rice bags), rice is shipped sequentially.

Fukushima Daiichi NPS



Area	Rice harvested in 2023	Rice harvested in 2022
Planting restriction	1,500ha	1,500ha
Agricultural land conservation / Test growing	550ha	850ha
Preparation for resuming planting	300ha	0ha
Inspection and management of all rice harvested	0ha	100ha
Total	2,350ha	2,450ha

*The total amounts do not necessarily match due to rounding

Prepared based on the "Areas Subject to Planting Restrictions for Rice to be Harvested in 2023" by the Ministry of Agriculture, Forestry and Fisheries (MAFF)

Entry and farming are restricted (planting restrictions) in Restricted Areas. In former Habitation Restricted Areas, etc., agricultural land conservation after decontamination and test growing under the management of the relevant municipalities may be conducted (agricultural land conservation/test growing), and in Preparation Areas for Lift of Evacuation Orders, etc., demonstration for resuming planting may be conducted under a management plan formulated by the prefecture and the relevant municipalities (preparation for resuming planting).

In areas not subject to evacuation orders that were under evacuation orders in the previous year or where rice containing radioactive cesium exceeding the standard limit was detected in the previous year, etc., the prefecture and the relevant municipalities formulate a management plan and measures to inhibit radioactive cesium absorption are taken thoroughly and all rice harvested in respective areas is managed and all bags are inspected (inspection and management of all rice harvested).

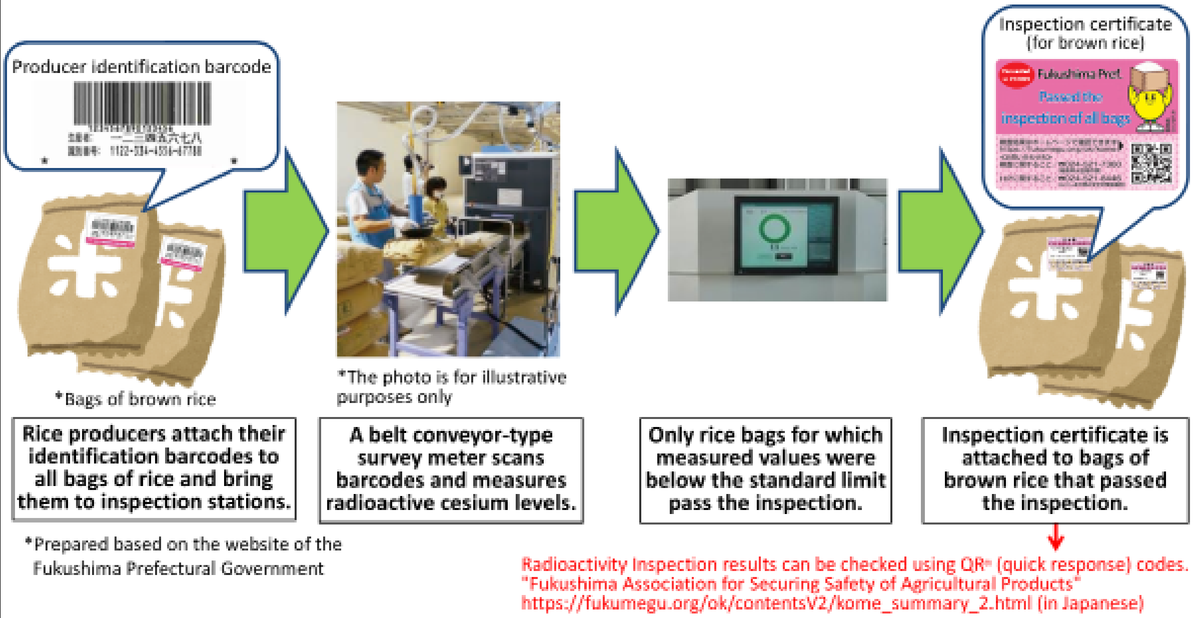
In areas where inspection and management of all rice harvested were obliged in the previous year and where rice containing radioactive cesium exceeding 50 Bk/kg was detected in the previous year, etc., measures to inhibit radioactive cesium absorption are taken thoroughly by each farm household and all farm households are inspected (inspection and management of all farm households). In Fukushima Prefecture, all rice bags are inspected, in principle.

However, Fukushima Prefecture started to adopt random inspection in lieu of inspection of all rice bags by stages starting from rice harvested in 2020.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Rice — Radioactivity Inspection of All Rice Bags by Fukushima Prefecture

Fukushima Prefecture has been inspecting all bags of rice harvested throughout the prefecture since 2012, apart from inspections based on the inspection guideline. For rice harvested in FY2020 onward, inspection of all rice bags has been replaced with random monitoring by stages. From rice harvested in FY2023, Tamura City started to adopt random monitoring.



*Prepared based on the website of the Fukushima Prefectural Government

Since 2012, Fukushima Prefecture has been inspecting all bags of rice harvested throughout the prefecture, not limited to the areas instructed by the national government, as an initiative by the prefecture. For radioactivity inspections, belt conveyor-type survey meters are used.

For rice harvested in FY2020 onward, inspection of all rice bags is replaced with random monitoring, except for rice harvested in former Areas under Evacuation Orders, etc[1]. From now on, the inspection method is to be shifted to random monitoring by stages also in former Areas under Evacuation Orders, etc. From rice harvested in FY2022, Hirono Town and Kawauchi Village, and from rice harvested in FY2023, Tamura City started to adopt random monitoring.

Whether the rice has passed the inspection can be checked as follows.

In the case of brown rice packed in a standard 30-kg paper bag that passed the inspection, an inspection certificate is attached to the paper bag. An identification number is entered in each inspection certificate, and inspection results can be checked on the website of the Fukushima Association for Securing Safety of Agricultural Products.

In the case of polished rice, a polished rice label to prove that it is made from brown rice that passed the inspection is attached. However, as this label is attached on a voluntary basis, some polished rice that passed the inspection may be distributed without the label.

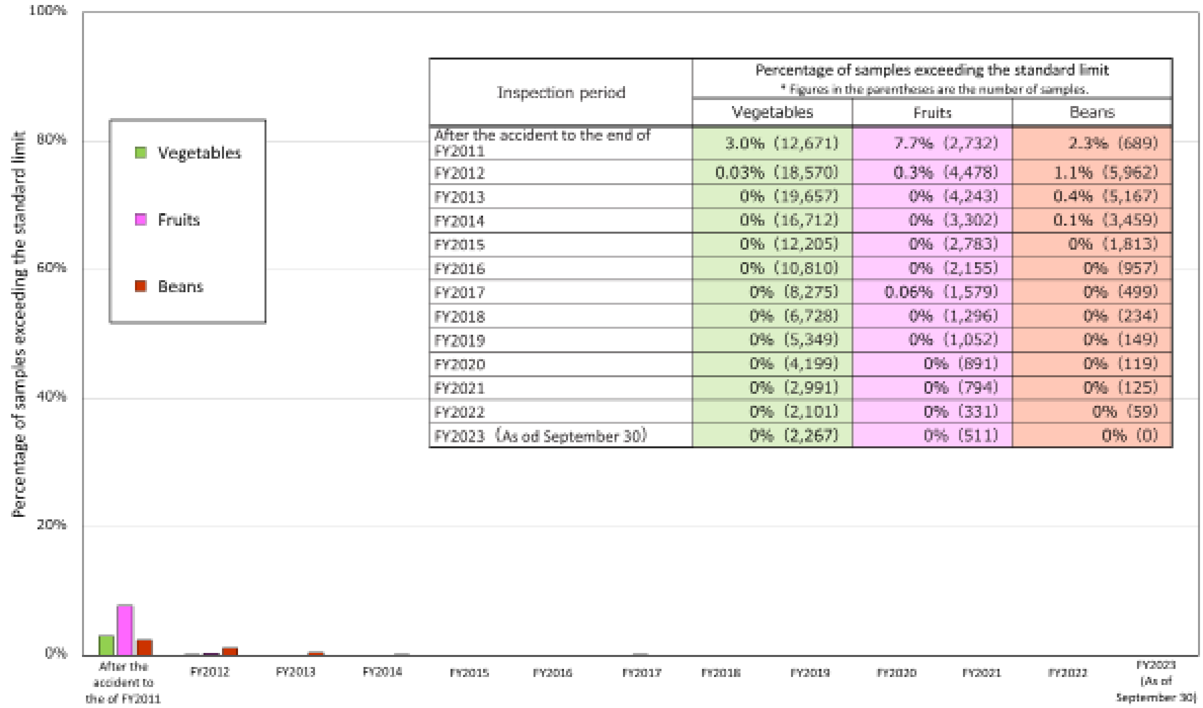
(Partially cited from the website of Fukushima Prefecture "Frequently Asked Questions about Radioactivity Inspection of All Rice Bags": https://www.pref.fukushima.lg.jp/sec/36035b/suiden-zenryozenhukurokensa-faq.html (in Japanese))

1. Former Areas under Evacuation Orders, etc.: Tamura City, Minamisoma City, Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, Namie Town, Katsurao Village, Iitate Village, and Kawamata Town (former Yamakiya Village)

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Vegetables, Fruits and Beans

Changes in Inspection Results for Vegetables, Fruits and Beans



Inspection period	Percentage of samples exceeding the standard limit * Figures in the parentheses are the number of samples.		
	Vegetables	Fruits	Beans
After the accident to the end of FY2011	3.0% (12,671)	7.7% (2,732)	2.3% (689)
FY2012	0.03% (18,570)	0.3% (4,478)	1.1% (5,962)
FY2013	0% (19,657)	0% (4,243)	0.4% (5,167)
FY2014	0% (16,712)	0% (3,302)	0.1% (3,459)
FY2015	0% (12,205)	0% (2,783)	0% (1,813)
FY2016	0% (10,810)	0% (2,155)	0% (957)
FY2017	0% (8,275)	0.06% (1,579)	0% (499)
FY2018	0% (6,728)	0% (1,296)	0% (234)
FY2019	0% (5,349)	0% (1,052)	0% (149)
FY2020	0% (4,199)	0% (891)	0% (119)
FY2021	0% (2,991)	0% (794)	0% (125)
FY2022	0% (2,101)	0% (331)	0% (59)
FY2023 (As od September 30)	0% (2,267)	0% (511)	0% (0)

* Coverage: 17 prefectures including the Tokyo Metropolis designated as inspection targets in the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies," which compiles basic approaches concerning radioactive materials in foods

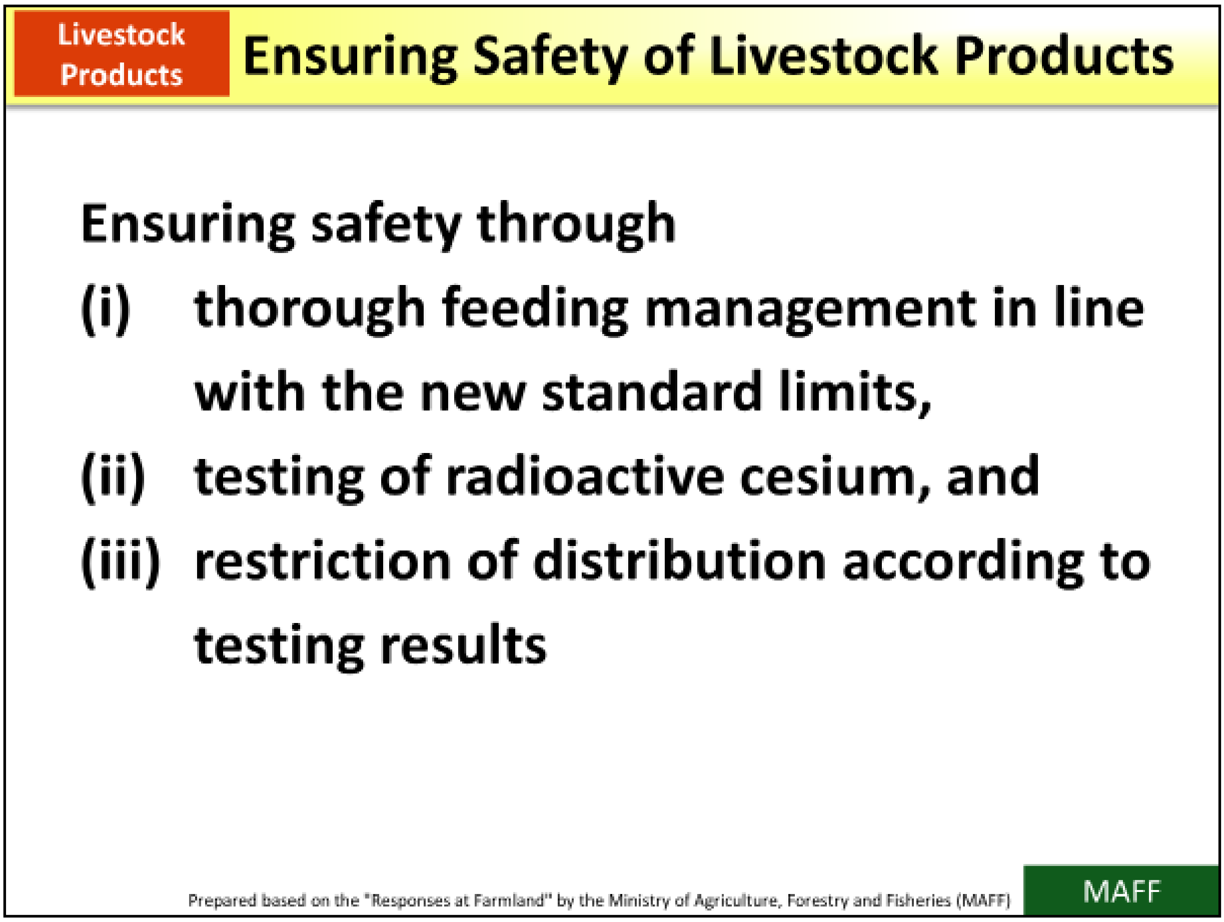
Prepared based on the "Inspection Results Concerning Radioactive Cesium Concentrations in Livestock Products" by the Ministry of Agriculture, Forestry and Fisheries and the "Inspection Results Concerning Radioactive Materials in Foods" by the Ministry of Health, Labour and Welfare

Upon production and shipment of vegetables, fruits and beans, measures to inhibit radioactive cesium absorption by the use of potassic fertilizer are taken (p.71 of Vol. 2, “Measures for Reducing Transfer of Radioactive Materials to Crops (2/5) - Measures to Inhibit Radioactive Cesium Absorption through Potassic Fertilization -”).

No vegetables and beans harvested in FY2015 onward have been found to contain radioactive cesium exceeding the standard limit up to September 2023.

No fruits harvested in FY2013 through to FY2016 were found to contain radioactive cesium exceeding the standard limit. There was one case where radioactive cesium exceeding the standard limit was detected among fruits harvested in FY2017, but there has been no such case for fruits harvested in FY2018 onward. This standard limit refers to 100 Bq/kg, which has been applied since April 2012 (in FY2011, provisional regulation values were applied, but tabulation is based on the current standard for the purpose of comparison with the results in and after 2012).

Included in this reference material on February 28, 2018
Updated on March 31, 2024



Measures for reducing radionuclides in livestock products include (i) thorough feeding management, such as feeding livestock with safe feed, (ii) testing of radioactive cesium before shipment, and (iii) restriction of distribution according to testing results. Through these measures, safety of livestock products has been ensured.

Included in this reference material on March 31, 2013

Livestock Products

Feed Management (1/2)

The reference values for radioactive cesium in feed were established in order to prevent distribution of any livestock products with radioactive cesium concentrations exceeding the standard limits (100 Bq/kg for general foods and 50 Bq/kg for milk).

	Reference value (Bq/kg)
Cattle	100
Pigs	80
Chickens	160
(Cultured fish	40)

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

MAFF

The reference values were established for feed by using radioactive cesium concentration as an indicator so that radioactive concentrations of livestock products would not exceed the standard limits.

Also for feed for cultured fish, the reference value was established in the same manner.

Included in this reference material on December 1, 2015
Updated on March 31, 2019

Livestock Products

Feed Management (2/2)

1. Thorough implementation of feeding management, including feeding forage (grass, hay, etc.) whose radiation levels are below the reference values

   and

2. Promotion of decontamination measures including inversion tillage in pastures where production of grass whose radiation levels are below the reference values is difficult

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

MAFF

On farms, thorough implementation of feeding management, including feeding forage whose radiation levels are below the reference values is ensured.

In pastures, efforts to produce forage crops whose radiation levels are below the reference values by decontamination measures, including inversion tillage, are making progress (p.70 of Vol. 2, “Measures for Reducing Transfer of Radioactive Materials to Crops (1/5) - Decontamination of Farmland -”).

Included in this reference material on December 1, 2015
Updated on March 31, 2017

Livestock Products

Inspections for Radioactive Cesium in Livestock Products

- Milk
  Inspections are conducted periodically by Fukushima Prefecture.
  This does not apply to cooler stations, etc. (i) in areas where feeding management is confirmed to be appropriate, (ii) where what is handled is only raw milk produced in areas whose distribution restrictions were lifted more than three years ago, and (iii) where inspection results for the latest three years are all below half of the standard limits.

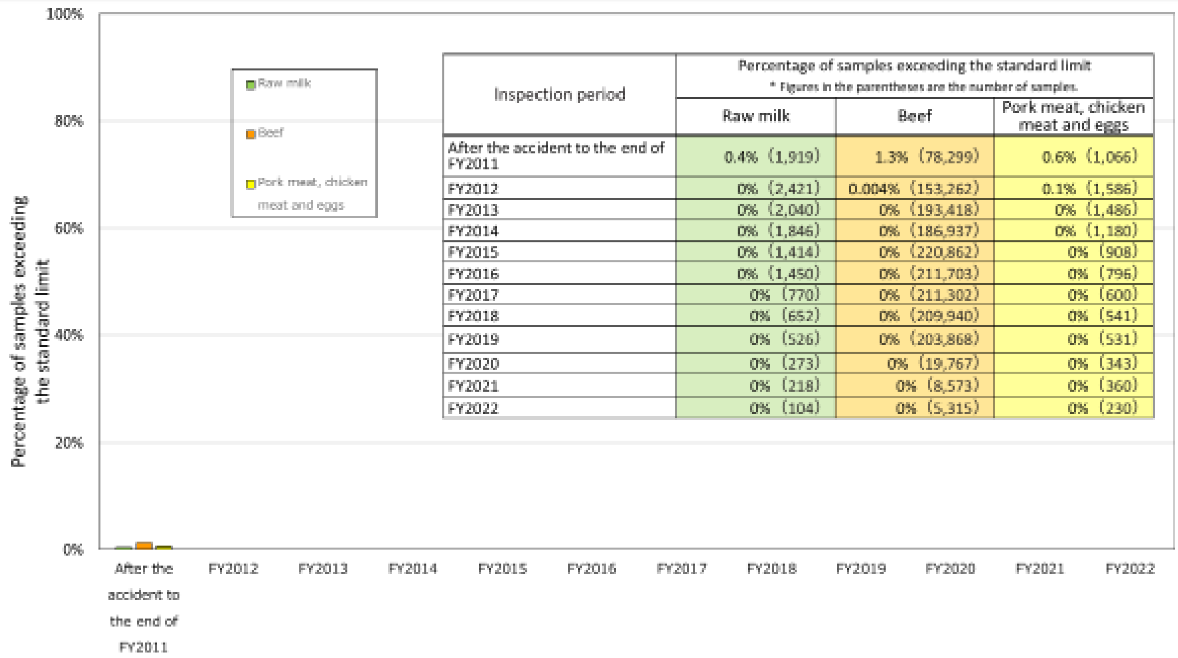
Prepared based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies" (March 30, 2023) by the Nuclear Emergency Response Headquarters

MAFF

Raw milk is also inspected periodically by Fukushima Prefecture.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Livestock Products | Changes in Inspection Results for Livestock Products



Inspection period	Percentage of samples exceeding the standard limit * Figures in the parentheses are the number of samples.		
	Raw milk	Beef	Pork meat, chicken meat and eggs
After the accident to the end of FY2011	0.4% (1,919)	1.3% (78,299)	0.6% (1,066)
FY2012	0% (2,421)	0.004% (153,262)	0.1% (1,586)
FY2013	0% (2,040)	0% (193,418)	0% (1,486)
FY2014	0% (1,846)	0% (186,937)	0% (1,180)
FY2015	0% (1,414)	0% (220,862)	0% (908)
FY2016	0% (1,450)	0% (211,703)	0% (796)
FY2017	0% (770)	0% (211,302)	0% (600)
FY2018	0% (652)	0% (209,940)	0% (541)
FY2019	0% (526)	0% (203,868)	0% (531)
FY2020	0% (273)	0% (19,767)	0% (343)
FY2021	0% (218)	0% (8,573)	0% (360)
FY2022	0% (104)	0% (5,315)	0% (230)

* Coverage: 17 prefectures including the Tokyo Metropolis designated as inspection targets in the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies," which compiles basic approaches concerning radioactive materials in foods

Prepared based on the "Inspection Results Concerning Radioactive Cesium Concentrations in Livestock Products" by the Ministry of Agriculture, Forestry and Fisheries and the "Inspection Results Concerning Radioactive Materials in Foods" by the Ministry of Health, Labour and Welfare

Feed for livestock is controlled to reduce radionuclides contained therein as low as possible.

■ Reference values for radioactive cesium concentrations in feed

Feed for cattle and horses: 100 Bq/kg
Feed for pigs: 80 Bq/kg
Feed for chickens: 160 Bq/kg
Feed for cultured fish: 40 Bq/kg

Since April 2011, inspection results for raw milk have all been below the standard limit of 50 Bq/kg. Regarding beef and pork meat, radioactive cesium concentrations exceeding the standard limit of 100 Bq/kg have not been detected since FY2013. Regarding chicken meat and eggs, radioactive cesium concentrations exceeding the standard limit have never been detected. Incidentally, these standard limits are those applied since April 2012 (in FY2011, provisional regulation values were applied, but tabulation is based on the current standard for the purpose of comparison with the results in and after 2012).

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Mushrooms and Wild Plants

Measures to Ensure Safety of Mushrooms and Non-Wood Forest Products

- ☐ Introduce safe production materials in order to reduce radioactive contamination
- ☐ Provide information on gathering of wild plants and mushrooms

Specific measures

1. Secure safe mushroom logs
   (Support for the purchase of mushroom logs and bed logs, matching of supply and demand of mushroom logs)
2. Decontaminate mushroom logs and bed logs and introduce makeshift greenhouses, etc.
3. Disseminate cultivation management in line with the guideline and give guidance therefor
4. Disseminate cultivation technology to reduce radioactive contamination
5. Provide information using the website and pamphlets and conduct guidance tours

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

MAFF

Other than wild plants and mushrooms for which cultivation management is impossible, shiitake mushrooms, etc. cultivated using mushroom logs show variation in radioactivity concentrations.

Therefore, measures to reduce contamination are being taken, such as implementing cultivation management in line with the "Guideline on Cultivation Management of Log-cultured Mushrooms to Reduce Radioactive Materials" for the purpose of ensuring that log-cultured mushrooms do not contain radioactive materials exceeding the standard limit for foods, and developing bed log washing machines necessary for cultivating safe mushrooms, etc.

In order to prevent distribution of wild plants and mushrooms with radioactivity concentrations exceeding the standard limit, each local government imposes distribution restrictions on producers and farmers markets and provides them with inspection results or other information.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Mushrooms and Wild Plants

Provisional Safety Standards for Mushroom Logs, etc. [Reference]

- Mushroom logs and beds may be distributed nationwide.
- In order to ensure the safety of supplied mushrooms, provisional safety standards for radioactive cesium concentrations for mushroom logs and beds were established.

Provisional safety standards (from April 2012)	
Mushroom logs and bed logs	50 Bq/kg
Culture media for beds and mushroom beds	200 Bq/kg

Bed logs: Mushroom logs wherein mushroom fungi are planted
Mushroom beds: Culture media mixed with sawdust and nutrients wherein mushroom fungi are planted

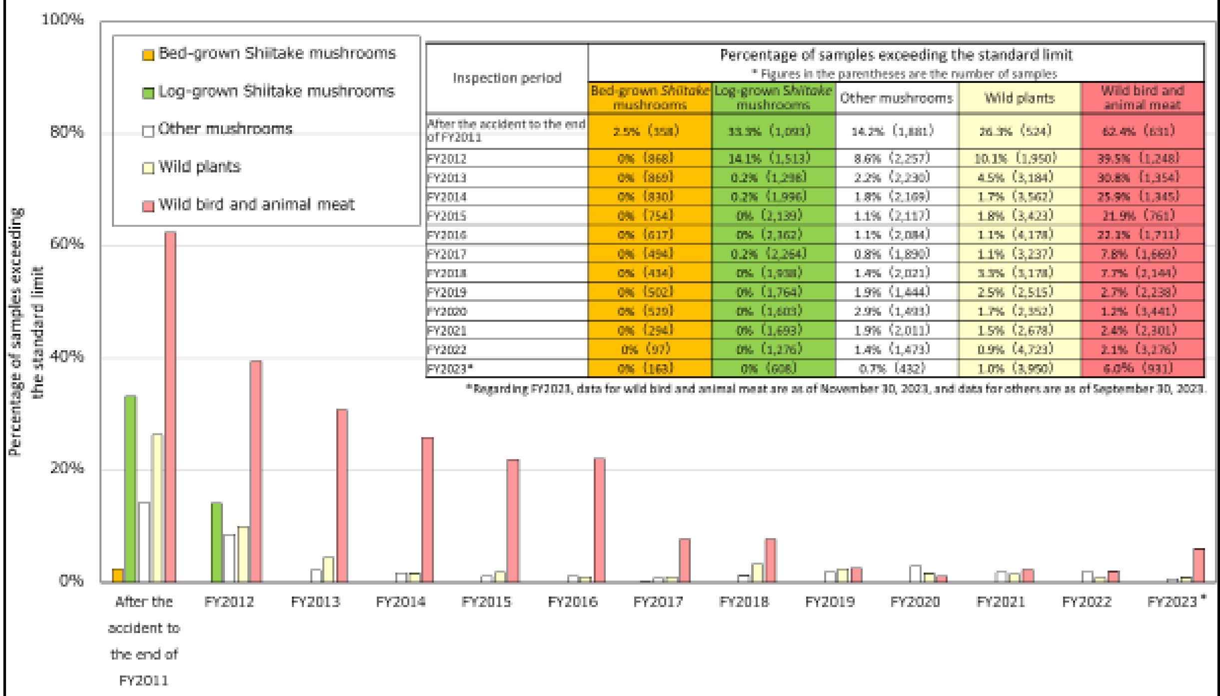
Prepared based on the "Responses at Farmland" by the Ministry of Agriculture, Forestry and Fisheries (MAFF)

MAFF

Mushroom logs and beds may be distributed nationwide in the same manner as livestock feeds. Therefore, in order to cultivate safe mushrooms, provisional safety standards for radioactive cesium concentrations were set at 50 Bq/kg for mushroom logs and bed logs and at 200 Bq/kg for mushroom beds, and they are managed properly so that contained radioactive materials do not exceed those standards.

Included in this reference material on March 31, 2013
Updated on March 31, 2021

Mushrooms, Wild Plants and Wild Bird and Animal Meat



Inspection period	Percentage of samples exceeding the standard limit * Figures in the parentheses are the number of samples				
	Bed-grown Shiitake mushrooms	Log-grown Shiitake mushrooms	Other mushrooms	Wild plants	Wild bird and animal meat
After the accident to the end of FY2011	2.5% (358)	33.3% (1,093)	14.2% (1,881)	26.3% (524)	62.4% (631)
FY2012	0% (868)	14.1% (1,513)	8.6% (2,257)	10.1% (1,950)	39.5% (1,248)
FY2013	0% (869)	0.2% (1,298)	2.2% (2,230)	4.5% (3,184)	30.8% (1,354)
FY2014	0% (830)	0.2% (1,996)	1.8% (2,169)	1.7% (3,562)	25.9% (1,345)
FY2015	0% (754)	0% (2,139)	1.1% (2,117)	1.8% (3,423)	21.9% (761)
FY2016	0% (617)	0% (2,162)	1.1% (2,084)	1.1% (4,178)	22.1% (1,711)
FY2017	0% (494)	0.2% (2,264)	0.8% (1,890)	1.1% (3,237)	7.8% (1,669)
FY2018	0% (434)	0% (1,938)	1.4% (2,021)	3.3% (3,178)	7.7% (2,144)
FY2019	0% (502)	0% (1,764)	1.9% (1,444)	2.5% (2,515)	2.7% (2,238)
FY2020	0% (529)	0% (1,603)	2.9% (1,493)	1.7% (2,352)	1.2% (3,441)
FY2021	0% (294)	0% (1,693)	1.9% (2,011)	1.5% (2,678)	2.4% (2,301)
FY2022	0% (97)	0% (1,276)	1.4% (1,473)	0.9% (4,723)	2.1% (3,276)
FY2023*	0% (163)	0% (608)	0.7% (432)	1.0% (3,950)	6.0% (931)

*Regarding FY2023, data for wild bird and animal meat are as of November 30, 2023, and data for others are as of September 30, 2023.

*Regarding FY2023, data for wild bird and animal meat are as of November 30, 2023, and data for others are as of September 30, 2023.

*Coverage: 17 prefectures including the Tokyo Metropolis designated as inspection targets in the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies," which compiles basic approaches concerning radioactive materials in foods

Prepared based on the "Inspection Results Concerning Radioactive Cesium Concentrations in Livestock Products" by the Ministry of Agriculture, Forestry and Fisheries and the "Inspection Results Concerning Radioactive Materials in Foods" by the Ministry of Health, Labour and Welfare

Regarding mushrooms, for which cultivation management is possible, thanks to efforts for securing safe logs and the introduction of makeshift greenhouses, etc., radioactive contamination has been reduced through the use of production materials in conformity to the standards. The percentage of mushrooms with radioactive concentrations exceeding the standard limit is decreasing. This standard limit refers to 100 Bq/kg, which has been applied since April 2012 (in FY2011, provisional regulation values were applied, but tabulation is based on the current standard for the purpose of comparison with the results in and after 2012).

■ Provisional safety standards regarding radioactive cesium for mushroom logs, bed logs, culture media for beds and mushroom beds
Mushroom logs and bed logs: 50 Bq/kg
Culture media for beds and mushroom beds: 200 Bq/kg

Radioactive concentrations exceeding the standard limit are still detected in some wild mushrooms and wild plants, for which cultivation management is difficult. Therefore, their shipment is thoroughly controlled continuously.

Wild bird and animal meat, such as boar meat and deer meat, still show radioactive concentrations exceeding the standard limit, although the number of such cases is on a decline. Feeding management like that for livestock animals is difficult for wild birds and animals that move around freely. Therefore, shipment of wild bird and animal meat is restricted by each prefecture in principle, and in some cases, only meat managed based on shipment and inspection policies formulated independently by respective local governments is permitted to be shipped out.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Fishery Products — Approach for Inspections of Fishery Products

○ **Monitoring is conducted once a week or so based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies"**

- **The fish species in which radioactive cesium exceeding 50 Bq/kg has been detected and major fishery products are intensively inspected.**
- **Inspection results of neighboring prefectures are taken into account.**

Coastal fish (e.g., Japanese sandlance, seabass, flounders, etc.)	Sea areas off prefectures are divided into zones in consideration of catch landing, fishery management and seasons, etc. and samples are collected at major ports.
Migratory fish (e.g., Skipjack tuna, sardines and mackerels, Pacific saury, etc.)	Fishing grounds are divided into zones off each prefecture from Chiba to Aomori (by lines extending along the prefectural borders to the east) in consideration of migration of fish, etc., and samples are collected at major ports of each zone.
Inland water fish (e.g., YAMAME (land-locked cherry salmon), Japanese smelt, Ayu sweetfish, etc.)	Prefectural areas are divided into zones appropriately in consideration of fishery rights, and samples are collected in major zones.

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

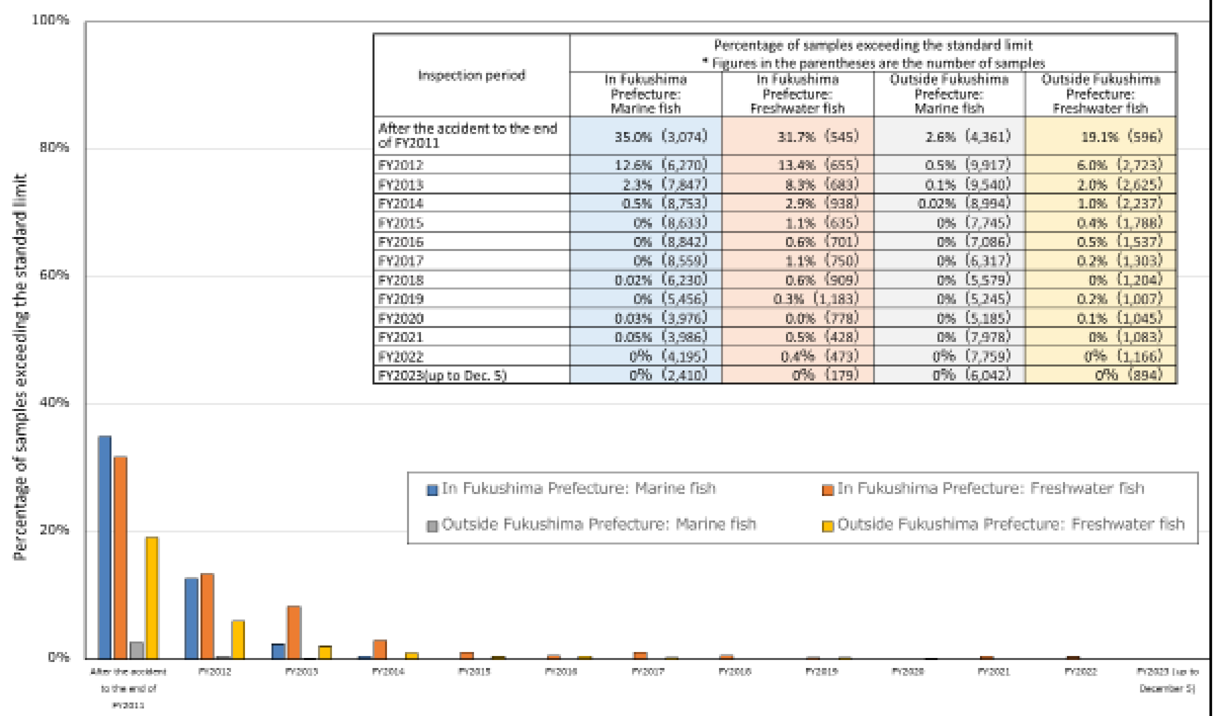
Monitoring of radioactivity in fishery products covers major fish species and fishing grounds, and species in which radioactive cesium concentration exceeding 50 Bq/kg has been detected, based on the "Concepts of Inspection Planning and Establishment and Cancellation of Items and Areas to which Restriction of Distribution and/or Consumption of Foods Concerned Applies (Guideline)."

At present, inspections are conducted by classifying the fish species based on their habitats and fishing seasons, while also taking into account inspection results of neighboring prefectures, as shown in the table. Regarding migratory fish, such as bonito and Pacific saury, which migrates over a wide area in the ocean, monitoring is conducted broadly by multiple prefectures based on their migratory routes.

Included in this reference material on March 31, 2013
Updated on March 31, 2021

Fishery Products

Chronological Changes in Inspection Results for Fishery Products



Inspection period	Percentage of samples exceeding the standard limit * Figures in the parentheses are the number of samples			
	In Fukushima Prefecture: Marine fish	In Fukushima Prefecture: Freshwater fish	Outside Fukushima Prefecture: Marine fish	Outside Fukushima Prefecture: Freshwater fish
After the accident to the end of FY2011	35.0% (3,074)	31.7% (545)	2.6% (4,361)	19.1% (596)
FY2012	12.6% (6,270)	13.4% (655)	0.5% (9,917)	6.0% (2,723)
FY2013	2.3% (7,847)	8.3% (683)	0.1% (9,540)	2.0% (2,625)
FY2014	0.5% (8,753)	2.9% (938)	0.02% (8,994)	1.0% (2,237)
FY2015	0% (8,633)	1.1% (635)	0% (7,745)	0.4% (1,788)
FY2016	0% (8,842)	0.6% (701)	0% (7,086)	0.5% (1,537)
FY2017	0% (8,559)	1.1% (750)	0% (6,317)	0.2% (1,303)
FY2018	0.02% (6,230)	0.6% (909)	0% (5,579)	0% (1,204)
FY2019	0% (5,456)	0.3% (1,183)	0% (5,245)	0.2% (1,007)
FY2020	0.03% (3,976)	0.0% (778)	0% (5,185)	0.1% (1,045)
FY2021	0.05% (3,986)	0.5% (428)	0% (7,978)	0% (1,083)
FY2022	0% (4,195)	0.4% (473)	0% (7,759)	0% (1,166)
FY2023(up to Dec. 5)	0% (2,410)	0% (179)	0% (6,042)	0% (894)

* Inspection results are tabulated on a nationwide basis.

Monitoring results from March 24, 2011 to December 5, 2023 tabulated by the Fisheries Agency

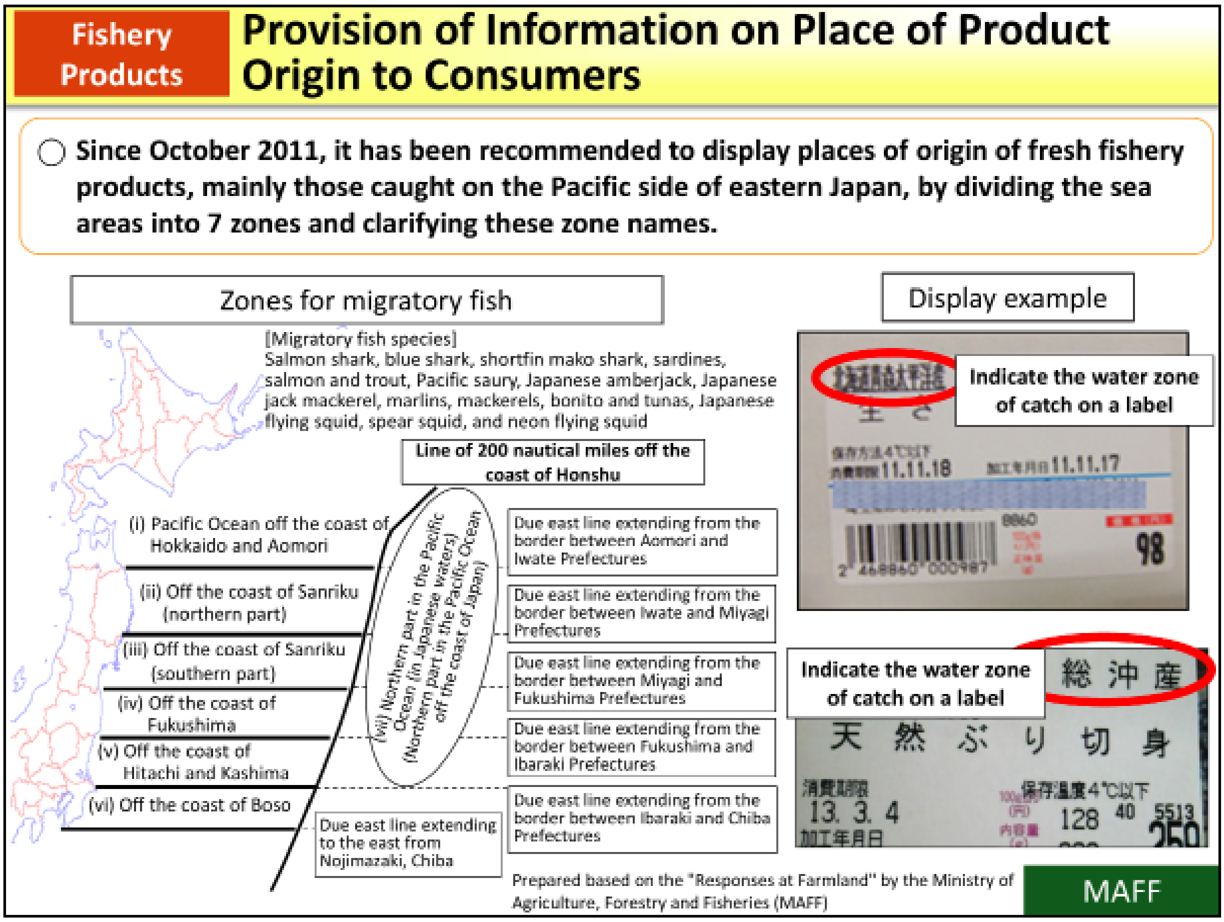
Monitoring of fishery products has been conducted in particular focusing on fish and shellfish which exceeded a radioactive cesium concentration of 50 Bq/kg or are the major products of the relevant prefectures. Monitoring is conducted once a week or so in principle. The number of fishery products exceeding the standard limit has been gradually decreasing.

Shortly after the Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS Accident, approx. 30% of the fishery samples collected in (the sea neighboring) Fukushima Prefecture exceeded the standard limit. Such samples decreased afterwards, and there have been only four samples exceeding the standard limit since April 2015. Since September 2014, there have been no samples collected in prefectures other than Fukushima Prefecture that contained radioactive cesium exceeding the standard limit.

Some freshwater fish caught in and outside Fukushima Prefecture still show radioactive cesium concentrations exceeding the standard limit even in FY2022, but the number of such fish is decreasing year by year.

The standard limit refers to 100 Bq/kg, which has been applied since April 2012 (in FY2011, provisional regulation values were applied, but tabulation is based on the current standard for the purpose of comparison with the results in and after 2012).

Included in this reference material on February 28, 2018
Updated on March 31, 2024



Since October 2011, the national government has been encouraging producers to display places of origin of fresh fishery products, mainly those caught on the Pacific side of eastern Japan so that consumers can easily understand where the relevant fishery product was caught.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Import Measures by Other Countries

Outline of Lifting and Easing of Food Import Measures by Other Countries and Regions after the TEPCO's Fukushima Daiichi NPS Accident

Status of countries and regions introduced import measures on Japanese food after the TEPCO's Fukushima Daiichi Nuclear Power Station accident

In response to the accident at TEPCO's Fukushima Daiichi NPS, countries and regions all over the world imposed various measures on imports from Japan. However, as a result of all-out efforts by the government of Japan, such regulatory measures have been lifted or eased (out of the 55 countries and regions that imposed measures, 48 lifted measures, while 7 continue imposing them).

Details of regulatory measures (Number of countries and regions)		Name of countries or regions
Completely lifted import measures (48)		Canada, Myanmar, Serbia, Chile, Mexico, Peru, Guinea, New Zealand, Colombia, Malaysia, Ecuador, Viet Nam, Iraq, Australia, Thailand, Bolivia, India, Kuwait, Nepal, Iran, Mauritius, Qatar, Ukraine, Pakistan, Saudi Arabia, Argentina, Turkey, New Caledonia, Brazil, Oman, Bahrain, Congo DR, Brunei, Philippines, Morocco, Egypt, Lebanon, UAE, Israel, Singapore, USA, UK, Indonesia, EU, Iceland, Norway, Switzerland, Liechtenstein
Continuing import measures (7)	Suspended import of items from some prefectures (5)	China, Hong Kong, Macau, South Korea, Taiwan
	Requests issuance of inspection certificates for items from some or all prefectures (2)	Russia, French Polynesia

* As of October 16, 2023; Classification in accordance with the details of the regulatory measures; Prefectures in Japan and items subject to respective regulatory measures differ by country or region.

Import ban on Japanese food by countries and regions after discharge of ALPS treated water

Some countries and regions introduced import ban after discharge of ALPS treated water.

Type of measures and number of countries or regions		Name of countries or regions
Import ban after discharge (4)	Import ban on fishery products from all the prefectures	China, Russia
	Import ban on fishery products etc. from 10 prefectures	Hong Kong
	Import ban on fresh food etc. from 10 prefectures	Macau

* As of October 16, 2023; Measures such as reinforcement of import inspection on Japanese fishery products are conducted by Thailand and Malaysia.

MAFF

In response to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, countries and regions all over the world imposed various measures on imports from Japan. However, as a result of all-out efforts by the government of Japan, such regulatory measures have been eased or lifted. The number of countries or regions imposing measures has decreased from 55 immediately after the accident to 7.

