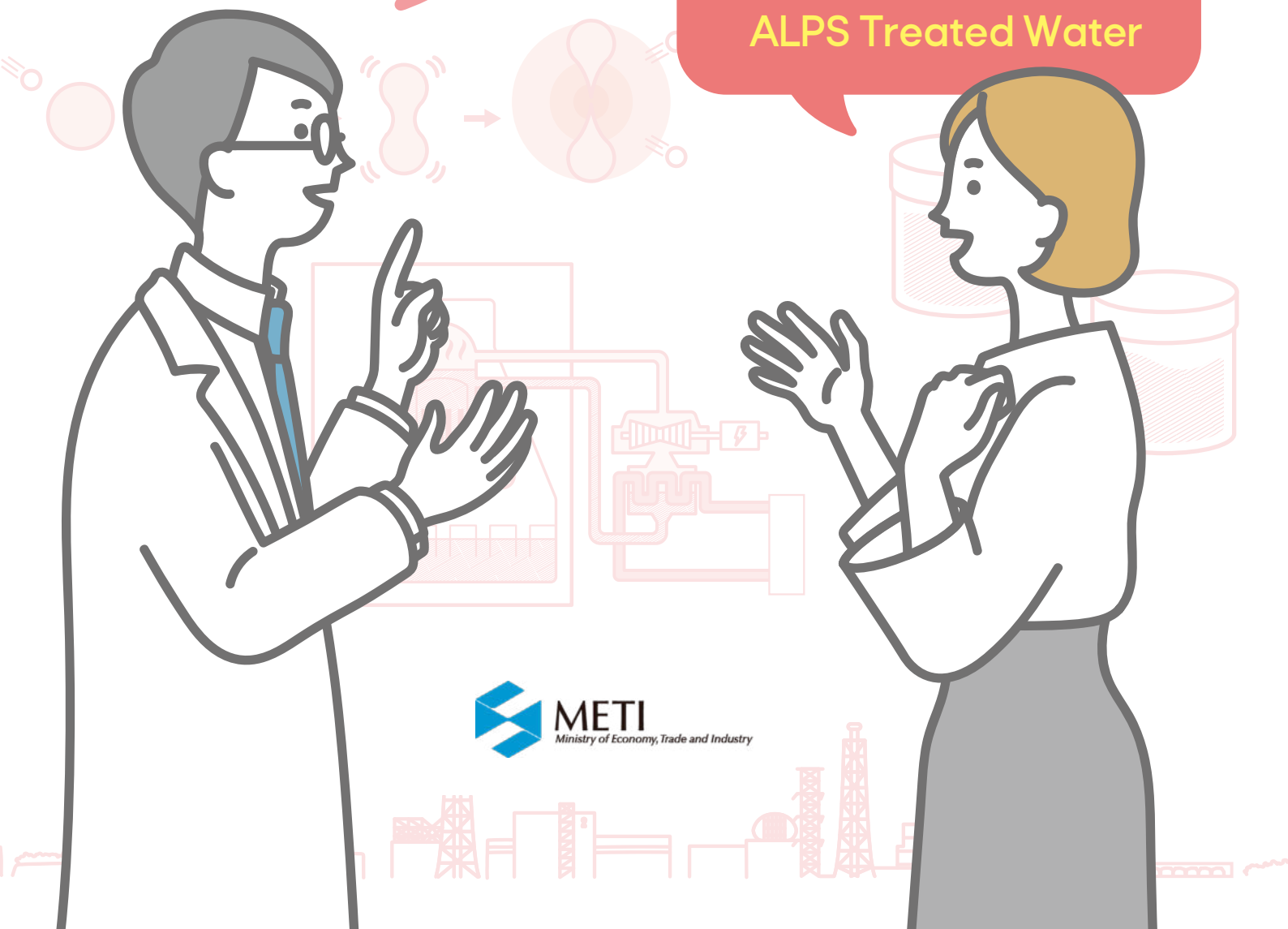
Important Stories on Decommissioning

Decommissioning of TEPCO's Fukushima Daiichi NPS
and the Discharge of ALPS Treated Water into the Sea

16 Things to Know about ALPS Treated Water



METI
Ministry of Economy, Trade and Industry

Introduction

On March 11, 2011, an accident occurred at TEPCO's Fukushima Daiichi Nuclear Power Station (NPS).

Through the daily efforts of the on-site workers, decommissioning work is steadily progressing with safety as the top priority. Meanwhile, the decommissioning of the Fukushima Daiichi NPS presents an unprecedented challenge globally, requiring long-term commitment. Therefore, it is essential to proceed with the understanding and support of the local community and society at large.

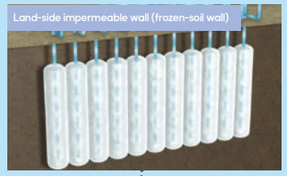
In this brochure, we will answer your concerns and questions about the decommissioning of the reactors in an easy-to-understand manner, and tell you about the present and future of this process, including recent topics such as the discharge of ALPS treated water into the sea, which commenced in 2023.

Contents

What is it like inside the Fukushima Daiichi NPS?

This is an overall view of the Fukushima Daiichi NPS.