Following the discharge of ALPS treated water into the sea, China imposed a total ban on imports of Japanese fishery products in August 2023, and Hong Kong and Macau suspended imports of fishery products, etc. from ten prefectures in Japan. In October, Russia joined China's restrictive measures against supply of fisheries products from Japan.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Chapter 9

Efforts toward Environment Restoration after the Accident

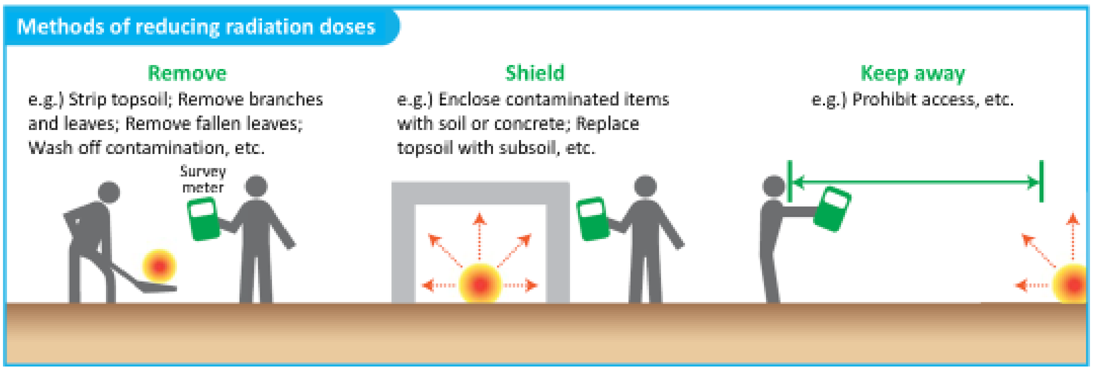
Chapter 9 explains efforts toward environment restoration after the accident, such as measures against environmental contamination by radioactive materials discharged due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and transition of Areas under Evacuation Orders.

You can understand how to restore areas contaminated with radioactive materials, how to treat waste, and what measures are being taken at present in Areas under Evacuation Orders and surrounding areas.

Decontamination

Reduction of Radiation Doses

Radioactive materials released into the air due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS fell onto the ground with rain, etc. and adhered to soil, vegetation, and buildings in people's living environment. Soil and vegetation, etc. thus contaminated are being removed through decontamination work. Removed soil and vegetation, etc. are shielded to prevent them from affecting the surroundings, thereby reducing radiation doses people receive from the environment.



Prepared based on the website, "Environmental Remediation," of the Ministry of the Environment

Radioactive materials released into the air due to the accident at TEPCO's Fukushima Daiichi NPS fell onto the ground with rain, etc. and adhered to buildings, soil, and vegetation, etc. across a wide area. Therefore, the national government has been striving to reduce additional exposure doses through decontamination such as removing those released radioactive materials.

There are three methods of reducing additional exposure doses to remove, to shield, and to keep away radioactive materials. Combination of these methods can reduce additional exposure doses efficiently.

The first is to remove radioactive materials adhering to soil, vegetation or buildings, etc. from people's living environment by such means as stripping topsoil, removing tree leaves, branches and fallen leaves, and washing and cleaning the surface of buildings.

The second is to cover radioactive materials with soil, etc. thereby shielding radiation and reducing ambient doses and exposure doses accordingly.

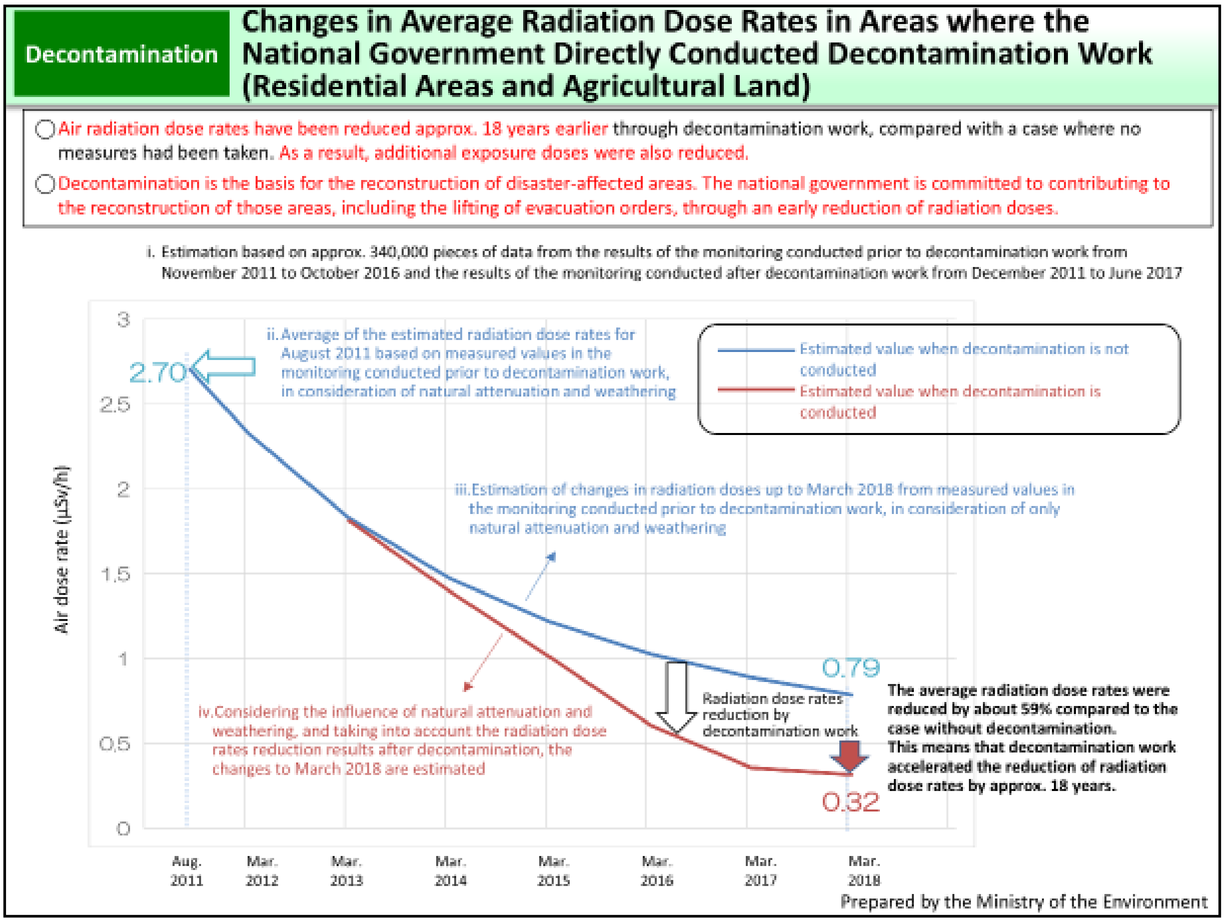
The third is to take advantage of the characteristic of radiation that the radioactivity intensity reduces as the distance increases (in inverse proportion to the square of the distance from the relevant radioactive material) (p.50 of Vol. 1, "Characteristics of External Exposure Doses").

If radioactive materials are kept away from people, exposure doses can be reduced. Therefore, one option is to prohibit access to places where radioactive materials exist.

These methods are combined and employed to reduce people's additional exposure doses.

(Related to p.176 of Vol. 1, "Three Principles of Reduction of External Exposure")

Included in this reference material on March 31, 2013
Updated on February 28, 2018



This figure shows radiation dose attenuation of accident-derived radioactive materials as estimated based on approx. 340,000 data from the results of the monitoring conducted prior to decontamination work from November 2011 to October 2016 and the results of the monitoring conducted after decontamination work from December 2011 to June 2017.

The blue line on the graph shows radiation dose rates estimated based on the values of August 2011 taking into account only the effects of natural attenuation and weathering (natural factors such as wind and rain). The red line on the graph shows radiation dose rates estimated including the effects of decontamination. Comparing both air dose rates in March 2018 shows that decontamination has reduced the average air dose rate by about 59%. This means that the reduction of radiation dose rates was accelerated by approx. 18 years through decontamination work.

Thus, through further decontamination combined with natural attenuation of radioactive materials and other factors, radiation doses could be reduced at an earlier stage.
(Related to p.11 of Vol. 1, “Half-lives and Radioactive Decay”)

Included in this reference material on March 31, 2014
Updated on March 31, 2024

This figure explains specific decontamination methods.

Even in areas where radiation doses are relatively low, fallen leaves and dirt containing radioactive materials are apt to accumulate under the leaves or in gutters of houses or in ditches on the street, causing higher ambient doses in the surrounding areas. At such locations, fallen leaves and dirt are removed and the relevant places are washed and cleaned.

There are areas where radioactive materials adhere to the shrubbery, underbrush or fallen leaves. Radioactive materials are removed through mowing of vegetation, pruning and removal of fallen leaves.

In areas where radiation doses are relatively high, other decontamination methods, in addition to those employed at areas with relatively low radiation doses, may need to be employed. For example, as radioactive materials mostly exist within a layer a few centimeters below the ground surface, effects of radioactive materials can be mostly diminished by stripping topsoil (for example, to a depth of 5 cm) or replacing topsoil with subsoil.

Areas where radioactive materials adhere to roofs and walls of buildings or on the paved road, relevant parts are washed and cleaned but such method may not be effective in cases where radioactive materials adhere firmly depending on the nature of their raw materials.

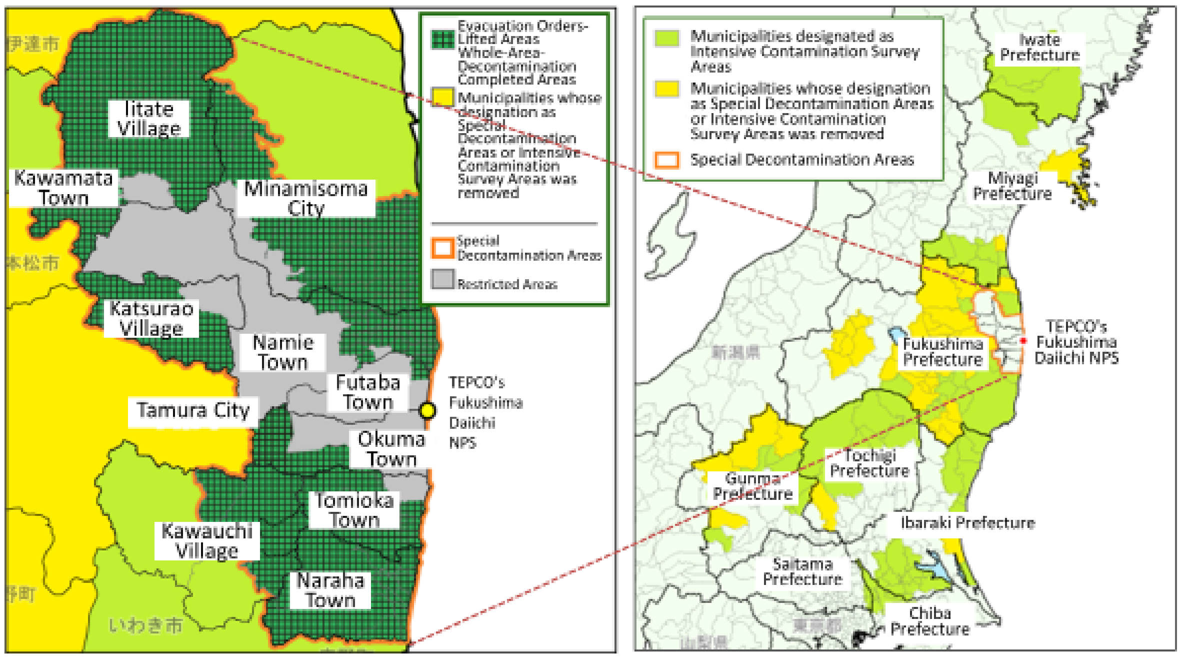
For farmland, proper methods need to be selected in consideration of the effects on agricultural products, as well as the effects on people due to exposure. In farmland plowed after the accident, radioactive materials exist little deeper from the ground surface. However, if all contaminated soil is removed, the farmland becomes unsuitable for farming. Therefore, at such farmland, various methods such as deep tillage (plowing soil as deep as 30 cm in principle) or inversion tillage (replacing topsoil with subsoil) (p.70 of Vol. 2, “Measures for Reducing Transfer of Radioactive Materials to Crops (1/5) - Decontamination of Farmland -”) are being employed.

Included in this reference material on March 31, 2013
Updated on February 28, 2018

Decontamination

Special Decontamination Areas and Intensive Contamination Survey Areas

Special Decontamination Areas | Intensive Contamination Survey Areas



As of December 31, 2023

Prepared based on the website, "Environmental Remediation," of the Ministry of the Environment

After the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, the Diet enacted the Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the Nuclear Power Station Accident Associated with the Tohoku District - Off the Pacific Ocean Earthquake that Occurred on March 11, 2011 (Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials) in August 2011.

Special Decontamination Areas and Intensive Contamination Survey Areas were designated as areas where decontamination is to be conducted under this Act on Special Measures.

Special Decontamination Areas are areas where the national government directly conducts decontamination work. 11 municipalities in Fukushima Prefecture which were once designated as a Restricted Area or a Deliberate Evacuation Area were designated as Special Decontamination Areas.

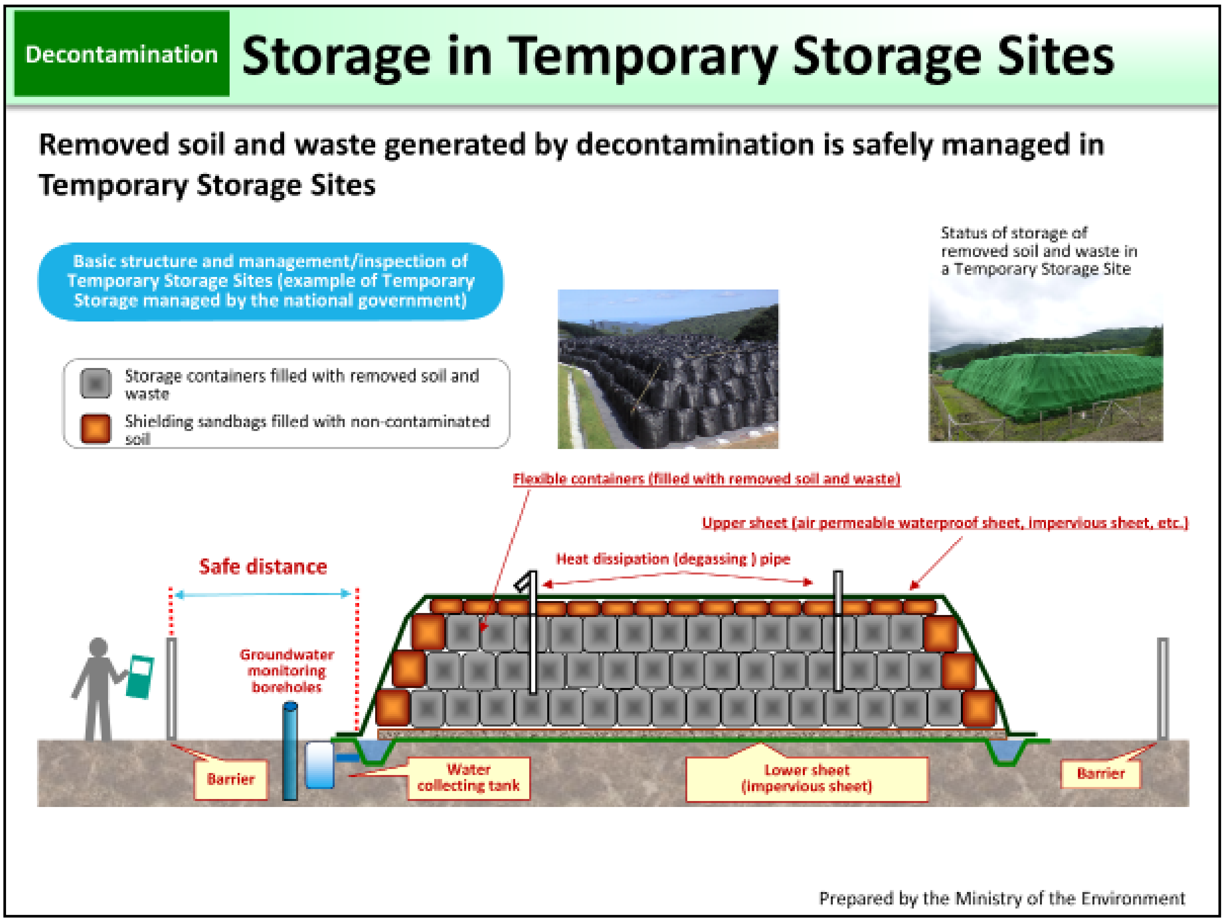
Intensive Contamination Survey Areas are areas where municipalities take the initiative in decontamination work, and a total of 104 municipalities in eight prefectures were designated as such. The national government has taken financial measures and technical measures to assist with decontamination work in these municipalities.

Whole area decontamination work was completed in all municipalities designated as Special Decontamination Areas by the end of March 2017. Thereafter, by the end of March 2018, whole area decontamination work was completed in all 100 municipalities in eight prefectures including Intensive Contamination Survey Areas, except for Restricted Areas.

In cases that there are any points where the effects of decontamination are not maintained after the completion of whole area decontamination work, causes are to be ascertained to the extent possible depending on the circumstances of individual points, and follow-up decontamination is to be conducted when it is found necessary by comprehensively taking into consideration the spread of the contamination and the effects and feasibility of decontamination work, in addition to additional exposure doses.

In Special Decontamination Areas, evacuation orders were all lifted by March 4, 2020, for all Habitation Restricted Areas and Preparation Areas for Lift of Evacuation Orders, and the designation as a Special Decontamination Area for Tamura City was removed in March 2022. Additionally, in Intensive Contamination Survey Areas, it was confirmed that radiation doses decreased to below 0.23 μSv/h in 36 municipalities by the end of December 2023, and the designation as Intensive Contamination Survey Areas was removed for these municipalities.

Included in this reference material on March 31, 2013
Updated on March 31, 2024



The soil and waste removed through decontamination work (removed soil and waste) are stored and managed temporarily on site or at Temporary Storage Sites.

Specifically, removed soil and waste are put in a container (flexible container, etc.) and placed on an impervious layer (impervious sheet, etc.), and is shielded sufficiently by such methods as placing sandbags filled with uncontaminated soil around the site to reduce ambient dose rates at the boundary to the same level as that in the surrounding areas.

Additionally, the site is covered with an impervious sheet, etc., thereby preventing scattering and leakage of removed soil and waste and further preventing infiltration of rainwater and resulting contamination of groundwater, etc.

Radiation doses at the site and radioactivity concentrations in groundwater are measured regularly.

Furthermore, from the perspective of keeping the site away from the public (securing distance), public access to the site is prohibited, and shortening of working hours and other measures are also considered from the perspective of reducing workers' exposure to radiation (p.176 of Vol. 1, "Three Principles of Reduction of External Exposure").

Included in this reference material on March 31, 2013
Updated on March 31, 2023

Decontamination

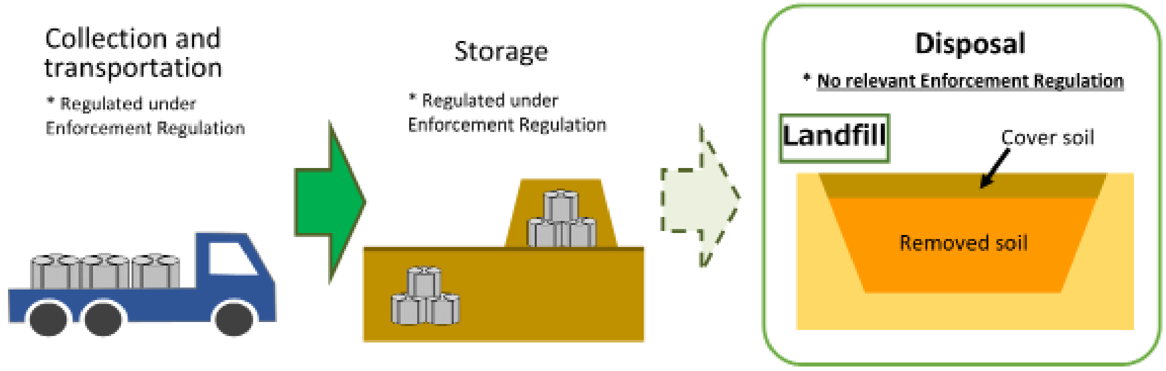
Status of Removed Soil Outside Fukushima Prefecture

○ Removed soil outside Fukushima Prefecture has been stored safely by respective municipalities based on the storage methods regulated by the national government.

○ Municipalities are to follow the disposal methods regulated by the national government, if they collect removed soil and dispose of it by means of landfill in the future.

○ However, specific disposal methods have not been determined, and the national government is required to specify disposal methods by Enforcement Regulation.

→ At present, the Study Team on Disposal of Removed Soil, which consists of intellectuals, is deliberating on disposal methods from professional standpoints. Furthermore, demonstration projects on landfill disposal have been implemented in Tokai Village in Ibaraki Prefecture, Nasu Town in Tochigi Prefecture, and Marumori Town in Miyagi Prefecture.



Prepared by the Ministry of the Environment

Removed soil outside Fukushima Prefecture has been stored safely by respective municipalities (decontamination entities) based on the storage methods regulated by the national government.

Municipalities are to follow the disposal methods regulated by the national government, in case of disposing of removed soil by means of landfill.

However, specific disposal methods have yet to be determined, and the national government is required to specify disposal methods by an Enforcement Regulation, etc.

Accordingly, the Ministry of the Environment (MOE) established the Study Team for Disposal of Removed Soil, which consists of intellectuals, in December 2016, and the Study Team has been continuing deliberations from professional standpoints. Furthermore, the MOE has been implementing demonstration projects on landfill disposal at three locations, Tokai Village in Ibaraki Prefecture, Nasu Town in Tochigi Prefecture (completed in March 2020), and Marumori Town in Miyagi Prefecture, with the aim of confirming influence on the workers and surrounding environments in case of disposing of removed soil by means of landfill.

Based on the results of the demonstration projects and deliberations by the Study Team, the national government will establish a necessary Enforcement Regulation and Guidelines.

Included in this reference material on March 31, 2019
Updated on March 31, 2023

Decontamination	Comprehensive Efforts to Restore Forests and Forestry in Fukushima

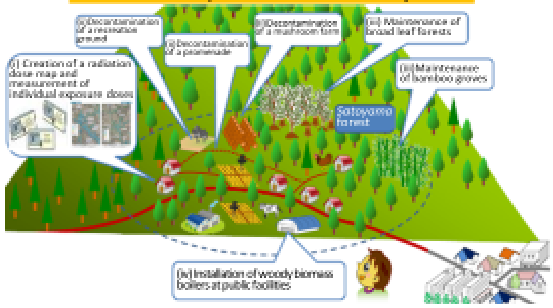
I. Efforts toward regeneration of forests and forestry

1. Efforts for ensuring safe and secure living environment
- Steadily continue decontamination work for forests near people's houses, etc.
- For residential areas surrounded by forests on three sides, taking measures as necessary, such as decontaminating forests 20m or further from the border or installing barriers to prevent soil runoff

3. Efforts for regenerating forestry in mountainous areas, etc.
- Promote a project to conduct tree thinning or other forest maintenance work together with measures concerning radioactive materials, and a demonstration project aiming for regeneration of forestry
- Newly prepare a guidebook on radiation safety that is easy to understand for workers

2. Efforts for restoring *Satoyama* forests close to residential houses
- Based on needs of local people, decontamination was conducted properly at places in the forest where residents enter for recreation or daily use; Make efforts for regenerating forestry in broad leaf forests and bamboo groves, etc.
- Select model districts in and around Areas under Evacuation Orders (including areas where evacuation orders have been lifted), comprehensively promote efforts for restoring *Satoyama* forests in those model districts, and reflect the outcomes of such efforts in carrying out further appropriate measures. (*In FY2020 onward, efforts for restoring *Satoyama* forests will be continued by expanding the coverage as the *Satoyama* Restoration Projects.)

Picture of *Satoyama* Restoration Model Projects



II. Future-oriented efforts for research and studies

- Continuously engage in research and studies for monitoring radiation doses in the forest, understanding behavior of radioactive materials and reducing radiation doses; Continue efforts for regeneration of forests and forestry into the future while utilizing the outcomes of such research and studies in formulating further measure

III. Information provision and communication

- Meticulously provide the latest information regarding knowledge on radioactive materials in forests and the national government's efforts toward regeneration of forests and forestry, using such media as relevant ministries' websites and PR magazines
- Continue efforts for ensuring safe and secure lives of the people in Fukushima through maintaining good communication, including dispatching experts

Prepared by the Ministry of the Environment

In addition to decontamination, comprehensive efforts for regenerating the forestry industry and ensuring safe and secure lives of the residents are indispensable for the regeneration of forests and forestry in Fukushima Prefecture. Based on the guideline, "Comprehensive Efforts to Restore Forests and Forestry in Fukushima," which was compiled by the Reconstruction Agency, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of the Environment in March 2016, relevant ministries and agencies have been carrying out measures comprehensively for those purpose, while obtaining the understanding of the people in Fukushima. The Reconstruction Agency, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of the Environment jointly conducted the *Satoyama* Restoration Model Project in 14 municipalities (Kawamata Town, Hirono Town, Kawauchi Village, Katsurao Village, Soma City, Nihonmatsu City, Date City, Tomioka Town, Namie Town, Iitate Village, Tamura City, Minamisoma City, Naraha Town, and Okuma Town) based on the guideline, and the outcome was compiled and published in November 2020. Since FY2020, efforts for restoring *Satoyama* forests have been continued as the "*Satoyama* Restoration Projects" by expanding the coverage to 48 municipalities.

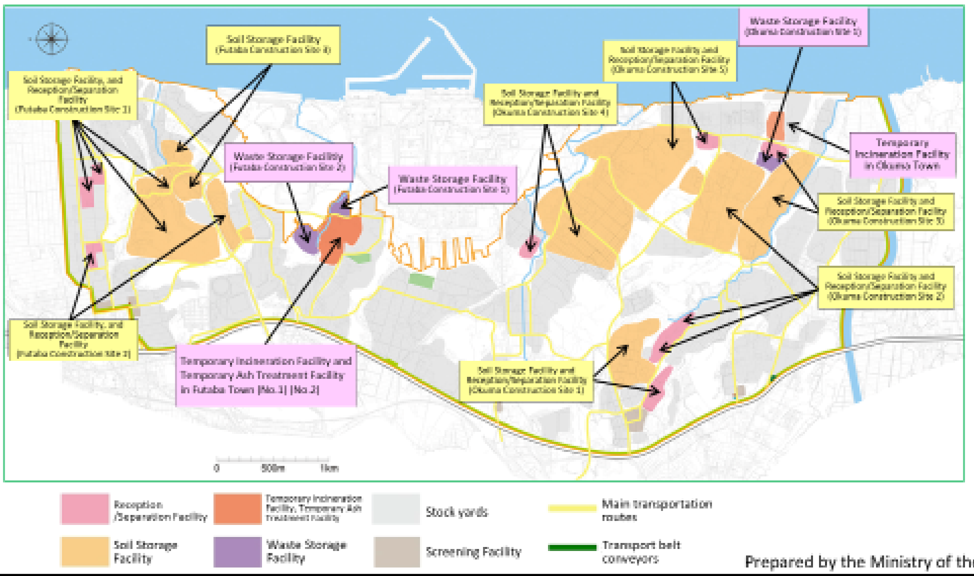
According to the knowledge obtained at the investigative committee on remediation established in the Ministry of the Environment, it is found that removal of sedimentary organic materials at locations 20m or further from the border of the forest adjacent to houses and farmland, etc. has little effect in reducing air dose rates at the forest border. Also, broad removal of sedimentary organic materials in forests may even make things worse, in ways such as increasing bad effects on trees due to causing erosion of dirt, etc. containing radioactive cesium or impoverishing the soil. Accordingly, under the basic policy to prioritize areas especially necessary from the perspective of protecting human health, decontamination of forests has been conducted within approx. 20m from the borders of the forests adjacent to houses or farmland, etc., in principle.

Included in this reference material on March 31, 2017
Updated on March 31, 2022

Interim Storage Facility

Interim Storage Facility for Removed Soil and Waste

- The Interim Storage Facility (ISF) was built to safely and intensively manage and store removed soil, waste, and incinerated ash (>100,000 Bq/kg) generated by decontamination in Fukushima Prefecture, until final disposal outside the prefecture within 30 years from the start of transportation to the Interim Storage Facility.
- The total area of the planned site for the ISF is approx. 1,600 ha (almost the same as the area of Shibuya City in Tokyo). Okuma Town and Futaba Town agreed to the request to build the facility, which was a very important decision. The Ministry of the Environment will continue to work on the ISF project with a "Safety First" approach.
- A cumulative total of 13.75 million m^3 of removed soil and waste generated due to decontamination work in Fukushima Prefecture (including Restricted Areas) had been transported to the ISF as of the end of December 2023.



Prepared by the Ministry of the Environment

At the ISF, the following are to be stored:

(i) Removed soil and waste (e.g. fallen leaves and branches, etc.) generated due to decontamination work in Fukushima Prefecture;

(ii) Incineration ash with radioactivity concentration exceeding 100,000 Bq/kg.

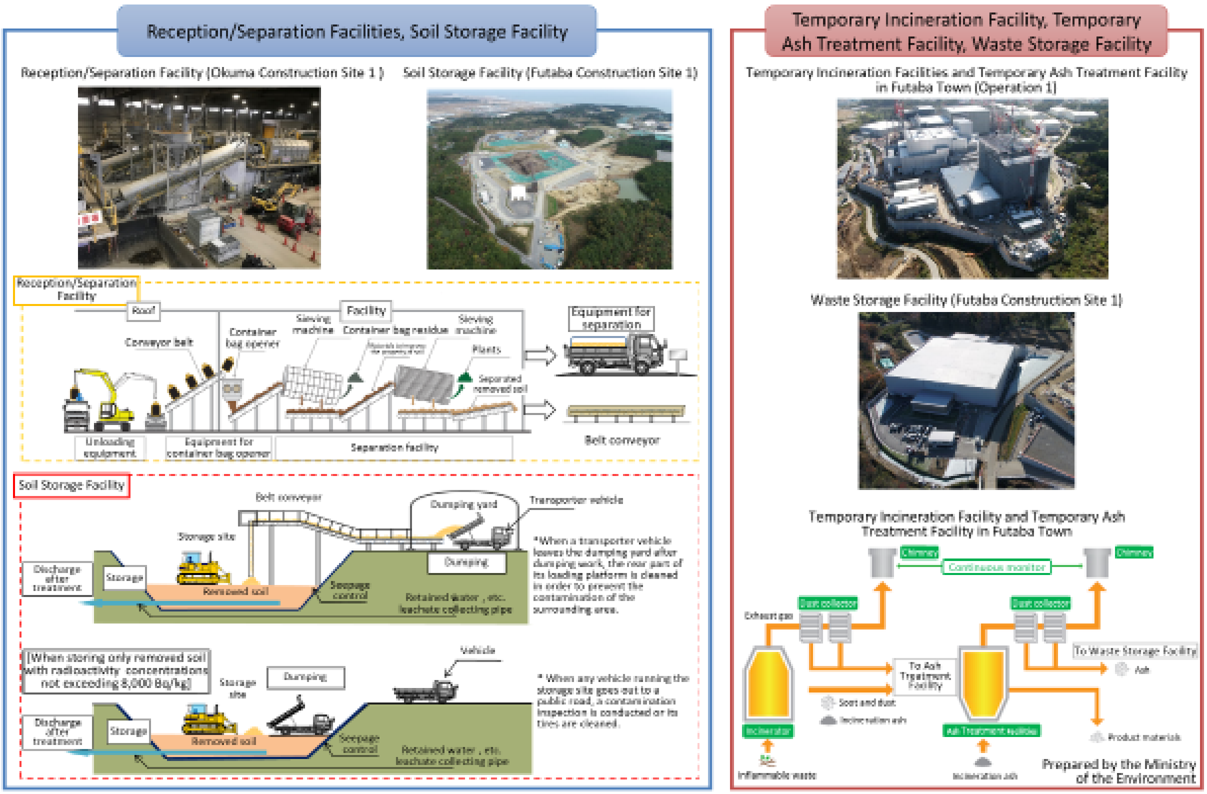
The ISF is a facility to safely and intensively manage and store the above until final disposal outside the prefecture within 30 years after the commencement of interim storage. It is comprised of Reception/Separation Facilities, Soil Storage Facilities, and Waste Storage Facilities, etc.

Consent to accept the construction of the ISF was obtained from Fukushima Prefecture in September 2014 and from Okuma Town and Futaba Town in January 2015. The total area of the planned site is approx. 1,600 ha, which is almost the same area as Shibuya City in Tokyo. By the end of December 2023, the national government acquired land of approx. 1,296 ha (approx. 81.0% of the total sites). With regard to land acquisition, the national government considers not only a relationship of trust with landowners but also the obtaining of understanding on the ISF project to be of utmost importance, and the national government is committed to continuing efforts while providing sufficient explanations to landowners.

Included in this reference material on January 18, 2016
Updated on March 31, 2024

Interim Storage Facility

Construction of Interim Storage Facility



The Reception/Separation Facilities receive the removed soil and waste which is transported from the Temporary Storage Sites in Fukushima Prefecture to the ISF. The soil and waste are unloaded from trucks, taken out from container bags and separated into combustibles and incombustibles. The Soil Storage Facilities store the soil treated at the Reception/ Separation Facilities safely in accordance with their radioactivity concentrations and other properties. As waste-related facilities, Temporary Incineration Facilities, Temporary Ash Treatment Facilities, and Waste Storage Facilities are also constructed. At Temporary Incineration Facilities, decontamination waste, disaster waste, and plants, etc. that are combustible are incinerated to minimize the volume. Generated incineration ash, etc. are melted at Temporary Ash Treatment Facilities to further reduce volume. Ash generated at Temporary Ash Treatment Facilities is encapsulated in square steel containers and stored at Waste Storage Facilities made of reinforced concrete, etc.

Construction of these facilities was commenced first for Reception/Separation Facilities and Soil Storage Facilities in November 2016. Then, reception and separation of the removed soil and waste started in June 2017 and storage of the soil sorted out started at the completed Soil Storage Facilities in October 2017. In March 2020, the ISF commenced operations of facilities for all processes of the treatment and storage of removed soil and waste.

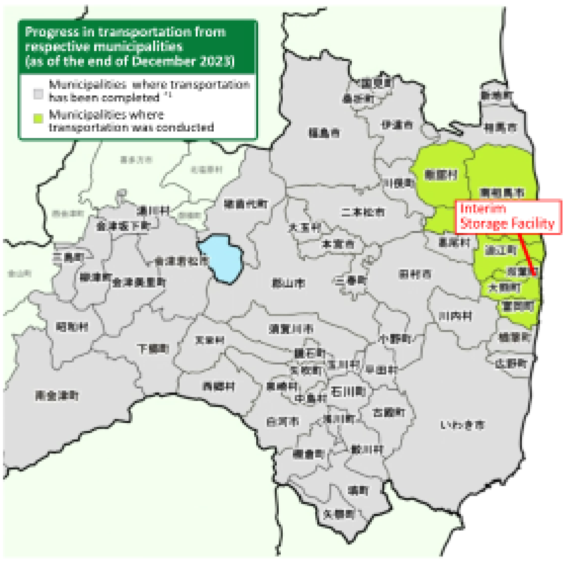
At these facilities, safety measures to prevent scattering and leakage of radioactive materials are taken. At the Reception/Separation Facilities, scattering of radioactive materials to outside of the facilities is being prevented by roofs, walls, and double doors and through negative pressure control. Floors are structured not to allow permeation of a liquid for the purpose of preventing contaminated water, etc. from permeating into groundwater. At Soil Storage Facilities, scattering of radioactive materials is prevented by watering, and covering with soil, and permeation into groundwater is prevented by seepage control. Leachate, etc. generated at these facilities is treated properly at a leachate treatment facility and is discharged after water quality management.

Included in this reference material on February 28, 2018
Updated on March 31, 2023

Interim Storage Facility

Transportation of Removed Soil and Waste

- ○ Transportation of the soil and waste from Temporary Storage Sites (TSS) to the Interim Storage Facility (ISF) has been implemented mostly using 10-ton dump trucks.
- ○ Transportation was commenced at the end of FY2014. In FY2023, removed soil and waste will be transported from 11 municipalities, and transportation of removed soil and waste generated in Specified Reconstruction and Revitalization Base Areas will also be promoted. Additionally, methods of transporting removed soil and waste directly to the ISF without going through a Temporary Storage Site will be considered.
- ○ Safe and secure transportation is being conducted through managing the whole amount of material to be transported and operation of trucks used for transportation, and conducting environmental monitoring, etc.
- ○ Approx. 13,750,000 m^3 of removed soil and waste (including those in Restricted Areas) has been transported to the ISF (as of the end of December 2023).



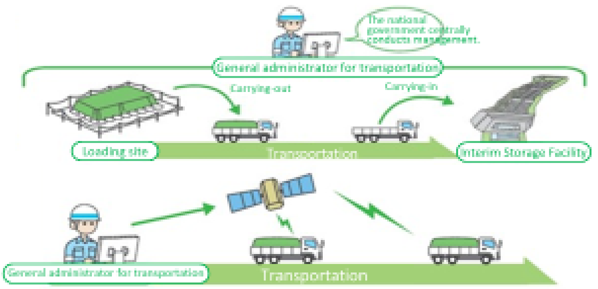
Management and monitoring of transportation

Management of the whole amount of material to be transported

- Objects to be transported from Temporary Storage Sites are all managed centrally by the unit of storage container.

Management of operation of trucks used for transportation

- Positional information, etc. of trucks is ascertained on a real-time basis by the use of GPS or other means.
- Instructions concerning schedule adjustments and route changes depending on circumstances.



*1 If any waste that needs to be transported is generated in the future, transportation will be resumed.

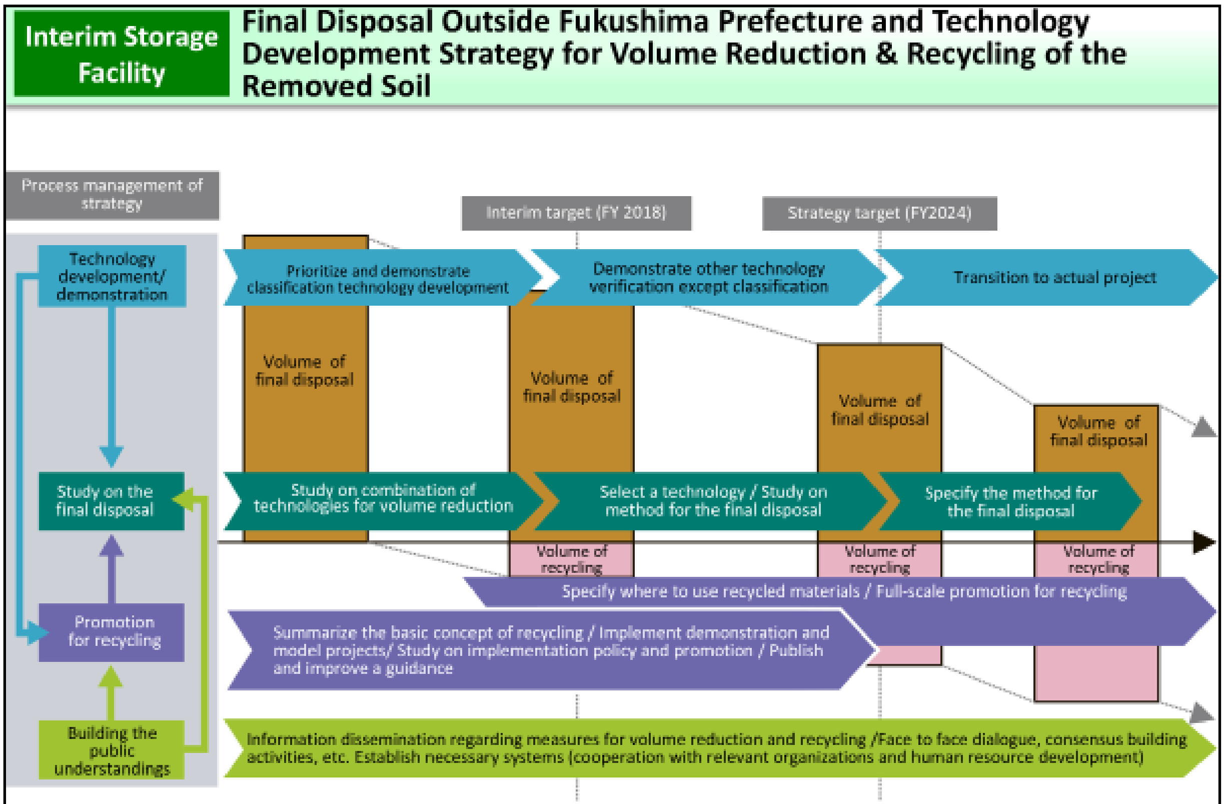
Prepared by the Ministry of the Environment

In line with the FY2023 Policies for the Interim Storage Facility (ISF) Project published on March 1, 2023, transportation of removed soil and waste generated in Specified Reconstruction and Revitalization Base Areas, etc. will be promoted. Additionally, methods of transporting removed soil and waste directly to ISF without using a Temporary Storage Site will be discussed. As of the end of December 2023, an accumulative total volume of approx. 13,750,000 m^3 of the removed soil and waste had been transported to the ISF.

Transportation is being conducted on a safety-first policy. Main traffic safety measures are as follows.

1. Training for new and current employees: Training on transportation of removed soil and waste to the ISF is provided to drivers of transport vehicles and other workers newly employed. In addition, current employees who are already engaging in transportation must also take refresher training every fiscal year.
2. Pre-driving of transportation routes: All drivers drive the transportation routes in advance to mutually check high-risk spots and things to be noted.
3. On-site checking of driving status: At spots where attention should be paid for speeding or heavily trafficked spots, etc., driving status of trucks transporting removed soil and waste is checked (including on their way back).
4. Commendation of superior drivers: With the aim of improving and maintaining drivers' motivation and safety awareness, superior driver certificates (displayed on helmets and dashboards) are given to drivers who conducted transportation safely for 100 days or longer via contractors.

Included in this reference material on February 28, 2018
Updated on March 31, 2024



(Source) Ministry of the Environment

(Figure) Outline of the "Technology Development Strategy for Volume Reduction & Recycling of the Removed Soil under Interim Storage"

Prepared by the Ministry of the Environment

The Interim Storage Facility (ISF) was established based on a very difficult decision made by the local people of Fukushima Prefecture. Fukushima Prefecture was most seriously damaged due to the nuclear accident and people of the prefecture have been forced to bear heavy burdens. In consideration of the fact that the people of Fukushima Prefecture are already bearing a very heavy burden, the national government set up a basic policy to achieve the “final disposal of removed soil and waste outside Fukushima Prefecture within 30 years from the start of the interim storage,” and on this premise, the people of Fukushima Prefecture accepted the construction of the ISF in the prefecture. The final disposal outside Fukushima Prefecture is the national government’s obligation and commitment to be fulfilled without fail as clearly stipulated by law.

For achieving the final disposal outside Fukushima Prefecture, it is important to reduce the total amount for final disposal through volume reduction and managed recycling of removed soil and incinerated ash. For that purpose, initiatives have been taken steadily to develop technologies concerning volume reduction, carry out demonstration projects for promoting recycling, and foster understanding nationwide, in line with the “Technology Development Strategy for Volume Reduction & Recycling of the Removed Soil and Waste under Interim Storage,” which the Ministry of the Environment released in April 2016, with the aim of presenting several feasible options for the structure, required area, etc. regarding the Final Disposal Site by FY2024.

Included in this reference material on March 31, 2019
Updated on March 31, 2024

Interim Storage Facility

Basic Concept for Safe Use of Removed Soil Processed into Recycled Materials

◯ The Ministry of the Environment (MOE) released "Basic Concept" in June 2016 to realize the **use of the removed soil under proper management** after volume reduction and recycling materialization on the premise of securing radiation safety.

◯ According to a policy of Basic Concept, MOE implements demonstration and model projects, confirms radiation safety, studies specific management systems, while fostering understandings of public all over Japan and developing an environment towards full-scale recycling.

Limited Use

✓ The use of contaminated soil is to be limited to public project whose management entity and responsible system are clear such as basic structure of banking, which assumed not to change shape artificially for a long time.

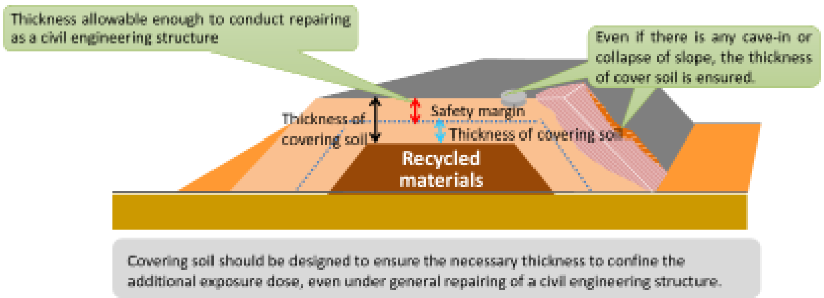
E.g., coastal levees, seaside protection forests, embankment materials for roads, cover soil for waste disposal sites, landfill materials and filler for land development, and farmland for flowers and resource crops

Proper Management

✓ The additional exposure dose should be restricted below 1 mSv/y during the construction.

✓ Radioactivity concentration recycling level of Cs-137 included in the soil is below 8,000 Bq/kg as a principle, and is set separately for each use.

✓ Shielding is installed to cover soil and prevent the leakage and scattering.
The data is also recorded.



Prepared by the Ministry of the Environment

To achieve the final disposal outside Fukushima Prefecture of the removed soil arising from decontamination work within the prefecture, it is important to reduce the total amount for final disposal through managed recycling.

In June 2016, the Ministry of the Environment (MOE) compiled the “Basic Concept for Safe Use of Removed Soil Processed into Recycled Materials” in order to promote the safe use of removed soil converted into recycled materials in an appropriate manner, while fostering understanding and confidence among the public and local residents. The Basic Concept envisages that the use of recycled soil should be limited only in public works, for which management entities and responsibility-related systems are clarified. It also sets the upper limit for radioactivity concentrations of recycled materials to limit additional effective dose, with the assumption that they are used under proper management, by such means as shielding with cover soil.

Based on this Basic Concept, the MOE is implementing demonstration projects for the creation of an embankment in Minamisoma City, for the development of farmland in the Nagadoro District of Iitate Village, and for the creation of embankments for roads in the Interim Storage Facility. Through these projects, the MOE found that ambient dose rates did not change before and after the creation of embankments and that radioactivity concentrations in the air and rainwater seepage, etc. were below the standard limit. Thus, it was confirmed that processed removed soil can be recycled safely. Furthermore, measured concentrations of radioactive cesium in rice and vegetables grown in developed farmland in the Nagadoro District of Iitate Village were confirmed to be far below the standard limit for general foods (100 Bq/kg). From now on, based on the results of these demonstration projects for recycling, the MOE will formulate the standards and guidelines and will proceed with the efforts for full-scale managed recycling in FY2025 onward.

At the aforementioned demonstration sites, the MOE organizes site tours for the general public, as well as tours and visits for a wide range of people, including students, local governments, and overseas organizations, with the aim of obtaining public understanding concerning final disposal and the managed recycling of removed soil and waste.

MOE’s website, “Recycling of Removed Soil”
http://josen.env.go.jp/chukanchozou/facility/recycling/ (in Japanese)

Included in this reference material on March 31, 2019
Updated on March 31, 2024

Waste — Waste to be Treated by the National Government under the Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials

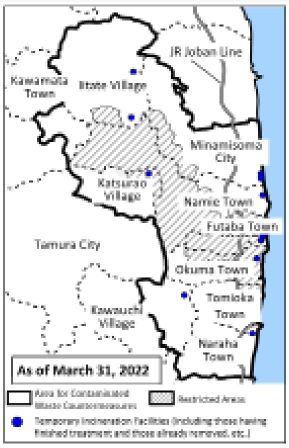
(i) Waste from the countermeasure area

○ Contaminated **waste from the countermeasure area*** designated by the Minister of the Environment that satisfies certain requirements

* An area that satisfies certain requirements, such that it is found that waste located in that area is likely to be contaminated to the extent requiring special management
(= municipalities containing former Restricted Areas and former Deliberate Evacuation Areas)

<Examples of waste from the countermeasure area>

- Debris due to the earthquake and the tsunami
- Waste from demolition of houses, etc.



(ii) Designated waste

○ Waste contaminated with radioactive materials derived from the accident **whose radioactivity concentration is found to exceed 8,000 Bq/kg and which is designated* by the Minister of the Environment**

* In light of the survey results concerning contamination status of incinerated ash at incineration facilities and based on applications filed by possessors of waste, the Minister of the Environment makes a designation when radioactivity concentration of waste is found to exceed 8,000 Bq/kg

<Examples of designated waste>

- Incinerated ash
- Agricultural and forestry waste (rice straw, compost), etc.


Incinerated ash


Agricultural and forestry by-products (rice straw)

⇒ The national government takes charge of the treatment of waste from the countermeasure area and designated waste

Prepared by the Ministry of the Environment

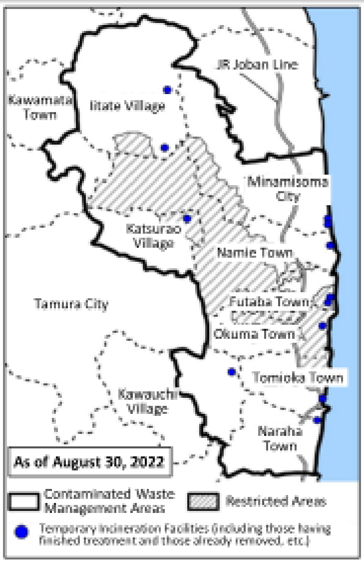
At present, the area extending over 10 municipalities in Fukushima Prefecture is designated as an Area for Contaminated Waste Countermeasures (an area designated by the Minister of the Environment as an area in which the national government needs to take charge of the collection, transport, storage and disposal of waste located therein; meaning the same as a Special Decontamination Area). Waste discharged from this area is being treated by the Ministry of the Environment as waste from the countermeasure area.

Waste contaminated with radioactive materials derived from the accident whose radioactivity concentration exceeds 8,000 Bq/kg is to be treated as designated waste by an appropriate method under the responsibility of the national government.

Included in this reference material on March 31, 2023

Waste

Progress of Disposal of Disaster Waste Directly Governed by the National Government in Designated Areas in Fukushima Prefecture



Disaster waste has been disposed of based on the Treatment Plan on Waste within the Management Areas (partial revision on December 26, 2013).

[Amount of Waste within the Management Areas having been transported to Temporary Storage Sites]

○ As of the end of November 2023, a total of approx. 3.39 million tons of waste had been transported to Temporary Storage Sites (of which, approx. 580,000 tons were incinerated, approx. 2,350,000 tons were recycled).

[Removal of tsunami rubble]

○ Tsunami rubble in former Restricted Areas was all transported to Temporary Storage Sites in March 2016, except for such rubble left in Restricted Areas.

[Installation of Temporary Incineration Facilities]

In operation	Namie Town, Okuma Town, Futaba Town i and Futaba Town ii
Completion of operation	Kawauchi Village, Iitate Village (Komiya district), Tomioka Town, Minamisoma City i, Minamisoma City ii, Katsurao Village, Iitate Village (Warabidaira district), and Naraha Town

*Tamura City and Kawamata Town use existing waste disposal facilities for disposing of disaster waste.

Demolition of a damaged house, etc.

Temporary Incineration Facility in Okuma Town (December 2017)

Prepared by the Ministry of the Environment

Waste from the countermeasure area in Fukushima Prefecture has been disposed of based on the Plan on Waste from the Countermeasure Area, which was revised in December 2013.

Such waste, which includes tsunami rubble, debris of damaged houses, and waste from houses after cleaning-up, has been transported sequentially to Temporary Storage Sites. As of the end of November 2023, a total of approx. 3.39 million tons had already been transported. Transported waste is recycled as much as possible.

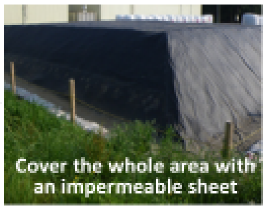
It was decided to incinerate combustible waste to reduce volume at Temporary Incineration Facilities constructed at 12 locations in nine municipalities. As of the end of December 2023, four such facilities were in operation and waste is being steadily incinerated.

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Waste

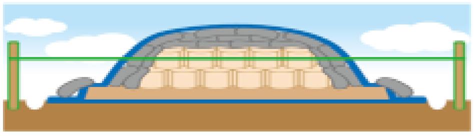
Ensuring Safety for Temporary Storage of Designated Waste

Temporary storage work (in the case of agricultural and forestry waste)



Structure of a Temporary Storage Site (in the case of agricultural and forestry waste)

- Take measures to prevent scattering and runoff of waste
- Take required measures against radiation (isolation or shielding using sandbags, etc.)
- Take measures to prevent infiltration of rainwater using impermeable sheet, etc.



Checking of storage status

The status of storage at Temporary Storage Sites is to be checked to ensure that designated waste is properly stored in compliance with the standards, etc. specified in the Act on Special Measures.

Staff of the Regional Environmental Office checking the storage status

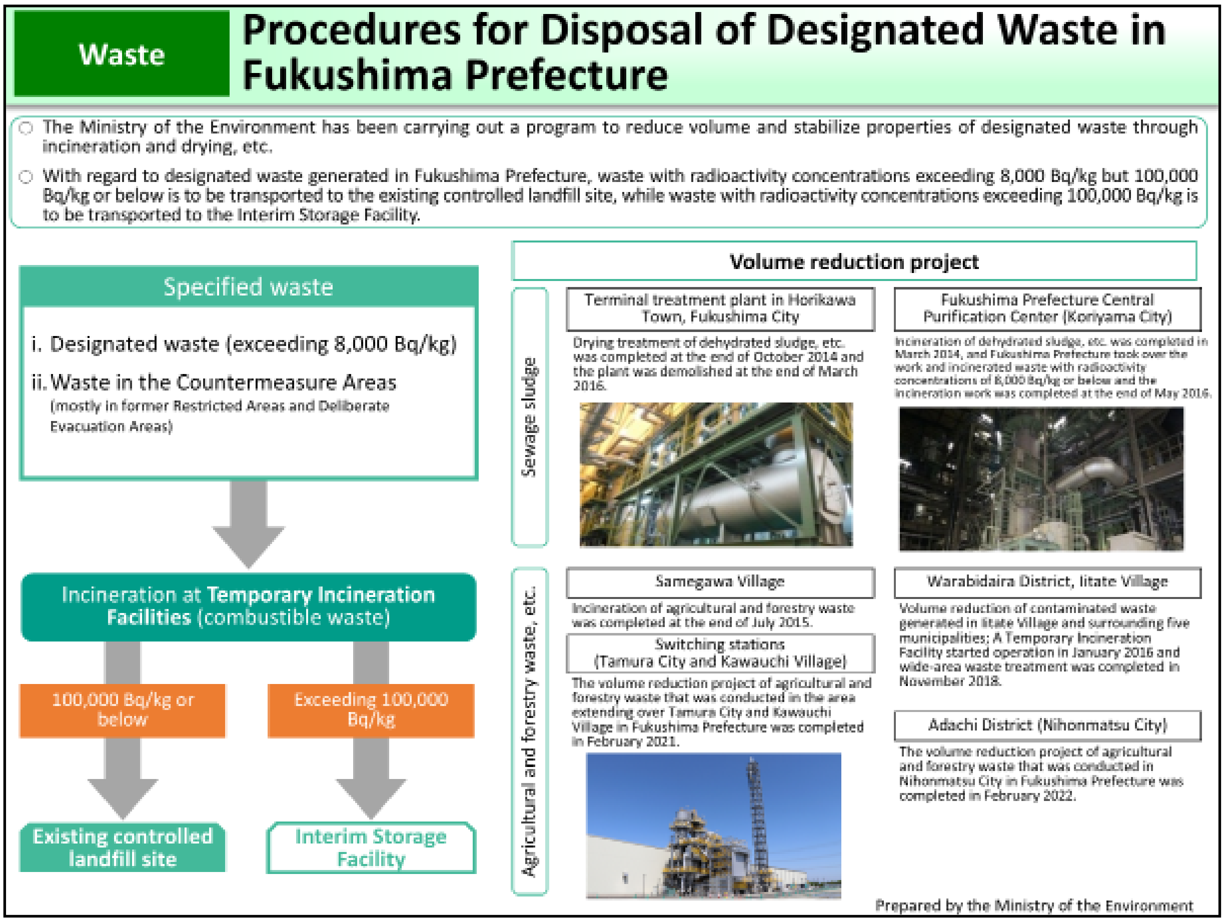
Prepared based on the website, "Information on Disposal of Radioactive Waste," of the Ministry of the Environment, etc.

Types of designated wastes include ash left after incinerating waste contaminated by radioactive materials, sludge generated through sewage treatment, soil generated at water treatment plants to supply tap water (p.42 of Vol. 2, “Waterworks System”), agricultural and forestry waste, such as rice straw and pasture grass, etc.

As of the end of September 2023, there was a total of over 450,000 tons of designated waste in 10 prefectures, including Tokyo Metropolis. The waste is temporarily being stored at incineration facilities, water treatment plants, sewage treatment facilities, farmland, etc., where it was generated, until the national government establishes a proper disposal system.

In accordance with the Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials, measures to prevent scattering and runoff of the waste are being taken and the materials are stored by covering them with impermeable sheets to prevent infiltration of rainwater. Officials of the Ministry of the Environment visit various locations and check the status of temporary storage periodically to ensure safe and proper storage of designated waste.

Included in this reference material on January 18, 2016
Updated on March 31, 2024



In Fukushima Prefecture, designated waste with radioactivity concentration exceeding 8,000 Bq/kg but 100,000 Bq/kg or below is to be transported to the existing controlled landfill site, while designated waste with radioactivity concentration exceeding 100,000 Bq/kg is to be transported to the Interim Storage Facility.

Additionally, designated waste is incinerated, dried or otherwise handled to reduce volume and stabilize their properties in Fukushima Prefecture.

Included in this reference material on January 18, 2016
Updated on March 31, 2023

Waste

Landfill Disposal of Specified Waste at Controlled Landfill Site

- In the specified waste landfill project, transportation of specified waste was commenced on November 17, 2017, and was completed on October 31, 2023.
- At the Clean Center Futaba, transportation of specified waste was commenced on June 1, 2023.

Developments concerning the Specified Waste Landfill Facility

- Dec. 14, 2013: The national government asked Fukushima Prefecture, Tomioka Town, and Naraha Town for consent to accept the construction of the site.
- Dec. 4, 2015: Fukushima Prefecture, Tomioka Town, and Naraha Town expressed their intention to approve the program.
- Apr. 18, 2016: Specified Waste Landfill Facility (former Fukushima Eco Tech Clean Center) was nationalized.
- Jun. 27, 2016: The national government concluded a safety agreement with Fukushima Prefecture and the two municipalities.
- **Nov. 17, 2017**: **Transport of waste was commenced**.
- **Oct. 31, 2023**: **Transportation of specified waste was completed**.

Waste to be landfilled and duration of waste transport

[Waste to be landfilled] (* Waste with radioactivity concentrations not exceeding 100,000 Bq/kg)
- Waste from the countermeasure area
- Designated waste in Fukushima Prefecture
- Household waste from 8 Futaba County municipalities

[Duration of waste transport]
- Waste from the countermeasure area and designated waste in Fukushima Prefecture: Approx. 6 years (Completed at the end of October 2023)
- Household waste from 8 Futaba County municipalities: Approx. 10 years

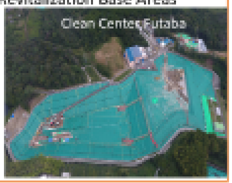
Developments concerning the Clean Center Futaba

- Aug. 5, 2019: The MOE concluded a basic agreement with the Futaba District Broader Municipality Association and Fukushima Prefecture.
- Aug. 7, 2020: The MOE concluded an implementation agreement with the Futaba District Broader Municipality Association.
- Dec. 2020: The MOE commenced the development work.
- Mar. 31, 2023: The development work was completed.
- **Jun. 1, 2023**: **Transportation of specified waste was commenced**.

Waste to be landfilled and duration of waste transport

[Waste to be landfilled] (* Waste with radioactivity concentrations not exceeding 100,000 Bq/kg)
- Household waste from 8 Futaba County municipalities
- Industrial waste and general waste from business activities generated in association with infrastructure development activities in Futaba County
- Specified waste generated in association with demolition of damaged buildings, etc. in Specified Reconstruction and Revitalization Base Areas

[Duration of waste transport]
- Transportation of specified waste was commenced in June 2023.



Designated waste, etc. with radioactivity concentrations not exceeding 100,000 Bq/kg generated in Fukushima Prefecture are to be disposed of promptly at the existing controlled landfill sites (Specified Waste Landfill Facility and Clean Center Futaba).

In order to implement this project at the Specified Waste Landfill Facility, the national government first asked Fukushima Prefecture for consent to accept the construction of an Interim Storage Facility in December 2013, and then provided explanations to Tomioka Town and Naraha Town, and their assemblies and residents.

In December 2015, consent was obtained from Fukushima Prefecture, Tomioka Town and Naraha Town for the implementation of this project. The national government nationalized the existing controlled landfill site in April 2016 and concluded a safety agreement with Fukushima Prefecture and the two municipalities in June 2016. Preparatory work was conducted thereafter and the transportation of specified waste was completed at the end of October 2023. Additionally, the Ministry of the Environment (MOE) has endeavored to provide related information positively through the Reprun Fukushima, a specified waste landfill information center, which commenced operation in August 2018.

Regarding the disposal of waste, etc. generated in association with the development of the Specified Reconstruction and Revitalization Base Areas, the MOE concluded a basic agreement with the Futaba District Broader Municipality Association and Fukushima Prefecture on August 5, 2019, concerning the utilization of the controlled landfill site owned by the Association. Transportation of specified waste was commenced in June 2023.

To steadily facilitate disposal of waste contaminated by radioactive materials, utmost efforts will be continued to properly carry out this project with safety as the top priority and to build a stronger relationship of trust with local residents.

Included in this reference material on January 18, 2016
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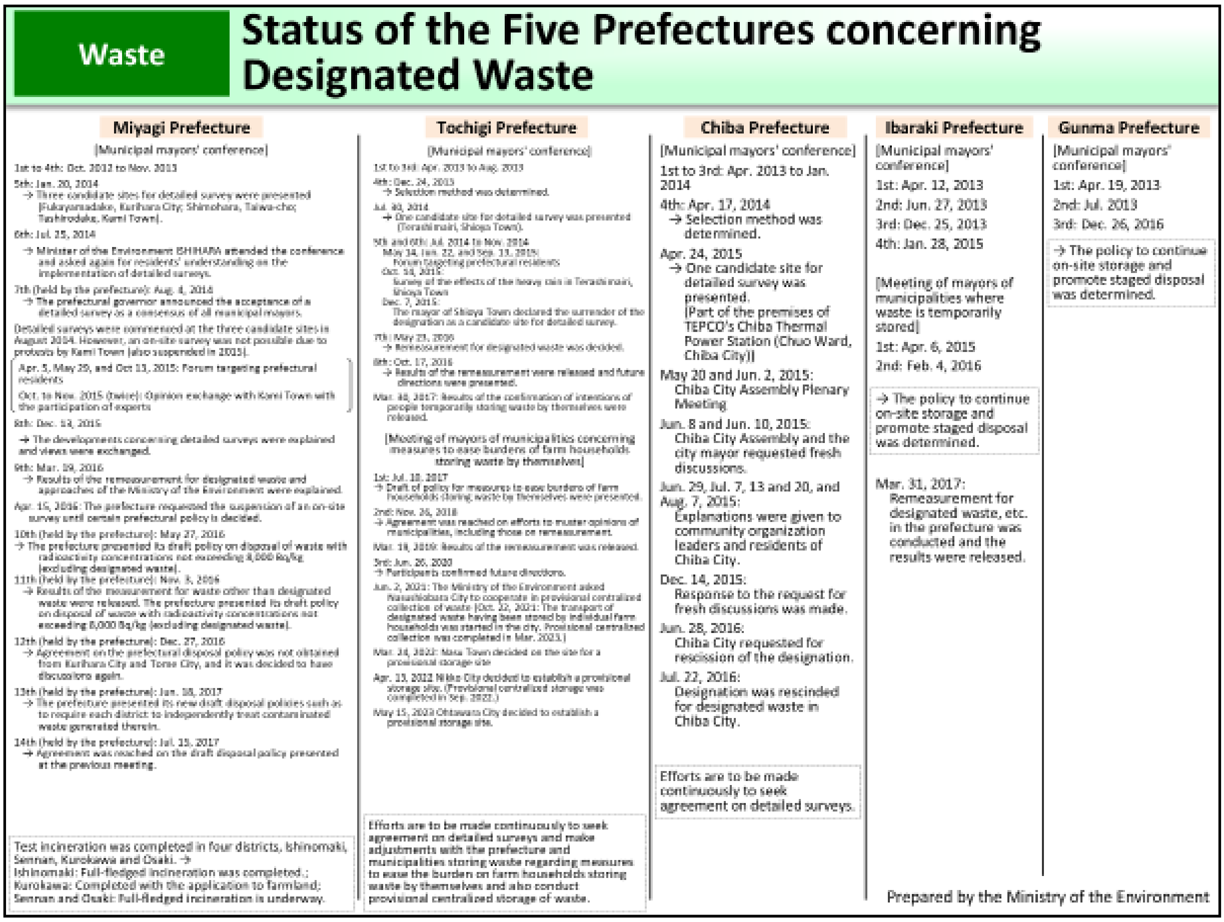


Prefectures other than Fukushima Prefecture which are in urgent need to secure Temporary Storage Sites for designated waste (Miyagi Prefecture, Tochigi Prefecture, Chiba Prefecture, Ibaraki Prefecture and Gunma Prefecture) are taking measures in accordance with the circumstances of respective prefectures, based on discussions at municipal mayors' conferences, while ascertaining the current status through the measurement of radioactivity concentrations.

Regarding candidate sites for detailed surveys, Miyagi, Tochigi and Chiba Prefectures followed selection methods determined through discussions at expert meetings and municipal mayors' conferences, and Miyagi presented selected candidate sites in January 2014, Tochigi in July 2014 and Chiba in April 2015. However, detailed surveys have not been conducted due to a failure to obtain understanding of relevant regions.

In the meantime, Miyagi Prefecture determined its policy that each municipality is to make efforts to dispose of contaminated waste with radioactivity concentrations not exceeding 8,000 Bq/kg under the initiative of the prefectural government, and the Ministry of the Environment (MOE) is offering financial and technical support. As part of such efforts, test incineration was commenced sequentially in four districts (Ishinomaki, Kurokawa, Sennan and Osaki) from March 2018 and was completed by July 2019. As of the end of September 2023, waste disposal was completed through full-fledged incineration, etc. in the Ishinomaki district and Kurokawa district, and full-fledged incineration was underway in the Sennan and Osaki districts.

In November 2018, the national government presented a provisional policy for volume reduction and centralized collection of designated waste by the unit of municipality, targeting Tochigi Prefecture and municipalities storing designated agricultural and forestry waste, with the aim of easing burdens of farm households that have been storing designated waste by themselves, while maintaining the basic policy to ultimately develop long-term management facilities. Agreement was reached on the provisional policy. Additionally, it was confirmed that the national government will compile its approach for the selection of provisional storage sites and make efforts to select relevant sites as promptly as possible in collaboration with Tochigi Prefecture and relevant municipalities. In June 2021, the MOE asked Nasushiobara City to cooperate in the provisional centralized collection of designated agricultural waste having been stored by individual farm households and disposal of waste with radioactivity concentrations not exceeding 8,000 Bq/kg after removal of their designation as designated waste. From October 2021 to March 2023, the MOE conducted transportation of designated waste from farm households to the provisional storage site in the city. Out of the transported designated waste, designated agricultural waste whose radioactive concentrations have decreased to 8,000 Bq/kg or lower was incinerated with other general waste after going through procedures for designation removal. In Nikko City, transportation of designated waste to the provisional storage site was completed, and Nasu Town and Ohtawara City respectively decided on a provisional storage site. In this manner, efforts are being made by relevant municipalities.

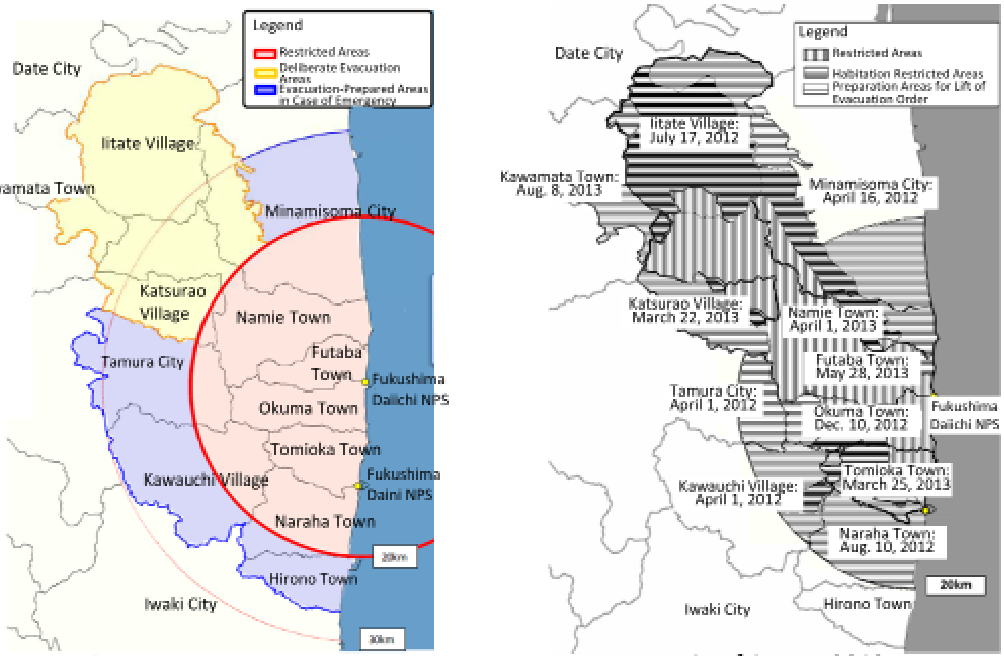
Chiba Prefecture is also continuing efforts to obtain understanding from the local residents for the implementation of a detailed survey concerning long-term management facilities.

Ibaraki and Gunma Prefectures determined the policies to continue on-site storage and promote staged disposal respectively in February 2016 and December 2016. Based on the determined policies, both prefectures will repair or reinforce storage sites as necessary and will dispose of designated waste whose radioactivity concentrations have reduced to 8,000 Bq/kg or lower at existing disposal facilities in a staged manner.

Included in this reference material on March 31, 2016
Updated on March 31, 2024

Activities in Areas under Evacuation Orders

Designation of Areas under Evacuation Orders



As of April 22, 2011
(when the designation of areas immediately after the accident was completed)

As of August 2013
(when the review of areas was completed)

* Dates in the parentheses are the dates on which the designation after the review was put into effect, respectively.

Prepared based on the 15th meeting of the Nuclear Emergency Response Headquarters (May 17, 2011) and the 31st meeting of the Nuclear Emergency Response Headquarters (August 7, 2013), etc.

Based on Article 15, paragraph (2) of the Act on Special Measures Concerning Nuclear Emergency Preparedness, a Declaration of a Nuclear Emergency Situation was issued at 19:03 on March 11, 2011. At 18:25 on the following day, evacuation orders were issued for the 20-km zone of TEPCO's Fukushima Daiichi NPS.

On April 11, 2011, areas around the 20-km zone where annual cumulative doses would be highly likely to exceed 20 mSv after the accident were designated as Deliberate Evacuation Areas, taking into account the standard limits for radiological protection in emergency exposure situations, and areas within 20 km to 30 km were designated as Evacuation-Prepared Areas in Case of Emergency. Additionally on April 21, 2011, considering future risks due to the accident, areas within 20 km from the NPS were designated as Restricted Areas and access was prohibited in principle.

In June 2011 onward, spots where decontamination work would not be easy and annual cumulative doses would be highly likely to exceed 20 mSv were designated as specific spots recommended for evacuation, based on the results of the environmental monitoring by the national government and Fukushima Prefecture.

On December 16, 2011, the reactors reached a state of cold shutdown and it was confirmed that the discharge of radioactive materials was under control. Accordingly, on December 26, the designation of Restricted Areas was removed and it was proposed to review Areas under Evacuation Orders and to newly designate Restricted Areas, Habitation Restricted Areas and Preparation Areas for Lift of Evacuation Orders. Upon reviewing Areas under Evacuation Orders, four problems common to all subjected areas were cited as problems to be addressed: (i) need to ensure safety and security of residents; (ii) need for decontamination and due consideration of children's radiation exposure; (iii) reconstruction of infrastructure and job creation; and (iv) compensation.

As requirements for lifting evaluation orders, the following were set: (i) it is certain that annual cumulative doses estimated based on ambient dose rates will become 20 mSv or lower; (ii) infrastructure (such as electricity, gas, water and sewer services, major transportation systems, and communication networks) and living-related services (such as medical services, nursing care, and postal services) indispensable for daily lives have been almost restored and decontamination work has progressed sufficiently centered on children's living environments; and (iii) consultations have been held sufficiently among the prefecture, municipalities and residents.

(Related to p.173 of Vol. 1, "ICRP Recommendations and Responses of the Japanese Government")

Included in this reference material on February 28, 2018
Updated on March 31, 2020

Activities in Areas under Evacuation Orders

Designation of Restricted Areas and Areas under Evacuation Orders and Removal Thereof

April 22, 2011, onward Area designation immediately after accident	April 2012, onward After confirming cold shutdown of the reactors
Restricted Areas(*1) Areas within 20 km in radius from the Nuclear Power Station (NPS); The relevant areas were designated as Areas under Evacuation Orders on March 12, 2011.	**Preparation Areas for Lift of Evacuation Order** Areas where it is confirmed that annual cumulative doses will surely become 20 mSv or lower(*2)
Deliberate Evacuation Areas Areas 20 km or farther from the NPS where cumulative doses would be highly likely to exceed 20 mSv within one year after the accident	**Habitation Restricted Areas** Areas where annual cumulative doses would be highly likely to exceed 20 mSv(*2)
Evacuation-Prepared Areas in Case of Emergency Areas within 20 km to 30 km in radius from the NPS other than Deliberate Evacuation Areas; The relevant areas were designated as In-house Evacuation Areas on March 12, 2011.	**Restricted Areas(*3)** Areas where annual cumulative doses exceed 50 mSv(*2) at present and would be highly likely to remain above 20 mSv(*2) even after 6 years from the accident

Areas under Evacuation Orders:

Areas for which evacuation orders were issued based on Article 15, paragraph (3) of the Act on Special Measures Concerning Nuclear Emergency Preparedness; Areas under Evacuation Orders and the 20-km zone of the Nuclear Power Station were rearranged and were newly designated as Preparation Areas for Lift of Evacuation Order, Habitation Restricted Areas or Restricted Areas.

(*1) Areas where access is restricted pursuant to the provisions of Article 63, paragraph (1) of the Disaster Countermeasures Basic Act as applied pursuant to Article 28, paragraph (2) of the Act on Special Measures Concerning Nuclear Emergency Preparedness, following the deemed replacement of terms

(*2) Based on the dose data obtained through the 4th airborne monitoring survey after correction as of March 31, 2012

(*3) The term "Areas where returning is difficult" was formerly used instead of "Restricted Areas" as a literal translation from Japanese.

Prepared based on the "Basic Idea on Review of the Restricted Areas and Areas under Evacuation Orders in Response to the Completion of Step 2 and Matters to be Discussed" (December 26, 2011; Nuclear Emergency Response Headquarters)

Immediately after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS on March 11, 2011, the Nuclear Emergency Response Headquarters issued evacuation orders in order to avoid risks to residents' lives and designated the areas within 20 km from the NPS as Areas under Evacuation Orders on March 12.

On April 22, for fear of any risks that residents might be exposed to a large amount of radiation at one time as a result of worsening of the situation, the Headquarters designated the relevant areas as Restricted Areas to prohibit access in principle, and also designated areas 20 km or farther from the NPS where cumulative doses would be highly likely to exceed 20 mSv within one year after the accident as Deliberate Evacuation Areas.

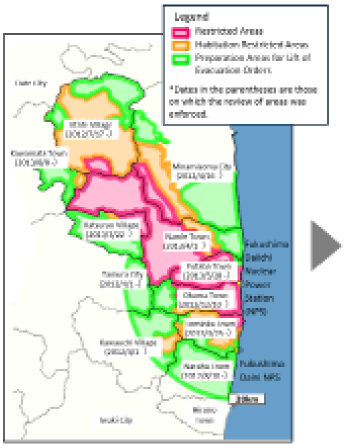
On December 16, the reactors reached a state of cold shutdown and the Nuclear Emergency Response Headquarters confirmed that the chaotic situation after the accident ended. Accordingly, on December 26, the basic idea on review of Restricted Areas and Areas under Evacuation Orders was presented. The Headquarters made preparations for the review while closely consulting with the prefecture, municipalities and residents and making adjustments, and at the same time endeavored to address problems common to all subjected areas.

On March 30, 2012, the Nuclear Emergency Response Headquarters reviewed Restricted Areas and Areas under Evacuation Orders in accordance with radiation doses and problems unique to respective areas. By August 2013, the designation of Restricted Areas and Specific Spots Recommended for Evacuation was completely removed, and Areas under Evacuation Orders were newly designated as Preparation Areas for Lift of Evacuation Orders, Habitation Restricted Areas, or Restricted Areas.
(Related to p.173 of Vol. 1, "ICRP Recommendations and Responses of the Japanese Government")

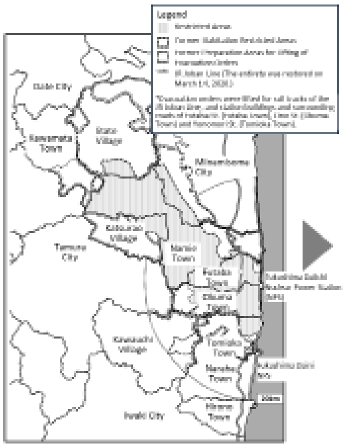
Included in this reference material on February 28, 2018
Updated on March 31, 2020

Reconstruction and Revitalization from the Accident

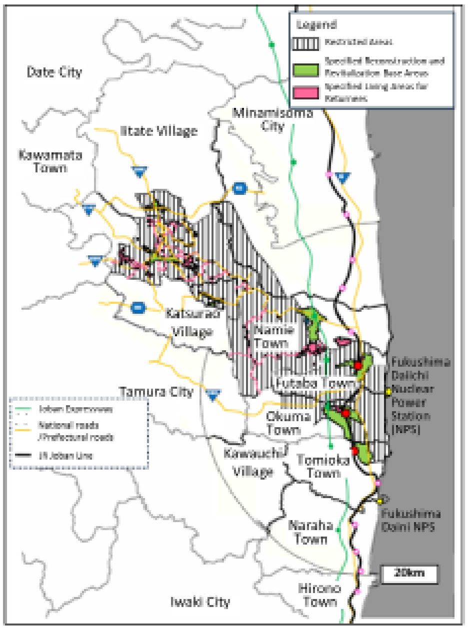
Removal of the Designation of Areas under Evacuation Orders



As of August 2013
(when the review of areas was completed)



As of March 2020
(lifting of evacuation orders for all areas designated as Preparation Areas for Lift of Evacuation Orders and Habitation Restricted Areas, except for Restricted Areas)



As of January 2024

Source: Prepared based on "Assistance of Residents Affected by the Nuclear Incidents (re. Evacuation Orders)" of the Ministry of Economy, Trade and Industry (https://www.meti.go.jp/english/earthquake/nuclear/roadmap/index.html), and data of the Reconstruction Agency, etc.

* Detailed developments so far are shown on the website and in the data above.

At the joint meeting of the Reconstruction Promotion Council and the Nuclear Emergency Response Headquarters held on March 7, 2013, it was pointed out that “a certain view should be indicated within the year” regarding the lifting of evacuation orders. Accordingly, procedures to be followed for lifting evacuation orders were presented based on the discussions over the Cabinet decision on December 20, 2013, titled “For Accelerating the Reconstruction of Fukushima from the Nuclear Disaster.” In order to ease returning residents’ anxiety over health effects of radiation, measures are being taken to reduce radiation exposure and eliminate health concerns (risk communication project). These measures include deployment of counselors, development of counselor support centers, ascertaining and management of personal doses, and radiation monitoring.

In the meantime, evacuation orders were lifted by March 2020 for all areas designated as Preparation Areas for Lift of Evacuation Orders or Habitation Restricted Areas, except for Restricted Areas.

Regarding Restricted Areas, evacuation orders were lifted for the first time for some areas in Futaba Town, Okuma Town and Tomioka Town within the Specified Reconstruction and Revitalization Base Areas (SRRBA) designated as Restricted Areas, upon the reopening of the entirety of the JR Joban Line in March 2020. Evacuation orders were also lifted for the SRRBA in Katsurao Village and Okuma Town in June 2022, in Futaba Town in August 2022, in Namie Town in March 2023, in Tomioka Town (Yonomori and Osuge Districts) in April 2023, in Iitate Village in May 2023, and in Tomioka Town (in Oragahama and Fukaya Districts) in November 2023. Evacuation orders were thus lifted for the entirety of the SRRBA. In areas other than the SRRBA in Restricted Areas, Specified Living Areas for Returnees were established in Okuma Town, Futaba Town, and Namie Town by January 2024. In order to lift evacuation orders for those Specified Living Areas for Returnees, the national government will continue efforts, such as decontamination work and infrastructure development. Although Kawauchi Village and Hirono Town had recommended evacuation for areas other than Areas under Evacuation Orders designated by the national government, based on their independent determinations, these evacuation recommendations were also lifted on January 31, 2012, and on March 31, 2012, respectively.

The latest information, the current status of evacuees and the details of the Areas under Evacuation Orders in 12 municipalities are posted on the Fukushima Prefecture’s portal site, “Fukushima Revitalization Information Portal Site,” and the Ministry of Economy, Trade and Industry’s website, “Assistance of Residents Affected by the Nuclear Incidents (re. Evacuation Orders).”

“Transition of the evacuation zones -Explanation-,” Fukushima Revitalization Information Portal Site

https://www.pref.fukushima.lg.jp/site/portal-english/en-1-3-1.html

“Assistance of Residents Affected by the Nuclear Incidents (re. Evacuation Orders)” of the Ministry of Economy, Trade and Industry

https://www.meti.go.jp/english/earthquake/nuclear/roadmap/index.html

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Reconstruction and Revitalization from the Accident

Traffic on Major Roads in Restricted Areas

- **Joban Expressway**: The entirety was restored in March 2015.
  Source: https://www.e-nexco.co.jp/en/pressroom/head_office/2014/1225/00006647.html
- **JR Joban Line**: The entirety was restored in March 2020.
  Source: https://www.jreast.co.jp/press/2019/20200117_ho01.pdf (in Japanese)
- **National roads and prefectural roads**: Transit without carrying and presenting a pass came to be permitted for National Road 6 from September 2014, for National Road 114 from September 2017, and for Prefectural Road 35 from September 2019.

Exposure doses of drivers passing through

Dose survey period		November 2018 to January 2019	August 2017	November to December 2019	
Section		Japan Expressway: between Hirono IC and Minamisoma IC	National Road 114: between the border of Kawamata Town and Namie IC	National Road 6: in Restricted Areas	Prefectural Road 35: in Restricted Areas
Exposure dose while passing through (μSv)	Automobiles	0.28	1.01	0.39	0.51
	Motorcycles	0.34	-	0.49	0.63

Reference) Exposure dose during a round flight between Tokyo and New York: approx. 80 to 110 μSv

Source: Prepared by the Support Team for Residents Affected by Nuclear Incidents based on the "Results of Radiation Dose Surveys in Restricted Areas along National Roads 114, 399 and 459 and Prefectural Roads 49 and 34" (September 15, 2017), the "Results of Radiation Dose Surveys in Restricted Areas along National Roads 6 and 114 and Prefectural Roads 34, 35, 36, 253 and 256" (January 30, 2020), and NEXCO East's website (https://jobando.jp/hibakusenryo/hibakuryo.html (in Japanese))

In Restricted Areas, transit had been restricted except for temporary entry of residents and transit based on the Special Transit Permission System.

As National Road 6 is a key major road for reconstruction and recovery of Fukushima Prefecture, after completion of decontamination and road repair work, special transit without carrying and presenting a pass came to be permitted for National Road 6 and Prefectural Road 36 on September 15, 2014, as a result of consultations with the relevant municipalities.

The Special Transit Permission System has also been applied to National Road 114 and Prefectural Road 35 based on consultations with the relevant local governments and organizations. From March 2020, motorcycles are also permitted to use some routes, such as National Road 6 and Prefectural Road 35. Furthermore, the entirety of National Road 6 was reopened to foot and bicycle traffic in association with the lifting of evacuation orders for the Specified Reconstruction and Revitalization Base Areas (SRRBA) in Okuma Town in June 2022 and in Futaba Town in August 2022. The entirety of National Road 114 and Prefectural Road 49 was reopened to foot and bicycle traffic in association with the lifting of evacuation orders for the SRRBA in Namie Town in March 2023. The most recent status of the application of the Special Transit Permission System and the results of dose surveys under the application of the system are published in the form of a notice issued by the Support Team for Residents Affected by Nuclear Incidents, Cabinet Office (https://www.meti.go.jp/earthquake/nuclear/kinkyu.html) (in Japanese).

Included in this reference material on February 28, 2018
Updated on March 31, 2024

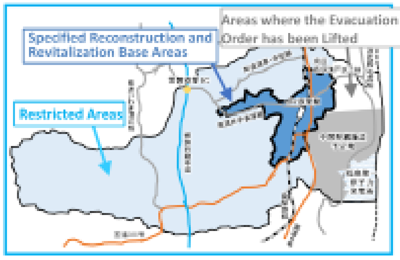
Reconstruction and Revitalization from the Accident

Development of Specified Reconstruction and Revitalization Base Areas and Radiological Protection Measures Therefor

[Approval of Plans for Specified Reconstruction and Revitalization Base Areas and Targeted Timing for the Lifting of Evacuation Orders]

Municipality name	Approval date	Targeted timing for the lifting of evaluation orders
Futaba Town	Sep. 15, 2017	Around spring of 2022 (Lifted on August 30, 2022)
Okuma Town	Nov. 10, 2017	By around spring of 2022 (Lifted on June 30, 2022)
Namie Town	Dec. 22, 2017	March 2023 (Lifted on March 31, 2023)
Tomioka Town	Mar. 9, 2018	Around spring of 2023 (Lifted on April 1 and November 30, 2023)
Iitate Village	Apr. 20, 2018	Around spring of 2023 (Lifted on May 1, 2023)
Katsurao Village	May 11, 2018	By around spring of 2022 (Lifted on June 12, 2022)

Example of a Specified Reconstruction and Revitalization Base Areas (Futaba Town)



"Specified Reconstruction and Revitalization Base Area Reconstruction and Revitalization Plan" by the Reconstruction Agency

https://www.reconstruction.go.jp/topics/main-cat1/sub-cat1-4/saiseikyoten/20170913162153.html (in Japanese)

"Radiological Protection Measures at Specified Reconstruction and Revitalization Base Areas"
(Dec. 12, 2018, by the Cabinet Office's Support Team for Residents Affected by Nuclear Incidents, the Reconstruction Agency, the Ministry of the Environment, and the Secretariat of the Nuclear Regulation Authority)

As Specified Reconstruction and Revitalization Base Areas are areas where entries have been strictly restricted as Restricted Areas, required measures are to reduce residents' exposure doses and meticulously respond to their worries over radiation.

Under this concept, radiological protection measures should be taken in two stages, the first stage to make preparations for returning and rebuild communities ahead of the lifting of the evacuation order and the second stage to achieve the lifting of the evacuation order for further accelerating related initiatives.

Prepared based on the "Radiological Protection Measures at Specified Reconstruction and Revitalization Base Areas" (2018) by the Cabinet Office's Support Team for Residents Affected by Nuclear Incidents, the Reconstruction Agency, the Ministry of the Environment, and the Secretariat of the Nuclear Regulation Authority and the "Toward the Lifting of Evacuation Orders and Returning and Inhabitation of Residents for Specified Reconstruction and Revitalization Base Areas" (2018) by the Nuclear Emergency Response Headquarters

As radiation doses have decreased in some Restricted Areas, the national government published its policy in August 2016 to develop "reconstruction bases with the aim of lifting evacuation orders and permitting inhabitation in such areas within around five years in light of the status of decreases in radiation doses." In response, the Act on Special Measures for the Reconstruction and Revitalization of Fukushima was amended in May 2017 and the system for Specified Reconstruction and Revitalization Base Areas (SRRBA) was established thereby. Plans for reconstruction and revitalization of SRRBA that municipalities (Futaba Town, Okuma Town, Namie Town, Tomioka Town, Iitate Village, and Katsurao Village) had formulated were all approved by May 2018 and their development has been promoted. As a result, evacuation orders were lifted for the SRRBA in Katsurao Village and Okuma Town in June 2022, in Futaba Town in August 2022, in Namie Town in March 2023, in Tomioka Town (Yonomori and Osuge Districts) in April 2023, in Iitate Village in May 2023, and in Tomioka Town (in Oragahama and Fukaya Districts) in November 2023. Evacuation orders were thus lifted for the entirety of the SRRBA.