Fukushima Daiichi Nuclear Power Station site map



Discharge outlet (depth approximately 12 m)

Discharge tunnel (seabed, approximately 1 km in length, inner diameter approximately 2.6 m)

Marine monitoring survey point

Seawall Defenses Against Chishima Trench Earthquake Tsunamis

Groundwater drain

Subdrain

Existing Seawall Defenses Against Outer-Rise Earthquake Tsunamis

ALPS Treated Water Dilution and Discharge Facility

Desalination station

Unit 1 Unit 2 Unit 3 Unit 4

Unit 6 Unit 5

Main process building

Common spent fuel pool

Tentative storage facility for cesium absorption vessel

A hill for observation by visitors

Seismic isolation building

Groundwater bypass

Desalination plant

High-performance ALPS

Additional ALPS

Planned area for waste treatment/ Storage facility and storage building

Spoil bank

Dry cask temporary storage facility

Sub-drain and other purification equipment

Peripheral monitoring area

Building No. 2

Building No. 1

Facility management building

Subcontractors' building

Access control facility

Tanks

Temporary storage facility for used adsorption vessels

Rubble

Felled trees

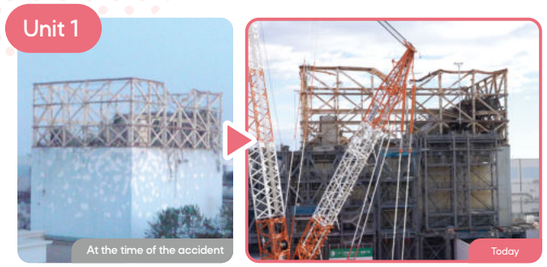
Used protective clothing.

*The diagram on this page shows the general layout of each facility.

How far has the decommissioning of the Fukushima Daiichi Nuclear Power Station progressed?

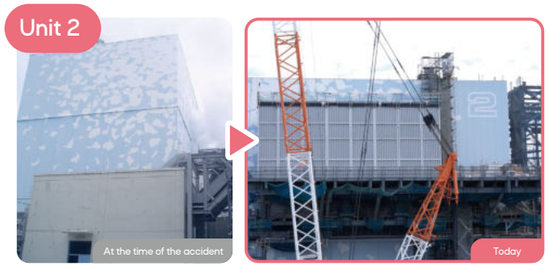
Current status of the reactor buildings

Unit 1



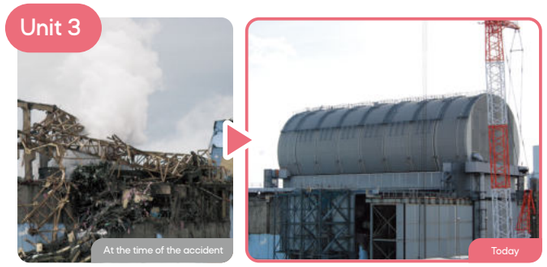
Large covers are being installed to fully enclose the building to prevent dust scattering in preparation for the planned removal of the fuel.

Unit 2



Platforms are being installed on the south side in preparation for fuel removal.
*Unit 2 was the only one among the damaged reactors that did not experience a hydrogen explosion. This is believed to be because a panel on the upper side of the Unit 2 reactor building was opened by the impact of the Unit 1 explosion, allowing hydrogen to be discharged outside.

Unit 3



Removal of the fuel began in 2019 and finished in February 2021, marking the first completion of the task for a reactor left with fuel debris.

Unit 4

Removal of the fuel began in November 2013 and was completed in December 2014.

Working environment for workers

Radiation levels on the premises have greatly decreased, and workers can now work in regular work clothes on about 96% of the site.

A cafeteria and a convenience store available at the large rest house

Emergency physicians on duty 24/7

Protective clothes

approx. 96% of the site

Simplified working equipment

Regular work clothes

Decommissioning work is steadily progressing, and the effects of radioactive materials are greatly improving.

Effects on the surrounding sea area

Sea

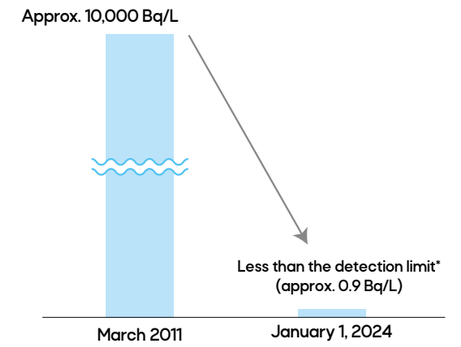
From the efforts that have been made so far, water quality in the surrounding sea area has greatly improved, and it has been confirmed to fully meet the international quality standards for drinking water.

Effects on the surrounding area

Use of quay for mooring ships resumed in February 2017(Namie Town)

Matsukawaura fishing port in October 2019

Concentration of radioactive materials in the waters around Fukushima Daiichi NPS



*The concentration of radioactive materials in the sea around the site refers to the Cs-137 level near the south discharge channel
*The international standard for drinking water quality is 10 Bq/L

Effects on the surrounding area

Air

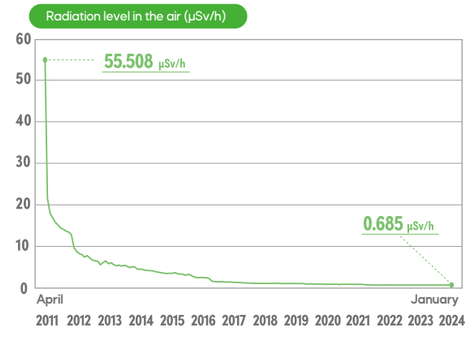
Levels measured at monitoring posts at the site boundary have sufficiently decreased compared to levels immediately after the accident, and levels have reached a stable condition.