In December 2018, as moves toward the lifting of evacuation orders for these municipalities had become active, the national government presented its policy to take radiological protection measures for SRRBA in two stages, a stage to prepare for returning and a stage to achieve the lifting of evacuation orders, with the aim of further accelerating efforts for lifting evacuation orders.

In a stage to prepare for returning, the national government will not only ensure steady management of individuals' doses and secure a consultation system, but also minutely obtain doses and other information and provide estimated exposure doses based on detailed dose maps and representative behavior patterns or otherwise take multi-layered measures in cooperation with local governments.

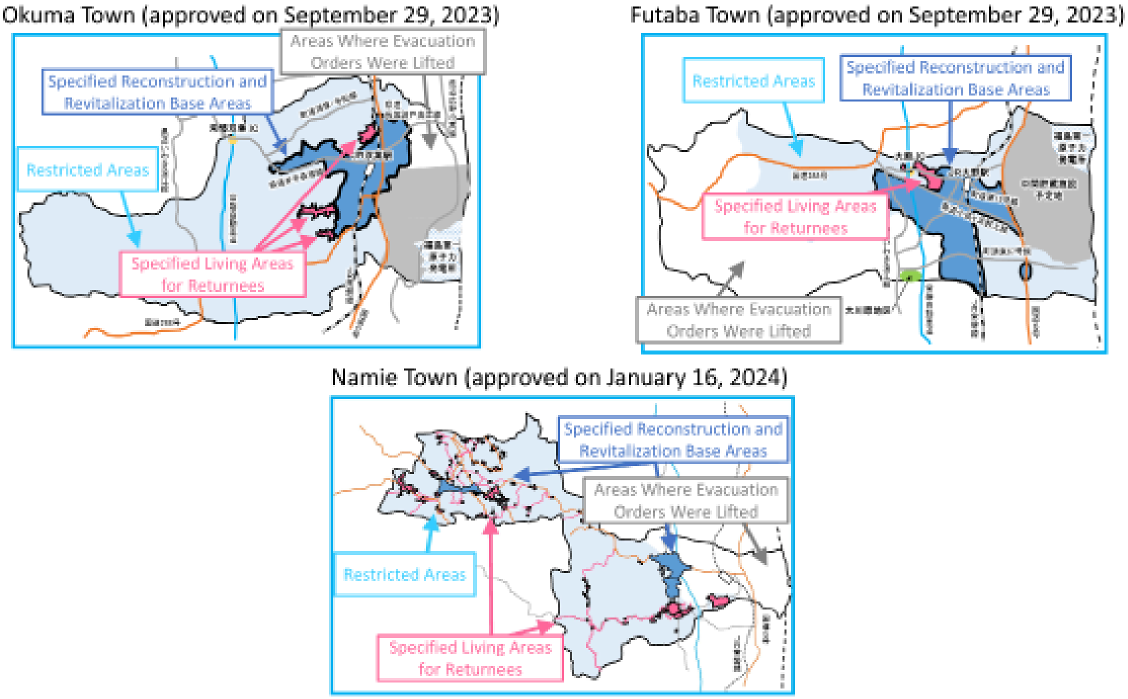
In a stage to achieve the lifting of evacuation orders, as residents spend more time and move around more widely than in the preparatory stage, the national government will take measures to reduce residents' exposure doses based on dose data and individuals' living conditions and risk communication measures to meticulously respond to residents' worries and anxieties, comprehensively and in a multi-layered manner in line with individual local governments' wishes, in addition to steadily managing individuals' doses and securing a consultation system.

Included in this reference material on March 31, 2020
Updated on March 31, 2024

Reconstruction and Revitalization from the Accident

Development of Specified Living Areas for Returnees

[Specified Living Areas for Returnees in each municipality]



Prepared based on the "Reconstruction and Revitalization Plans for the Specified Living Areas for Returnees," "Current Status of Reconstruction and Future Efforts," etc. of the Reconstruction Agency

Residents who are eager to return to their original residences in areas other than the Specified Reconstruction and Revitalization Base Areas in Restricted Areas have long been forced to live as refugees and local governments have strongly requested that the national government clarify its policy on the lifting of evacuation orders as early as possible. In consideration of such circumstances, in August 2021, the national government formulated a policy to grasp residents' intention individually and carefully and promote decontamination of areas necessary for returnees in order to enable residents who are eager to return to their original residences to do so during the 2020s (the Nuclear Emergency Response Headquarters and the Reconstruction Promotion Council). In order to achieve this policy, the national government amended the Act on Special Measures for the Reconstruction and Revitalization of Fukushima in June 2023, under which a system was created to enable mayors of the municipalities containing Specified Areas under Evacuation Orders to establish Specified Living Areas for Returnees (SLAR) outside the Specified Reconstruction and Revitalization Base Areas. In the SLAR, each municipality aims to achieve return of residents through lifting of evacuation orders and to assist returnees' reconstruction of livelihoods.

Under this system, Okuma Town and Futaba Town obtained approval from the Prime Minister for their Reconstruction and Revitalization Plans for the Specified Living Areas for Returnees in September 2023 and Namie Town obtained the same in January 2024. Decontamination, infrastructure development, and other initiatives toward the lifting of evacuation orders will be promoted based on these plans. (Approval of the plans: as of the end of January 2024)

Included in this reference material on March 31, 2024

Reconstruction and Revitalization from the Accident

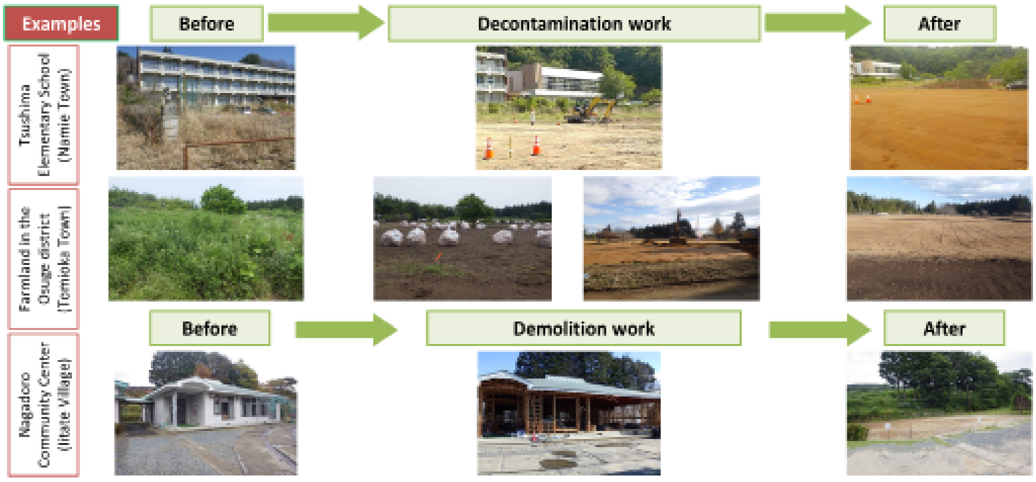
Decontamination and Demolition of Houses and other Buildings in Specified Reconstruction and Revitalization Base Areas

○ Works to demolish houses and other buildings and decontamination work have commenced in all of the six towns and villages (Futaba Town, Okuma Town, Namie Town, Tomioka Town, Iitate Village and Katsurao Village). Works have been completed for station squares, kindergartens, gymnasiums and other public facilities. Efforts to restore the environment are thus steadily progressing.

○ In order to achieve lifting of evacuation orders for the entirety of the Specified Reconstruction and Revitalization Base Areas (SRRBA) from around the spring of 2022 to around the spring of 2023, as had been targeted, demolition and decontamination of houses in the areas are being conducted in collaboration with relevant ministries and agencies.

○ In the SRRBA, decontamination has been completed for over 90%, and the demolition of houses and other buildings has been completed for approximately 84% out of the total number of applications (as of the end of November 2023).

○ In September 2023, for some areas in Futaba Town and Okuma Town, Reconstruction and Revitalization Plans for the Specified Living Areas for Returnees were approved, and decontamination and demolition of houses and other buildings were commenced in December 2023.



Prepared by the Ministry of the Environment

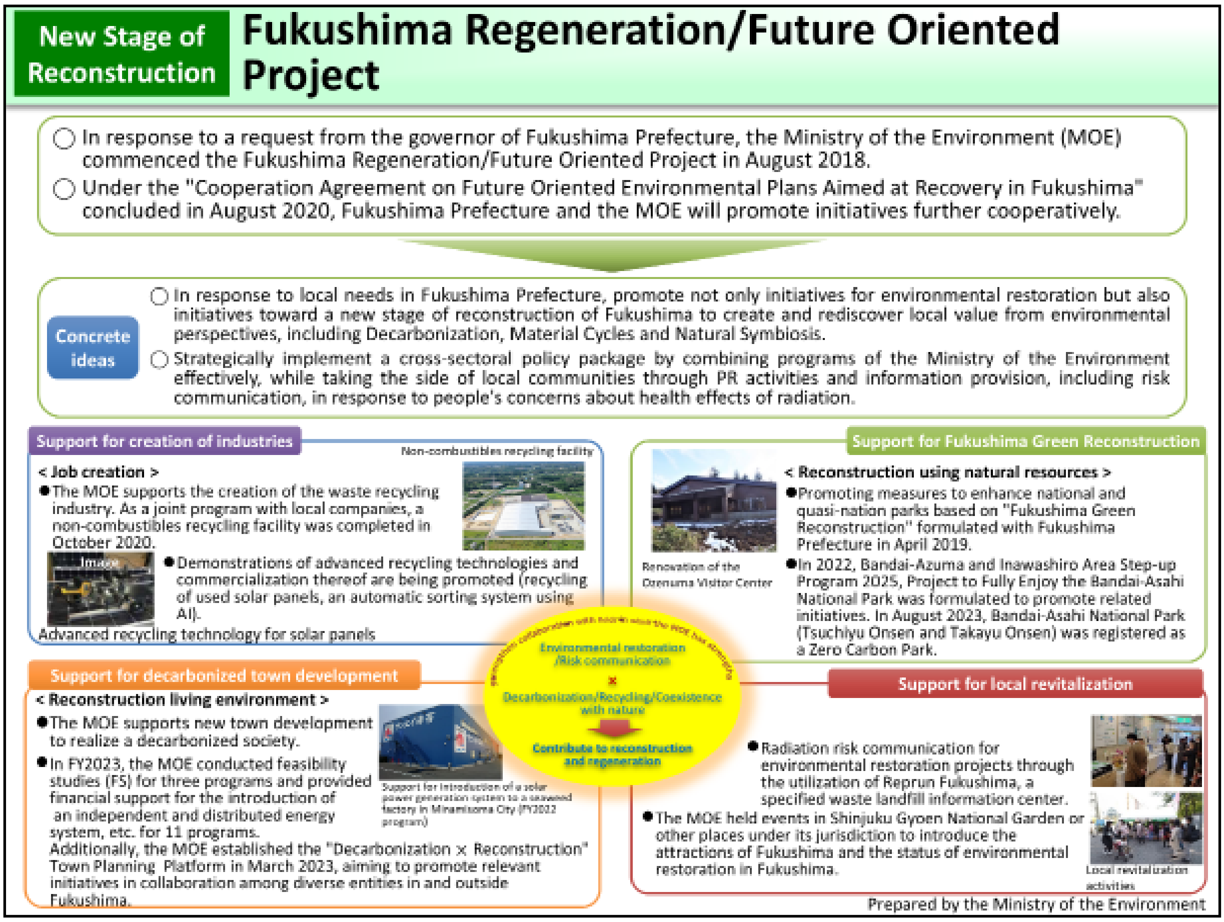
For Restricted Areas, relevant municipalities formulated plans for Specified Reconstruction and Revitalization Base Areas (SRRBA) and environmental development (decontamination and development of infrastructure, etc.) in those areas based on the Act on Special Measures for the Reconstruction and Revitalization of Fukushima. After obtaining approval for the formulated plans from the Prime Minister, they are to make efforts to achieve the lifting of evacuation orders within five years.

The Ministry of the Environment (MOE) carried out decontamination work and the demolition of houses and other buildings in the SRRBA based on those plans. Evacuation orders were lifted for the SRRBA in Katsurao Village and Okuma Town in June 2022, in Futaba Town in August 2022,in Namie Town in March 2023, in Tomioka Town (Yonomori and Osuge Districts) in April 2023, in Iitate Village in May 2023, and in Tomioka Town (in Oragahama and Fukaya Districts) in November 2023. Evacuation orders were thus lifted for the entirety of the SRRBA.

At present, decontamination work has been completed for over 90%, and the demolition of houses and other buildings has been completed for approximately 84% out of the total number of applications (as of the end of November 2023). Specified waste from demolished houses and other buildings is to be disposed of after volume reduction for disposal at the controlled landfill site managed by the Futaba District Broader Municipality Association (Clean Center Futaba). In August 2019, the MOE, the Association and Fukushima Prefectural Government concluded the basic agreement thereon. In June 2023, transportation of specified waste was commenced.

For areas other than the SRRBA, the national government amended the Act on Special Measures for the Reconstruction and Revitalization of Fukushima in June 2023, under which a system was created to enable mayors of the municipalities containing Specified Areas under Evacuation Orders to establish the Specified Living Areas for Returnees (SLAR). In the SLAR, each municipality aims to achieve return of residents through lifting of evacuation orders and to assist returnees' reconstruction of livelihoods. With the aim of commencing pioneering decontamination work within FY2023, in September 2023, for some areas in Futaba Town and Okuma Town, Reconstruction and Revitalization Plans for the Specified Living Areas for Returnees were approved, and decontamination and demolition of houses and other buildings were commenced on December 20, 2023.

Included in this reference material on March 31, 2021
Updated on March 31, 2024



In response to local needs in Fukushima Prefecture, the Ministry of the Environment (MOE) is promoting not only initiatives for environmental restoration but also initiatives toward a new stage of reconstruction of Fukushima to create and rediscover local value from environmental perspectives, including decarbonization, material cycles and natural symbiosis (Fukushima Regeneration/Future Oriented Project).

In August 2020, the MOE concluded the “Cooperation Agreement on Promotion of Future-oriented Environmental Measures for the Reconstruction of Fukushima” with Fukushima Prefecture. Under this agreement, the MOE is promoting future-oriented environmental measures in collaboration with the prefecture, such as steady promotion of the Fukushima Green Reconstruction Concept and promotion of global warming countermeasures at the same time as the reconstruction of Fukushima.

With the aim of promoting waste treatment and creation of industries in Restricted Areas, a non-combustibles recycling project in public-private collaboration was adopted and a non-combustibles recycling facility was completed in Okuma Town in October 2020. In addition, since FY2021, the MOE has been implementing a project to promote the creation of pioneering communities titled “Decarbonization × Reconstruction” Town Planning and has intensively supported *survey*, *planning*, and *equipment* for introducing an independent and distributed energy system, etc. in Fukushima. Solar power generation systems were introduced to the Okuma Town Office Building and a seaweed factory in Minamisoma City.

In April 2019, the Fukushima Green Reconstruction Concept was formulated with the aim of reconstructing Fukushima by the use of natural resources, such as natural parks, and in November 2020, the Fukushima Green Reconstruction Promotion Council was established to promote cooperative initiatives by Fukushima Prefecture, the MOE, and municipalities and relevant bodies in Fukushima. In March 2022, the Bandai-Azuma and Inawashiro Area Step-up Program 2025, Project to Fully Enjoy Bandai-Asahi National Park, was formulated and promotion to further enhance the attractions of national parks, etc. in Fukushima are being implemented. In August 2023, Bandai-Asahi National Park (Tsuchiyu Onsen and Takayu Onsen) was registered as a Zero Carbon Park.

Included in this reference material on March 31, 2022
Updated on March 31, 2024

New Stage of Reconstruction

Fukushima Innovation Coast Framework

- The framework aiming to **create new industries** in Hamadori area, etc. for the purpose of industrial revitalization of the district
- The "**Fukushima Innovation Coast Promotion Organization**" (since July 2017; President: Saito Tamotsu (Senior Advisor, IHI)), the national government, Fukushima Prefecture, and municipalities are cooperatively carrying out activities for such purposes as forming industrial clusters, providing education and fostering human resources, increasing the number of visitors, and providing information, while placing the focus on **six priority fields**.

Six priority fields

Decommissioning

Technology development calling for wisdom domestically and internationally

Naraha Center for Remote Control Technology Development where demonstration tests necessary for decommissioning work, etc. are being conducted

Robots and drones

Accumulation of the robot industry centered on the Fukushima Robot Testing Field

Fukushima Robot Testing Field that simulates an environment for using field robots on land, at sea and in the air

Medical field

Cultivation of companies' sales channels through support for technology development

Fukushima Medical Device Development Support Centre

Energy, environment and recycling-related field

Establishment of cutting-edge renewable energy recycling technology

Promotion of the introduction of renewable energy

Manyo no Sato Wind Farm in Minamisoma

Agriculture, forestry and fisheries industry

Revitalization of the agriculture, forestry and fisheries industry by the use of ICT and robot technology

Creation of a new agricultural model by the use of ICT

Demonstration of driverless tractors

Aerospace

Demonstration of a flying vehicle and invitation of related companies

Aerospace Festa Fukushima

Fukushima Innovation Coast Promotion Organization, national government, Fukushima Prefecture, municipalities, etc.

Industrial clusters
- Top-level activities to invite companies and support matching
- Support for construction of plants and development of new products

Education and human resources development
- Holding of classes to foster human resources in collaboration with educational institutions

Increase of the number of visitors
- Creation of new attractions jointly with local communities

Information provision
- Opening of the Great East Japan Earthquake and Nuclear Disaster Memorial Museum and holding of symposiums

経済産業省

The Study Group on the Fukushima Innovation Coast Framework compiled the Framework in June 2014, aiming to build a new industrial base in the Hamadori area, etc. in order to recover the industry and employment in the district that was severely affected by the earthquake and the nuclear disaster.

At the third Subcommittee Meeting for Promoting the Fukushima Innovation Coast Framework held on November 25, 2019, discussions were held on the "Blueprint of Industrial Development Placing the Fukushima Innovation Coast Framework at the Core," which shows independent and sustainable industrial development in the Hamadori area, etc. envisaged from a medium- to long-term and broad perspective, as well as the direction of concrete initiatives therefor to be promoted by the national government, Fukushima Prefecture, municipalities and related organizations. Discussions were centered on further materialization of the Framework that aims to develop a new industrial base in the Hamadori area, etc. On December 9, 2019, the Reconstruction Agency, the Ministry of Economy, Trade and Industry and Fukushima Prefecture jointly compiled the Blueprint.

For achieving the Framework, efforts have been made under the initiative of the Fukushima Innovation Coast Promotion Organization to develop bases for R&D on decommissioning, research and demonstration on robot technology, and information provision (the Great East Japan Earthquake and Nuclear Disaster Memorial Museum), to materialize projects in such fields as environment and recycling, energy including hydrogen and renewable energy, the agriculture, forestry and fisheries industry, medical services, and aerospace, and to form industrial clusters, and foster human resources, etc.

Major activities include 1,147 demonstration experiments (as of the end of September 2023) conducted at the Fukushima Robot Test Field, which was opened in full in March 2020. Some companies are expanding business in the neighboring areas, such as Namie Town and Futaba Town, while using the Field as their core. In the Grand Design and Action Plan for a New Form of Capitalism and the Follow-up, which were decided at the Cabinet meeting on June 7, 2022, it is stated that the national government will intensively offer support for the improvement of the demonstration field and practical development of startups, etc. with the aim of making the Fukushima Hamadori area into an advanced area for creating startups. Based on this decision, since FY2023, the national government has been implementing preferential measures for startups (point addition to startups and reduction of subsidy rates for large companies) and the development of a broad area flight route in the Regional Reconstruction Commercialization Development Promotion Project (Innovation Subsidies).

Included in this reference material on February 28, 2018
Updated on March 31, 2024

Chapter 10

Health Management

Chapter 10 outlines the Fukushima Health Management Survey and other surveys and examinations that are conducted for the purpose of promoting the health of the residents of Fukushima Prefecture and ensuring their safety in light of the effects of radiation due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS.

You can understand Fukushima Prefecture's efforts for health management in order to promote and maintain residents' good health toward the future.

Outline of the Fukushima Health Management Survey

What is Fukushima Prefecture's Fukushima Health Management Survey?

Considering the effects of radiation due to the nuclear disaster, Fukushima Prefecture has been conducting the "Fukushima Health Management Survey" since June 2011 in order to monitor and improve the health of residents for the long term into the future.

The Fukushima Health Management Survey consists of the following five components.

(i) Basic Survey (estimation of external doses) (all residents)

(ii) Detailed Surveys

- **Thyroid Ultrasound Examination** (residents aged around 18 or younger as of March 11, 2011)
- **Comprehensive Health Checkup** (residents in Evacuation Areas)
- **Mental Health and Lifestyle Survey** (residents in Evacuation Areas)
- **Pregnancy and Birth** Survey (pregnant women who have obtained a maternity handbook for each fiscal year)

Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University (information on the Fukushima Prefecture's Fukushima Health Management Survey)

In the aftermath of the diffusion of radioactive materials from the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, subsequent evacuations and such, the "Fukushima Health Management Survey" was commenced in Fukushima Prefecture, aiming to improve and maintain the health of the residents of the prefecture into the future by means of understanding their health conditions and linking such data to the prevention and early detection and treatment of diseases, while assessing their radiation doses.

Within the Fukushima Health Management Survey, the Basic Survey was offered to all residents of Fukushima Prefecture to ascertain their external doses during the four months following the accident at the NPS, and the Thyroid Ultrasound Examination has been conducted for all residents who were around 18 years old or younger at the time of the accident. The Comprehensive Health Checkup to ascertain physical health conditions and the Mental Health and Lifestyle Survey to ascertain mental health conditions have also been conducted for approximately 210,000 people who were residing in areas designated for evacuation after the accident. Furthermore, the Pregnancy and Birth Survey has been conducted for pregnant women who obtained a maternity handbook within Fukushima Prefecture and those who obtained a maternity handbook somewhere else but gave birth in the prefecture.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

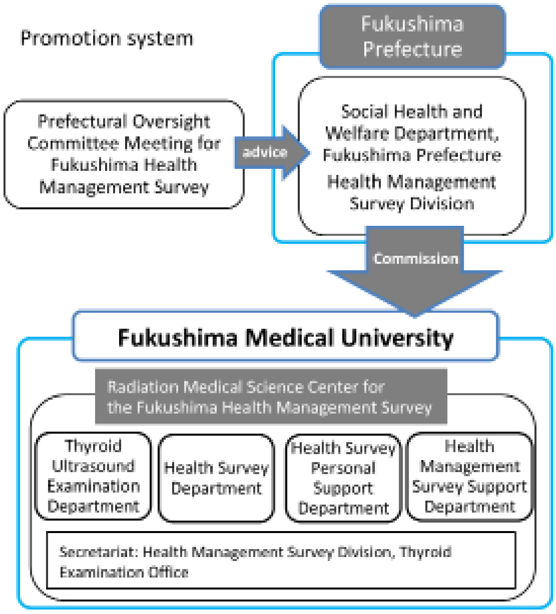
Outline of the Fukushima Health Management Survey

Fukushima Health Management Survey (Survey Promotion System)

[Purpose of the Survey]

Considering the effects of radiation due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, Fukushima Prefecture has commissioned Fukushima Medical University to conduct the "Fukushima Health Management Survey" for all residents of the prefecture in order to monitor and improve their health for the long term and ensure their safety and peace of mind.

By continuously conducting surveys and health checkups, the Survey aims to achieve the prevention and early detection and treatment of diseases and improve the health of residents into the future, while developing better systems for research, education and medical services.



[Promotion system]

With advice, etc. from qualified individuals comprising the Prefectural Oversight Committee Meeting for Fukushima Health Management Survey, Fukushima Prefecture and Fukushima Medical University have been jointly conducting the Survey.

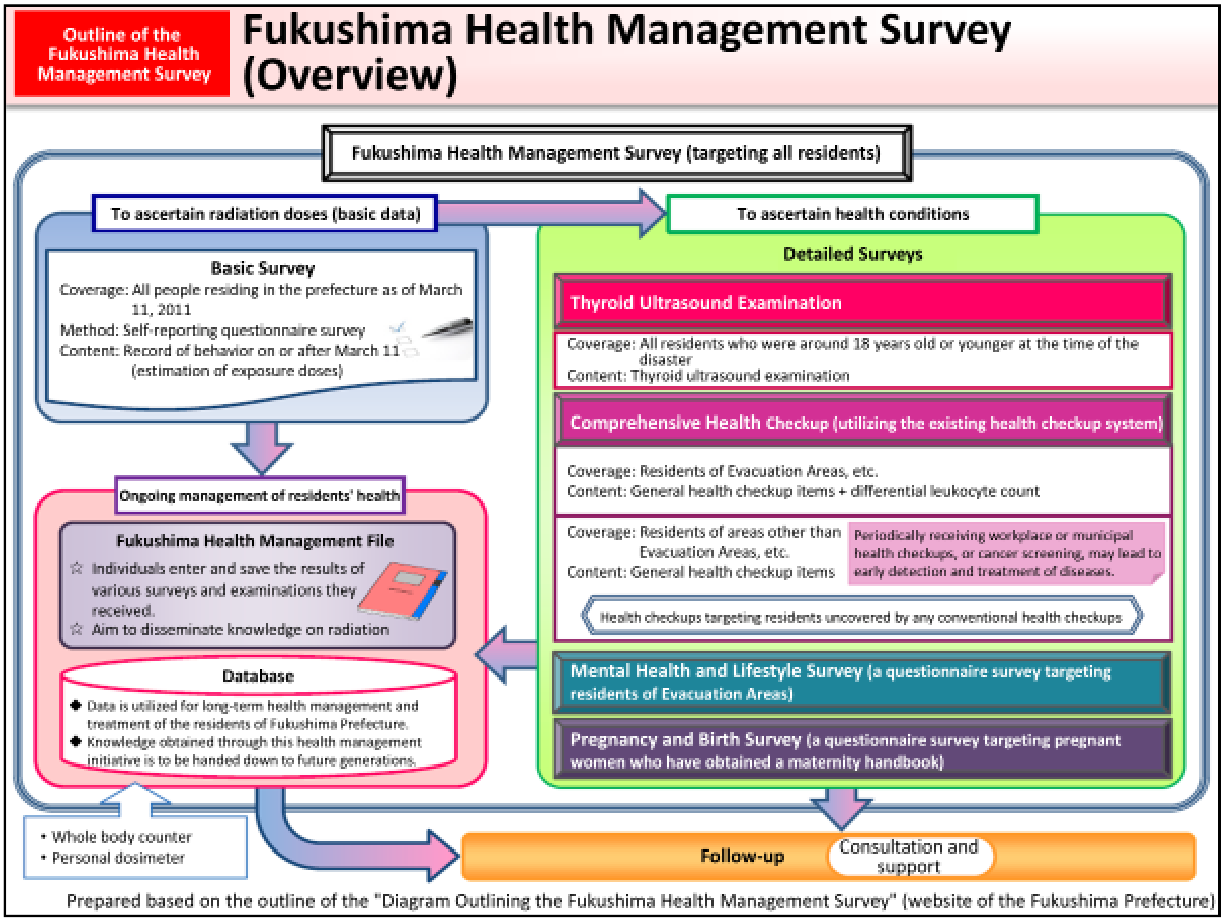
Fukushima Medical University established the Radiation Medical Science Center for the Fukushima Health Management Survey in September 2011.

Prepared based on the "Fukushima Health Management Survey, Fukushima Prefecture" (website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University)

The Fukushima Health Management Survey is being carried out by Fukushima Medical University under commission from Fukushima Prefecture, which serves as the responsible entity. Fukushima Medical University established the Radiation Medical Science Center for the Fukushima Health Management Survey to carry out the Survey.

Fukushima Prefecture set up the Prefectural Oversight Committee Meeting for Fukushima Health Management Survey with the aim of obtaining advice on the Fukushima Health Management Survey from a broad panel of experts.

Included in this reference material on March 31, 2015
Updated on March 31, 2022



The Fukushima Health Management Survey is broadly divided into the Basic Survey and Detailed Surveys.

The Basic Survey was conducted for the purpose of estimating residents' external doses for the four months after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS based on their behavioral records and obtaining data that is to serve as the basis for monitoring and protecting their health into the future.

The Detailed Surveys are to ascertain residents' present health conditions, as follows:

The first is the Thyroid Ultrasound Examination for all residents who were around 18 years old or younger as of March 11, 2011. As cases of thyroid cancer increased among children after the Chornobyl NPS Accident, this examination aims to ascertain children's thyroid status and promote their health for the long term.

The second is the Comprehensive Health Checkup for people who used to reside in Evacuation Areas, being conducted with the aim of achieving the prevention, early detection, and treatment of lifestyle-related diseases that may be caused by changes in their living circumstances.

The third is the Mental Health and Lifestyle Survey, which is also conducted for people from Evacuation Areas. This is for offering support to the affected people to ease anxiety caused by the Great East Japan Earthquake and the accident at the NPS.

The fourth is the Pregnancy and Birth Survey targeting pregnant women who have worries over various things including radiation fears in relation to childbirth and child rearing.

Fukushima Prefecture compiles all data into a centralized database for the long-term utilization of accumulated knowledge.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Basic Survey

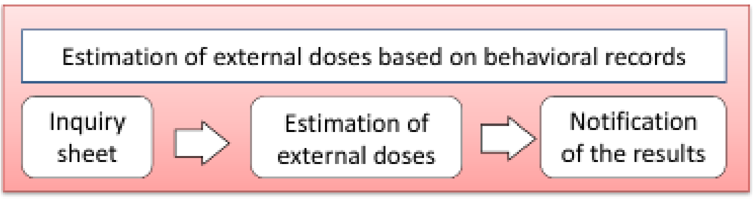
Basic Survey: Purpose

A survey to obtain data that is to serve as the basis for monitoring and protecting residents' health

In order to estimate external doses, individuals were asked to keep and submit a record of their behavior.

Based on collected behavioral records for the four months from March 11 to July 11, 2011, each individual's external dose was estimated using the External Dose Estimation System developed by the National Institute of Radiological Sciences.

[Survey scheme]



Estimated results and the period for estimation are reported to participating individuals to let them know their own external doses, and at the same time, the obtained data are utilized in the Detailed Surveys and individuals' health management to be continued for the long term.

Prepared based on the 4th Expert Meeting on Communications with Nuclear Disaster Victims Regarding Their Health, Ministry of the Environment

The Basic Survey was commenced for the purpose of estimating the level of external doses of the residents of Fukushima Prefecture based on the records of their behavior, informing them of the estimation results individually, and thereby promoting and maintaining the health of the prefectural residents, in light of the effect of radiation due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, which occurred following the Great East Japan Earthquake.

Specifically, inquiry sheets were delivered to the applicable residents to ask them to record their behavior during the four months after the accident. Based on the behavioral records entered in the inquiry sheets, individuals' external doses were estimated using a program developed by the National Institute of Radiological Sciences. The four months after the accident, which is the targeted period of the Basic Survey, is the period during which ambient dose rates were the highest, and it is most important to determine people's external doses during this period.

Individuals' estimated external doses were compiled and statistically processed, and have been utilized for analyzing radiation exposure and its health effects in Fukushima Prefecture.

Included in this reference material on March 31, 2013
Updated on March 31, 2020

Basic Survey: Outline

Basic Survey

[Period for estimation]

Behavior during the four months from March 11 to July 11, 2011

[Coverage]

Approx. 2.06 million people

- Residents of the prefecture:

  People with residence registration in the prefecture from March 11 to July 1, 2011

- People residing outside the prefecture:

  (1) People who were registered as residents in other prefectures but were residing in the prefecture from March 11 to July 1, 2011

  (2) People residing outside the prefecture who commuted to work or school in the prefecture from March 11 to July 1, 2011

  (3) People residing outside the prefecture who temporarily stayed in the prefecture from Mar. 11 to Mar. 25, 2011

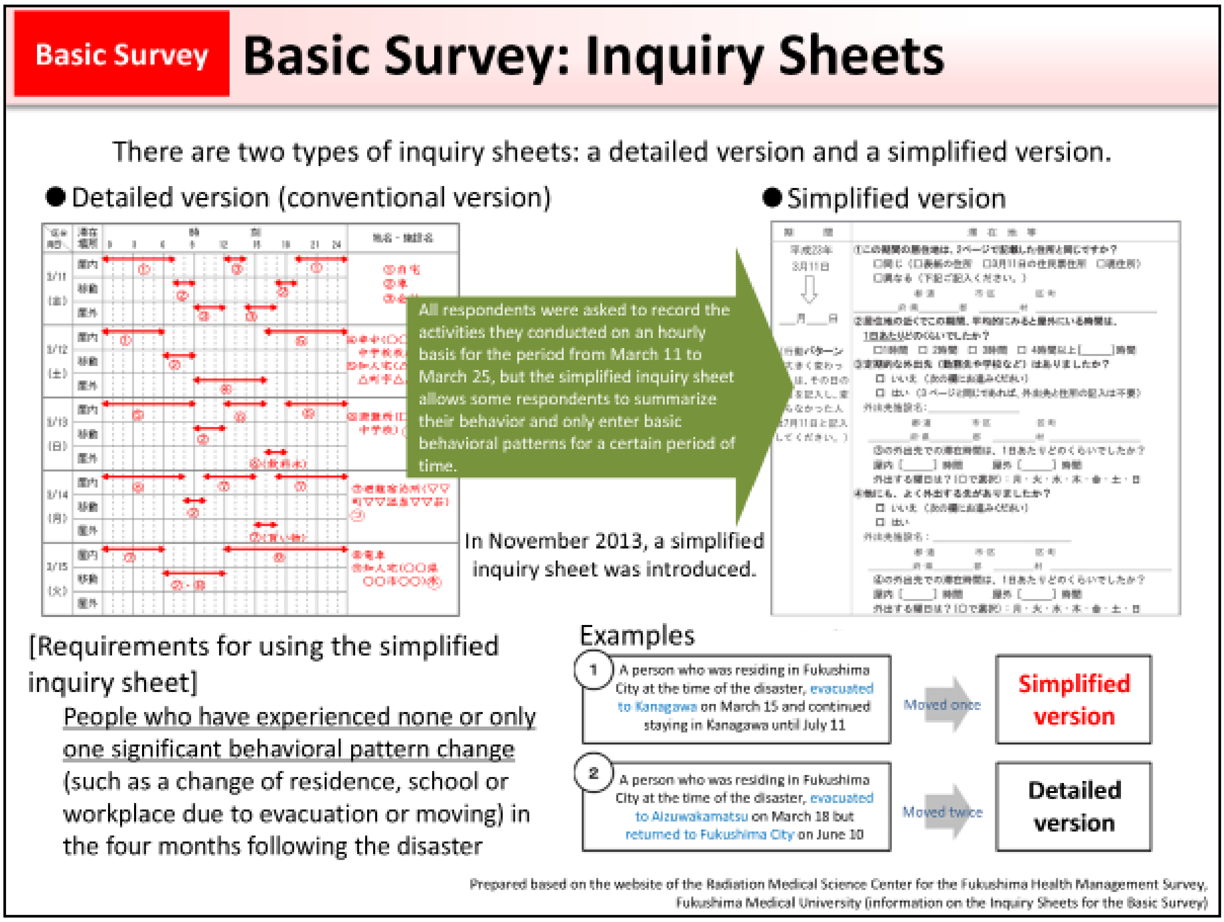
(For people residing outside the prefecture, inquiry sheets were sent upon their request.)

The 4th Expert Meeting on Communications with Nuclear Disaster Victims Regarding Their Health, Ministry of the Environment

The period for surveying behavioral records was the four months from March 11 to July 11, 2011.

The Basic Survey covered approx. 2.06 million people who were registered as residents of the prefecture at the time of the disaster. People registered as residents in other prefectures were also covered if they resided, commuted to work or school, or temporarily stayed in the prefecture during this period.

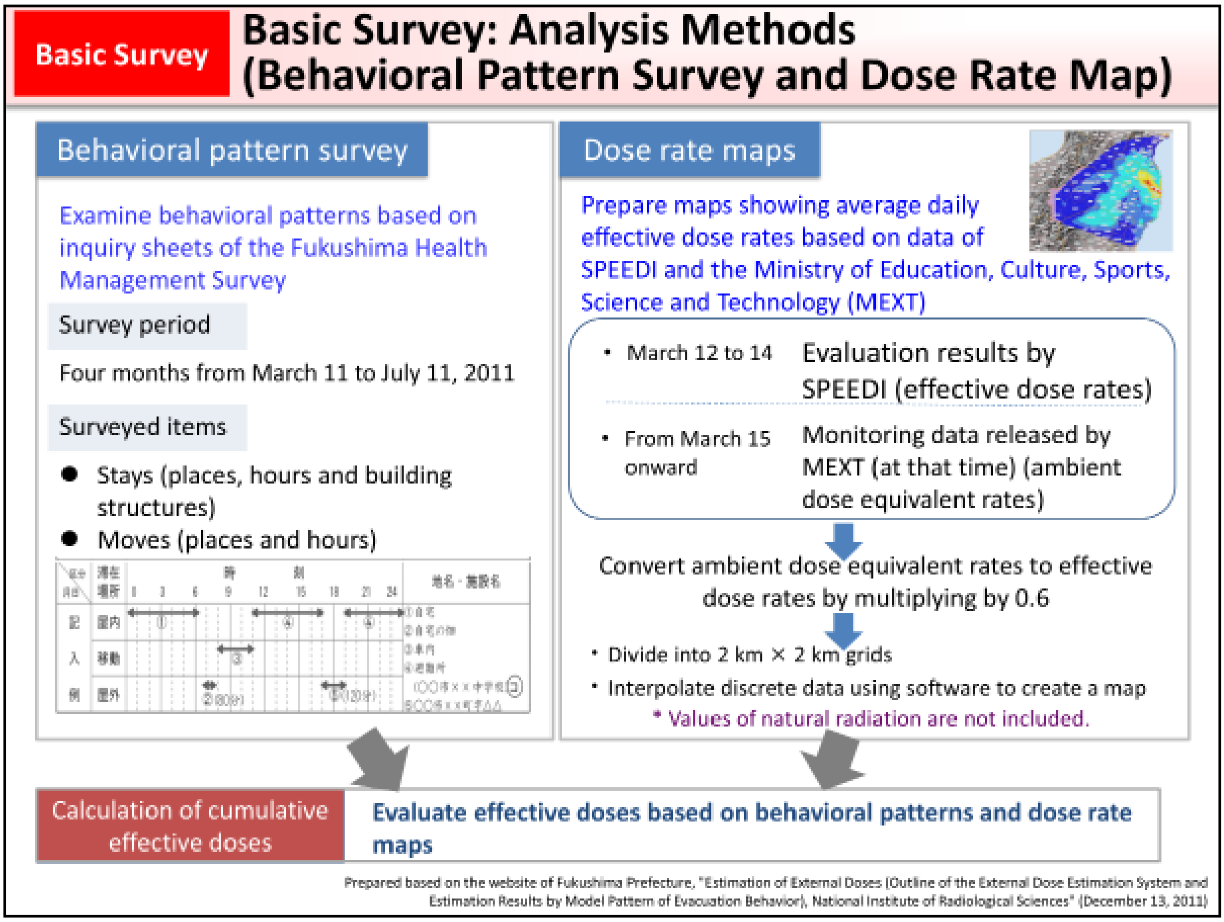
Included in this reference material on March 31, 2013
Updated on March 31, 2019



The inquiry sheet for the Basic Survey requires respondents to record the activities they conducted on an hourly basis for the period from March 11 to March 25. In response to complaints concerning the difficulty in filling in the sheet, a simplified version was introduced in November 2013.

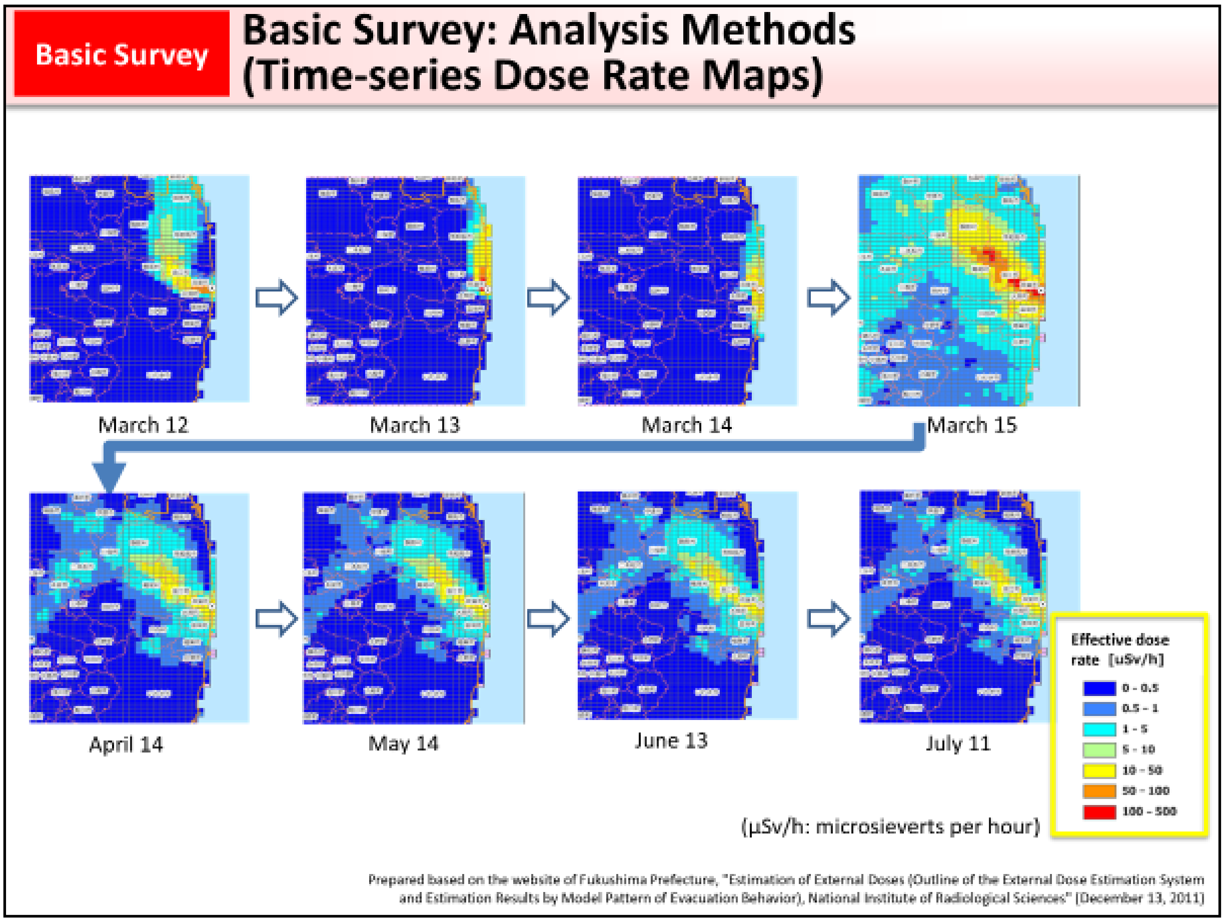
However, in order to maintain the accuracy of the survey, the simplified inquiry sheet may be used only by those who have experienced none or only one significant change in their living place due to evacuation or moving, etc. in the four months following the disaster.

Included in this reference material on March 31, 2013
Updated on March 31, 2019



In the Basic Survey, external doses were evaluated combining the results of the behavioral pattern survey and the created dose rate maps. The evaluation was conducted based on dose rate maps and behavioral records entered by respondents, such as where and how long they stayed in buildings, and the type of buildings where they stayed, during the survey period.

Included in this reference material on March 31, 2013
Updated on March 31, 2019



Dose rate maps used here are the monitoring data released by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) (at that time).[1]

1. For the three days from March 12 to March 14, which are included in the period (March 12 to March 15, 2011) during which the monitoring data released by MEXT (at that time) is not available, calculation results by SPEEDI (System for Prediction of Environmental Emergency Dose Information) using the data on radioactive material discharge released by the Nuclear and Industrial Safety Agency (at that time) in June 2011 were applied. Data for March 15 was assumed to be the same as that for March 16, and from March 16 onward, the monitoring data released by MEXT (at that time) was used.