The surrounding area

In June 2023, the completion of the Manabiya Yumenomori educational facility in Okuma Town.

In August 2022, the opening of the new town hall in Futaba Town.

Measurements from a monitoring post (West gate) at the site boundary of the Fukushima Daiichi NPS



*Changes in monthly average levels measured at a monitoring post (MP.5) at the site boundary of the Fukushima Daiichi NPS

Glossary

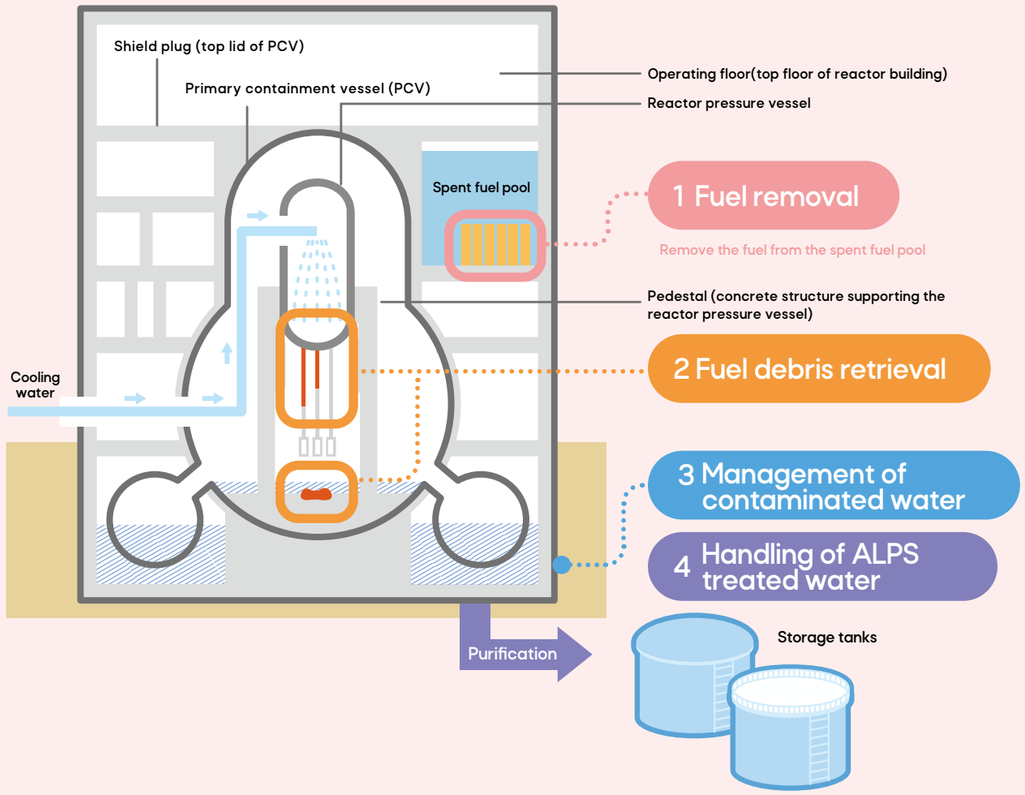
Fuel debris... A material formed when molten nuclear fuel mixes with structural materials inside the reactor and then solidifies there.

What kind of tasks and how will they be carried out in the decommissioning of Fukushima Daiichi NPS?

5 main tasks

1. Fuel removal
2. Fuel debris retrieval
3. Management of contaminated water
4. Handling of ALPS treated water
5. Waste treatment and disposal / Dismantling of reactor facilities, etc.

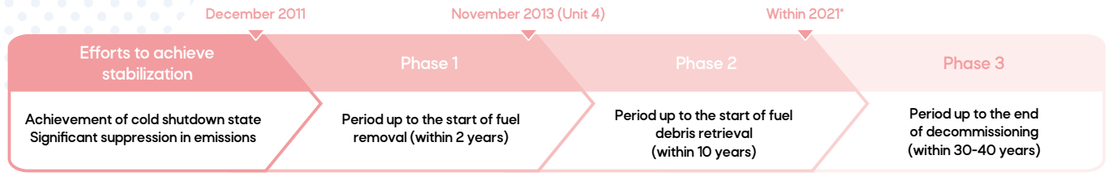
Reactor building (diagram)



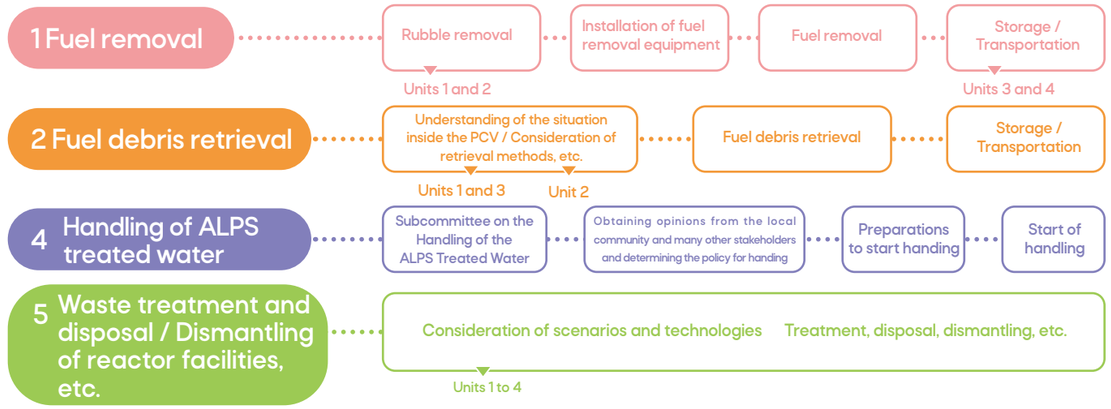
Decommission is work to reduce the risk of radioactive materials to local people and the environment.

Overall decommissioning process

Decommissioning will be carried out safely and steadily over 30 to 40 years.

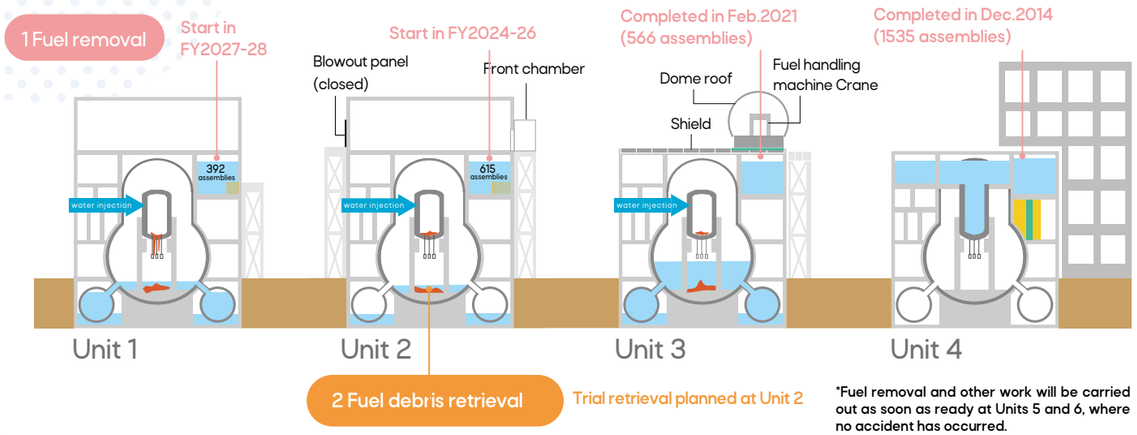


*Based on the development status of the robotic arm required for the trial retrieval of fuel debris, it is anticipated that the process by the end of October 2024 at the latest.



Status of each unit

Due to differences in each unit's situation, the status and progress of countermeasures vary.



*Fuel removal and other work will be carried out as soon as ready at Units 5 and 6, where no accident has occurred.

Glossary

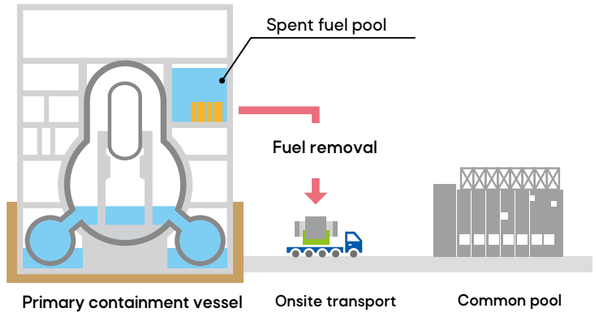
Primary containment vessel(PCV)... A steel vessel housing the reactor and associated cooling system equipment, etc. Its function is to prevent the diffusion of radioactive material to the surrounding area in case of fuel damage.

What does “removing the fuel” mean?

Removing the fuel from the spent fuel pool located in the reactor buildings.
The fuel removal from Units 3 and 4 has been fully completed.

Fuel removal

There are fuel assemblies remaining in the reactor buildings. Removal consists of a series of operations in which spent fuel is collected from the spent fuel pool using handling equipment and transported to the common pool on the premises of the nuclear power station.

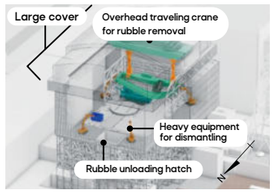


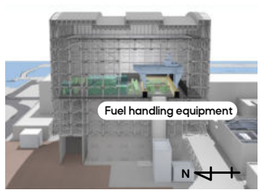
Progress

It is absolutely necessary to proceed with caution to ensure that radioactive substances do not disperse during the work. Therefore, removal work is being carried out for each reactor in the most suitable process according to the situation inside each unit.

Unit 1 — Installation of large covers will be completed around summer 2025. Fuel removal to start in FY2027-2028.

Aiming to finish removal in about 2 years

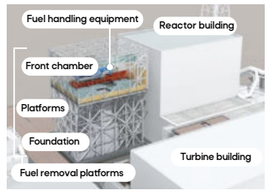


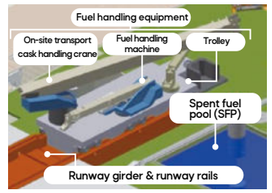


Rubble deposited inside the building needs to be removed before fuel removal can be started. To prevent dust scattering during rubble removal, work to cover the entire building is in process.

Unit 2 — Fuel removal to start in FY2024-2026

Aiming to finish removal in about 2 years





The planned method involves drilling a small hole on the south side of the building and removing fuel from the hole using a crane-type removal machine, without dismantling the building.

Unit 3 — Removal completed in February 2021

Unit 4 — Removal completed in December 2014

Units 5 and 6 — Removal is to be carried out as soon as ready while considering the progress at Units 1 and 2

Schedule

- Efforts will continue to be made to complete the removal of fuel from all units by the end of 2031.
- The removed fuel will be stored on-site for the time being while conducting long-term integrity assessments and considering optimal processing and storage methods.