Included in this reference material on March 31, 2013
Updated on March 31, 2019

Basic Survey

Basic Survey: Obtained Responses and Their Representativeness

The response rate was 27.7% for the entire Fukushima Prefecture.
However, as a result of the examination on the representativeness, the dose distribution based on the responses obtained so far in the seven districts in the prefecture was found to be unbiased and to properly represent that of respective districts.

Table 1

Responses to the Basic Survey

As of March 31, 2023

Coverage		2,055,236	
Number of responses	Detailed version	493,997	24.0%
	Simplified version	75,441	3.7%
	Total	569,438	27.7%

* Response rates are rounded off for each category.

Table 2

Response rate by age group

As of March 31, 2023

Age group	0~9	10~19	20~29	30~39	40~49	50~59	60~	計
Response rate	46.8%	36.3%	18.2%	24.9%	22.5%	23.0%	27.9%	27.7%

* Rates (%) are rounded off.

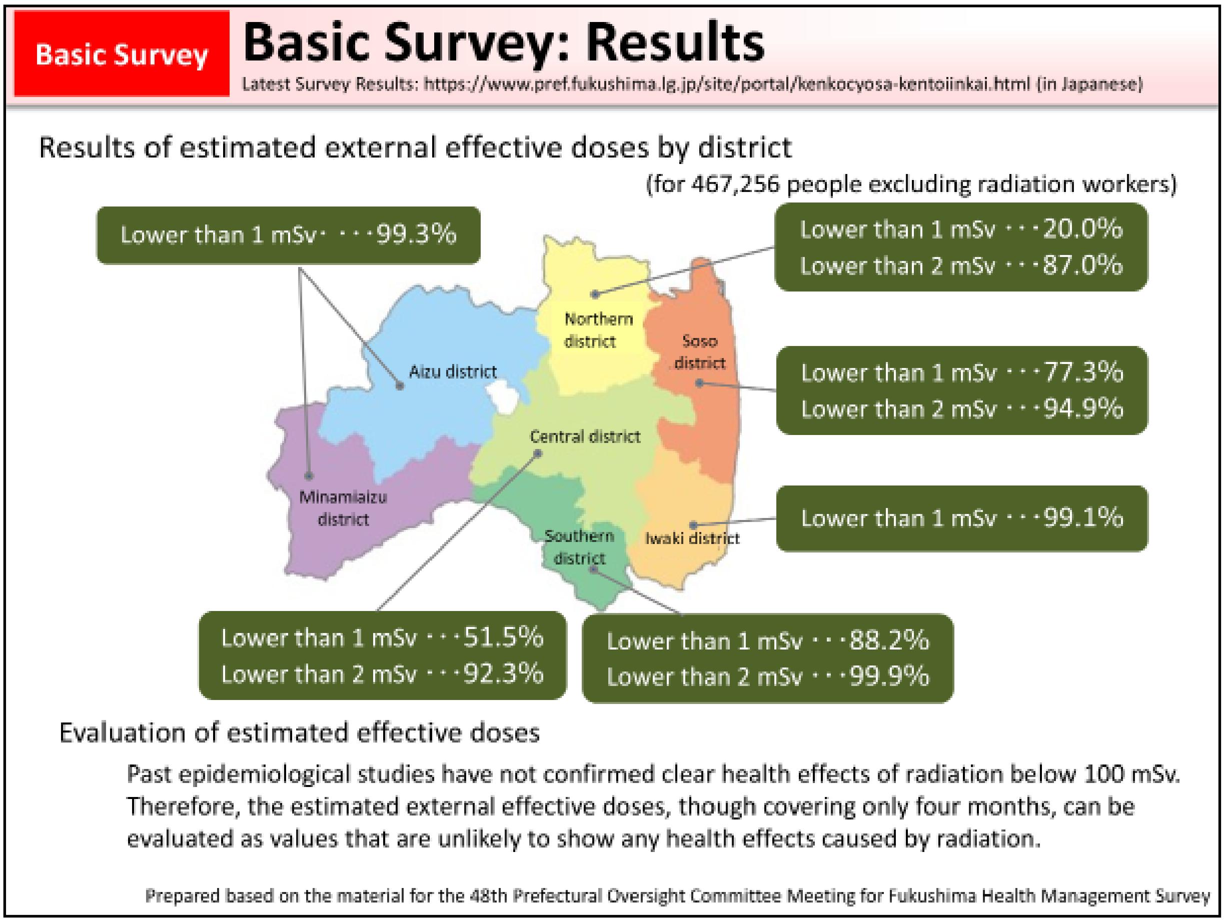
Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Approx. 569,438 people have responded so far (response rate: 27.7%).

In light of the fact that the response rate of the Basic Survey had remained unchanged at around 27%, an examination on the representativeness of the dose distribution was conducted in FY2015. As a result of the examination, the dose distribution based on the responses obtained so far in the seven districts in the prefecture was found to be unbiased and to properly represent that of respective districts.

See the following website for details:
https://www.pref.fukushima.lg.jp/uploaded/attachment/151271.pdf (in Japanese)

Included in this reference material on March 31, 2013
Updated on March 31, 2024



Out of a total of 555,216 people for whom external effective doses have been estimated by March 31, 2023, a total of 476,476 people submitted records of their behavior for the entirety of the four-month period for estimation. The figure above shows the estimation results of 467,256 people, excluding those who had engaged in radiation work, by district. As shown in the figure, people for whom estimated external effective doses were lower than 1 mSv accounted for 88.2% in the southern district, 99.3% in the Aizu and Minamiaizu districts, 77.3% in the Soso district, and 99.1% in the Iwaki district. The maximum value was 25 mSv estimated for a person residing in the Soso district.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Purpose and Coverage

"We will promote the health of the children in Fukushima for the long term."

[Purpose]

It has been reported that cases of thyroid cancer increased among children after the Chornobyl NPS Accident due to internal exposure to radioactive iodine. Although radioactive iodine doses are considered to be lower in Fukushima than in Chornobyl, the Thyroid Ultrasound Examination was commenced with the aim of ascertaining children's thyroid status and promoting their health for the long term.

[Coverage]

All people of Fukushima Prefecture who were aged zero to 18 as of March 11, 2011 (those born from April 2, 1992, to April 1, 2011) (approx. 368,000 people)
* For the Full-scale Survey in FY2014 onward, the coverage was expanded to include those born from April 2, 2011, to April 1, 2012 (approx. 381,000 people in total).

Prepared based on the Report on the Fukushima Prefecture's Fukushima Health Management Survey (FY2019)

It has been reported that cases of thyroid cancer increased among children after the Chornobyl NPS Accident due to internal exposure to radioactive iodine. Compared with the Chornobyl NPS Accident, the amount of radioactive materials discharged into the environment after the accident in Fukushima was much smaller, and estimated internal and external doses of the residents were even smaller. Therefore, it is predicted that there would be no epidemiologically detectable thyroid health risks (p.141 of Vol. 1, "Evaluation of the Interim Report on Thyroid Cancer Compiled by the Expert Meeting on Health Management After the TEPCO's Fukushima Daiichi NPS Accident"). However, as concerns remain about effects of radiation due to the accident on children's thyroid glands, the Thyroid Ultrasound Examination has been continued under the framework of the Fukushima Health Management Survey with the aim of ascertaining children's thyroid status and promoting their health into the future.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Outline (1/3)

● Examination schedule

	Category	Period	Eligible persons
First examination	**Preliminary Baseline Survey** Ascertain children's thyroid status	Oct. 2011 - March 2014	Residents who were residing in Fukushima Prefecture at the time of the disaster and were approximately 18 years old or younger (those born from April 2, 1992, to April 1, 2011)
Second examination	**Full-scale Survey** Make comparison with the results of the Preliminary Baseline Survey	April 2014 - March 2016	Those born from April 2, 1992, to April 1, 2012 Once every two years until becoming 20 years old, then once every five years after becoming 25 years old, for example, at the ages of 25, 30 and so on
Third examination		May 2016 - March 2018	
Fourth examination		April 2018 - March 2020	
Fifth examination		April 2020 - March 2023	

Due to the impact of the COVID-19 pandemic, the fifth-round survey was conducted during the period of three years from FY2020 to FY2022.

Prepared based on the report of the "Fukushima Health Management Survey" by Fukushima Prefecture (FY2021)

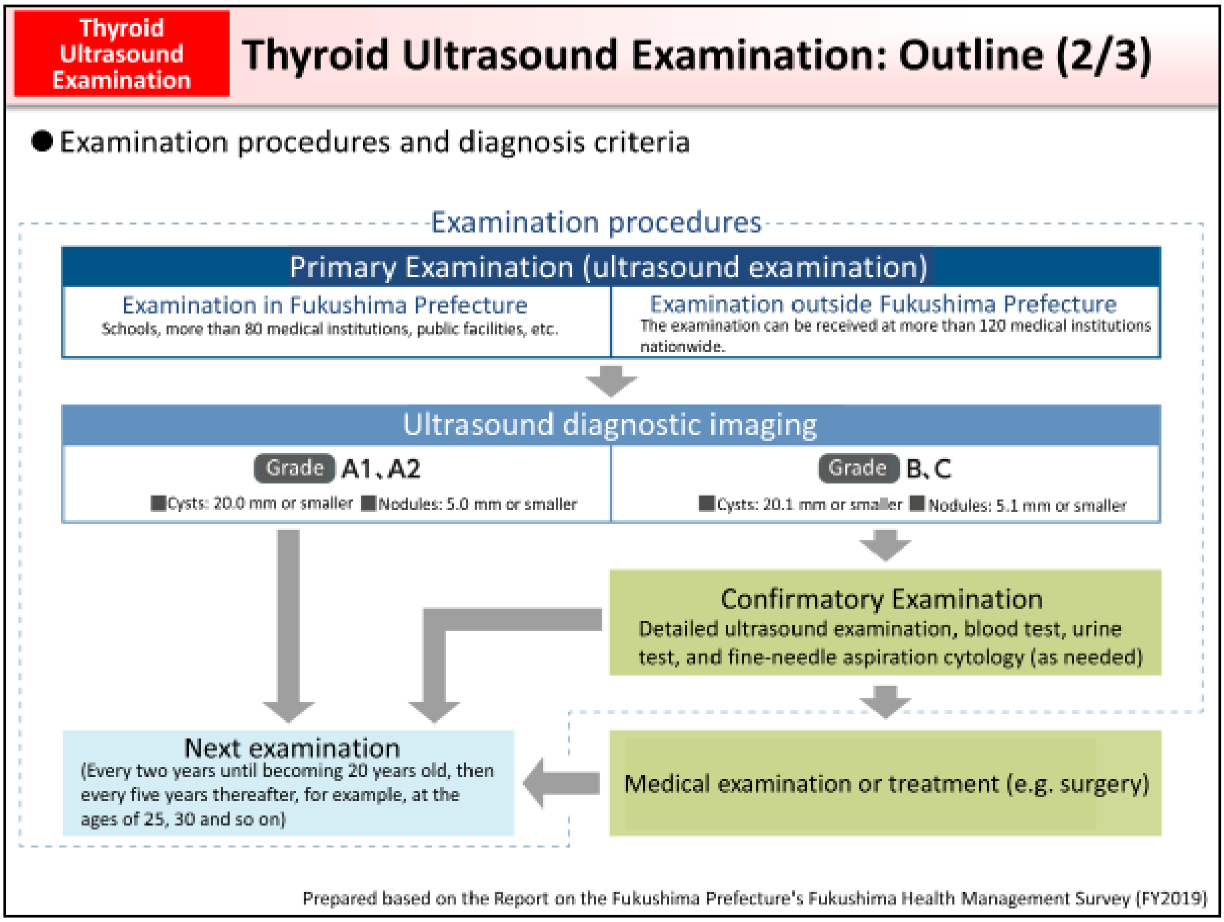
Even though radiation effects are unlikely to be detected, ascertaining the current thyroid status of the relevant group of people is very important in order to monitor and support health for the long term. Therefore, the Thyroid Ultrasound Examination was conducted for all children in Fukushima Prefecture after the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS over a period of approximately two and a half years from October 2011 (Preliminary Baseline Survey).

Then, in FY2014, the coverage was expanded to include those born from April 2, 2011, to April 1, 2012, and the Full-scale Survey was conducted as the second-round survey.

From the third-round survey onward, the participants receive examinations once every two years until they become 20 years old and once every five years thereafter.

Due to the impact of the COVID-19 pandemic, the fifth-round survey was conducted during the period of three years from FY2020 to FY2022.

Included in this reference material on March 31, 2013
Updated on March 31, 2023



The Primary Examination checks whether there are any nodules or cysts and measures the sizes thereof, if any. The Confirmatory Examination is recommended to those who are considered to require a more detailed examination.

In the Confirmatory Examination, a more accurate ultrasound examination, plus blood and urine tests are conducted, and fine-needle aspiration cytology is also conducted when a doctor considers it necessary.

The Thyroid Ultrasound Examination is completed at this point.

Then, individuals who are found to require treatment receive it from their regular healthcare provider, under the relevant medical insurance system.

Included in this reference material on March 31, 2016
Updated on March 31, 2021

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Outline (3/3)

● Content of the examination

[Primary Examination]

An ultrasound examination assesses whether there are any nodules or cysts. The examination ordinarily finishes in three to five minutes with no pain involved.

The diagnosis panel, consisting of medical specialists, reviews the ultrasound images and makes diagnoses. The examination results are sent by post, but explanations are given at the examination venues or by phone upon participants' requests.

[Confirmatory Examination]

When a more detailed examination is found to be necessary as a result of the Primary Examination, the Confirmatory Examination is conducted for the relevant person.
In the Confirmatory Examination, another ultrasound examination, plus blood and urine tests are conducted.

If a doctor considers it necessary as a result of these tests, fine-needle aspiration cytology of the thyroid may also be performed and interpreted.

Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University (Information on the Thyroid Ultrasound Examination, FAQs)

An ultrasound examination is conducted with an participant lying on his/her back. A doctor places an ultrasonic probe with jelly on its tip over the participant's thyroid (located around the base of the neck) and examines whether there are any cysts or nodules while moving the probe over the participant's skin.

The examination ordinarily finishes in three to five minutes with no pain involved.

Definitive diagnoses from the Primary Examination are not made at the venues. In order to make comprehensive and objective judgments, ultrasound images are later reviewed by a panel of medical specialists. This is to ensure a consistently high level of diagnostic accuracy throughout the Fukushima Health Management Survey.

The sizes of nodules and cysts mentioned above are reference values for making diagnoses. If any nodules or cysts found in ultrasound images are suspected to be malignant, the case is designated as Grade B irrespective of the sizes of the nodules or cysts and the Confirmatory Examination is recommended.

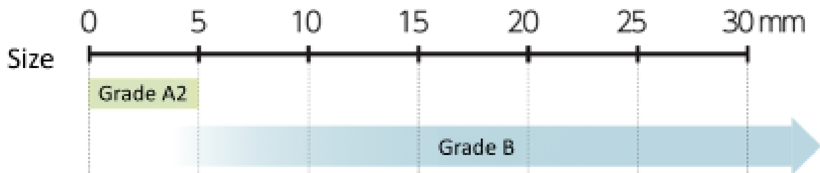
In the Confirmatory Examination, a more accurate ultrasound examination, plus blood and urine tests, are conducted. If, as a result of these tests, a doctor considers it necessary, fine-needle aspiration cytology, an examination of a sample tissue taken from the person's thyroid, may also be conducted.

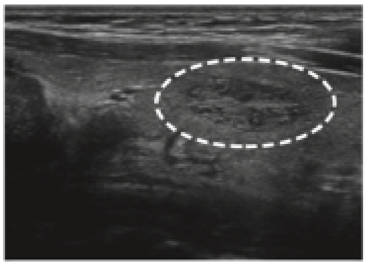
Included in this reference material on March 31, 2016
Updated on March 31, 2019

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Nodules

A nodule, which might also be called a lump, is an irregular density of thyroid cells.





Nodules
* The part circled with a dotted line is a nodule.

- Nodules may be benign or malignant (cancerous), and most are benign. Even if a detected nodule is 5.0 mm or smaller, if the Confirmatory Examination is considered to be necessary, the diagnosis is Grade B.
- It has been widely known that many cases of thyroid cancer are occult (latent), showing no symptoms or health effects over a lifetime. Occult thyroid cancer is 5.0 mm or smaller in most cases and it is considered to be disadvantageous for patients to detect and treat them. Accordingly, it is generally recommended not to conduct a detailed examination, such as cytological testing, for nodules of 5.0 mm or smaller.
- Therefore, in the Thyroid Ultrasound Examination conducted through the Fukushima Health Management Survey, the Confirmatory Examination is not performed for nodules of 5.0 mm or smaller; instead, an ultrasound examination (Primary Examination) is to be conducted in 2 to 5 years.

Prepared based on the Report on the Fukushima Prefecture's Fukushima Health Management Survey (FY2019)

A nodule, which might also be called a lump, is a thyroid cell with irregular density. Some nodules are malignant, but most are benign.

It has been known that thyroid cancer is often latent, presenting no symptoms or health effects over a lifetime. Thus, detecting all cancers and forcing patients to receive treatment may be sometimes rather disadvantageous, so a detailed examination, such as cytological testing, is not generally conducted for small nodules. In the Thyroid Ultrasound Examination conducted through the Fukushima Health Management Survey, the Confirmatory Examination is not performed for nodules of 5 mm or smaller; instead, the next regularly scheduled ultrasound examination (Primary Examination) is to be conducted.

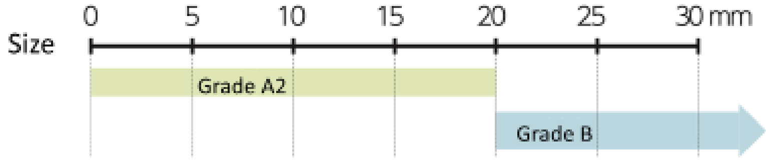
In some cases, a person once diagnosed as Grade A1 is diagnosed as Grade A2 or Grade B in the next examination, or conversely, a person once diagnosed as Grade A2 is subsequently diagnosed as Grade A1.

Included in this reference material on March 31, 2013
Updated on March 31, 2021

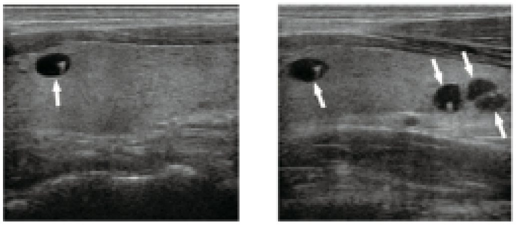
Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Cysts

A cyst, which resembles a bag filled with fluid, is generally benign, and is often found even in healthy people



Cysts are generally benign, but those of 20 mm or larger may cause a feeling of pressure in the throat and fluid in a cyst is sometimes withdrawn.



Single cyst Multiple cysts

* The parts pointed with arrows are cysts.

- A cyst, which resembles a bag filled with fluid, is benign, and is often found even in healthy people.
- Cysts often change in size or number, and many people have multiple cysts.
- Examinations so far revealed that cysts are seldom found in infants and young children but are found more often in elementary, junior high, and high school students.

Prepared based on the Report on the Fukushima Prefecture's Fukushima Health Management Survey (FY2021)

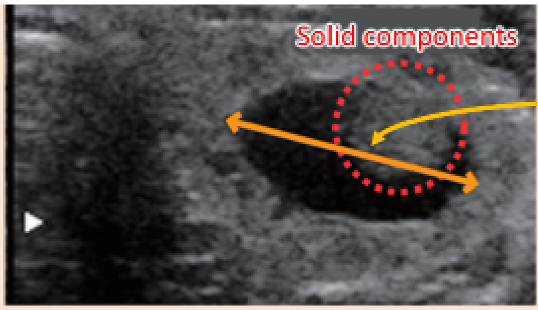
Cysts identified in the Thyroid Ultrasound Examination being conducted in Fukushima Prefecture are considered benign, consisting only of fluid and containing no cells. They are often found even in healthy people, especially among primary and secondary school students. Therefore, repeated examinations often find cysts as children grow up.

Included in this reference material on March 31, 2013
Updated on March 31, 2023

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Handling of Cysts with Solid Components

Cysts with solid components are all judged as nodules.



Measure the entirety of a nodule

When the maximum size of a nodule with solid and cystic components (the length of the orange arrow) is 5.1 mm or larger, the participant is diagnosed as Grade B.

- "Cysts with solid components," which are cysts containing nodules inside, are all evaluated as nodules in this examination.
- In such case, not the size of a nodule inside but the maximum size of a cyst with the nodule is recorded. For example, when a 3 mm-nodule is found in a 30 mm-cyst, the relevant participant is judged to have a 30 mm-nodule and is diagnosed as Grade B (as the size exceeds 5.1 mm).

Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University (information on the Thyroid Ultrasound Examination, FAQs)

Some cysts contain nodules. In the Thyroid Ultrasound Examination conducted in the Fukushima Health Management Survey, those cysts with solid components (nodules) are all judged as nodules and diagnosis criteria for nodules are applied.

For example, a 30 mm-cystic lesion with a 3 mm-solid component is judged as a nodule and diagnosis criteria for nodules are applied. As the size is larger than 5.1 mm, the participant is diagnosed as Grade B and is advised to receive the Confirmatory Examination.

Lesions judged as fluid-only cysts are considered to be benign.

(Related to p.134 of Vol. 2, “Thyroid Ultrasound Examination: Cysts”)

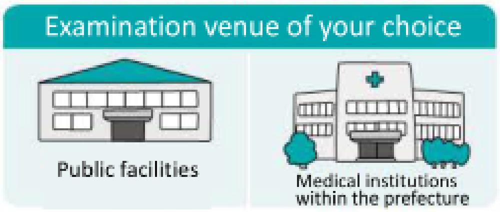
Included in this reference material on March 31, 2016
Updated on March 31, 2022

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: System for Examinations in and outside Fukushima

Expansion of available institutions and system for implementing examinations in Fukushima Prefecture

Efforts have been continued to increase the number of institutions in Fukushima Prefecture and to enhance system for implementing examinations in order to reduce the number of people who cannot receive the examination due to various reasons.



Expansion of institutions for implementing examinations outside Fukushima Prefecture

Efforts have been continued to increase institutions so that people can receive the examination even outside the prefecture.

The examination can be received at more than 120 medical institutions nationwide.
In order to receive the Thyroid Ultrasound Examination, you need to make a reservation in advance with the Radiation Medical Science Center for the Fukushima Health Management Survey.

Provision of explanation booths

Since July 2015, booths have been set up at examination venues in public facilities, etc. for providing participants with explanations on examination results. Physicians explain provisional examination results available on the day using ultrasound images.

When explanation booths cannot be set up at the examination venue or for examination performed in some venues such as schools, telephone consultation services are provided instead.

Prepared based on the Fukushima Health Management Survey Reports (2018 and 2019)

The Thyroid Ultrasound Examination is conducted in collaboration between Fukushima Medical University and medical institutions in and outside Fukushima Prefecture. For more convenience to residents of the prefecture, efforts have been made to increase venues and opportunities with the aim of promoting the health of the residents in Fukushima Prefecture for the long term.

Included in this reference material on March 31, 2015
Updated on March 31, 2021

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Order of Full-scale Survey

The examination has been conducted sequentially, starting in areas where ambient dose rates were highest after the disaster.

- Full-scale Survey (fourth-round survey) (for those aged 18 or younger)
  - Municipalities where the FY2018 Primary Examination was conducted (25 municipalities)
  - Municipalities where the FY2019 Primary Examination was conducted (34 municipalities)
- Full-scale Survey (fifth-round survey) (those living outside Fukushima Prefecture and classification for analysis)
  - Municipalities where the FY2020 Primary Examination was conducted (25 municipalities)
  - Municipalities where the FY2021 Primary Examination was conducted (34 municipalities)

Prepared based on the material for the 36th and 43rd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

The Thyroid Ultrasound Examination has been conducted sequentially, starting in areas where ambient dose rates were higher at the time of the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS.

For Full-scale Surveys following the Preliminary Baseline Survey, notices of the examination have been sent mostly in the same order.

Since the Full-scale Survey (fourth-round survey), the examination has been conducted mostly in the same order for those aged 18 or younger. However, for those aged 19 or older, the examination has been conducted not by region but by age (school year). In FY2018, those born in FY1996 (aged 22) and born in FY1998 (aged 20) were examined, and in FY2019, those born in FY1997 (aged 22) and born in FY1999 (aged 20) were examined.

Since FY2017, the examination has been conducted for those who become 25 years old in the relevant year, and then once every five years thereafter.

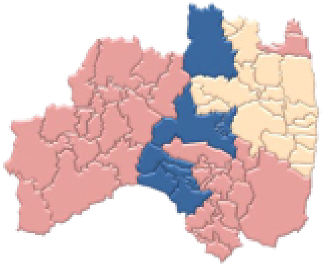
Due to the impact of the COVID-19 pandemic, the Full-scale Survey (fifth-round survey) was decided to be carried out in three years. As originally planned, notices of the examination were sent to examination targets living outside Fukushima Prefecture in FY2020 and FY2021, and the examination may be received until the end of FY2022.

Included in this reference material on March 31, 2015
Updated on March 31, 2022

Thyroid Ultrasound Examination

Order of Implementing the Full-scale Survey (Fifth-round Survey) of the Thyroid Ultrasound Examination (within Fukushima Prefecture)

- Full-scale Survey (fifth-round survey): At elementary schools and junior high schools in Fukushima Prefecture



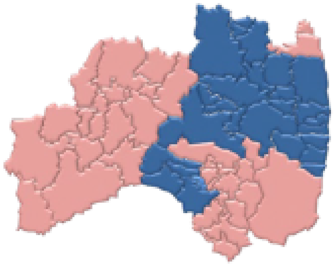
Municipalities where the Primary Examination was conducted in FY2020 (18 municipalities)

Municipalities where the Primary Examination was conducted in FY2021 (7 municipalities)

Municipalities where the Primary Examination was conducted in FY2022 (34 municipalities)

* Due to the impact of the COVID-19 pandemic, the survey at elementary schools and junior high schools for FY2020 was commenced in September 2020.

- Full-scale Survey (fifth-round survey): At high schools in Fukushima Prefecture



Municipalities where the Primary Examination was conducted in FY2021 (25 municipalities)

Municipalities where the Primary Examination was conducted in FY2022 (34 municipalities)

Prepared based on materials for the 43rd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Due to the impact of the COVID-19 pandemic, the Full-scale Survey (fifth-round survey) was decided to be carried out in three years. The survey at elementary schools and junior high schools for FY2020 was commenced in September 2020 and has been conducted from FY2020 through to FY2022. The survey at high schools in Fukushima Prefecture is planned to be conducted in FY2021 and FY2022. For students who graduate high schools in the fiscal year preceding the survey year, notices for examinations in public facilities or other institutions implementing examinations are sent.

Included in this reference material on March 31, 2022

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the Preliminary Baseline Survey

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people)			
					Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	367,637	300,472 (81.7)	9,511	300,472 (100.0)	154,605(51.5)	143,573 (47.8)	2,293(0.8)	1 (0.0)

Grade A : 99.2%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people)	Number of those who received a definitive diagnosis (people)				
			Rate of definitive diagnosis (%)	For next examination		For regular healthcare program, etc.	
		Examination rate (%)		A 1	A 2		Those who received fine-needle aspiration cytology
Total	2,293	2,130 (92.9)	2,091 (98.2)	132 (6.3)	579 (27.7)	1,380 (66.0)	547 (39.6)

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 116 people; 39 males and 77 females

Average age: 17.3 ± 2.7 years old (8 to 22 years old); At the time of the disaster: 14.9 ± 2.6 years old (6 to 18 years old)

Average tumor size: 13.9 ± 7.8 mm (5.1 to 45.0 mm)

● Out of 116 people whose tumors were diagnosed as malignant or suspicious for malignancy, 102 received surgery (benign nodule: 1; papillary cancer: 100; poorly differentiated cancer: 1).

Prepared based on the material for the 31st Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These are the results of the Preliminary Baseline Survey, which was the very first Thyroid Ultrasound Examination (FY2011 to FY2013).

Participants diagnosed as Grade A in the Primary Examination accounted for 99.2% of the total, while those diagnosed as Grade B accounted for 0.8%. It became clear that most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and that those diagnosed as Grade B had nodules of 5.1 mm or larger.

In the Confirmatory Examination, as a result of a more accurate ultrasound examination and other tests, 34%, or approximately one out of three who received the Confirmatory Examination, were diagnosed as being equivalent to Grade A and were recommended to receive the next periodic examination (Full-scale Survey) in the same manner as those diagnosed as Grade A in the Primary Examination. This is because those who were suspected to have any abnormalities were diagnosed as Grade B just to be safe in the Primary Examination, and such people include those eventually diagnosed as Grade A in the Confirmatory Examination as a result of comprehensive and objective judgments through a more detailed examination, etc.

Among the participants whose results of the Confirmatory Examination were finalized, 66% were shifted to ordinary medical care covered by health insurance, and appropriate measures are determined by the responsible doctor, based on individual findings and circumstances.

Furthermore, 39.6% went through fine-needle aspiration cytology, and 116 participants were diagnosed as malignant or suspicious for malignancy. Out of these participants, it is known that 102 had surgery. However, not all the patients who are diagnosed as malignant or suspicious for malignancy are indicated for immediate surgery, and the decisions are made depending on the individuals' situations after the consultation among physicians, participants, and their families.

Included in this reference material on March 31, 2016
Updated on March 31, 2023

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the First Full-scale Survey (Second-round Survey)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people)			
					Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	381,237	270,552(71.0)	15,663	270,552 (100.0)	108,726(40.2)	159,596(59.0)	2,230(0.8)	0 (0.0)

Grade A : 99.2%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
				For next examination		For regular healthcare program, etc.	
		Examination rate (%)		A 1	A 2		Those who received fine-needle aspiration cytology
Total	2,230	1,877(84.2)	1,834(97.7)	63(3.4)	367(20.0)	1,404(76.6)	207(14.7)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 71people; 32 males and 39 females

Average age: 16.9 ± 3.2 years old (9 to 23 years old); At the time of the disaster: 12.6 ± 3.2 years old (5 to 18 years old)

Average tumor size: 11.1 ± 5.6 mm (5.3 to 35.6 mm)

● Out of 71 people whose tumors were diagnosed as malignant or suspicious for malignancy, 55 received surgery (papillary cancer: 54; other types of thyroid cancer: 1).

Prepared based on the material for the 42nd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These are the results of the first Full-scale Survey, which was the second round of the Thyroid Ultrasound Examination.

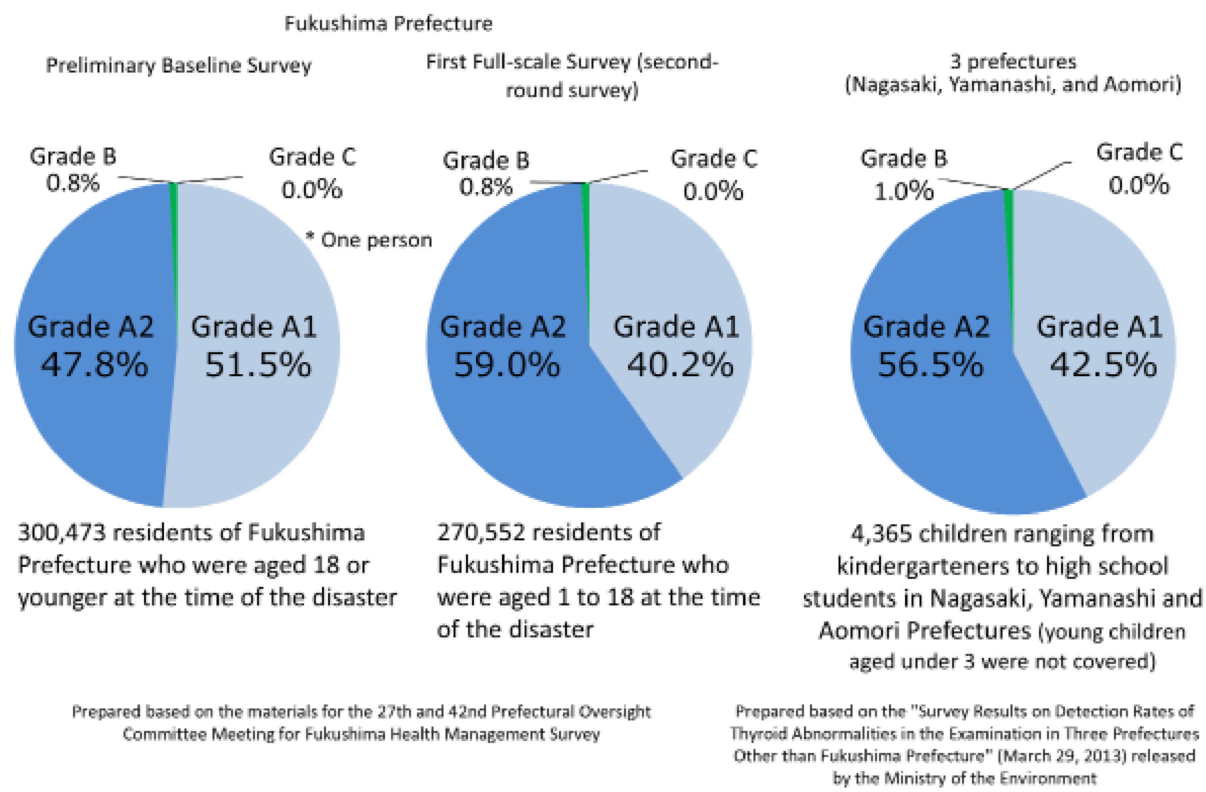
Participants diagnosed as Grade A in the Primary Examination accounted for 99.2% of the total, while those diagnosed as Grade B accounted for 0.8%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed in the Preliminary Baseline Survey.

In the Confirmatory Examination, as a result of fine-needle aspiration cytology, 71 participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2016
Updated on March 31, 2022

Thyroid Ultrasound Examination

Comparison between the Thyroid Ultrasound Examination and the Examination in Other Prefectures



When the Thyroid Ultrasound Examination commenced, many concerns were raised about a relatively high percentage of participants diagnosed as Grade A2. Therefore, in FY2012, the Ministry of the Environment (MOE) conducted the thyroid examination targeting approx. 4,300 children in Nagasaki, Yamanashi and Aomori Prefectures (3-prefecture examination) in the same manner as the examination conducted in Fukushima Prefecture.

The Preliminary Baseline Survey in Fukushima Prefecture covered those aged zero to 18 at the time of the disaster, and the first Full-scale Survey covered those aged two to 23 at the time of the examination, respectively, while the 3-prefecture examination excluded children aged under 3 and covered only those aged 3 to 18. As the sample size of the cohort was much smaller in the 3-prefecture examination, a simple comparison cannot be made, but the results show that those diagnosed as Grade A2 were not exceedingly greater in number among the children of Fukushima Prefecture. The results of the 3-prefecture examination after age adjustment based on the demographics of Japan as of 2010 show that the detection rate of cysts was reported as 52.35% and that of nodules as 1.54%,[1] which were similar to the results of the Preliminary Baseline Survey and the first Full-scale Survey in Fukushima Prefecture. The report of the 3-prefecture examination also made the following observations: “It is generally known that the detection rate of nodular lesions is lower in the group of participants aged 3 to 5 than in the group of participants aged 6 or older, and that females show higher detection rate than males. Therefore, there is the possibility that a detection rate tabulated based on simple descriptive statistical methods as in this case may be higher than the actual rate.”[2] In fact, the percentage of those diagnosed as Grade A2 in the first Full-scale Survey (second-round survey) excluding participants aged 2 or younger was extremely close to the results of the 3-prefecture examination.

1. Hayashida N, et al. Thyroid Ultrasound Findings in Children from Three Japanese Prefectures: Aomori, Yamanashi and Nagasaki. PLoS One. 8(12): e83220, 2013.
2. “Report on the Outcome of the FY2012 Survey on Detection Rates of Thyroid Abnormalities” (commissioned by MOE), The Japan Association of Breast and Thyroid Sonology (March 2013)

Included in this reference material on March 31, 2014
Updated on March 31, 2022

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the Second Full-scale Survey (Third-round Survey)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people)			
					Breakdown by grade (%)			
					A		Those recommended to take the Confirmatory Examination	
		Examination rate (%)	Participants at venues outside of the prefecture		A 1	A 2	B	C
Total	336,667	217,922(64.7)	12,512	217,922 (100.0)	76,431(35.1)	139,989(64.2)	1,502(0.7)	0 (0.0)

Grade A: 99.3%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people) Examination rate (%)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
				For next examination		For regular healthcare program, etc.	
				A 1	A 2		Those who received fine-needle aspiration cytology
Total	1,502	1,104(73.5)	1,068(96.7)	9(0.8)	100(9.4)	959(89.8)	79(8.2)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 31 people; 13 males and 18 females
Average age: 16.3 ± 2.9 years old (12 to 23 years old); At the time of the disaster: 9.6 ± 2.9 years old (5 to 16 years old)
Average tumor size: 12.9 ± 6.4 mm (5.6 to 33.0 mm)

● Out of 31 people whose tumors were diagnosed as malignant or suspicious for malignancy, 29 received surgery (papillary cancer: 29).

Prepared based on the material for the 42nd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These are the results of the second Full-scale Survey, which was the third round of the Thyroid Ultrasound Examination. Participants diagnosed as Grade A in the Primary Examination accounted for 99.3% of the total, while those diagnosed as Grade B accounted for 0.7%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed in the Preliminary Baseline Survey and the first Full-scale Survey (second-round survey). In the Confirmatory Examination, as a result of fine-needle aspiration cytology, 31 participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2019
Updated on March 31, 2022

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the Third Full-scale Survey (Fourth-round Survey)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people) Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	294,228	183,410 (62.3)	10,234	183,410 (100.0)	61,712 (33.6)	120,304 (65.6)	1,394 (0.8)	0 (0.0)

Grade A: 99.2%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
		Examination rate (%)		For next examination		For regular healthcare program, etc.	
				A 1	A 2		Those who received fine-needle aspiration cytology
Total	1,394	1,036 (74.3)	1,016 (98.1)	6 (0.6)	88 (8.7)	922 (90.7)	91 (9.9)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 39 people; 17 males and 22 females
Average age: 17.0 ± 3.1 years old (9 to 24 years old); At the time of the disaster: 8.3 ± 2.9 years old (0 to 14 years old)
Average tumor size: 13.1 ± 6.3 mm (6.1 to 29.4 mm)

● Out of 39 people whose tumors were diagnosed as malignant or suspicious for malignancy, 34 received surgery (papillary cancer: 34).

Prepared based on the material for the 46th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These are the results of the third Full-scale Survey which was the fourth round of the Thyroid Ultrasound Examination.

Participants diagnosed as Grade A in the Primary Examination accounted for 99.2% of the total, while those diagnosed as Grade B accounted for 0.8%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed in the Preliminary Baseline Survey and the first and second Full-scale Surveys (second- and third-round surveys).

In the Confirmatory Examination, as a result of fine-needle aspiration cytology, 39 participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2021
Updated on March 31, 2023

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the Fourth Full-scale Survey (Fifth-round Survey)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people)			
					Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture (people)		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	252,938	113,937 (45.0)	7,960	113,932 (100.0)	32,835 (28.8)	79,751 (70.0)	1,346 (1.2)	0 (0.0)

Grade A: 98.8%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
				For next examination		For regular healthcare program, etc.	
		Examination rate (%)		A 1	A 2		Those who received fine-needle aspiration cytology
Total	1,346	985 (73.2)	918 (93.2)	5 (0.5)	74 (8.1)	839 (91.4)	80 (9.5)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 39 people; 10 males and 29 females
Average age: 17. 7±3.0 years old (12 to 24 years old); At the time of the disaster: 6.7±3.1 years old (1 to 12 years old)
Average tumor size: 12.8±7.3 mm (7.0 to 46.7 mm)

● Out of 39 people whose tumors were diagnosed as malignant or suspicious for malignancy, 27 received surgery (papillary cancer: 27)

Prepared based on the material for the 49th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These are the results of the fourth Full-scale Survey, which was the fifth round of the Thyroid Ultrasound Examination.

The survey was conducted over three years due to the influence of COVID-19 pandemic.

Participants diagnosed as Grade A in the Primary Examination accounted for 98.8% of the total. Those diagnosed as Grade B accounted for 1.2%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller, and most of those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed in the Preliminary Baseline Survey and the Full-scale Surveys (the second, third, and fourth-round surveys).

In the Confirmatory Examination, as a result of fine-needle aspiration cytology, 39 participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of Full-scale Survey (the survey at age 25 years)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people) Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	129.007	11,781(9.1)	4,262	11,674 (99.1)	4,952(42.4)	6.087(52.1)	635(5.4)	0 (0.0)

Grade A: 94.6%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people) Examination rate (%)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
				For next examination		For regular healthcare program, etc.	
				A 1	A 2		Those who received fine-needle aspiration cytology
Total	635	523(82.4)	500(95.6)	5(1.0)	37(7.4)	458(91.6)	43(9.4)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 22 people; 4 males and 18 females
Average age: 25.3 ± 0.7 years old (24 to 27 years old); At the time of the disaster: 15.5 ± 1.6 years old (12 to 18 years old)
Average tumor size: 14.4 ± 10.7 mm (5.3 to 49.9 mm)

● Out of 22 people whose tumors were diagnosed as malignant or suspicious for malignancy, 14 received surgery (papillary cancer: 13; follicular cancer: 1).

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

From FY2017, during the implementation period of the Full-scale Survey (third-round survey), a survey for those who became 25 years old during the relevant fiscal year was commenced as part of the Full-scale Survey. These are the results of the Primary Examination for residents born in FY1992 through FY1996 and the Confirmatory Examination for those born in FY1992 to FY1995.

Participants diagnosed as Grade A in the Primary Examination accounted for 94.6% of the total, while those diagnosed as Grade B accounted for 5.4%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed so far, but targeted participants were older than in prior examinations, and therefore, the percentages of those diagnosed as Grade B and those diagnosed to have nodules were higher compared with the Preliminary Baseline Survey and the Full-scale Surveys (second- to fourth-round surveys).

In the Confirmatory Examination, as a result of fine-needle aspiration cytology, 22 participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2021
Updated on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of Full-scale Survey (the survey at age 30 years)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Results of the Primary Examination

	Number of eligible persons (people)	Number of participants (people)		Diagnosis rate (%)	Number of those diagnosed (people) Breakdown by grade (%)			
		Examination rate (%)	Participants at venues outside of the prefecture		A		Those recommended to take the Confirmatory Examination	
					A 1	A 2	B	C
Total	22,626	1,524(6.7)	562	1,474 (96.7)	655(44.4)	693(47.0)	126(8.5)	0 (0.0)

Grade A: 91.5%

● Results of the Confirmatory Examination

	Number of eligible persons (people)	Number of participants (people) Examination rate (%)	Rate of definitive diagnosis (%)	Number of those who received a definitive diagnosis (people)			
				For next examination		For regular healthcare program, etc.	
				A 1	A 2		Those who received fine-needle aspiration cytology
Total	126	75(59.5)	58(77.3)	1(1.7)	2(3.4)	55(94.8)	5(9.1)

* The total of percentages with one decimal place may not be 100% due to rounding.

● Results of the fine-needle aspiration cytology

Malignant or suspicious for malignancy: 3 people; 0 male and 3 females

● Out of 3 people whose tumors were diagnosed as malignant or suspicious for malignancy, 1 received surgery (papillary cancer: 1).

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

From FY2017, during the implementation period of the Full-scale Survey (fifth-round survey), a survey for those who became 30 years old during the relevant fiscal year was commenced as part of the Full-scale Survey. These are the results of the Primary Examination and the Confirmatory Examination for those born in FY1992.

Participants diagnosed as Grade A in the Primary Examination accounted for 91.5% of the total, while those diagnosed as Grade B accounted for 8.5%. Most of those diagnosed as Grade A2 had cysts of 20 mm or smaller and most of those diagnosed as Grade B had nodules of 5.1 mm or larger. This tendency was the same as that observed so far, but targeted participants were further older than in prior examinations, and therefore, the percentages of those diagnosed as Grade B and those diagnosed to have nodules were higher compared with the previous Full-scale Survey (the survey at age 25 years).

In the Confirmatory Examination, as a result of fine-needle aspiration cytology, three participants were diagnosed that their tumors were malignant or suspicious for malignancy.