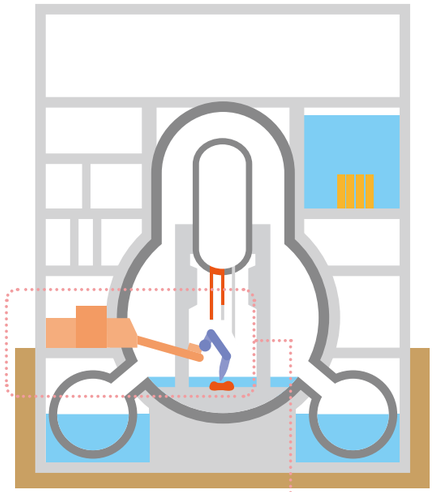
What does “retrieval of fuel debris” mean?

Fuel debris refers to fuel that melted inside the reactors, mixed with various structures, solidified, and we are working on trial retrieval using remote robots.

Results of an internal investigation of the primary containment vessel

In order to confirm the condition of the fuel debris in Unit 1, underwater robots were used to survey the inside of the reactor containment vessel by March 2023. It was confirmed that the lower part of the inner wall of the pedestal was damaged almost all the way around and that the reinforcement bars were exposed. The Nuclear Regulation Authority has evaluated that even if the pedestal were to lose its support function, there would be no risk with the seismic resistance of the reactor building and no significant radiation exposure risk to the surrounding area.

The panoramic photo of the inner wall of the pedestal

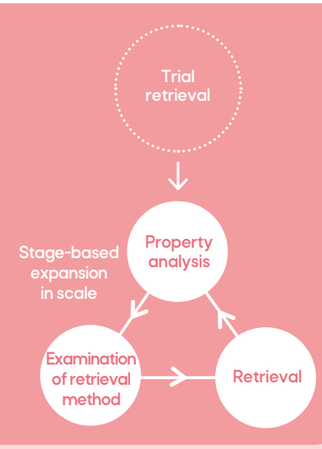


Previous investigations of Unit 2 found distribution of fuel debris in the reactor containment vessel and status of damage to the structure of the reactor. Deposits resembling fuel debris were also identified. In February 2019, during a survey, deposits resembling fuel debris were successfully picked up and lifted.

Plans

Based on the results of the investigation, we will proceed with the work prioritizing safety in a phased approach while flexibly revising the operations. Initially, we will commence trial retrieval at Unit 2 and then gradually expand the scale of removal. The start date for the trial retrieval is expected to be around October 2024 at the latest.

Robotic arm for trial retrieval

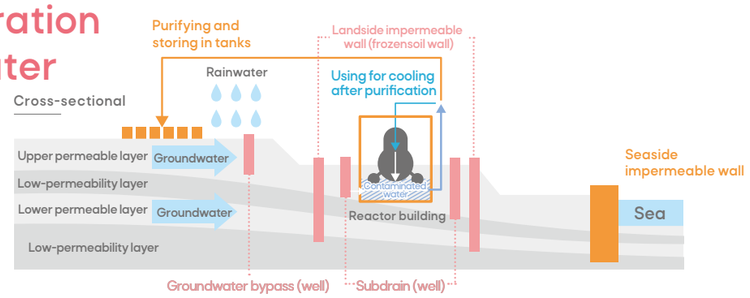


Glossary Turbine building... A building housing the turbine generator. At Fukushima Daiichi NPS, the turbine building is located on the sea side of the reactor building.

How are measures taken against contaminated water?

Mechanism of generation of contaminated water

Water used to cool the fuel debris comes in contact with them and contains high concentrations of radioactive materials. When this water mixes with groundwater and rainwater that flows into the buildings, so-called “contaminated water” is generated.

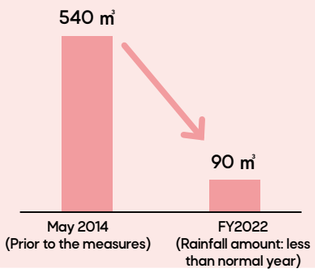


The three principles and the outcomes of the countermeasures implemented thus far

1 Redirecting groundwater from contamination sources

Major reduction in the amount of contaminated water generated

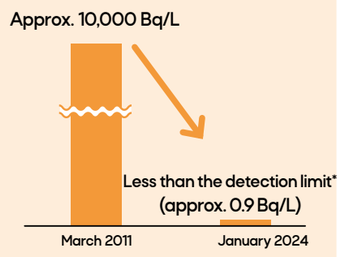
Amount of contaminated water generated (daily average)



2 Preventing leakage of contaminated water

Meets drinking water standards

Concentration of radioactive materials in the sea around the station

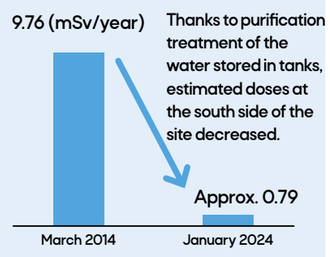


*The concentration of radioactive materials in the sea around the station refers to the Cs137 level near the south discharge channel
*The international standard for drinking water quality is 10 Bq/L

3 Removing contamination sources

1mSv / year attained at the site boundary

Estimated doses from facilities at the the south side of the site*



Thanks to purification treatment of the water stored in tanks, estimated doses at the south side of the site decreased.

*Storage tank area

Various measures have been implemented based on three basic principles. As a result, the risk of radiation from contaminated water has been greatly reduced.

Examples of key countermeasures under the three principles

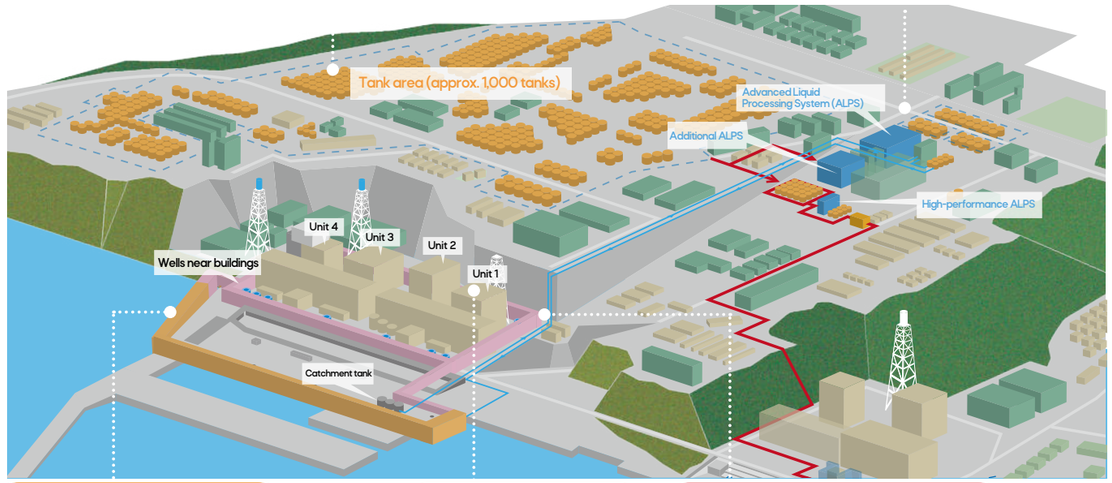
2 Preventing leakage of contaminated water

Completed changing from flanged tanks to welded joint tanks

3 Removing contamination sources

Advanced Liquid Processing System(ALPS)

Purifying water by removing most of the radionuclides except tritium (hydrogen-3)



Installation of sea-side steel impermeable wall

2 Preventing leakage of contaminated water

We are keeping the groundwater level around the building higher than the contaminated water level to prevent the contaminated water from leaking out of the building.

Land-side impermeable wall (frozen-soil wall)

*Conceptual drawing

1 Redirecting groundwater from contamination sources

Plans

Efforts to further reduce the risk of radiation from contaminated water

- Through continued efforts in rainwater management and other measures, we will further reduce the amount of contaminated water generated.
- We aim to reduce the amount of contaminated water generated to 100 ㎥ per day or less by 2025 and to approximately 50-70 ㎥ per day by fiscal year 2028, relative to average rainfall amounts.

Glossary

Subdrain… A well was installed near a building to lower the level of groundwater around the building and thereby suppress the influx of groundwater into the building and efflux of groundwater to the area on the sea side of the building. Groundwater pumped up from the subdrain is purified and discharged after checking that the operational targets are met.

Is ALPS treated water really safe?

I will provide accurate information about the ALPS treated water point by point.

On August 24, 2023, the ocean discharge of ALPS treated water into the sea began. To address everyone's questions, this booklet will explain why ALPS treated water is safe across 16 separate topics.

Scan here for more detailed information.

1 The handling of ALPS treated water is an essential task for the decommissioning of Fukushima Daiichi NPS and the reconstruction of Fukushima.

2 After thorough and prolonged deliberation, the decision to adopt ocean discharge as the handling method has been finalized.

3 ALPS treated water is formerly contaminated water from which most of the radioactive materials have been removed.

4 Water in tanks containing radioactive materials that exceed the regulatory standards other than tritium will be repurified.

5 The tritium concentration in the ALPS treated water discharged into the sea fully meets the safety standards of national and international organizations (WHO).

6 Tritium is a type of hydrogen and is a radioactive material that is widely found in nature.

7 In general, it is extremely difficult to remove tritium from water containing ALPS treated water, and no practical technology exists yet.

8 The total amount of tritium discharge is below the target value of Fukushima Daiichi NPS at the time of operation.

9 At nuclear facilities in the world, tritium is discharged in compliance with safety standards.

10 The radiological impact from the discharge into the sea is negligible on people and the environment.

11 When the water is sufficiently diluted with seawater and separated by 2-3 kilometers from the water discharge point, the tritium concentration will be the same as that of the surrounding seawater.

12 The International Atomic Energy Agency (IAEA) has been reviewing thoroughly the discharge of ALPS treated water into the sea.

13 To ensure safer handling of ALPS treated water, a third-party organization (JAEA) also verifies the water before it is discharged.

14 Thorough sea area monitoring has been and will continue to be conducted before and after the commencement of the discharge and the measurement results are published online.

15 Water containing the ALPS-treated water is and has been used to carry out a breeding test with flounder and other fish, and it was confirmed that tritium did not accumulate in the body.

16 Updates regarding the Fukushima Daiichi NPS's situation are disseminated at the local, national, and international levels to prevent further reputational damage.

Glossary

ALPS... ALPS stands for Advanced Liquid Processing System and is a "multinuclides remov al system" that purifies contaminated water by removing various radioactive materials. It can remove radioactive materials other than tritium from the contaminated water until the water meets safety standards.