Included in this reference material on March 31, 2024

Thyroid Ultrasound Examination

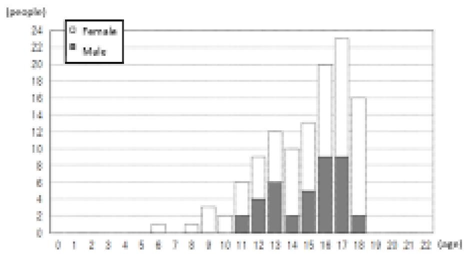
Thyroid Ultrasound Examination: Results of the Preliminary Baseline Survey and the Full-scale Survey (Details of Fine-needle Aspiration Cytology 1)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

- Age distribution of participants whose tumors were diagnosed as malignant or suspicious for malignancy as a result of fine-needle aspiration cytology

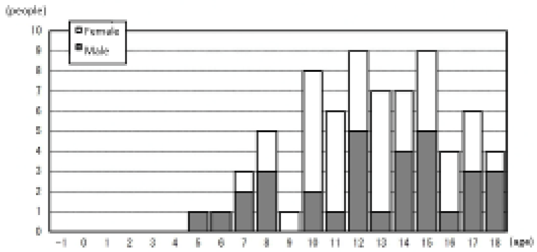
Results of the Preliminary Baseline Survey (116 participants)

Age distribution as of March 11, 2011



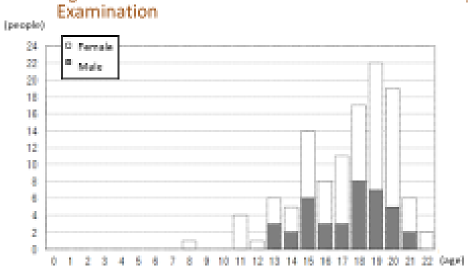
Results of the Full-scale Survey (second-round survey) (71 participants)

Age distribution as of March 11, 2011

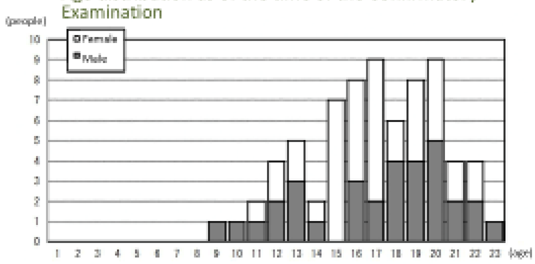


"-1" on the horizontal axis refers to Fukushima Prefecture residents born from April 2, 2011, to April 1, 2012.

Age distribution as of the time of the Confirmatory Examination



Age distribution as of the time of the Confirmatory Examination



Prepared based on the Materials for the 31st Prefectural Oversight Committee Meetings for Fukushima Health Management Survey

These graphs show the age distributions of participants whose thyroid lesions were diagnosed as malignant or suspicious for malignancy by fine-needle aspiration cytology in the Preliminary Baseline Survey and the Full-scale Survey (second-round survey): they are shown by the age as of March 11, 2011 (top) and at the time of the Confirmatory Examination (bottom). The results of the Preliminary Baseline Survey and the Full-scale Survey (second-round survey) do not show the situation where thyroid cancer is found more frequently among young children (aged zero to 5), who are considered to have higher sensitivity to radiation, than among people in the other age groups.

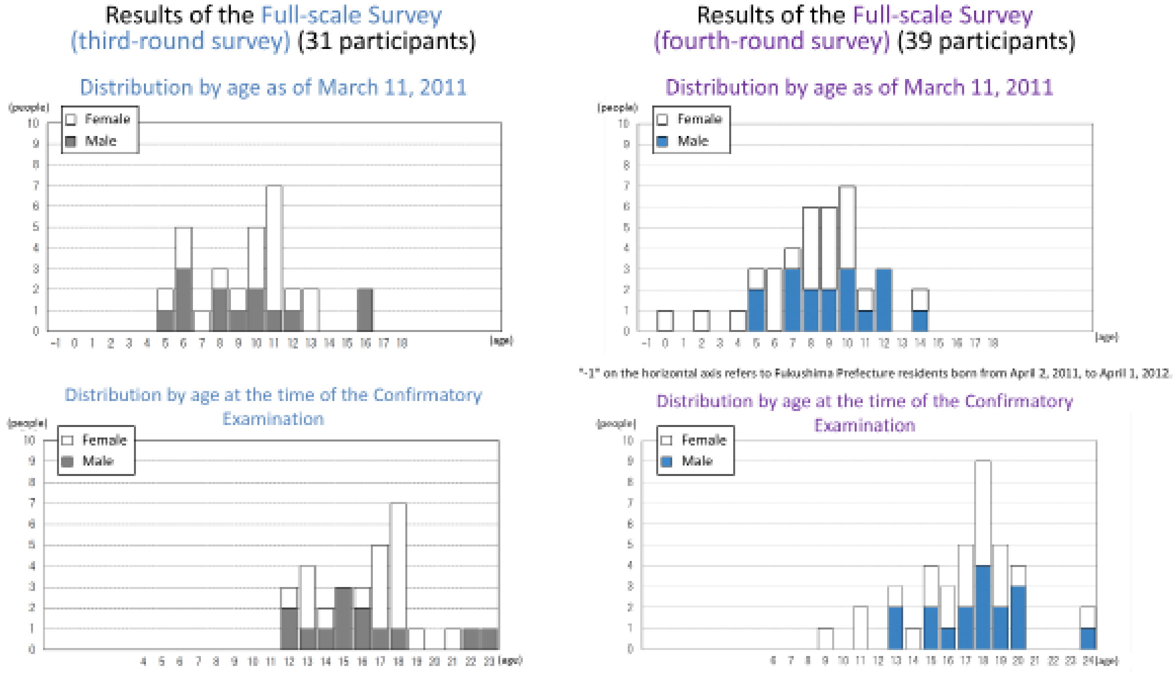
Included in this reference material on March 31, 2014
Updated on March 31, 2021

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Results of the Preliminary Baseline Survey and the Full-scale Survey (Details of Fine-needle Aspiration Cytology 2)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Age distribution of participants whose tumors were diagnosed as malignant or suspicious for malignancy as a result of fine-needle aspiration cytology



Prepared based on the material for the 42nd and 46th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These graphs show the age distribution, as of March 11, 2011, of participants who subsequently had thyroid lesions diagnosed as malignant or suspicious for malignancy by fine-needle aspiration cytology in the second and third Full-scale Surveys (third- and fourth-round surveys), and their ages at the time of the Confirmatory Examination. The distribution by age at the time of the disaster tends to be shifted towards younger ages compared with the results of the Preliminary Baseline Survey and the first Full-scale Survey (second-round survey), but the distribution by age at the time of the Confirmatory Examination was the same as in the case of the Preliminary Baseline Survey and the first Full-scale Survey (second-round survey).

Included in this reference material on March 31, 2021
Updated on March 31, 2023

Thyroid Ultrasound Examination

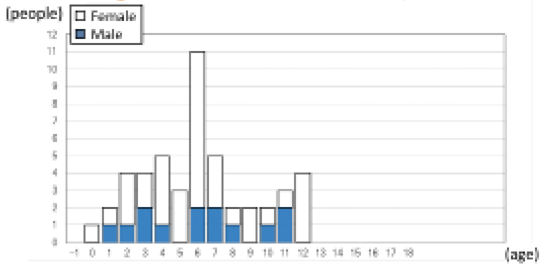
Thyroid Ultrasound Examination: Results of the Preliminary Baseline Survey and the Full-scale Survey (Details of Fine-needle Aspiration Cytology 3)

Latest Examination Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

● Age distribution of participants whose tumors were diagnosed as malignant or suspicious for malignancy as a result of fine-needle aspiration cytology

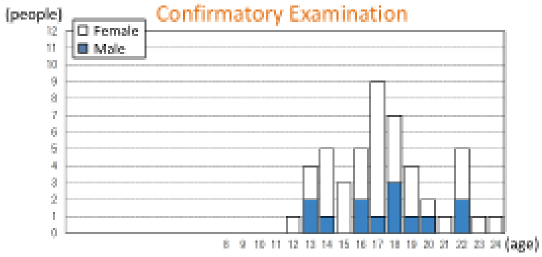
Results of the Full-scale Survey (fifth-round survey) (48 participants)

Age distribution as of March 11, 2011



"-1" on the horizontal axis refers to Fukushima Prefecture residents born from April 2, 2011, to April 1, 2012.

Age distribution as of the time of the Confirmatory Examination



Prepared based on the material for the 53rd Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

These graphs show the age distributions of participants whose thyroid lesions were diagnosed as malignant or suspicious for malignancy by fine-needle aspiration cytology in the Full-scale Survey (fifth-round survey): they are shown by the age as of March 11, 2011 (top) and at the time of the Confirmatory Examination (bottom). The distribution by age at the time of the disaster tends to be shifted towards younger ages compared with the results of the Preliminary Baseline Survey and the first Full-scale Survey (second-round survey), but the distribution by age at the time of the Confirmatory Examination was the same as in the case of the Preliminary Baseline Survey and the Full-scale Surveys (up to the fourth-round survey).

Included in this reference material on March 31, 2025

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Remarks on the Results of the Preliminary Baseline Survey

● The Thyroid Ultrasound Examination, which had no precedent for childhood screening, revealed thyroid cancers that might have otherwise gone unnoticed.

Percentage of participants whose tumors were diagnosed as malignant or suspicious for malignancy as a result of fine-needle aspiration cytology (against the total participants of the Primary Examination)

FY2011	FY2012	FY2013
0.03%	0.04%	0.04%

Material for the 20th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

● Evaluation of thyroid cancers found in the Preliminary Baseline Survey, the Interim Report by the Prefectural Oversight Committee Meeting for Fukushima Health Management Survey (March 2016)

"Comprehensively considering that: exposure doses due to the accident at the Fukushima Daiichi NPS were generally lower than those caused by the Chernobyl NPS Accident; the period of time from the exposure to the detection of cancers is short (mostly from one to four years); cancers have not been detected in those aged 5 or younger at the time of the accident; and there is no significant regional difference in detection rates, it can be concluded that thyroid cancers found so far through the Thyroid Examination cannot be attributed to radiation discharged due to the accident.

However, the possibility of radiation effects may be small but cannot be completely denied at this point in time. Additionally, it is necessary to accumulate information in the long term for accurate evaluation of the effects. Therefore, the Thyroid Ultrasound Examination should be continued, while meticulously explaining the disadvantages of receiving the examination and obtaining the understanding of participants."

○ The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) reiterated in its 2017 White paper* that excessive thyroid cancer risks due to radiation exposure do not need to be taken into consideration.

* Developments since the 2013 UNSCEAR Report on the levels and effects of radiation exposure due to the nuclear accident following the great east-Japan earthquake and tsunami (A 2017 White Paper to guide the Scientific Committee's future programme of work)

In order to ascertain radiation effects, it is necessary to monitor developments over a long term.

Thyroid cancers found so far through the Thyroid Ultrasound Examination being conducted in Fukushima Prefecture are considered to be unrelated to the radiation discharged due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS.

This evaluation is based on a comprehensive judgment of the following facts:

1. Exposure doses due to the accident at the Fukushima Daiichi NPS were generally lower compared with those caused by the Chornobyl NPS Accident.
2. The period of time from the exposure to the detection of cancers is short, mostly from one to four years.
3. Cancers have not been detected in those who were 5 years old or younger at the time of the accident.
4. Age distribution of patients significantly differs in Fukushima Prefecture and Chornobyl (p.140 of Vol. 1, "Comparison between the Chornobyl NPS Accident and the TEPCO's Fukushima Daiichi NPS Accident (Ages at the Time of Radiation Exposure)").
5. There are no significant differences in detection rates among different regions.

However, it is necessary to monitor developments over a long term to ascertain radiation effects.

(Related to p.141 of Vol. 1, "Evaluation of the Interim Report on Thyroid Cancer Compiled by the Expert Meeting on Health Management After the TEPCO's Fukushima Daiichi NPS Accident")

Included in this reference material on March 31, 2015
Updated on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Outline of the Evaluations of the First Full-scale Survey (Second-round Survey) Results

In June 2019, the Thyroid Ultrasound Examination Evaluation Subcommittee, which was established under the Prefectural Oversight Committee for the Fukushima Health Management Survey, concluded that "at present, there are no indication of radiation effect on thyroid cancers found in the first Full-scale Survey," in consideration of the points described below. The Subcommittee reported this conclusion at the Prefectural Oversight Committee Meeting held in July 2019, and the Committee approved this report.

- As a result of the analysis of association between estimated absorbed thyroid doses and thyroid cancer detection rates published by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), no constant correlation (doses and effects), such as an increase in detection rates associated with an increase in doses, was found.
- The detection rates of suspected thyroid cancer through ultrasound examinations, etc. are higher among people who were older at the time of the accident, and the age group in which thyroid cancer was detected more frequently is different from that after the Chornobyl NPS Accident (mainly young children).

Prepared based on material for the 35th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

In June 2019, the Thyroid Ultrasound Examination Evaluation Subcommittee, which was established under the Prefectural Oversight Committee for the Fukushima Health Management Survey, published the "Report on the Results of the first Full-scale Survey of the Fukushima Thyroid Ultrasound Examination." In the Report, the Subcommittee states that no correlation is found between thyroid cancer cases detected through the first Full-scale Survey (second-round survey) and radiation exposure due to Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS Accident. Additionally, the Subcommittee points out the necessity to review evaluations of the Thyroid Ultrasound Examination and examination results from the following perspectives:

- It is necessary to analyze accumulated results of the second and third Full-scale Surveys.
- It is necessary to conduct analyses by properly ascertaining the status of developing cancer among the subjects of Thyroid Ultrasound Examination using regional and national cancer registries.
- It is necessary to study correlation between doses and incidence rates of thyroid cancer in the future by using more detailed data on estimated thyroid exposure doses as a case-control study with adjusted confounding factors or as a prospective study.

Included in this reference material on March 31, 2020
Updated on March 31, 2024

Thyroid Ultrasound Examination

Thyroid Ultrasound Examination: Outline of the Evaluations of the Results of the Preliminary Baseline Survey through to the Third Full-scale Survey (Fourth-round Survey)

In July 2023, the Thyroid Ultrasound Examination Evaluation Subcommittee, which was established under the Prefectural Oversight Committee for the Fukushima Health Management Survey, presented its findings, based on the following results of the epidemiological analyses, that "no association is found between a detection rate of thyroid cancer in the Preliminary Baseline Survey through to the third Full-scale Survey and radiation exposure due to the accident" and made a report on the findings at the Committee meeting held in November 2023.

- As a result of the analysis by the method of a cross-sectional survey using the estimated absorbed thyroid doses published in the report by UNSCEAR, no constant correlation, such as an increase in detection rates of participants whose tumors were diagnosed as malignant or suspicious for malignancy associated with an increase in exposure doses (correlation between doses and effects), was found in any of the surveys.
- As a result of the analysis through case-control study regarding correlation between individual's estimated exposure dose and a diagnosis as being malignant or suspicious for malignancy, regarding thyroid cancer cases detected in the Preliminary Baseline Survey through to the third Full-scale Survey and thyroid cancer cases registered only in the cancer registry up to 2018, no constant correlation, such as an increase in detection rates associated with an increase in radiation exposure doses (correlation between doses and effects), was found.

Prepared based on the material for the 49th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

In July 2023, the Thyroid Ultrasound Examination Evaluation Subcommittee, which was established under the Prefectural Oversight Committee for the Fukushima Health Management Survey, published the “Report on the Results of the Preliminary Baseline Survey through to the Third Full-scale Survey (Fourth-round Survey) of the Thyroid Ultrasound Examination.” In the Report, the Subcommittee presented its findings, based on the following results of the epidemiological analyses, that “no association is found between a detection rate of thyroid cancer in the Preliminary Baseline Survey through to the third Full-scale Survey and radiation exposure due to the accident.” The Subcommittee made a report on the findings at the Committee meeting held in November 2023.

- As a result of the analysis by the method of a cross-sectional survey using the estimated absorbed doses to the thyroid published in the report of the UNSCEAR, no constant correlation, such as an increase in detection rates of participants whose tumors were diagnosed as malignant or suspicious for malignancy associated with an increase in exposure doses (correlation between doses and effects), was found in any of the surveys.
- As a result of the analysis through case-control study regarding correlation between individual’s estimated exposure dose and a diagnosis as being malignant or suspicious for malignancy, regarding thyroid cancer cases detected in the Preliminary Baseline Survey through to the third Full-scale Survey and thyroid cancer cases registered only in the cancer registry up to 2018, no constant correlation, such as an increase in detection rates associated with an increase in radiation exposure doses (correlation between doses and effects), was found.

Included in this reference material on March 31, 2024

Comprehensive Health Checkup

Comprehensive Health Checkup: Purpose

Due to the Great East Japan Earthquake and the subsequent accident at TEPCO's Fukushima Daiichi NPS, many people were forced to live under evacuation and experienced significant changes in their diet, fitness or other daily habits. Some have worries over their health due to their inability to receive health checkups. Therefore, Fukushima Prefecture commenced the Comprehensive Health Checkup for people residing in Evacuation Areas with the aim of ascertaining the overall health conditions of the residents and utilizing the obtained data for the prevention of lifestyle-related diseases and early detection and treatment of diseases.

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Due to the Great East Japan Earthquake and the subsequent accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, many residents were forced to live as evacuees. Fukushima Prefecture has been conducting the Comprehensive Health Checkup for the purpose of monitoring whether they have any physical problems and guiding them to early treatment as necessary.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Comprehensive Health Checkup

Comprehensive Health Checkup: Outline (1/2)

[Check items]

Age group	Check items
Aged zero to 6 (babies and preschoolers)	Body height and weight [Only when requested] Complete blood cell count (red blood cell count, hematocrit, hemoglobin, platelet count, white blood cell count, and differential white blood cell count)
Aged 7 to 15 (first to ninth grade students)	Body height, weight, blood pressure, and complete blood cell count (red blood cell count, hematocrit, hemoglobin, platelet count, white blood cell count, and differential white blood cell count) [Only when requested] Blood biochemistry (AST, ALT, γ-GT, TG, HDL-C, LDL-C, HbA1c, glucose, serum creatinine, and uric acid)
Aged 16 or older	Body height, weight, abdominal girth (or BMI), blood pressure, and complete blood cell count (red blood cell count, hematocrit, hemoglobin, platelet count, white blood cell count, and differential white blood cell count) Urinalysis (protein, glucose and blood) Blood biochemistry (AST, ALT, γ-GT, TG, HDL-C, LDL-C, HbA1c, glucose, serum creatinine, eGFR, and uric acid) * Items in red letters are additional items that are not ordinarily checked in the specified health checkups.

[Eligible persons]

- Residents who were registered at covered areas from March 11, 2011 to April 1, 2012 (also after moving out of those covered areas)
- Residents registered at covered areas as of April 1 of the examination year

[Covered areas]

Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, Namie Town, Katsurao Village and Iitate Village, Minamisoma City, Tamura City, Kawamata Town, and parts of Date City (areas containing Specific Spots Recommended for Evacuation)

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Check items for all age groups are decided so that each of the residents residing in covered areas can ascertain their own health conditions and obtained data can be utilized for the prevention and early detection and treatment of lifestyle-related and other diseases.

Based on the check items for the Specific Health Checkup targeting people aged 16 or older, ordinary health checkups are conducted by adding other necessary items, such as blood counts (those in red letters).

The Comprehensive Health Checkup covers people who were residing in any of the municipalities designated as Restricted Areas, Deliberate Evacuation Areas or Evacuation-Prepared Areas in Case of Emergency or in any of the areas containing Specific Spots Recommended for Evacuation[1] at the time of the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS and residents registered at those areas as of April 1 of the examination year.

1. The entire areas of Tamura City, Minamisoma City, Kawamata Town, Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, Namie Town, Katsurao Village and Iitate Village, and parts of Date City

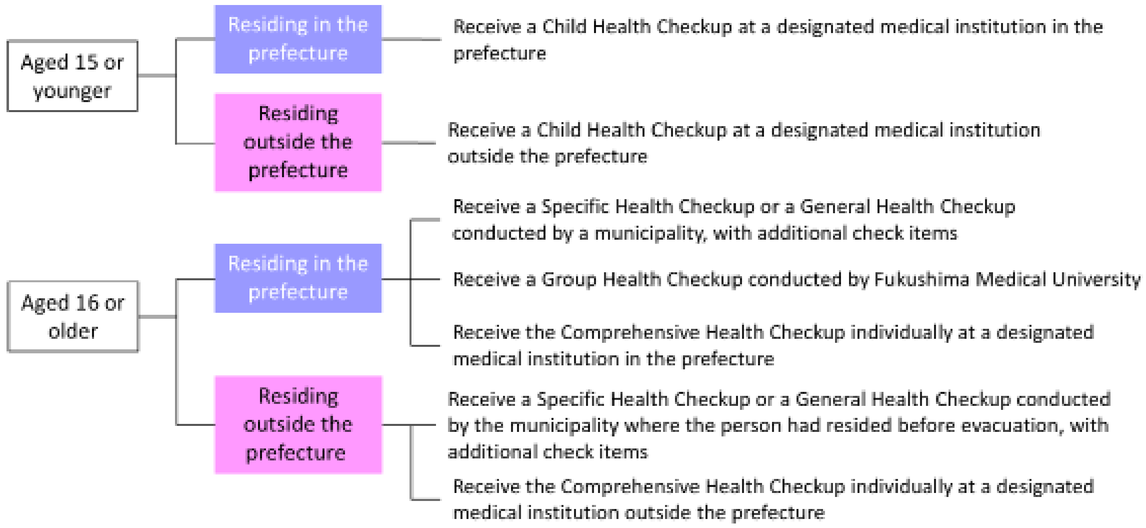
Included in this reference material on March 31, 2013
Updated on March 31, 2024

Comprehensive Health Checkup

Comprehensive Health Checkup: Outline (2/2)

Every year, the Comprehensive Health Checkup is conducted at designated medical institutions individually for all children aged 15 or younger and people aged 16 or older who reside outside the prefecture. Every year, residents aged 16 or older who reside within the prefecture can receive the Comprehensive Health Checkup by any of the following three methods:

1. Receive a Specific Health Checkup or a General Health Checkup conducted by a municipality, wherein the items specific to the Comprehensive Health Checkup are additionally checked
2. Receive a Group Health Checkup conducted by Fukushima Medical University
3. Individually receive the Comprehensive Health Checkup at any of the designated medical institutions in the prefecture



Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University (Information on the Comprehensive Health Checkup)

Children aged 15 or younger, regardless of whether residing inside or outside Fukushima Prefecture, can receive health checkups at any of the designated medical institutions with pediatricians.

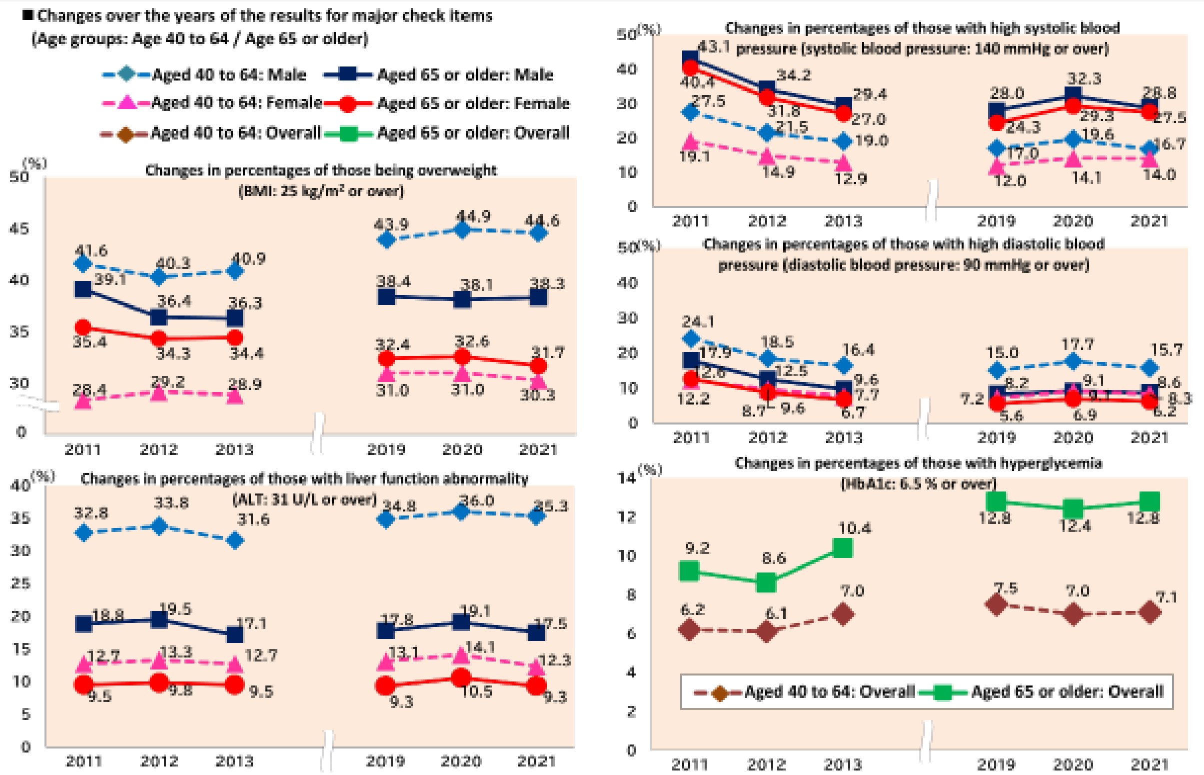
People aged 16 or older who reside in Fukushima Prefecture can select any of the following methods to receive checkups: the Specific Health Checkup or the General Health Checkup conducted by municipalities, with additional check items specific to the Comprehensive Health Checkup; the Group Health Checkup conducted by Fukushima Medical University; or the Comprehensive Health Checkup at designated medical institutions in the prefecture.

Included in this reference material on March 31, 2013
Updated on March 31, 2023

Comprehensive Health Checkup

Comprehensive Health Checkup: What Has Become Clear (Overweight, High Blood Pressure, Liver Function Abnormality, and Hyperglycemia)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)



Prepared based on the materials for the 21st, 41st, 44th and 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Based on the results of the Comprehensive Health Checkup from FY2011 to FY2021, longitudinal changes in major check items are shown.

●Participants being overweight

The percentage of overweight people (BMI: 25 kg/m^2 or over) were higher among males than among females for all fiscal years. Among males and females aged 40 to 64, the percentage of overweight people showed a slightly increasing trend from FY2019 to FY2021, compared with that from FY2011 to FY2013.

●Participants with high blood pressure

The percentage of participants with high systolic blood pressure (systolic blood pressure: 140 mmHg or over) showed a declining trend from FY2011 to FY2013 for both males and females aged 40 or older. The percentage remained almost the same overall from FY2019 to FY2021, but showed a slightly increasing trend in FY2020.

For both males and females aged 40 or older, the percentage of participants with high diastolic blood pressure (diastolic blood pressure: 90 mmHg or over) showed a declining trend from FY2011 to FY2013. The percentage remained almost the same overall from FY2019 to FY2021, but showed a slightly increasing trend in FY2020.

●Participants with liver function abnormality

The percentage of participants with liver function abnormality (ALT: 31 (U/L) or over) had remained almost the same overall from FY2011 to FY2013 and from FY2019 to FY2021, but the relevant percentage among males aged 40 to 64 showed a slightly increasing trend from FY2019 to FY2021.

●Participants with hyperglycemia

The percentage of participants aged 65 or older with hyperglycemia (HbA1c: 6.5% or over) showed a slightly increasing trend from FY2019 to FY2021, compared with that from FY2011 to FY2013.

Included in this reference material on March 31, 2016
Updated on March 31, 2024

Mental Health and Lifestyle

Mental Health and Lifestyle Survey: Purpose

"We will promote the mental and physical health of residents of the Evacuation Areas, etc."

Due to harsh experiences of the Great East Japan Earthquake and the accident at TEPCO's Fukushima Daiichi NPS and subsequent life as evacuees, many people are experiencing anxiety and stress. Accordingly, Fukushima Prefecture commenced the Mental Health and Lifestyle Survey with the aim of accurately understanding the mental and physical problems of residents and meticulously providing each of them with proper health, medical and welfare services.

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Many of the residents whose houses are located in municipalities designated as Evacuation Areas were forced to evacuate and live as evacuees for a prolonged period of time. They have experienced drastic changes in their living environment and have been forced to change their individual lifestyles as well. In order to carefully watch not only the physical disorders but also mental problems of these residents and offer them appropriate support and build a better system therefor, Fukushima Prefecture has been conducting the Mental Health and Lifestyle Survey.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Mental Health and Lifestyle

Mental Health and Lifestyle Survey: Outline (1/2)

[Eligible persons]

- Residents who were registered at any of the covered areas from March 11, 2011, to April 1, 2012 (also after moving out of the covered areas)
- Residents registered at covered areas as of April 1 of the fiscal year during which the survey is conducted
- Others, as warranted, based on Basic Survey results, even if the above conditions are not met

[Covered areas]

Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, Namie Town, Katsurao Village, Iitate Village, Minamisoma City, Tamura City, Kawamata Town, and parts of Date City (areas containing Specific Spots Recommended for Evacuation)

[Method]

Inquiry sheets: Self-reporting responses or responses from guardians submitted by post or online

[Major survey items]

- Present physical and mental status
- Lifestyle (sleep, smoking, and exercise habits)
- Present living conditions (adults)

[Measures for support]

Collected responses are evaluated and analyzed by the staff which include physicians of Fukushima Medical University. If respondents are considered to require counseling and support regarding their mental health and lifestyle, support by phone is provided by the "Mental and Physical Health Support Team," which consists of staff including certified public psychologists, public health nurses, and clinical nurses.

When professional medical care is considered to be required through the support by phone, registered physicians of medical institutions in Fukushima Prefecture (*see p.159 of Vol. 2, "Mental Health and Lifestyle Survey: Outline (2/2)") are introduced.

When continued support is necessary, required support will be discussed and offered in collaboration with the municipality where the person had originally resided before evacuation.

Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

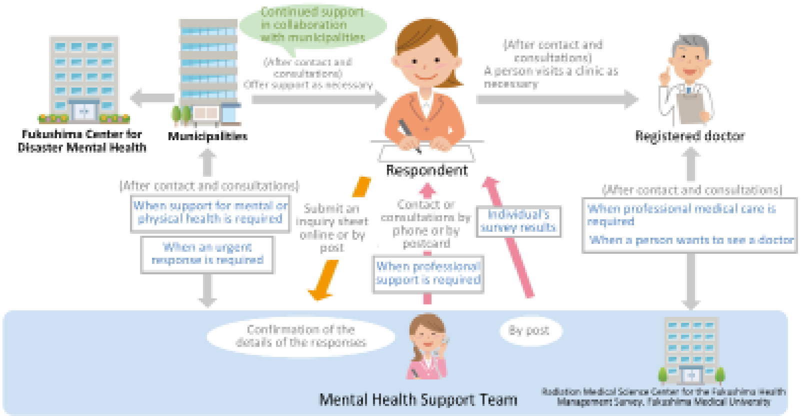
As in the case of the Comprehensive Health Checkup, the Mental Health and Lifestyle Survey also covers residents who were registered from March 11, 2011, to April 1, 2012, and as of April 1 of the relevant survey year, at any of the municipalities that were designated as Restricted Areas, Deliberate Evacuation Areas or Evacuation-Prepared Areas in Case of Emergency or at any of the areas containing Specific Spots Recommended for Evacuation at the time of the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS. Others, as warranted, based on Basic Survey results are also covered, even if the above conditions are not met. Different inquiry sheets are used depending on the age groups, with the aim of taking required measures more appropriately. Children are divided into four age groups: those aged zero to 3; those aged 4 to 6; elementary school students; and junior high school students. People aged 16 or older are categorized as adults.

In addition to questions concerning mental problems, such as depression and anxiety disorder, the survey items include questions about changes in lifestyles, such as diet, sleep, drinking, smoking, and exercise habits.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Mental Health and Lifestyle | Mental Health and Lifestyle Survey: Outline (2/2)

- Procedures from submission of an inquiry sheet to receipt of support -
Relevant organizations and doctors are collaboratively offering care.



* For people who are considered to require continued support, care is provided in collaboration with regional registered doctors and municipalities, etc.

* Survey results are sent individually from FY2014.

* Registered doctors: Psychiatrists and pediatricians, etc., who have received lectures concerning disaster mental health and radiation medical science:
As of July 1, 2023, there are 117 registered doctors in 78 medical institutions.

* Based on the results of the questionnaire survey, support by phone has been provided to about 100 children and 2,000 adults in recent years. The support by phone adopts an outreach system under which support providers make phone calls to support recipients.

* Additionally, for some people who are not eligible for support by phone, support in writing is offered.

Prepared based on the materials for the 49th Prefectural Oversight Committee Meetings for Fukushima Health Management Survey

Analysis results and advice based thereon are individually sent to people who have submitted inquiry sheets. For respondents who are considered to require professional support as a result of analyzing their responses, certified public psychologists, public health nurses, or clinical nurses, etc. make a phone call to offer support concerning problems with their mental health and lifestyles. If necessary, brochures containing health-related information and contacts for consultation services are provided by mail.

Remarks by people who have received support by phone include, “I am glad that I can confess what I cannot say to my family,” or, “I am relieved to know that I can call this number to make consultations whenever I feel depressed.”

Regarding those in need of continued support or professional medical care, support is offered in collaboration with municipalities, the Fukushima Center for Disaster Mental Health and registered doctors who can provide professional advice.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

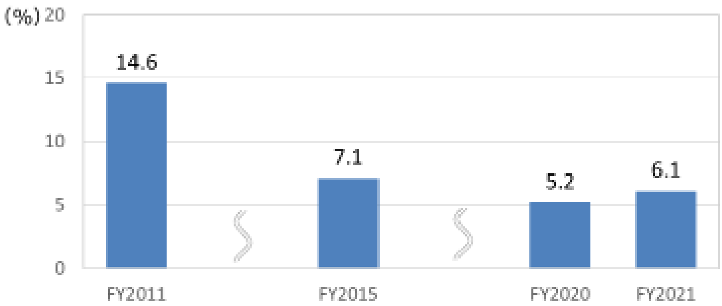
Mental Health and Lifestyle

Mental Health and Lifestyle Survey: What Has Become Clear (1/5)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

[Mental health of adults (aged 16 or older)]

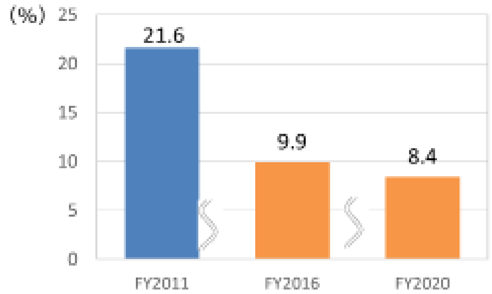
● Percentage of people who are considered to require support for their depressions and anxieties



Measurement scale: K6*

* Respondents reply to each question of a six-item questionnaire concerning their depression and anxieties with a score from zero to four points. When the total is 13 points or over, a mood disorder or anxiety disorder is suspected.

● Percentage of people who are considered to require support for their traumatic stresses due to the disaster



Measurement scale: PCL* (FY2011 to FY2013)
PCL-4** (FY2016 to FY2020)

* Respondents reply to each question of a 17-item questionnaire concerning their frequently arising problems and need arising from their disaster experience (traumatic stress) with a score from one to five. When the total is 44 points or over, PTSD is suspected.

** Respondents reply to each question of a 4-item questionnaire with a score from one to five points. When the total is 12 points or over, PTSD is suspected.

In order to ease psychological burdens associated with replying to the questionnaire, the FY2014, FY2015 and FY2021 surveys did not include PCL-related questions.

Prepared based on the materials for the 45th and 48th Prefectural Oversight Committee Meetings for Fukushima Health Management Survey

K6[1] is used as a scale to evaluate the levels of mental health of adults (aged 16 or older). Although K6 has been declining (improving), compared with that in FY2011, the results of the FY2021 survey showed a slight increase (worsening). This may be an effect of COVID-19. Compared with the value (3.0%) in a prior study in Japan (Kawakami, 2007), K6 still remains at a high level (bad).

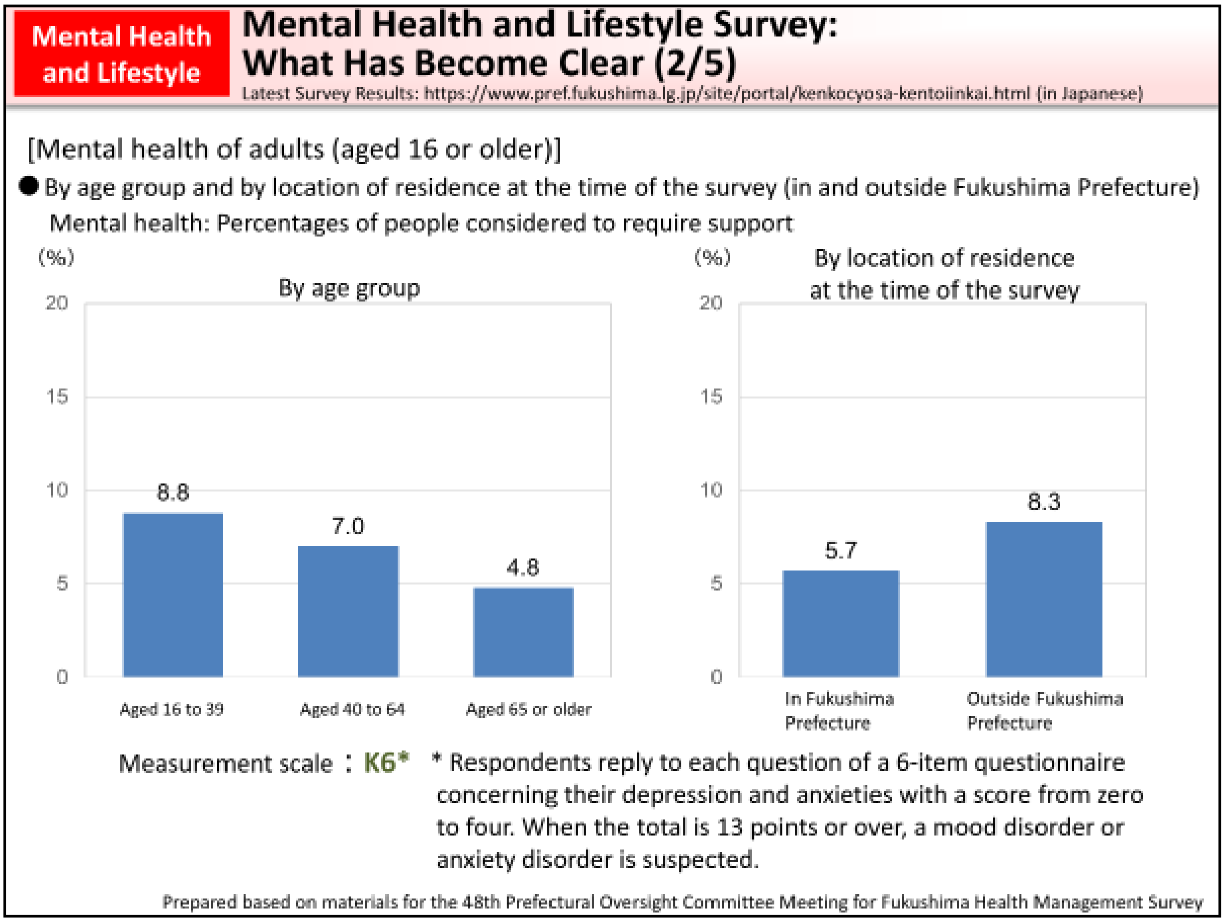
Females tend to show higher values than males.

As a scale to evaluate traumatic stress of adults (aged 16 or older), PCL[2] is used. PCL declined (improved) significantly, compared with the results of the FY2011 survey, but it was found that nearly 10% of the participants still have strong traumatic stress.

By gender, females generally show higher values than males, and values tend to become higher for older participants.

1. K6: Respondents reply to each question of a six-item questionnaire concerning the frequencies with which they felt depressed or anxious during the past 30 days (such as “Have you felt extremely nervous?” or “Have you felt desperate and helpless?”). This survey targets people aged 16 or older to evaluate risks of any mood or anxiety disorder.
2. PCL (Post-Traumatic Stress Disorder Checklist): Respondents reply to each question concerning their mental and physical reactions (traumatic stress) during the past 30 days in relation to their disaster experience. This survey also targets people aged 16 or older to evaluate individuals’ levels of traumatic stress. Following the suspension for two years after being conducted in FY2011 to FY2013, the survey was conducted in FY2016 to FY2020 using PCL-4, a shortened version, but has been suspended again since FY2021.

Included in this reference material on March 31, 2015
Updated on March 31, 2024



Respondents to the FY2021 survey were classified into three groups by their age (16 to 39, 40 to 64, and 65 or older), and a comparison was made concerning their mental health conditions using a measurement scale, K6[1]. As a result, it was found that the percentage of people considered to require support based on the K6 scale tends to be higher among younger people.

As a result of classifying those respondents by location of residence at the time of the FY2021 survey and comparing those who resided in Fukushima Prefecture and those who resided outside Fukushima Prefecture, the percentage of adults (aged 16 or older) considered to require support based on the K6 scale tends to be higher among those who resided outside Fukushima Prefecture. Compared with the relevant percentage (3.0%) in a prior study in Japan (Kawakami, 2007), the percentage for those in Fukushima Prefecture was approximately 1.9 times and that for those outside Fukushima Prefecture was approximately 2.8 times higher.

1. K6: Respondents reply to each question of a six-item questionnaire concerning the frequencies with which they felt depressed or anxious during the past 30 days (such as “Have you felt extremely nervous?” or “Have you felt desperate and helpless?”). This survey targets people aged 16 or older to evaluate risks of any mood or anxiety disorder.

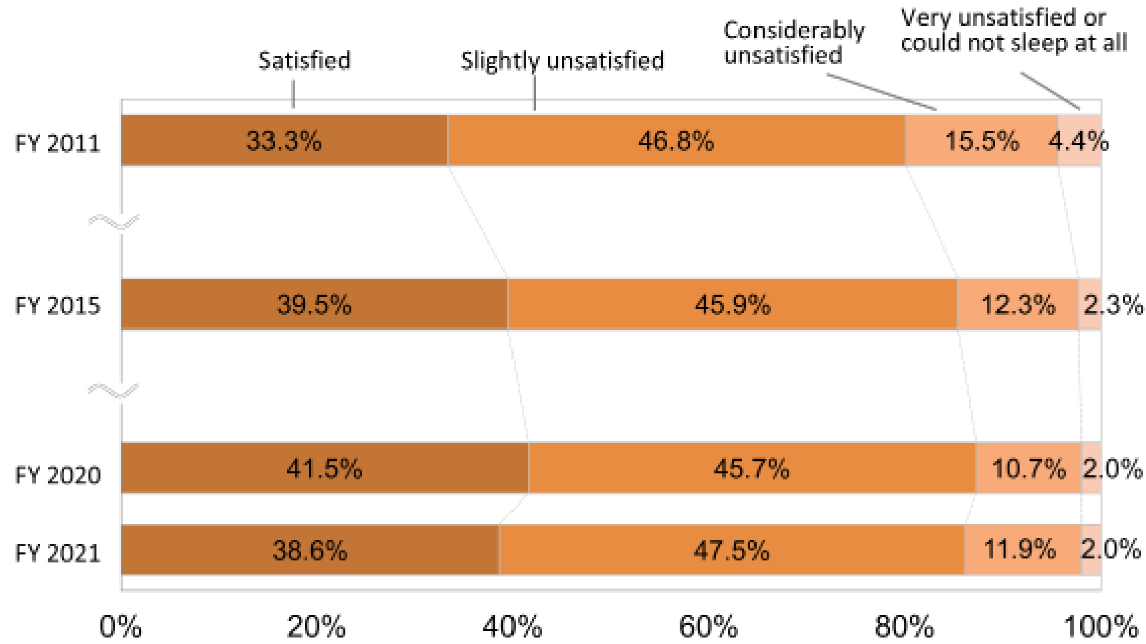
Included in this reference material on March 31, 2019
Updated on March 31, 2024

Mental Health and Lifestyle

Mental Health and Lifestyle Survey: What Has Become Clear (3/5)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

[Levels of satisfaction on sleep during the latest one-month period] Those aged 16 or older



Prepared based on the materials for the 48th Prefectural Oversight Committee Meetings for Fukushima Health Management Survey

Sleep is a significant factor that exerts influence on various chronic diseases such as high blood pressure or diabetes, as well as affecting people's mental health.