I want to tell you about ALPS treated water

1 The handling of ALPS treated water is an essential task for the decommissioning of Fukushima Daiichi NPS and the reconstruction of Fukushima.

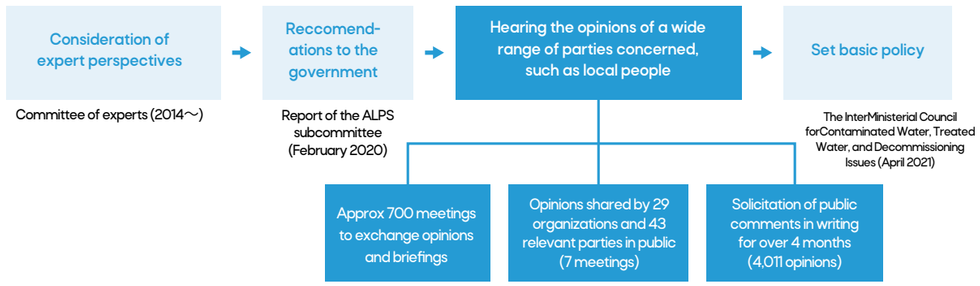
Examples of facilities required for decommissioning

- Storage facilities for spent fuel
- Maintenance and training facility for fuel debris retrieval
- Storage and analysis facilities for fuel debris and radioactive waste

Decommissioning of the Fukushima Daiichi NPS is a major prerequisite for reconstruction of Fukushima. However, there are already over 1,000 massive storage tanks on-site, leading to concerns about a lack of space to build the facilities required for future decommissioning work. In addition, the opinions exist that there is a risk of collapse in the event of a disaster, and that the presence of the large tanks itself is a cause of adverse impacts on reputation. Thus, handling of ALPS treated water and reducing the number of tanks is essential tasks for decommissioning and reconstruction.

2 After thorough and prolonged deliberation, the decision to adopt ocean discharge as the handling method has been finalized.

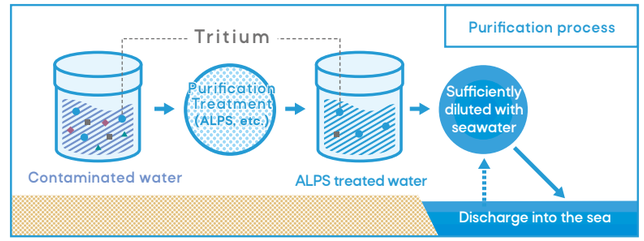
Handling of ALPS treated water has been discussed with experts for over 6 years. As a result, it was evaluated that discharge into the sea is the most reliable method, taking into account that there are precedents in Japan and abroad and that monitoring is easy. After hearing opinions in public and soliciting public comments in writing, the Government of Japan (GoJ) set the policy of discharging ALPS treated water into the sea.



3 ALPS treated water is formerly contaminated water from which most of the radioactive materials have been removed.

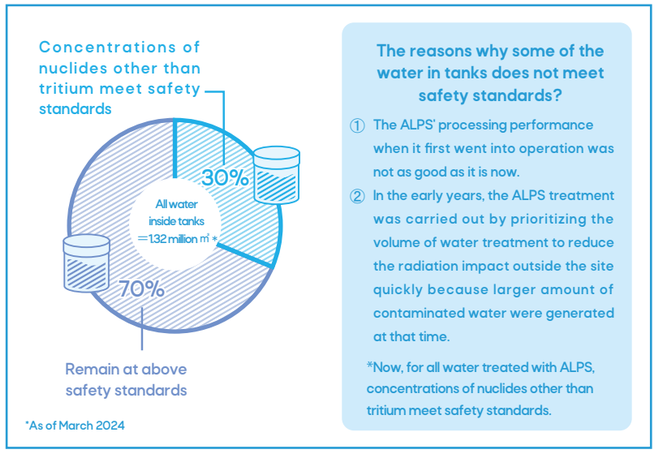
ALPS treated water is the water from which “contaminated water”, generated due to cooling the fuel debris, and groundwater and rainwater flowing into the reactor building, has been purified to the extent that it meets safety standards for radioactive materials other than tritium. In order to meet safety standards, tritium is significantly diluted with seawater before discharging. The discharge of ALPS treated water into the sea is unlikely to have an impact on the human body or the environment.

Advanced Liquid Processing System (ALPS)



4 Water in tanks containing radioactive materials that exceed the regulatory standards other than tritium will be repurified.

Some of the water stored in tanks contains some radioactive materials other than tritium in concentrations exceeding safety standards. However, these radioactive materials can be removed through re- purification (Secondary treatment). Secondary treatment tests have already been conducted, confirming that those materials can be removed without problems.



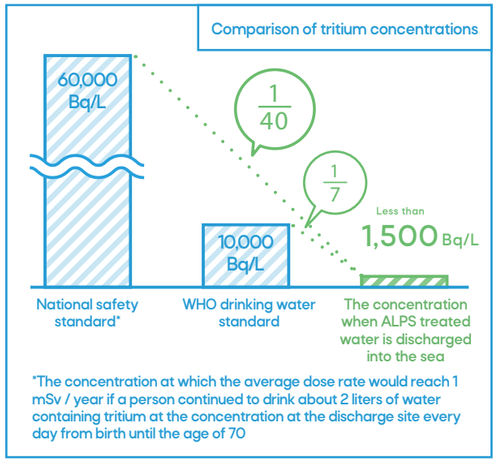
Glossary

Tritium… Tritium, a type of hydrogen (hydrogen-3), is naturally present in our environment every day. It can be found in tap water, rainwater, and even in our bodies. Tritium is considered a radioactive substance that exists widely in nature. The radiation emitted by tritium is weak and can be stopped by a single sheet of paper.