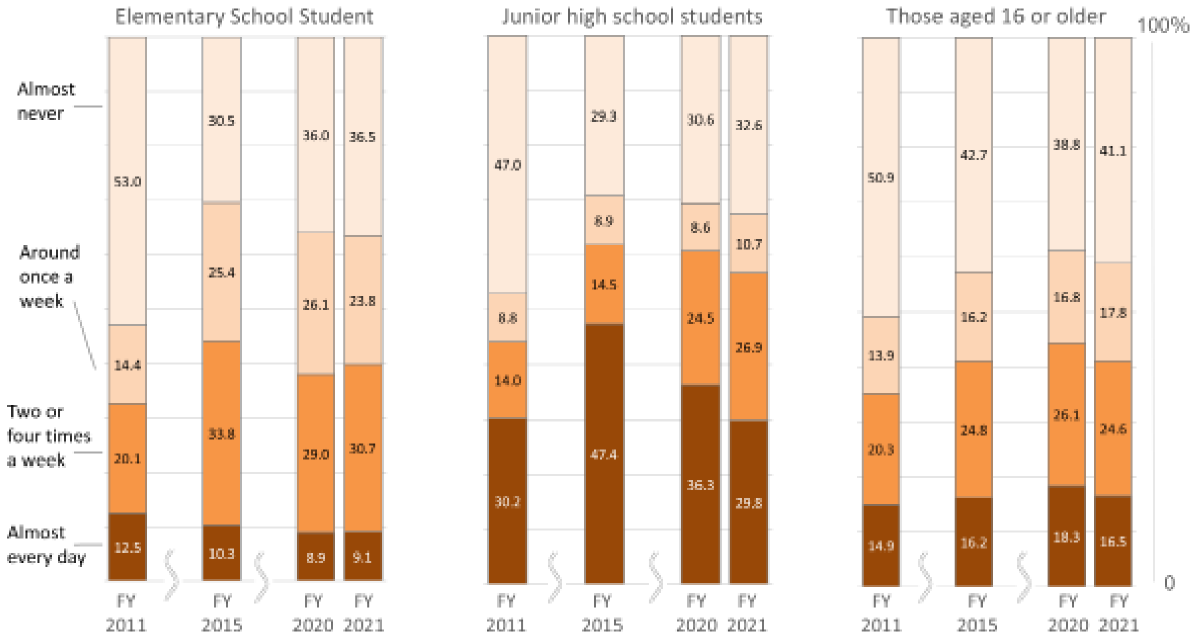
The figure shows that about 60% of the respondents are still somewhat unsatisfied with their sleep, while the number of those satisfied with their sleep is gradually increasing. The results of the FY2021 survey show a slight decrease in the percentage of those satisfied with their sleep, compared with the results of the FY2020 survey.

Included in this reference material on March 31, 2016
Updated on March 31, 2024

Mental Health and Lifestyle Survey: What Has Become Clear (4/5)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

[Percentages concerning daily exercises]

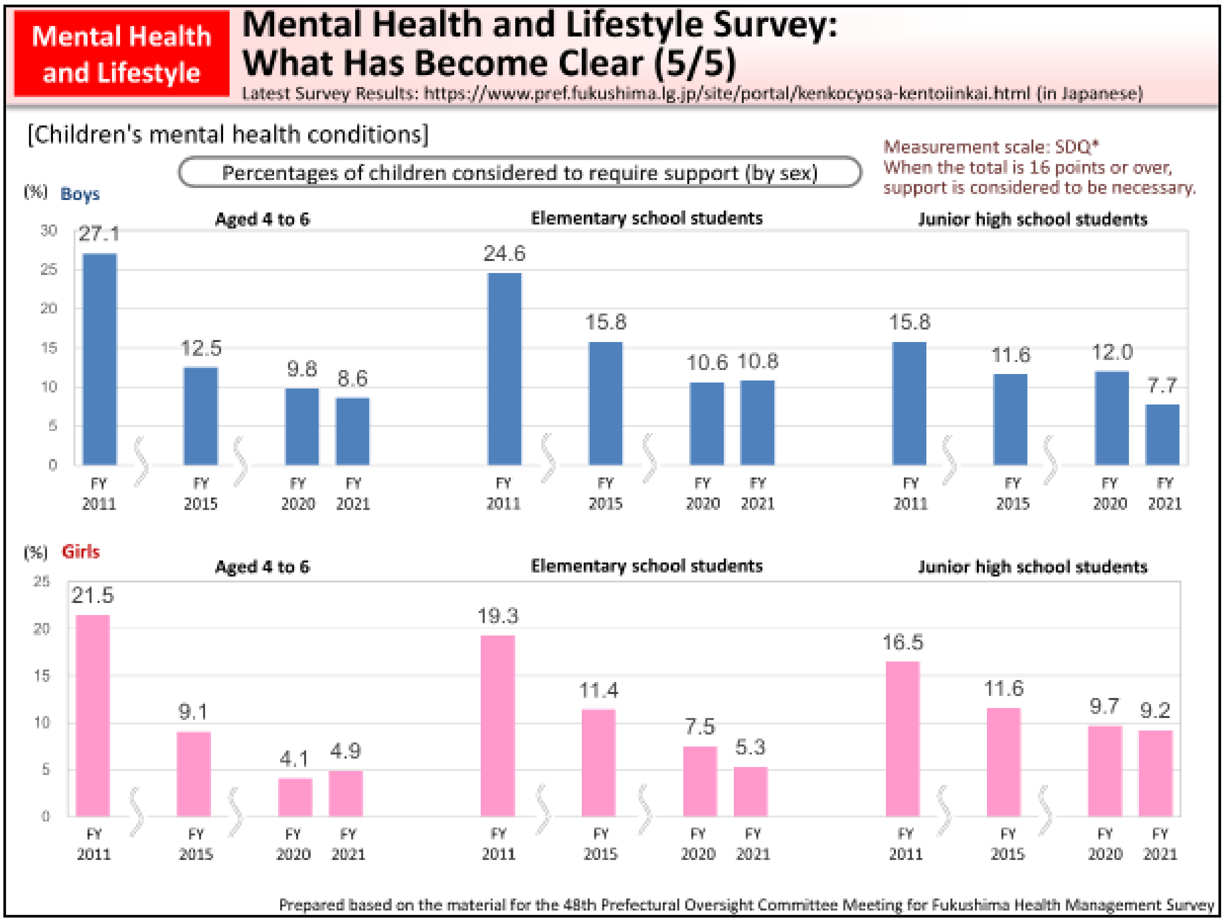


Prepared based on the material for the 48th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Compared with the results of the FY2011 survey, elementary school students and junior high school students came to have more chances for exercise in FY2015, showing an improving trend. However, those who almost never exercise increased in FY2020 and FY2021. The frequency of exercise had increased gradually among adults (aged 16 or older) until FY2020, but decreased in FY2021. The impact of COVID-19 may be one of the causes of this decrease in the frequency of exercise in FY 2021.

In particular, exercises are considered to exert a significant influence on the growth of elementary school students and junior high school students, and exercise habits are also very important for adults for improving their mental health and preventing lifestyle-related diseases.

Included in this reference material on March 31, 2016
Updated on March 31, 2024



As an indicator to evaluate children's mental health conditions, SDQ[1] is utilized.

In the FY2021 survey, the percentages of children showing a high SDQ score decreased from those in the FY2011 survey for all categories.

Compared with the percentage of children showing an SDQ score of 16 or over (9.5%) reported in a prior study in Japan (Matsuishi et al., 2008), the percentages of high-risk children decreased both for boys and girls in all categories in the FY2021 survey.

Because the survey also covers children who were born or came to reside in Fukushima Prefecture after the disaster, much of the recent data are for children who did not experience the disaster.

1. SDQ (Strengths and Difficulties Questionnaire): Respondents reply to each question of a 25-item questionnaire concerning children's moods and behavior during the past six months (such as "Gives due consideration to other's feelings" or "Is restless and cannot stay still for a long time"). This survey covers those aged 4 to 15 to judge whether they need professional support or not.

Included in this reference material on March 31, 2015
Updated on March 31, 2024

Pregnancy and Birth Survey

Pregnancy and Birth Survey: Purpose

"We will promote the health of pregnant women in Fukushima Prefecture."

The Pregnancy and Birth Survey was commenced in order to ascertain mental and physical health conditions of pregnant women in Fukushima Prefecture after the Great East Japan Earthquake and the subsequent accident at TEPCO's Fukushima Daiichi NPS, with the aim of alleviating their anxieties and providing necessary care, and also improving obstetric and gynecological care in Fukushima Prefecture.

Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University (information on the Pregnancy and Birth Survey)

Fukushima Prefecture has been conducting the Pregnancy and Birth Survey in order to ascertain mental and physical health conditions of pregnant women in the prefecture after the Great East Japan Earthquake and the subsequent accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS, with the aim of alleviating their anxieties and providing necessary care, and also improving obstetric and gynecological care in Fukushima Prefecture.

Included in this reference material on March 31, 2013
Updated on March 31, 2022

Pregnancy and Birth Survey

Pregnancy and Birth Survey: Outline (1/2)

[Eligible persons]
Pregnant women who obtained a maternity handbook within Fukushima Prefecture and those who obtained a maternity handbook somewhere else but gave birth in the prefecture during the survey period for every fiscal year

Fiscal year	Eligible persons	Responses from
FY2011	16,001 people	9,316 people (58.2%)
FY2012	14,516 people	7,181 people (49.5%)
FY2013	15,218 people	7,260 people (47.7%)
FY2014	15,125 people	7,132 people (47.2%)
FY2015	14,572 people	7,031 people (48.3%)
FY2016	14,154 people	7,326 poeple (51.8%)
FY2017	13,552 people	6,449 people (47.6%)
FY2018	12,838 people	6,649 people (51.8%)
FY2019	11,909 people	6,328 people (53.1%)
FY2020	11,382 people	6,359 people (55.9%)
FY2021	(The main survey ended in FY2020.)	

Conducted the first follow-up survey in approx. 4 years after delivery

Eligible persons	Responses from
7,252 people	2,554 people (35.2%)
5,602 people	2,021 people (36.1%)
5,734 people	2,706 people (47.2%)
5,856 people	2,719 people (46.4%)

Conducted the second follow-up survey in approx. 8 years after delivery

Eligible persons	Responses from
6,643 people	2,354 people (35.4%)
5,152 people	2,178 people (42.3%)
5,402 people	2,492 people (46.1%)

[Survey method]
Inquiry sheets are sent to the targeted pregnant women, asking them to fill in the sheets and send them back.
(From the FY2016 survey, responses are accepted by post or online.)

Major survey items are as follows:
- Pregnant women's mental health conditions
- Present living conditions (circumstances of a refugee life or forced separation from family members)
- Situations during delivery and pregnant women's physical health conditions
- Confidence in raising children
- Attitude toward the next pregnancy

Prepared based on the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University and the materials for the 47th Prefectural Oversight Committee Meetings for Fukushima Health Management Survey

The Pregnancy and Birth Survey covers (i) pregnant women who newly obtained a maternity handbook in Fukushima Prefecture and (ii) those who obtained a maternity handbook elsewhere but gave birth in the prefecture during the survey period.

For those falling under (i), inquiry sheets are sent based on information provided by each municipality in the prefecture. Those falling under (ii) may use inquiry sheets provided by obstetric institutions in the prefecture or request the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University, to send them inquiry sheets.

For respondents to the main survey in FY2011 to FY2014, the first follow-up survey (4 years after delivery) was completed and the second follow-up survey (8 years after delivery) is being conducted.

Survey targets are asked to fill in inquiry sheets and send them back. From the FY2016 survey, responses can also be submitted online.

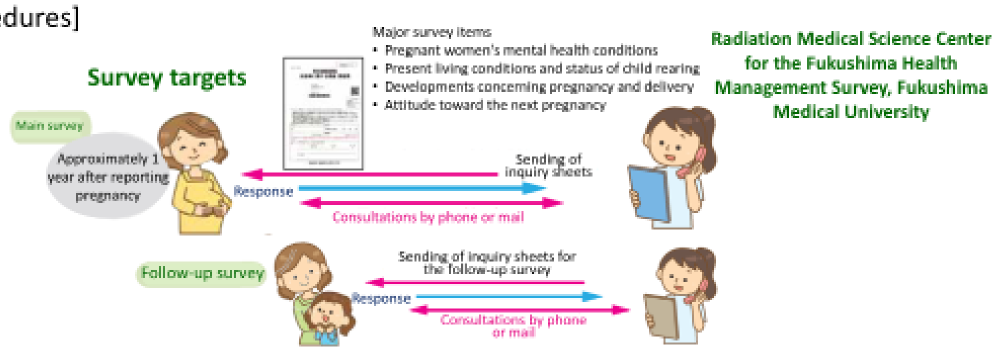
The number of women who become pregnant and give birth in Fukushima Prefecture decreased after the disaster in FY2012 but temporarily increased in FY2013. However, the number has been on a decline thereafter as seen nationwide.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Pregnancy and Birth Survey

Pregnancy and Birth Survey: Outline (2/2)

[Survey procedures]



First survey (4 years after delivery): Conducted in FY2015 to FY2018 targeting respondents of the surveys conducted in FY2011 to FY2014
Second survey (8 years after delivery): Conducted in FY2019 to FY2022 targeting respondents of the surveys conducted in FY2011 to FY2014

[Pregnancy and Birth Survey] Since the FY2016 survey, responses can be submitted online.

- Main survey
  Ended with the FY2020 survey
- First follow-up survey
  Ended with the FY2018 survey
- Second follow-up survey
  Ended with the FY2022 survey

Prepared based on the leaflet on the Pregnancy and Birth Survey, and the website of the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University

Details of the responses are compiled by the Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University, to detect people considered to be in need of support.[1] If there are any people who are considered to be in need of support, midwives, public health nurses, doctors or other specialized staff members offer telephone consultations or other support to such people by mail or by other means.

The main survey ended with the FY2020 survey.

From FY2015, the first follow-up survey to ask about mental and physical health conditions was conducted targeting FY2011 survey respondents (4 years after delivery). The survey ended with the FY2018 survey.

From FY2019, the second follow-up survey was conducted targeting FY2011 survey respondents (8 years after delivery), and the survey ended with the FY2022 survey.

1. Respondents who replied that they tend to feel depressed and that they are not interested in things, or respondents who are considered to be in need of support based on the content of their free remarks (such as those who are in need of help, who are severely depressed, who need support for child rearing, who are worried about radiation doses, or who directly made requests or are requiring concrete answers)

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Pregnancy and Birth Survey

Pregnancy and Birth Survey: Achievement and Content of Support

[Changes in coverage]

Out of all respondents, for those who were judged to be in need of support from the content of their responses, support has been offered by full-time midwives, etc. by phone or mail.

Fiscal year	Number of people who received support by phone	Percentage of those who received support among all respondents		Number of people who received support by phone	Percentage of those who received support among all respondents		Number of people who received support by phone	Percentage of those who received support among all respondents
FY2011	1,401 people	15.0%	First survey following up the FY2011 survey	375 people	14.7%	Second survey following up the FY2011 survey	421 people	17.9%
FY2012	1,104 people	15.4%	First survey following up the FY2012 survey	256 people	12.7%	Second survey following up the FY2012 survey	386 people	17.7%
FY2013	1,101 people	15.2%	First survey following up the FY2013 survey	393 people	14.5%	Second survey following up the FY2013 survey	469 people	18.8%
FY2014	830 people	11.6%	First survey following up the FY2014 survey	380 people	14.0%			
FY2015	913 people	13.0%						
FY2016	951 people	13.0%						
FY2017	799 people	12.4%						
FY2018	711 people	10.7%						
FY2019	668 people	10.6%						
FY2020	688 people	10.8%						

[Topics of the consultations by phone]

	Main survey						First follow-up survey			Second follow-up survey
	FY2011	FY2012	FY2013	FY2014 to FY2017 (the ranking remained unchanged)	FY2018 to FY2019 (the ranking remained unchanged)	FY2020	FY2015 FY2011 survey respondents	FY2016 FY2012 survey respondents	FY2017 to FY2018 (the ranking remained unchanged) FY2013-2014 survey respondents	FY2019 to FY2021 (the ranking remained unchanged) FY2011-2013 survey respondents
1st	Worries over radiation and its effects	Mothers' mental and physical health	Mothers' mental and physical health	Mothers' mental and physical health	Mothers' mental and physical health	Matters concerning child rearing	Mothers' mental and physical health	Mothers' mental and physical health	Mothers' mental and physical health	Mothers' mental and physical health
2nd	Mothers' mental and physical health	Matters concerning child rearing	Matters concerning child rearing	Matters concerning child rearing	Matters concerning child rearing	Mothers' mental and physical health	Worries over radiation and its effects	Matters concerning child rearing	Matters concerning child rearing	Matters concerning child rearing
3rd	Matters concerning child rearing	Worries over radiation and its effects	Children's mental and physical health	Matters concerning family life	Children's mental and physical health	Matters concerning family life	Matters concerning child rearing	Children's mental and physical health	Matters concerning family life	Children's mental and physical health

Matters concerning child rearing include concerns about baby food, night crying, constipation, vaccination, etc.

Prepared based on the material for the 44th and 47th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Immediately after the disaster, the most frequent topic was worries over radiation and its effects, but the percentage of such consultations is declining over time. Since FY2012, consultations on mothers' mental and physical health and matters concerning child rearing have increased and now rank high.

The percentage of people requiring support found in the main survey has been gradually decreasing.

From the follow-up surveys in FY2013 onward, support was expanded to cover those considered to be in need of support based on the content of their free comments. Accordingly, the percentage of those requiring support found in the first follow-up survey continued to be around 14%.

The percentages of those requiring support found in the second follow-up surveys were 17% to 18%.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

Pregnancy and Birth Survey

Pregnancy and Birth Survey: What Has Become Clear (1/2)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

[Percentages of premature births, low birth-weight babies, and congenital abnormalities or anomalies]

Percentages of premature births, low birth-weight babies, and congenital abnormalities or anomalies obtained through the Pregnancy and Birth Survey were almost the same as the general level and those obtained through nationwide surveys.

	Percentage of premature births (%)		Percentage of low birth-weight babies (%)		Percentage of congenital abnormalities or anomalies (%)	
	Main survey*	Nationwide survey	Main survey*	Nationwide survey	Main survey	General level
FY2011	4.6	5.7	8.6	9.6	2.85	2 to 3 (based on the Obstetrics and Gynecology Clinical Practice Guidelines: Obstetrics 2023)
FY2012	5.6	5.7	9.2	9.6	2.39	
FY2013	5.2	5.8	9.6	9.6	2.35	
FY2014	5.3	5.7	9.8	9.5	2.30	
FY2015	5.6	5.6	9.4	9.5	2.24	
FY2016	5.3	5.6	9.2	9.4	2.55	
FY2017	5.3	5.7	9.2	9.4	2.38	
FY2018	5.2	5.6	9.0	9.4	2.19	
FY2019	5.1	5.6	9.1	9.4	2.71	
FY2020	4.4	5.5	8.1	9.2	2.21	

* As percentages are retabulated by excluding cases of dead births, values differ from those in the reports on the surveys in FY2011 to FY2018.
Premature births: Babies born at a gestational age from 22 weeks to less than 37 weeks
Low birth-weight babies: Babies born smaller than 2500g
Nationwide surveys: Annual percentages based on the Vital Statistics

Prepared based on the material for the 44th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

Radiation effects on newborn babies had been worried about, but the percentages of premature births, low birth-weight babies, and congenital abnormalities or anomalies in Fukushima Prefecture after the disaster were found to be almost the same as generally available data, including Vital Statistics collected nationally.

Included in this reference material on March 31, 2015
Updated on March 31, 2024

Pregnancy and Birth Survey

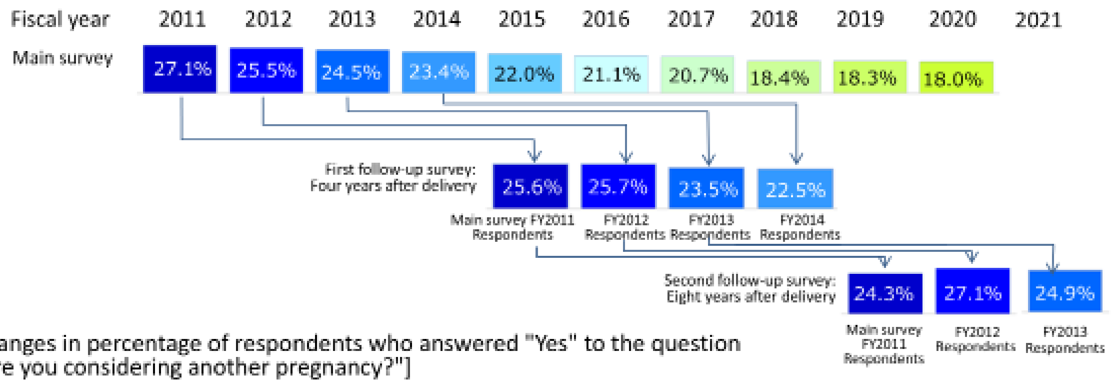
Pregnancy and Birth Survey: What Has Become Clear (2/2)

Latest Survey Results: https://www.pref.fukushima.lg.jp/site/portal/kenkocyosa-kentoiinkai.html (in Japanese)

[Changes in pregnant women's depressive tendencies]

The percentage of respondents who replied that they tend to feel depressed and/or that they are not interested in things

Pregnant women's depressive tendencies have been decreasing gradually, but those who gave birth within one to two years after the disaster showed higher depressive tendencies even after four years compared with those who gave birth later.



[Changes in percentage of respondents who answered "Yes" to the question "Are you considering another pregnancy?"]

Nationwide survey		Main survey								
FY2010	FY2015	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
51.0%	50.0%	52.9%	52.8%	57.1%	53.3%	54.6%	52.4%	52.2%	51.3%	50.0%

Nationwide survey 2010 : Percentage of respondents who are married for less than 10 years and plan to have a child in the nationwide survey, "Fourteenth Japanese National Fertility Survey in 2010" (when having any children already)
Nationwide survey 2015 : Percentage of respondents who are married for less than 10 years and plan to have a child in the nationwide survey, "Fifteenth Japanese National Fertility Survey in 2015" (when having any children already)

* The 2011 survey did not contain the relevant question.

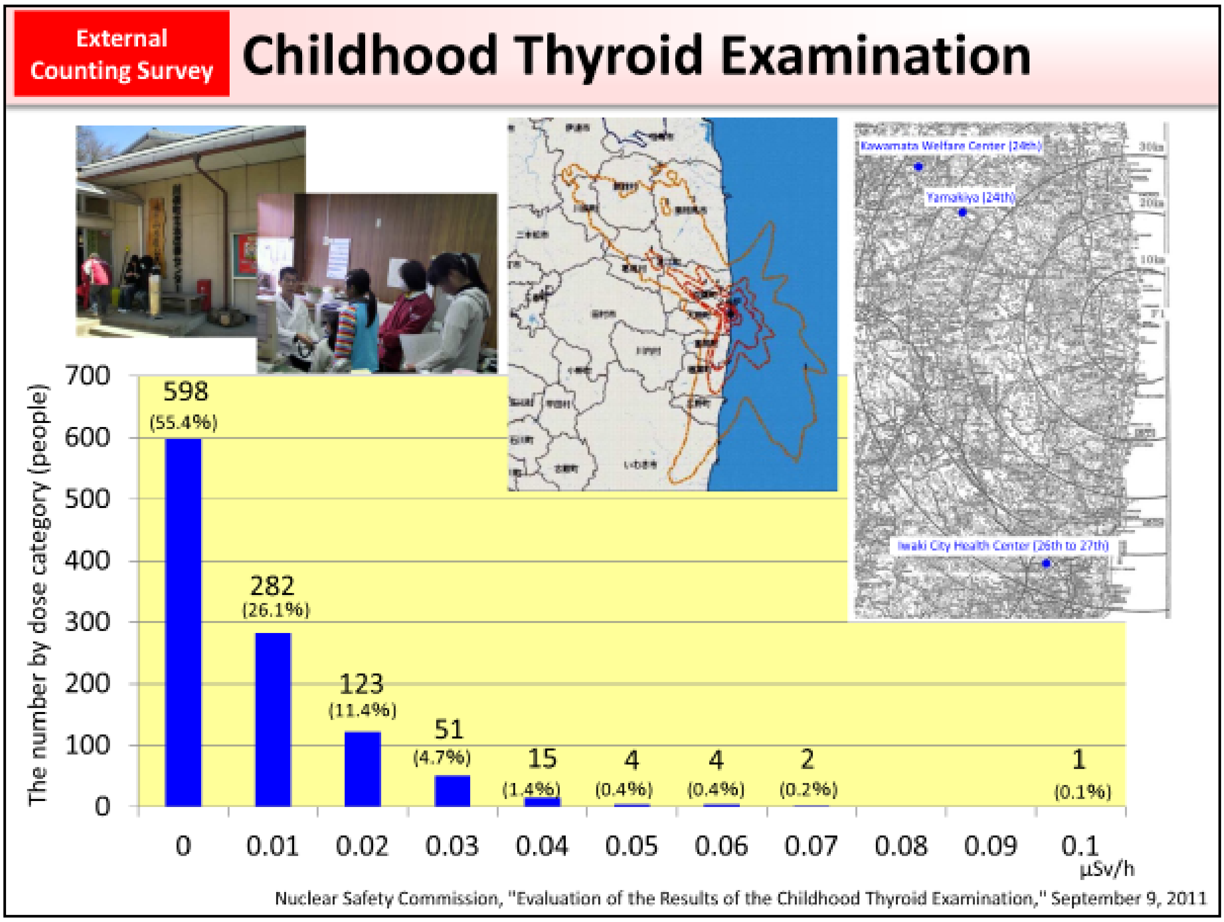
Prepared based on the material for the 44th and 47th Prefectural Oversight Committee Meeting for Fukushima Health Management Survey

For questions concerning pregnant women's depressive tendencies, respondents who replied that they tend to feel depressed and/or that they are not interested in things have been decreasing. However, those who gave birth within one to two years after the disaster showed higher depressive tendencies even after four years compared with those who gave birth later.

According to the "Healthy Parents and Children 21" (a national campaign to promote improvement of health standards of mothers and children), the percentage of postnatal depression evaluated using the Edinburgh Postnatal Depression Scale was 8.4% in FY2013, 9.8% in FY2017, and 9.7% in FY2021 nationwide. The percentage estimated from the results of the FY2020 Pregnancy and Birth Survey was 10.0% (reference used for the calculation: Mishina H, et al. Pediatr Int. 2009; 51: 48).

The FY2020 Pregnancy and Birth Survey also revealed that respondents considering another pregnancy accounted for 50.0%. Since the FY2012 survey, more than half of the respondents wish to have more children. For reference, respondents who have been married for less than ten years and plan to have a child accounted for 60% (or 51% among those who already have any children) in the Fourteenth Japanese National Fertility Survey in 2010 and 57% (or 50% among those who already have any children) in the Fifteenth Japanese National Fertility Survey in 2015.

Included in this reference material on March 31, 2015
Updated on March 31, 2024

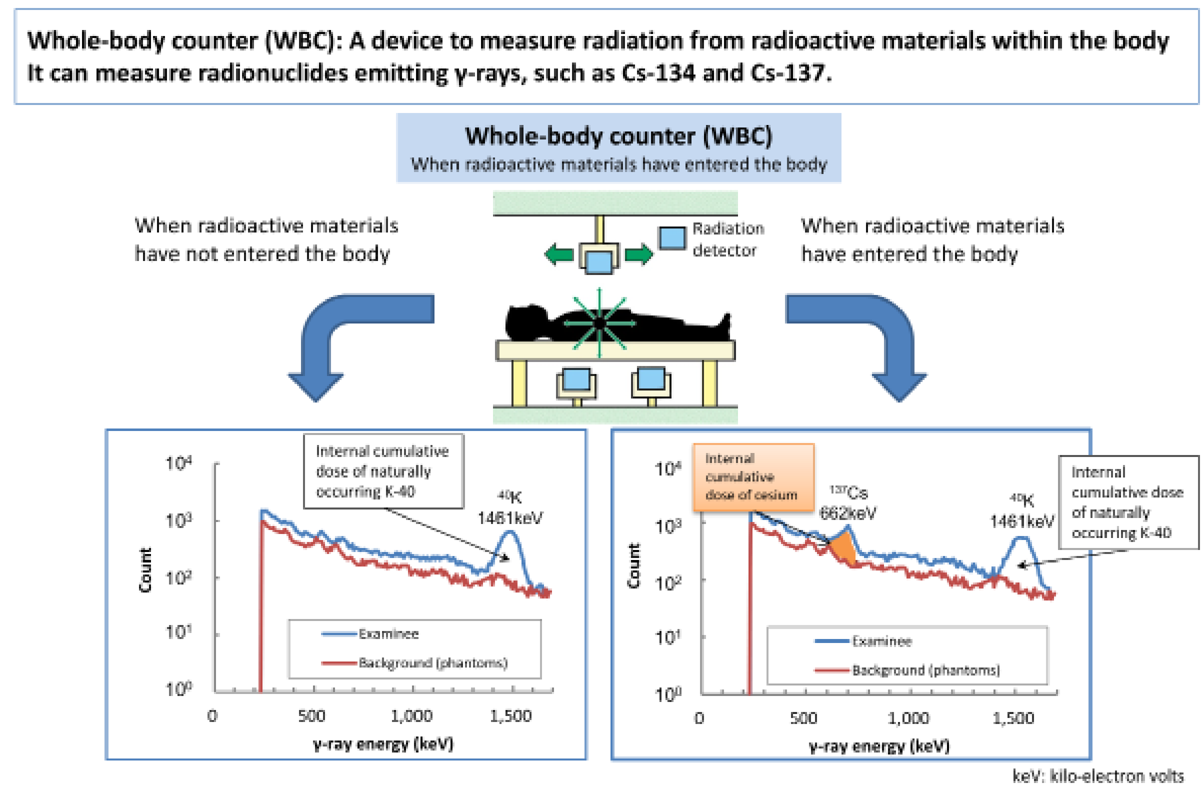


Based on estimates by SPEEDI on March 23, 2011, the Local Nuclear Emergency Response Headquarters conducted the Childhood Thyroid Examination to ascertain health effects of radiation on children in response to a request from the Technical Advisory Organization in an Emergency of the Nuclear Safety Commission of Japan (dated March 23 and 25). The figure shows the results for 1,080 children for whom measurement was conducted properly, out of 1,149 survey targets. The figure excludes the results for 66 children for whom simplified measurement was not appropriate due to environmental doses at their measuring spots (proper evaluation based on simplified measurement was difficult due to high ambient dose rates) and for three children whose ages were unknown. However, for all children who received the examination, measured values were below 0.2 μSv/h, which is set as the standard screening level by the Nuclear Safety Commission of Japan.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

External Counting Survey

Internal Exposure Measurement Using a Whole-body Counter



A whole-body counter is a device to measure γ-rays emitted from the body. As γ-ray energy differs by radionuclide, if a specific amount of energy, for example, 1,461 keV, which is the γ-ray energy of radioactive potassium (K-40), is counted, this can be interpreted as γ-rays emitted from K-40 in the body. The γ-ray energy of Cs-137 is 662 keV.

Potassium is an essential element for a living organism and approximately 0.01% of it is radioactive. Radioactive potassium is mainly dissolved in cellular water and exists in muscles but not so much in fat cells that contain little water.

As radioactive cesium spreads all over the body, the internal dose of cesium is measured using a whole-body counter.

(Related to p.60 of Vol. 1, “Instruments for Measuring Internal Exposure”)

Included in this reference material on March 31, 2013
Updated on March 31, 2016

External Counting Survey

Results of the Internal Exposure Measurement Using a Whole-body Counter

Targeting the residents of the Evacuation Areas and the areas where internal and external exposure doses are likely to be higher than in other areas based on the results of the environmental monitoring survey, etc. (Yamakiya District in Kawamata Town, Iitate Village and Namie Town), the internal exposure measurement using a whole-body counter commenced on June 27, 2011. The targeted areas were expanded sequentially, and measurements were conducted for a total of 347,226 people by November 30, 2023. For over 99.9% of them, committed effective doses due to Cs-134 and Cs-137 were below 1 mSv and even the maximum measured value was 3 mSv. Measured values were all unlikely to cause any health effects.

(i) Targeted local governments: All 59 municipalities in Fukushima Prefecture
(ii) Organizations that conducted the measurement
Fukushima Prefecture; Hirosaki University Hospital; Minamisoma City General Hospital; Japan Atomic Energy Agency; Niigata Prefecture Radiation Examination Office; Hiroshima University Hospital; Nagasaki University Hospital; Japanese Red Cross Otsu Hospital; Mori no Miyako Industrial Health Association; National Hospital Organization Kanazawa Medical Center; Ehime University Hospital; and the National Institute of Radiological Sciences
(iii) 'Mobile measurement' using whole-body counter vehicles outside Fukushima Prefecture
Fukushima Prefecture runs whole-body counter vehicles for mobile measurement so that evacuees outside the prefecture can also receive measurement. By March 2016, mobile measurement was conducted in 38 prefectures including the Tokyo Metropolis (other than Aomori, Ibaraki, Niigata, Ishikawa, Shiga, Hiroshima, Aichi and Nagasaki Prefectures), where there is no permanent organization to which Fukushima Prefecture commissions the measurement.
(iv) Measurement results (committed effective doses) (Results up to November 2023 were released on December 14, 2023.)

	Jun. 27, 2011 – Jan. 31, 2012	Feb. 1, 2012 – Nov. 30, 2023	Total
Less than 1 mSv	15,384 people	331,816 people	347,200 people
1 mSv	13 people	1 person	14 people
2 mSv	10 people	Zero	10 people
3 mSv	2 people	Zero	2 people
Total	15,409 people	331,817 people	347,226 people

* Committed effective dose: Assuming that until the end of January 2012, a person ingested radiation once on March 12, 2011, and, from February 2012 onward, a person orally ingested the equal amount of radiation every day from March 12, 2011, to the day preceding the measurement date, the person's lifetime internal doses are calculated by summing up the doses for fifty years in the case of an adult and for the years elapsed until becoming 70 years old in the case of a child.

Prepared based on the website of Fukushima Prefecture, "Results of the Internal Exposure Measurement Using a Whole-body Counter"

Targeting the residents of the Evacuation Areas and the areas where internal and external exposure doses are likely to be higher than in other areas based on the results of the environmental monitoring survey, etc. (Yamakiya District in Kawamata Town, Iitate Village and Namie Town), the internal exposure measurement using a whole-body counter commenced on June 27, 2011. The targeted areas were expanded sequentially, and the measurements were conducted for a total of 347,226 people by November 30, 2023. For over 99.9% of them, committed effective doses due to Cs-134 and Cs-137 were below 1 mSv and even the maximum measured value was 3 mSv. Measured values were all unlikely to cause any health effects.

Included in this reference material on March 31, 2013
Updated on March 31, 2024

External Counting Survey

Internal Exposure due to Foods

- Radioactive cesium is eliminated from the body over time.
- The internal exposure measurement using a whole-body counter being conducted at present examines the effects of radiation that is ingested orally on a daily basis.
- Measured values exceeding 1 mSv are considered to be mostly caused by radiation **derived from wild plants or animals**. Since March 2012, values exceeding 1 mSv have not been detected.

* Reference:p.86 of Vol. 2, "Mushrooms, Wild Plants and Wild Bird and Animal Meat"

Q. What if the measurement using a whole-body counter detected any value exceeding the detection limit?

A. The relevant person may have eaten a lot of foods – not allowed in commercial markets – that contain radioactive cesium at high concentrations, e.g., wild mushrooms, wild plants, wild bird and animal meat (wild boars, bears, etc.).

Prepared based on the following:
Masaharu Tsubokura, et.al. "Reduction of High Levels of Internal Radio-Contamination by Dietary Intervention in Residents of Areas Affected by the Fukushima Daiichi Nuclear Plant Disaster: A Case Series," PLoS One. 2014; 9(6): e100302., US National Library of Medicine, National Institutes of Health, Published online 2014 Jun 16

As radioactive cesium is eliminated from the body over time, the radioactive cesium that people ingested immediately after the disaster has mostly been eliminated.

The internal exposure measurement using a whole-body counter being conducted at present examines the effects of radiation that is ingested orally on a daily basis. Measured values exceeding 1 mSv per year are considered to be mostly caused by radiation derived from wild plants and animals. As long as people eat only foods distributed through regulated commercial marketplaces, their annual internal doses will not exceed 1 mSv. If the annual internal dose exceeds 1 mSv, the relevant person may have eaten a lot of foods – not allowed in commercial markets – that contain radioactive cesium at high concentrations. In particular, cases have been reported where wild mushrooms are suspected to cause high internal doses.

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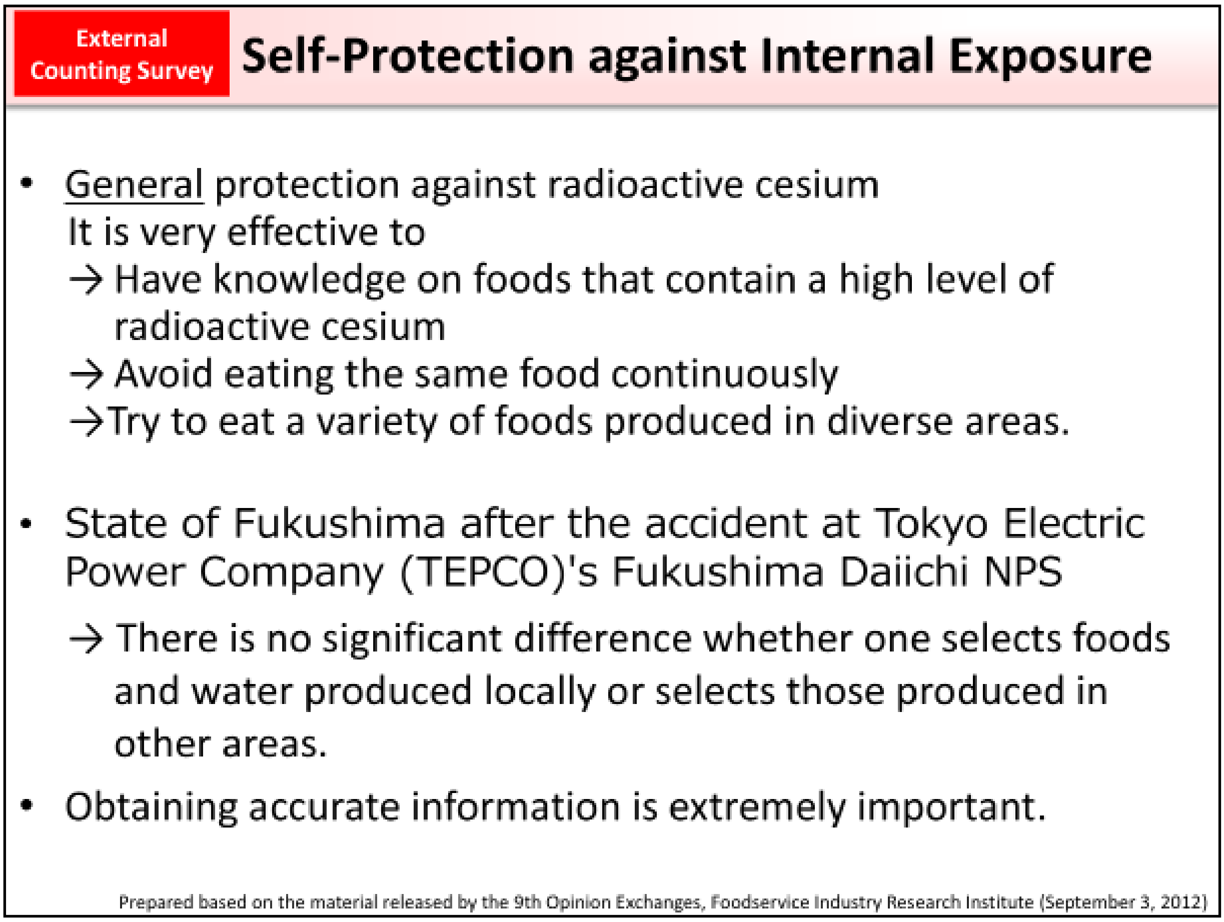
Updated on December 31, 2017



In order to avoid further internal exposure, it is effective to have knowledge on foods that contain a high level of radioactive cesium, avoid eating same food continuously, and try to eat a variety of foods produced in diverse areas. Obtaining accurate information is extremely important.

Included in this reference material on March 31, 2013
Updated on March 31, 2020

Abbreviations

Act on Special Measures Concerning Nuclear Emergency	Act on Special Measures Concerning Nuclear Emergency Preparedness
Act on Special Measures (Concerning the Handling of Environment Pollution by Radioactive Materials)	Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the Nuclear Power Station Accident Associated with the Tohoku District - Off the Pacific Ocean Earthquake that Occurred on March 11, 2011
ADI	Acceptable Daily Intake
ALARA	As Low As Reasonably Achievable
ALPS	Advanced Liquid Processing System
BMI	Body Mass Index
BSS	Basic Safety Standards
CT	Computed Tomography
DDREF	Dose and Dose Rate Effectiveness Factor
DNA	Deoxyribonucleic Acid
EEG	Electroencephalogram
EUROCAT	European Surveillance of Congenital Anomalies
GM counter	Geiger-Müller counter
HPCI	High Pressure Coolant Injection System
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ILO	International Labour Organization
INES	International Nuclear and Radiological Event Scale
IQ	Intelligence Quotient
IXRPC	International X-ray and Radium Protection Committee
JAEA	Japan Atomic Energy Agency
JESCO	Japan Environmental Storage & Safety Corporation
J-RIME	Japan Network for Research and Information on Medical Exposure
LNT model	Linear Non-Threshold model
MRI	Magnetic Resonance Imaging

MRL	Maximum Residue Levels
NAS	National Academy of Sciences
ND	Not Detected
OECD/NEA	Organisation for Economic Co-operation and Development/Nuclear Energy Agency
PET	Positron Emission Tomography
PFA	Psychological First Aid
PTSD	Posttraumatic Stress Disorder
RCIC	Reactor Core Isolation Cooling System
SDQ	Strengths and Difficulties Questionnaire
SPEEDI	System for Prediction of Environmental Emergency Dose Information
TDI	Tolerable Daily Intake
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
WBC	Whole Body Counter
WHO	World Health Organization

Units

Sv	Sievert
Bq	Becquerel
Gy	Gray
eV	electron volt
J	Joule

SI prefixes

Symbol	Reading	Exponential (decimal notation)
T	tera	10^{12} (1 000 000 000 000)
G	giga	10^{9} (1 000 000 000)
M	mega	10^{6} (1000 000)
k	kilo	10^{3} (1 000)
d	deci	10^{-1} (0.1)
c	centi	10^{-2} (0.01)
m	milli	10^{-3} (0.001)
μ	micro	10^{-6} (0.000 001)
n	nano	10^{-9} (0.000 000 001)

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A

Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials

The radioactive materials released due to the accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Station (NPS) after the Great East Japan Earthquake caused environmental pollution. This Act aims to promptly reduce the influence of this environmental pollution on human health and living environments, and provides for the monitoring and measurement of the environmental pollution, disposal of waste contaminated with radioactive materials, decontamination of soil and other countermeasures. (Based on the website of the Ministry of the Environment)

Actinoid

The actinoid (actinide) series encompasses the 15 elements with atomic numbers from 89 to 103, namely Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, and Lr. All actinoids are radioactive and release energy upon radioactive decay. Naturally occurring uranium and thorium and artificially produced plutonium are the most abundant actinides on Earth.

Additional doses

The term "additional dose" refers to a dose received from radioactive sources that were unintentionally generated. After the TEPCO's Fukushima Daiichi NPS Accident, the additional dose often refers to the dose from the artificial radionuclides (e.g., Cesium-137) distinct from the dose from naturally existing radionuclides (e.g., Potassium-40).

Advanced Liquid Processing System

Multi-nuclide removal equipment (known as the Advanced Liquid Processing System, or ALPS) that removes 62 kinds of radioactive materials other than tritium. "ALPS treated water" refers to water that has been treated by the Advanced Liquid Processing System (ALPS) and other equipment and has been purified to a level where contained radioactive materials, except for tritium, satisfy the regulatory standards for environmental discharge. Prior to the treatment using ALPS, contaminated water is purified to remove cesium, strontium, etc.

ALPS treated water

See "Advanced Liquid Processing System".

Ambient dose

An ambient dose refers to the amount of radiation in the air. Gamma rays from radioactive materials on or near the ground surface and gamma rays from radioactive materials in the air affect ambient dose levels.

Areas under Evacuation Orders

Areas for which evacuation orders were issued based on Article 15, paragraph (3) of the Act on Special Measures Concerning Nuclear Emergency Preparedness; Areas under Evacuation Orders consisted of Deliberate Evacuation Areas and the 20-

km zone of the Nuclear Power Station. The areas were reviewed and were newly organized as Preparation Areas for Lift of Evacuation Order, Habitation Restricted Areas, and Restricted Areas.

Areas where Returning is Difficult

See “Restricted Areas”.

Artificial radionuclides

Man-made radionuclides produced by a nuclear reactor and an accelerator in contrast to naturally-occurring radionuclides. (Based on the website of the Nuclear Fuel Cycle Engineering Laboratories, JAEA)

Atmospheric nuclear testing

Nuclear testing conducted on the ground, at sea or in the air; There are also underwater nuclear testing, underground nuclear testing and exoatmospheric nuclear testing. Nuclear testing other than that to be conducted underground was all banned under the Partial Test Ban Treaty (PTBT), which was signed in 1963. (Based on the website of Japan Atomic Energy Agency)

B

Basic Survey

The Basic Survey is a questionnaire survey targeting roughly 2,050,000 residents of and visitors to Fukushima Prefecture as of March 11, 2011. Estimated external radiation doses were calculated based on recorded movements of respondents in the four months following the nuclear accident. (Based on the website of the Radiation Medical Science Center, Fukushima Medical University)

C

Calibration constant

Calibration means to clarify the relationship between a correct value and instrument readings, and such relationship expressed in a ratio is referred to as a calibration constant. When measuring radiation, correct values are to be obtained by multiplying instrument readings by a calibration constant. A calibration constant is generally indicated on a calibration label attached to a radiation meter.

Cell degeneration

Passing from a state of goodness to a lower state by losing qualities desirable for normal cell function that results in, for example, deformity or malfunctioning.

Cesium

Cesium (Caesium) is a chemical element with atomic number 55. Cesium-137 (Cs-137) and Cesium-134 (Cs-134) are radioisotopes of cesium and their physical half-lives are about 30 and two years, respectively. Cs-137 decomposes to Ba-137 through beta decay associated with gamma radiation (0.662 MeV), and then to nonradioactive barium. Cs-137 is generated as one of the fission products, whereas Cs-134 is generated through neutron capture of stable cesium. The biological half-life of cesium is about 70 to 100 days for adults and is shorter for children. Cs-137 and Cs-134 were released into the environment due to the TEPCO's Fukushima Daiichi NPS Accident as well as other radioisotopes such as radioiodine. On the other hand, Cs-

137 is commonly used as a gamma emitter in industrial application.

Chornobyl Nuclear Power Station Accident
A nuclear reactor accident that occurred at Unit 4 of the Chornobyl Nuclear Power Station in the Ukrainian Republic on April 26, 1986.

Chronic exposure
Chronic exposure means continuous or intermittent exposure to radiation over a long period of time. In contrast to acute exposure, tissue reactions caused by exposure are less severe if the total radiation dose is the same.

Codex Alimentarius Commission
An intergovernmental body created in 1963 by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) for the purpose of protecting consumers' health and ensuring fair-trade practices in the food trade, etc.; The Commission establishes international standards for foods.

Cold shut-down
A situation where a fission reaction has been suppressed through the insertion of control rods and the temperature in the reactor is stably maintained at 100°C or lower by continued cooling.

Committed effective dose
The sum of the products of the committed organ or tissue equivalent doses and the appropriate tissue weighting factors (w_T). The commitment period is taken to be 50 years for adults, and to age 70 years for children. (Cited from ICRP, 2007) (See p.56 in Vol. 1 (Chapter 2) for details)

Committed effective dose coefficient
The coefficient is indicated as a committed effective dose for a person who has ingested or inhaled 1Bq of radioactive materials considering type of radionuclide, intake route (ingestion, inhalation, etc.), and age group (adults, young children, infants). The coefficient differs by age group because time integrated dose is taken into account for a period of 50 years for adults and for a period of becoming up to age 70 for children, and also because biological half-lives and sensitivity differ between adults and children.
Intake (Bq) × (Committed) effective dose coefficient (mSv/Bq) = (Committed) effective dose (mSv)
(Based on the website of the Food Safety Commission of Japan)

Committed effective doses per unit intake (Bq)
See "Committed effective dose coefficient".

Comprehensive Health Checkup
The program aims at early detection and treatment of diseases as well as prevention of lifestyle-related diseases. Its main target includes 210,000 former residents of evacuation zones whose lifestyle changed drastically after the accident. Additional tests such as differential leukocyte count are performed apart from the routine tests included in the general medical check-up at the workplace or by the local government. (Based on the website of the Radiation Medical Science Center, Fukushima Medical University)

Confidence interval

In “frequentist inference”, a confidence interval is an interval defined in terms of the sampling distribution of a statistic of interest (i.e. the distribution of estimates of the statistic that would arise from repeated—generally hypothetical—realizations of data generated from the same underlying distribution as the observed data) such that, for example, the probability that a 95% confidence interval for a given parameter contains the true value of that parameter is 0.95. (Cited from UNSCEAR, 2017)

Confinement function

A function as a protective wall to prevent diffusion of radioactive materials into the environment; At a reactor, even if radioactive materials leak from the primarily cooling system by pipe rupture, etc., it should be ensured that the confinement function of the reactor containment vessel works properly to prevent diffusion of radioactive materials into the environment.

Containment vessel

Steel vessel enclosing a nuclear reactor containing radioactive material. It is designed, in any emergency, to keep radioactive materials inside of the vessel and to prevent the release thereof when the radioactive material is leaked from nuclear reactor.

Contaminated water

Contaminated water is water containing radioactive materials of fuel debris. It is generated due to continued water injection for cooling fuel that had been melted and solidified (fuel debris) and due to the inflow of rainwater and groundwater into the reactor building. Contaminated water has been generated every day since the accident at TEPCO’s Fukushima Daiichi NPS. Contaminated water is treated using cesium adsorption equipment and a desalinator. Separated clean water is repeatedly used for cooling fuel debris. (See p.13 in Vol. 2 (Chapter 6) for details)

Controlled disposal sites

One type of disposal site where countermeasures have been taken to prevent contamination of groundwater and public waters caused by seeping water from radioactive waste. One of the countermeasures is water shielding work that covers the sides and bottom of the disposal site with plastic sheets, etc. Disposal sites are categorized into three types depending on methods of reducing influence of the waste to be landfilled on the surrounding environment, i.e., controlled type, isolated type, and stabilized type. (Based on the website of the EIC Network)

Cooling system

A system to remove the heat generated in a reactor; There are the primary core cooling system and the emergency core cooling system.

Core fuel

There is an area to load fuel assemblies in the inside of the reactor pressure vessel. This area is referred to as a reactor core. Nuclear fuel in the area is referred to as core fuel.

Core melt

A situation where fuel assemblies overheat due to abnormal deterioration of the cooling capacity of a reactor, and the fuel assemblies in the reactor core or core internals melt down. (Based on the website of Fukushima Prefecture [d])

Cosmic rays

High energy ionizing particles such as protons, neutrons, etc. from outer space. These particles produce complex compositions at the surface of the earth through nuclear reaction with nitrogen or oxygen in the air.

Count per minute (cpm)

Number of counts per unit time when measuring radiation using a counting device (a device to count the amount of incident radiation); Number of counts per minute is indicated as cpm and number of counts per second is indicated as cps. (kcpm=1000cpm) (Based on the website of Fukushima Prefecture [d])

D

Decay (disintegration)

The process of spontaneous transformation of a radionuclide. The decrease in the activity of a radioactive substance. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Declaration of a nuclear emergency situation

A declaration of an emergency situation that the Prime Minister issues based on the Act on Special Measures Concerning Nuclear Emergency (see the Act on Special Measures Concerning Nuclear Emergency Preparedness) for the purpose of protecting citizens' lives, bodies and property from a nuclear disaster; Based on the declaration, the national government establishes the Nuclear Emergency Response Headquarters (headed by the Prime Minister) and provides instructions necessary for protecting citizens to nuclear operators, government organizations and relevant local governments, etc.

Decommissioning

Dismantling a nuclear reactor and the other related facilities for which it has been decided to discontinue operation or make adjustments to ensure that they pose no risks into the future.

Deliberate Evacuation Areas

Areas in municipalities located within 20km to 30km in radius from TEPCO's Fukushima Daiichi NPS where exposure doses are highly likely to reach 20 mSv in one year after the accident; The designation of Deliberate Evacuation Areas is one of the physical protection measures taken after the accident at the NPS. (Based on the website of Fukushima Prefecture [d])

Designated waste

Contaminated waste that is confirmed to be over 8,000 Bq/kg of radioactive concentration and is designated by the Minister of the Environment. The Minister of the Environment designates the waste when it is contaminated with more than 8,000 Bq/kg, based on the investigation results of the contamination status of incinerated ash and such or an application submitted by the owner of the waste.

Detection limit

The minimum amount or concentration of a targeted radioactive material in a test sample that can be detected by a certain analysis method under appropriate management and operation. (Based on the website of the Food Safety Commission of

Japan)

Deterministic effect
Health effects that only appear if a threshold level of dose is exceeded, e.g. radiation-induced erythema (burns). Deterministic effects will appear within the hours, days or weeks following a high radiation exposure.
(Cited from the website of UK Health Security Agency, Radiation Protection Services)

Directional dose equivalent
The dose equivalent at a point in a radiation field that would be produced by the corresponding expanded field in the ICRU sphere at a depth, d, on a radius in a specified direction, X. The unit of directional dose equivalent is joule per kilogram ($J\ kg^{-1}$) and its special name is sievert (Sv). (Cited from ICRP, 2007)

Director General of the Nuclear Emergency Response Headquarters
In the event of a nuclear emergency situation as prescribed in Article 15 of the Act on Special Measures Concerning Nuclear Emergency, the Prime Minister issues a declaration of a nuclear emergency situation. The national government establishes the Nuclear Emergency Response Headquarters (headed by the Prime Minister), provides necessary instructions to nuclear operators, government organizations and relevant local governments, etc., and also establishes the Local Nuclear Emergency Response Headquarters (headed by the Vice-Minister) at an off-site center and formulates the Joint Council for Nuclear Emergency Response. (Based on the website of Fukushima Prefecture [d])

Dissolved Cs
See “Cesium”.

Distribution Restrictions
Based on the Act on Special Measures Concerning Nuclear Emergency Preparedness, when any agricultural products containing radioactive materials at levels exceeding the standard values are found, the national government issues distribution restrictions to prevent the distribution of products from the relevant production areas for each of such areas (for each of the present or former municipalities; regarding fishery products, additionally for each sea area, lake or river).

Dose constraint
A prospective and source-related restriction on the individual dose from a source, which provides a basic level of protection for the most highly exposed individuals from a source, and serves as an upper bound on the dose in optimisation of protection for that source. For occupational exposures, the dose constraint is a value of individual dose used to limit the range of options considered in the process of optimisation. For public exposure, the dose constraint is an upper bound on the annual doses that members of the public should receive from the planned operation of any controlled source. (Cited from ICRP, 2007)

Dose-response relationship
Relationship between the magnitude of a dose and the biological response in an organism, system or (sub)population. (Cited from WHO, Health Risk Assessment, 2013)

Dosimeter

A device for measuring an individual's exposure to ionizing radiation. (Cited from UNSCEAR, 2013)

E

Electron

An elementary particle with low mass, 1/1836 that of a proton, and unit negative electric charge. Positively charged electrons, called positrons, also exist. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Emergency core cooling system

A safety system to cool a reactor core in the event of pipe rupture in the reactor cooling system, etc. by immediately injecting coolant into the reactor core; Even if a nuclear fission chain reaction is stopped by insertion of control rods immediately in an emergency, fission products continue to generate decay heat and the fuel assemblies need to be cooled. An emergency core cooling system is used for this purpose.

Energetically unstable (Unstable energy state)

See "Nucleus Stability/Instability".

Enriched uranium

See "Uranium".

Environmental monitoring

The measurement of external dose rates due to sources in the environment or of radio-nuclide concentrations in environmental media. (Cited from WHO, Health Risk Assessment, 2013)

Environmental radiation

Naturally occurring radiation or artificial radiation in the living environment; Naturally occurring radiation includes cosmic rays from the outer atmosphere and radiation deriving from naturally occurring radioactive elements that constitute the earth's crust. Part of artificial radiation that is referred to as environmental radiation is radiation released from fallout from past nuclear testing and radiation that was generated at nuclear facilities and exists in the environment. (Based on the website of Japan Atomic Energy Agency)

Epidemiological Studies

Studies of the distribution in a population of disease and other health issues as related to age, sex, race, ethnicity, occupation, economic status, or other factors. (Cited from the website of the United States Environmental Protection Agency)

Exposure dose

A situation where a human body is exposed to radiation is referred to as exposure and the amount of radiation that a person has received is referred to as an exposure dose, which is expressed in Grays (Gy) or Sieverts (Sv). (Based on the website of Japan Atomic Energy Agency)

F

Fine-needle aspiration cytology

This diagnostic procedure entails puncturing a fine needle into suspicious lesions, aspirating cells from the lesions through a needle and inspecting the nature of the cells, i.e., malignant or not, under the microscope. (Based on the website of the National Cancer Center Japan)

Food Sanitation Act

An Act for securing food safety and preventing the occurrence of sanitary hazards caused by eating and drinking. (Based on the website of the Ministry of Health, Labour and Welfare [b])

Frozen soil wall

A frozen soil wall is made by freezing the surrounding ground like a wall. Thereby the flow of the underground water is blocked. The frozen soil wall reduces the inflow of underground water into reactor buildings and inhibits the generation of contaminated water. This mechanism was adopted as one of the countermeasures to inhibit the generation of contaminated water at TEPCO's Fukushima Daiichi NPS. (Based on the website of Fukushima Prefecture [d])

Fuel cladding

A thin circular tube covering fuel; A fuel clad prevents radioactive fission products from leaking from the fuel into the coolant. Zircalloy is used for fuel clads of a light-water reactor's fuel rods. (Based on the website of Japan Atomic Energy Agency)

Fuel debris

"Fuel debris" is a complex of fuel, metallic cladding, channel boxes, etc. that were melted out from fuel assemblies and were re-solidified afterwards. Fuel debris needs to be cooled continuously as its thermal energy increases due to the radiation emitted therefrom. When handling fuel debris, which emits radiation, radiation shielding is required.

Fukushima Health Management File

An A4-sized Fukushima Health Management File is composed of three parts: the first part contains individual records such as dose measurements, health status, health checkup data, and hospital records, the second part contains leaflets about radiation etc., and the third part is "clear holders" as a storage space for record sheets. The file has been provided to each Fukushima resident so as to utilize the file for individual health management. In addition, it is an individual database about long-term health status, laboratory measurements, etc. that can be informative for future study. (Based on the website of Fukushima Prefecture [c])

G

Gaseous cesium

See "Cesium" and "Plume".

Germanium semiconductor detector

A radiation detector using a germanium semiconductor; A germanium semiconductor detector has excellent energy resolution and is widely used for gamma-ray spectrometry to identify radionuclides.

Groundwater drain

A well pumping up groundwater.

H

Habitation Restricted Areas

Areas designated by municipal mayors as areas where entry should be restricted and evacuation is ordered for the purpose of preventing risks on residents' lives and bodies; After the accident, areas within a 20-km radius from TEPCO's Fukushima Daiichi NPS were designated as former Restricted Areas. (Based on the website of Fukushima Prefecture [d])

Hand-held dose-rate instrument

An easy-to-carry-around instrument to measure ambient dose rates (e.g., a NaI (Tl) survey meter).

High Pressure Coolant Injection System (HPCI)

A safety system to cool a reactor core in the event of a loss of coolant in the reactor core by immediately injecting coolant into the reactor core at high pressure; One of the multiple safety systems contained in the emergency core cooling system.

High-dose radiation

According to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), a total dose exceeding 2,000 mGy (2 Gy) is referred to as high-dose radiation. (Based on UNSCEAR, 1993)

Hydrogen explosion

A phenomenon where hydrogen precipitously reacts with oxygen to explode.

I

ICRP Recommendations

The basic idea (concept) and numerical standards for radiological protection recommended by the International Commission on Radiological Protection (ICRP); These are collectively referred to as ICRP Recommendations. (Based on the website of Japan Atomic Energy Agency)

Inert element

An inert element does not readily enter into chemical combination with other elements. Examples are helium, argon, krypton, xenon and radon. (Cited from WHO, Health Risk Assessment, 2013)

Infrared

A kind of electromagnetic wave in region of the spectrum comprising wavelengths in the range 700 nm to 1 mm. This wave does not ionize material but makes material warm.

Inspection of All Rice Bags

Fukushima Prefecture measures the radioactive cesium level of rice produced in the prefecture in 2012 or later. The rice is tested on a bag-by-bag basis with radiation detectors prepared by the prefectural government. Each bag, containing 30 kilograms of rice, is inspected for safety before shipment so as to prevent the distribution of rice whose radioactive cesium level exceeds the safety standard limit. (Based on the website of Fukushima Prefecture [b])

Intake

The activity of a radionuclide taken into the body (by inhalation or ingestion or through the skin) in a given time period or as a result of a given event. (Cited from WHO, Health Risk Assessment, 2013)

Intensive Contamination Survey Areas

Areas where municipalities take the initiative in decontamination work; Of municipalities including areas where measured ambient dose rates were 0.23 μSv/h or higher, 65 municipalities in eight prefectures are designated as Intensive Contamination Survey Areas (as of the end of March 2025).

Interim storage facility

A facility to manage and store the soil and waste containing radioactive materials safely and intensively until their final disposal.

International Atomic Energy Agency (IAEA)

An autonomous international organization within the United Nations system for scientific and technical co-operation in the nuclear field concerning nuclear safety, nuclear energy, nuclear security, etc. The headquarters is located in Vienna, Austria.

International Basic Safety Standards (BSS)

The BSS is an IAEA document of General Safety Requirements published in collaboration with other international bodies such as WHO, ILO, OECD/NEA, etc., that is issued for IAEA member states in order to materialize the ICRP's recommendations on radiation protection into actual laws and guidelines. The latest version published in 2014 that incorporates the ICRP 2007 Recommendation.

Intervention level

An intervention level is the level of avertable dose at which a specific protective action or remedial action is taken in an emergency exposure situation or chronic exposure situation. (Cited from IAEA, 1999)

Inversion tillage

Replacement of topsoil with subsoil, thereby radioactivity concentrations are reduced in the soil layer where plants take root.

Iodine

Iodine is a chemical element with symbol I and atomic number 53. It is the fourth halogen below fluorine, chlorine, and bromine. Stable and non-radioactive iodine is an essential nutrient that humans need and get through intake of food. Iodine is essential for the thyroid gland to function properly and produce thyroid hormones. Radioiodine, such as I-131, I-125, is used as a radioactive tracer in research and clinical diagnosis in nuclear medicine for diagnostic tests as well as in radiotherapy for hyperactive thyroid gland (hyperthyroidism). I-131 also plays a major role as a radioactive isotope present in nuclear fission products, and was a significant contributor to the health hazards from the Chornobyl NPS accident. Radioactive iodine can disperse in gaseous or particulate form. In soil, however, it combines easily with organic materials and moves more slowly through the environment.

Ionizing radiation

Ionizing radiation is a more precise name of all types of radiation with energy large enough to ionize a molecule. Included under this designation are radiation from radioactive sources, X-rays, short wavelength UV, particles from accelerators, particles from outer space and neutrons. Ionizing radiation is categorized into direct (primary) ionizing radiation and indirect (secondary) ionizing radiation. The former includes charged particles such as α-particles, β-particles (electrons), positrons and the latter includes γ-rays, X-rays, neutrons. (Cited from Henriksen & Maillie, 2002, p.20)

Isotope

Nuclides with the same number of protons but different numbers of neutrons. Not a synonym for nuclide. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

J

Japan's national doses

The average exposure doses received by one Japanese person; Radiation sources include naturally occurring radiation and artificial radiation (medical radiation and radiation derived from nuclear power plant accidents, etc.). Japan's national dose is evaluated to be 2.1 mSv on average from naturally occurring radiation and 3.87 mSv on average from medical radiation (for diagnosis) per year. (Based on NSRA, 2011)

K

Kerma

Unit of exposure that represents the kinetic energy transferred to charged particles per unit mass of irradiated medium when indirectly ionizing (uncharged) particles, such as photons or neutrons, traverse the medium. If all of the kinetic energy is absorbed "locally", the kerma is equal to the absorbed dose. The quantity (K) is expressed in μGy/h at 1 m. (Cited from WHO, Preliminary Dose Estimation, 2012)

L

Lanthanoid

The lanthanoid (lanthanide) series of chemical elements comprises the 15 metallic chemical elements with atomic numbers 57 through 71. They are called lanthanoids because the elements in the series are chemically similar to lanthanum.

Linear non-threshold (LNT) model

The assumption that the risk of cancer increases linearly as radiation dose increases. This means, for example, that doubling the dose doubles the risk and that even a small dose could result in a correspondingly small risk. Using current science, it is impossible to know what the actual risks are at very small doses. (Cited from the website of the United States Environmental Protection Agency)

Local exposure
A situation where part of the body, not the whole body, is mainly exposed to radiation.

M

Medical exposure
Exposure incurred by patients as part of their own medical or dental diagnosis or treatment; by persons, other than those occupationally exposed, knowingly, while voluntarily helping in the support and comfort of patients; and by volunteers in a programme of biomedical research involving their exposure. (Cited from ICRP, 2007)

Melt of nuclear fuel
Melting of core fuel from overheating that occurs in a severe nuclear reactor accident.

Mental Health and Lifestyle Survey
The survey aims to provide adequate care mainly for evacuees who are at a higher risk of developing mental health problems (e.g., post-traumatic stress disorder, depression, anxiety disorder) and lifestyle-related issues (e.g., obesity, problem drinking, sleep difficulties).

N

NaI scintillation spectrometer
A gamma-ray measurement system that detects scintillation consisting of NaI crystals is generally referred to as an NaI scintillator. (Based on the website of Japan Atomic Energy Agency)

Naturally occurring radioactive materials
Materials found in nature that emit ionizing radiation that have not been moved or concentrated artificially. K-40 is one natural radioactive material and exists in plants and human bodies.
(Cited from the website of the United States Environmental Protection Agency)

Neutron
An elementary particle with unit atomic mass approximately and no electric charge. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Noble gas
An inert radioactive gas that does not readily enter into chemical combination with other elements. Examples are helium, argon, krypton, xenon and radon. (Cited from WHO, Health Risk Assessment, 2013)

Nuclear and Industrial Safety Agency
An organization that the national government established in the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, for the purpose of ensuring safety of nuclear power and other types of energy and securing industrial safety; The Agency was abolished as part of the full-fledged revision of the safety regulation system in response to the accident at TEPCO's Fukushima Daiichi NPS in

March 2011. (Based on the website of Japan Atomic Energy Agency)

Nuclear fuel rods

A nuclear fuel rod consists of nuclear material covered with a metal clad. Multiple rods constitute a fuel assembly and multiple fuel assemblies constitute a reactor core. For light-water reactors, uranium dioxide is used for nuclear material and zircalloy is used for metal clads.

Nuclear reactor

A device in which nuclear fission can be sustained in a self-supporting chain reaction involving neutrons. In thermal reactors, fission is brought about by thermal neutrons. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Nuclear Safety Commission

The Nuclear Safety Commission was established in the Cabinet Office in 1978 as an organization that plans, deliberates and decides how to ensure safety concerning research, development and utilization of nuclear power. The accident at TEPCO's Fukushima Daiichi NPS in March 2011 triggered fundamental reform of the safety regulation system, and the Nuclear Regulation Authority was newly established as an administrative organ that integrally regulates nuclear safety on September 19, 2012, and the Nuclear Safety Commission was abolished. (Based on the website of Japan Atomic Energy Agency)

Nucleus stability/instability

Whether a nucleus is stable or unstable depends on the numbers of its constituent protons and neutrons. An unstable nucleus emits radiation to change into a nucleus that is energetically more stable.

Nuclide

A species of atom characterised by the number of protons and neutrons and, in some cases, by the energy state of the nucleus. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Nuclide concentration

The concentration of radioisotopes in certain materials, such as soil, water, air, foodstuff, and so on.

O

Ordinance on Prevention of Ionizing Radiation Hazards

The Ordinance on Prevention of Ionizing Radiation Hazards aims to minimize the health hazards out of radiation for workers and was established based on the Industrial Safety and Health Law. (Based on the website of the Ministry of Health, Labour and Welfare [a])

Organization for Economic Cooperation and Development / Nuclear Energy Agency (OECD/NEA)

An international organization that aims to contribute to the development of nuclear energy as an economic energy source; A subordinate agency of the Organization for Economic Cooperation and Development (OECD).

P

Particulate cesium
See “Cesium” and “Plume”.

Personal dose equivalent
An operational quantity: the dose equivalent in soft tissue (commonly interpreted as the ‘ICRU sphere’) at an appropriate depth, d, below a specified point on the human body. The unit of personal dose equivalent is joule per kilogram ($J\ kg^{-1}$) and its special name is sievert (Sv). The specified point is usually given by the position where the individual’s dosimeter is worn. (Cited from ICRP, 2007)

Physical attenuation
A phenomenon that the number of radioactive isotopes decrease due to radioactive decay.

Plume (Radiation plume)
Mass of air and vapour in the atmosphere carrying radioactive material released from a source.
(Cited from WHO, Preliminary Dose Estimation, 2012)

Plutonium
Plutonium is a radioactive chemical element with symbol Pu and atomic number 94. It is an actinide metal and is produced by a nuclear reaction of uranium. Pu-239 is a fissile isotope and can be used for nuclear fuels and nuclear weapons. Man-made plutonium existing in the environment originates from radioactive fallout associated with nuclear weapon tests in the past. (Based on the website of Fukushima Prefecture [d])

Post-Traumatic Stress Disorders (PTSD)
Post-traumatic stress disorder (PTSD) is a mental disorder triggered by a terrifying event, causing flashbacks, nightmares and severe anxiety for prolonged periods. (Based on the website of National Center of Neurology and Psychiatry)

Potassium
Potassium is a chemical element with symbol K and atomic number 19. It is one of the alkali metals. Potassium in nature occurs only in ionic salts and is chemically similar to sodium. Naturally occurring potassium is composed of three isotopes, of which K-40 is the most common radioisotope in the human body. Natural potassium contains 0.0117% of K-40, which exists in animals and plants. About 4,000 Bq of K-40 is contained in the body of an adult male. Potassium ions are vital for the functioning of all living cells. Potassium is also used for agricultural fertilizer.
Potassium and cesium are alkali metals and cesium absorbed in plants shows behavior similar to potassium. Therefore, after the accident at TEPCO’s Fukushima Daiichi NPS, potassic fertilizer is used for crops as a measure to inhibit radioactive cesium absorption. (Based on the website of Fukushima Prefecture [d])

Precautionary Evacuation Areas
A term used in the 2013 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), which refers to areas where evacuation orders were issued from March 12 to March 15, 2011; Specifically, the term refers to

Futaba, Okuma, Tomioka, Naraha, Hirono, Minamisoma, Namie, Tamura, Kawauchi and Katsurao. (Based on UNSCEAR, 2013)

Pregnancy and Birth Survey

The survey aims to provide appropriate medical care and support to mothers who were given a Maternal and Child Health Handbook and to their children. (Based on the website of the Radiation Medical Science Center, Fukushima Medical University)

Preparation Areas for Lift of Evacuation Order

Areas where it has been confirmed that annual accumulated doses will surely be below 20 mSv and efforts are to be made for early return of residents; Passing on major roads and temporary return of residents are flexibly permitted. Physical protection measures, such as screening and dose management, are not necessary in principle upon temporary entry. (Based on the website of Fukushima Prefecture [d])

Provisional regulation values

Provisional regulation values were regulation values that were used provisionally for regulation of the radioactivity in foodstuffs just after the accident at TEPCO's Fukushima Daiichi NPS because there had been no standard values. The provisional regulation values were used until the start of use of the standard values newly determined by the government.

Public exposure

Exposure incurred by members of the public from radiation sources, excluding any occupational or medical exposure and the normal local natural background radiation. (Cited from ICRP, 2007)

Q

Quantitation limit

The minimum amount or concentration of a nuclide whose quantity can be determined by a certain analysis method. (Based on the website of the EIC Network)

R

Radiation Dose Map

See "Spatiotemporal Distribution of Ambient Dose Rates".

Radiation effects

There are two major types of radiation effects: somatic effects and heritable effects. Somatic effects are classified into acute effects, which include hair loss and sterility, and late effects, which include cataracts and cancer. From the perspective of protection against radiation, somatic effects are also classified as deterministic effects (tissue reactions) and stochastic effects (cancer and heritable disorders). Although heritable effects have been demonstrated in animal studies, the effects have not been found among the offspring of atomic bomb survivors or cancer survivors treated with radiation. (Based on the website of the National Institute of Radiological Sciences)

Radiation fluence

Radiation (particle) fluence is defined as the quotient of dN by da, where dN is the number of particles incident upon a sphere of cross-sectional area da. (Cited from ICRP, 2007)

Radiation management

Measures and control to protect workers in charge of operations at nuclear/radiation facilities and residents living near such facilities from radiation exposure. (Based on the website of Japan Atomic Energy Agency)

Radiation monitoring posts

A facility installed for monitoring environmental radiation around the nuclear facilities; In general, a facility for only measuring ambient dose rates is referred to as a monitoring post, and a facility for also measuring radioactive concentrations and meteorological data is referred to as a monitoring station. (Based on the website of Fukushima Prefecture [d])

Radiation protection

Radiation protection is the means for protection of people from harmful effects of exposure to ionizing radiation or contamination with radioactive materials. (Based on the website of Japan Atomic Energy Agency)

Radiation protection culture

Health-promoting lifestyle of people living in the contaminated area by radioactive materials, lifestyle which is backed up with knowledge and skills about radiation and radiation protection.

Radiation weighting factor

A dimensionless factor by which the organ or tissue absorbed dose is multiplied to reflect the higher biological effectiveness of high-LET radiations compared with low-LET radiations. It is used to derive the equivalent dose from the absorbed dose averaged over a tissue or organ. (Cited from ICRP, 2007)

Radioactive Cesium

See “Cesium”.

Radioactive cloud (plume) immersion

See “Plume”.

Radioactive decay

See “Decay (disintegration) ”.

Radioactive disintegration

See “Decay (disintegration) ”.

Radioactive Iodine

See “Iodine”.

Radioactive strontium

See “Strontium”.

Radiosensitivity (radiation sensitivity/sensitivity to radiation/sensitive to radiation)

Proneness of cells to be killed by radiation; As a rule, radiation exposure kills cells more easily that are dividing or programmed to divide many times in the future or in a developmentary immature stage. (Based on the website of Japan Atomic Energy Agency)

Reactor building

A concrete building that houses major equipment of a reactor.

Reactor core

The area in a reactor where fuel assemblies are loaded and fission reaction occurs actively.

Reactor core isolation cooling System

A safety system for boiling-water reactors that provides cooling water to a reactor core using a pump powered by steam in a reactor when an abnormal incident in the reactor results in preventing the ordinary system from supplying water to the reactor. (Based on the website of Japan Atomic Energy Agency)

Reactor pressure vessel

A steel vessel that houses nuclear fuel, a moderator, coolant and other major components and wherein high-pressure steam is produced by fission energy. (Based on the website of Fukushima Prefecture [d])

Reconstruction Agency

The national government's administrative agency that was organized for proactively carrying out reconstruction work with due consideration to areas severely damaged by the Great East Japan Earthquake with the aim of achieving reconstruction as early as possible. (Based on the website of the Reconstruction Agency [b])

Recriticality

Criticality is a situation where a fission reaction continues without supply of neutrons from the outside. Recriticality is a phenomenon where changes in the temperature, shape or composition of a reactor core results in criticality again. (Based on the website of Japan Atomic Energy Agency)

Recycling of the removed soil

On the premise of securing radiation safety, "recycling" here means to make the soil and waste removed through off-site decontamination work into materials again after volume reduction. These materials are to be used for construction, such as the basic structure of banks in public projects which are assumed not to change shape artificially for a long time. Also, areas which use the removed soil are supposed to be managed by an appropriate administrator and responsibility-taking system.

Reduction coefficient (Dose reduction coefficient)

A ratio between the ambient dose rate due to artificial radioactive materials measured inside a building and that measured outside, when contamination by artificial radioactive materials inside the building and under the floor can be ignored; It is a value specific to a building and is also referred to as a shielding coefficient.

Reference level

In an emergency exposure situation or an existing exposure situation, the level of dose, risk or activity concentration above which it is not appropriate to plan to allow exposures to occur and below which optimization of protection and safety would continue to be implemented. (Cited from WHO, Preliminary Dose Estimation, 2012)

Repair enzymes (DNA repair enzymes)

Enzymes necessary for repairing DNA damage. Genetic mutation affecting such enzymes induces cancer proneness. There are several DNA repair mechanisms such as mismatch repair, nucleotide excision repair, homologous recombination repair, non-homologous end joining repair and so on, and each mechanism utilizes unique or shared enzymes to repair DNA damage.

Restricted Areas

Areas where annual accumulated doses are currently over 50 mSv and are highly likely to be over 20 mSv even six years after the accident at TEPCO's Fukushima Daiichi NPS; Residents who temporarily enter these areas must undergo thorough screening, manage their own individual doses and wear protective gear. The term "Areas where returning is difficult" was formerly used instead of "Restricted Areas" as a literal translation from Japanese. (Based on the website of Fukushima Prefecture [d] and the website of the Ministry of Economy, Trade and Industry)

* Areas formerly called "Restricted Areas" were areas within a 20km radius of TEPCO's Fukushima Daiichi NPS as designated in April 2011. In March 2012, this area designation was reviewed in consideration of radiation doses and region-specific problems for individual areas and the designation was lifted for all areas formerly designated as Restricted Areas by August 2013.

Risk communication

Risk communication is a component of risk management, which is the selection of risk control options. It is the process that provides the information on which government, industry, or individual decision makers base their choices. Successful risk communication does not guarantee that risk management decisions will maximize general welfare; it only ensures that decision makers will understand what is known about the implications for welfare of the available options. (Cited from Improving Risk Communication, 1989)

S

Scintillation counter

A device containing material that emits light flashes when exposed to ionising radiation. The flashes are converted to electric pulses and counted. The number of pulses is related to dose. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Screening

In the field of health and medical care, "screening" means to provisionally identify persons with a disease or disorder by rapid and high through-put laboratory tests or procedures. In the field of analysis and inspection, "screening" means to provisionally select samples containing target substances or organisms, etc. by rapid and high through-put laboratory tests. Screening results are not conclusive, and further detailed examinations or diagnoses, etc. are needed to reach the final conclusions. (Based on the website of the Food Safety Commission of Japan)

Secretariat of the Nuclear Regulation Authority (NRA)

An organization that functions as the secretariat of the Nuclear Regulation Authority newly inaugurated in September 2012 after the accident at TEPCO's Fukushima Daiichi NPS.

Self-shielding effect

An effect in measurement in a situation where radiation in the air is shielded by a person or sample subject to the measurement; For example, when a person wears a personal dosimeter around his/her chest, radiation from behind is shielded by the person him/herself upon the measurement.

Solid cancers

Cancers originating in solid organs, as opposed to blood cancers such as leukaemia. (Cited from WHO, Health Risk Assessment, 2013)

Source term

The types, quantities, and chemical forms of the radionuclides that encompass the source of potential for exposure to radioactivity; After a nuclear accident, a source term including its release rate is critical for risk assessment. (Based on the US Health Physics Society)

Spatiotemporal distribution of ambient dose rates

Ambient dose rates change with time and place due to the physical decay and environmental migration of radionuclides. (Based on the website of Fukushima Prefecture [d])

Special Decontamination Areas

Areas where the national government directly conducts decontamination work; Basically, 11 municipalities in Fukushima Prefecture which were once designated as a former Restricted Area or a Deliberately-Evacuated Settlement are designated.

Specific Spots Recommended for Evacuation

Areas that do not fall under former Restricted Areas or Deliberately-Evacuated Settlements but where accumulated doses are highly likely to be over 20 mSv in one year after the accident were designated as Specific Spots Recommended for Evacuation and the national government recommended evacuation. The designation of these areas was lifted on December 28, 2014. (Based on the website of Fukushima Prefecture [a])

Specified Reconstruction and Revitalization Base Areas

Zones among Restricted Areas for which evacuation orders are lifted and where people are allowed to reside; As a result of the amendment of the Act on Special Measures for the Reconstruction and Revitalization of Fukushima (in May 2017), it was made possible to designate these zones. (Based on the website of the Reconstruction Agency [a])

Spent fuel pool

A spent fuel pool is a storage where nuclear spent fuels are cooled until their heat production due to the remaining radioactivity (after shutdown of a reactor) decreases sufficiently.

Stable cold shut-down conditions
See “Cold shut-down”.

Stable iodine tablets
A drug containing a certain amount of non-radioactive or “cold” sodium iodide or potassium iodine; If one takes an adequate amount of the drug before inhalation or consumption of radioactive iodine after a nuclear accident, “cold” iodine fills the thyroid organ and prevents the accumulation of radioactive or “hot” iodine into the thyroid. (Based on the website of Japan Atomic Energy Agency)

Stochastic (health) effect
Health effect whose probability of occurrence depends on the dose received. Occurrence is usually many years after the exposure, and there is believed to be no threshold level of dose below which no effect will occur. (Cited from the website of UK Health Security Agency, Radiation Protection Services)

Stripping of topsoil (Topsoil removal)
Topsoil of farmland is to be shallowly (4 - 5cm) stripped using a tractor or other equipment to remove radioactive cesium. Radioactive cesium that fell down onto farmland is easily absorbed into soil and remained in the surface layer. Therefore, stripping and removing topsoil is effective.

Strontium
Strontium is the chemical element with symbol Sr and atomic number 38. Strontium has physical and chemical properties similar to those of calcium. Sr-90 is a radioisotope with a physical half of 28.8 years and is produced as a fission product in a nuclear reactor. Sr-90 is one of the concerned radionuclides in a nuclear accident because it is likely to accumulate in bones in a similar manner to calcium. (Based on the website of Fukushima Prefecture [d])

Subdrain
A well installed for adjusting groundwater levels around a reactor building. (Based on the website of Fukushima Prefecture [d])

Sum of ratios of concentrations required by law
For water that contains multiple nuclides, the regulatory standards for discharge state that the sum of the ratios of their concentrations to the limits respectively required by law must be less than one. This concentration limit applies to the discharge of radioactive waste to the environment, which is stipulated in the Regulation for Enforcement the Reactor Regulation Act (Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors).

Suppression chamber
Torus-shaped steel equipment that is located at the lower part of a reactor containment vessel and stores a large amount of water; A rectangular version made of concrete is referred to as a suppression pool. It is important safety equipment that provides water for the emergency core cooling system (ECCS) in the event of a loss of cooling water due to such reasons as a primary pipe rupture accident. A suppression

chamber suppresses pressure increases in a nuclear reactor. When the pressure within a reactor containment vessel increases, steam is sent to a suppression chamber to reduce the increased pressure. A suppression chamber also removes particulate radionuclides upon releasing pressure.

Suppression pool
See "Suppression chamber".

Suspended Cs
See "Cesium".

T

The Act on Special Measures Concerning Nuclear Emergency Preparedness
The Act was enacted and enforced in 1999 for the purpose of protecting citizens' lives, bodies and property in consideration of the unique characteristics of nuclear disasters. The Act specifies various matters concerning nuclear disasters and provides that in an emergency due to a nuclear disaster, the Prime Minister is to issue a declaration of a nuclear emergency situation and establish the Nuclear Emergency Response Headquarters.

The Fukushima Health Management Survey
The accident that occurred at the TEPCO's Fukushima Daiichi NPS after the Great East Japan Earthquake on 11 March 2011 has resulted in long-term, ongoing anxiety among the residents of Fukushima, Japan. Soon after the disaster, Fukushima Prefecture launched the Fukushima Health Management Survey to investigate long-term low-dose radiation exposure caused by the accident. Fukushima Medical University took the lead in planning and implementing this survey. The primary purpose of this survey is to monitor the long-term health of residents, promote their future well-being, and confirm whether long-term low-dose radiation exposure has health effects. (Based on the website of the Radiation Medical Science Center, Fukushima Medical University)

The Nuclear Emergency Response Headquarters
See "Director General of the Nuclear Emergency Response Headquarters".

The radiation exposure dose
See "Exposure dose".

Thermal electrons
Electrons which emit from the surface of highly heated metal.

Threshold
Minimal absorbed radiation dose that will produce a detectable degree of any given effect. (Cited from WHO, Health Risk Assessment, 2013)

Thyroid Ultrasound Examination
Thyroid Ultrasound Examination covers roughly 380,000 residents aged 0 to 18 years at the time of the nuclear accident. The Preliminary Baseline Survey has been

performed within the first three years after the accident, followed by complete thyroid examinations to detect newly growing tumors from 2014 onward, and the residents will be monitored regularly thereafter. (Based on the website of the Radiation Medical Science Center, Fukushima Medical University)

Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi Nuclear Power Station (NPS) Accident (2011)

An accident at TEPCO's Fukushima Daiichi NPS located on the Pacific coast in Fukushima Prefecture, which was caused by the Great East Japan Earthquake that occurred at 14:46 on March 11, 2011, and the subsequent massive tsunami. (Based on the website of Fukushima Prefecture [d])

Trench

An underground tunnel for storing utility equipment such as power cables and pipes.

Tritium

Tritium is a radioisotope of hydrogen composed of one proton and two neutrons. Tritium, which combines with oxygen and comprises water molecules in the same manner as ordinary hydrogen, often exists around us while being contained in water molecules. It is created in nature as a result of the reaction of cosmic rays with nitrogen and oxygen in the air, in addition to be artificially created through the operation of a nuclear power plant. In nature, tritium is contained in rainwater, sea water, and tap water, and also exists in the human body as tritium water.

Tritium emits β-particles, one type of radiation, but β-particles emitted from tritium only have weak energy (18.6 keV at the largest) and can be shielded with a piece of paper. Therefore, external exposure from tritium is unlikely to exert any influence on the human body. A biological half-life for water containing tritium is ten days, and even if it is ingested, it will be eliminated from the body promptly and will not accumulate in any specific organs. (See p.79 in Vol. 1 (Chapter 2) for details)

Turbine building

At a nuclear power plant, steam pressure is converted into rotational energy by a turbine, which is further converted into electricity by a power generator. A building that houses a turbine and a power generator is referred to as a turbine building.

U

Undifferentiated

The developmental state of cells or organs that are immature or not differentiated. Any kind of tissues in the body contains stem cells capable of dividing and producing intermediately differentiated cells that further differentiate into mature functioning cells. In this case, stem cells are undifferentiated cells while mature functioning cells are differentiated cells.

UNSCEAR

The United Nations Scientific Committee on the Effects of Atomic Radiation

Uranium

Uranium is a chemical element with symbol U and atomic number 92. In nature, uranium is composed of U-238 (99.275%), U-235 (0.72%) and U-234 (0.005%).

The half-lives of U-238 and U-235 are about 4.47 billion years and 704 million years, respectively. U-235 is the only naturally occurring fissile isotope, which makes it widely used in nuclear reactors.
Enriched uranium is a type of uranium in which the percent composition of U-235 has been increased through the process of isotope separation. Enriched uranium is a critical component for both civil nuclear power generation and military nuclear weapons. (Based on the website of Fukushima Prefecture [d])

V

Vent

An operation to reduce pressure in a reactor containment vessel when the pressure increases abnormally, by way of discharging the inner gas.

W

Waste within the Management Areas

Waste within areas designated by the Minister of the Environment that meet certain requirements, such as areas that are highly contaminated and require special treatment.

Water-zirconium reaction

Zircalloy is used for fuel clads for light-water reactors. If fuel is exposed from cooling water, it becomes hot and this triggers a chemical reaction of zirconium in the fuel clad with water vapor to generate hydrogen. The phenomenon where hot zirconium reacts with water vapor and generates hydrogen in this manner is referred to as a water-zirconium reaction. (Based on the website of Japan Atomic Energy Agency)

WHO

World Health Organization

Whole-body counter

A device to measure the amount of radioactive materials taken into and deposited inside the human body from outside for the purpose of examining the internal exposure dose. (Based on the website of Fukushima Prefecture [d])

Whole-body exposure

A situation where the whole body is evenly exposed to (external) radiation; This term is used in contrast to local exposure, which refers to a situation where only part of the body is exposed to radiation. (Based on the website of Japan Atomic Energy Agency)

Z

Zeolite

Zeolite is Aluminosilicate, a kind of clay mineral. It comprises porous crystals. Fine pores are usually around 0.2 to 1.0 nm in diameter. Zeolite has ion-exchange capacity and adsorptive capacity.

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