I want to tell you about ALPS treated water

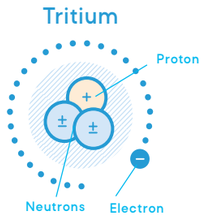
5 The tritium concentration in the ALPS treated water discharged into the sea fully meets the safety standards of national and international organizations (WHO).

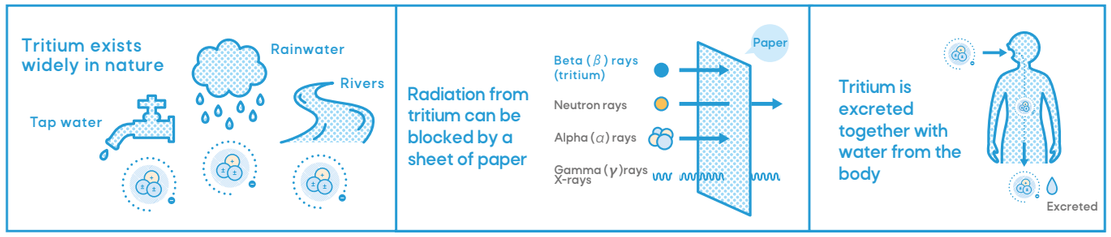
When discharged ALPS treated water into the sea, the tritium concentration is set to be below 1,500 becquerels per liter. This standard represents 1/40 of the national safety standard (based on internationally common principles) of 60,000 becquerels per liter, and approximately 1/7 of the World Health Organization (WHO) drinking water guideline of 10,000 becquerels per liter.



6 Tritium is a type of hydrogen and is a radioactive material that is widely found in nature.

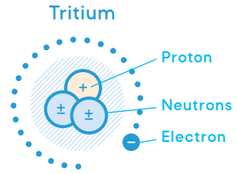
Tritium, a type of hydrogen (hydrogen-3), is naturally present in our environment. It can be found in tap water, rainwater, and even in our bodies. The radiation emitted by tritium is weak and can be stopped by a single sheet of paper. It is not accumulated in the human body and is excreted together with water from the body.

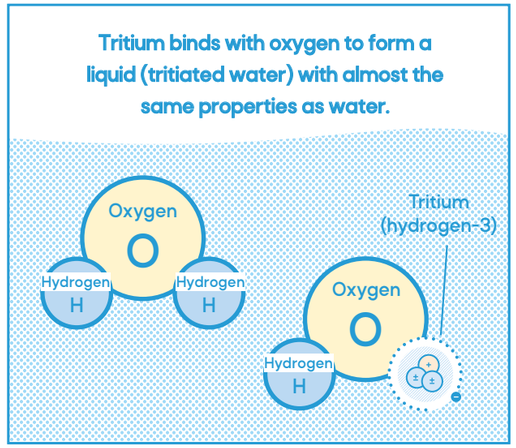




7 In general, it is extremely difficult to remove tritium from water containing ALPS treated water, and no practical technology exists yet.

Tritium binds with oxygen to form a liquid (tritiated water) with almost the same properties as water. Thus, removing tritium from water is very difficult, and there is no tritium separation technology applicable to ALPS treated water at this time. The IAEA has made the same acknowledgment.

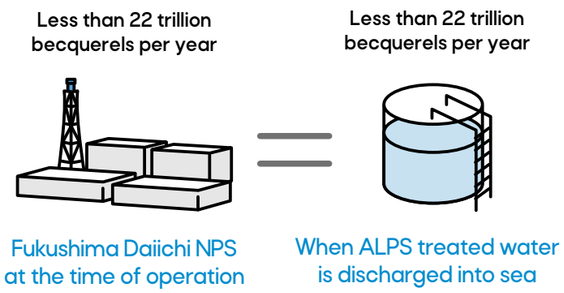




8 The total amount of tritium discharge is below the target value of Fukushima Daiichi NPS at the time of operation.

The annual total amount of tritium discharged into the sea is managed appropriately to remain below the operational target value set during the operation of the Fukushima Daiichi NPS. Additionally, a discharge plan is formulated at the end of each fiscal year to minimize the annual discharge of tritium as much as possible.

Operational target value for tritium discharge



Glossary

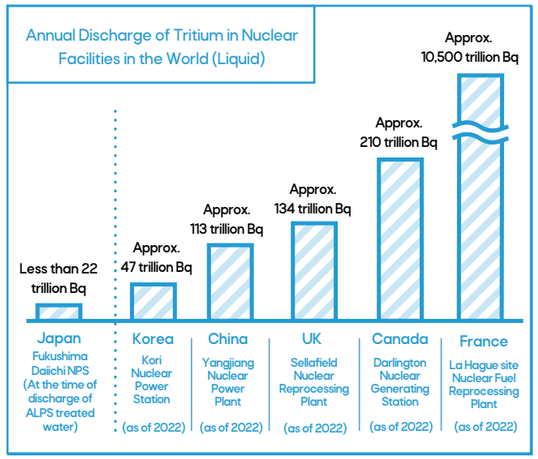
WHO Guidelines for Drinking-water Quality... Guidelines prescribing numerical targets and measures to be taken to ensure the safety of drinking water, set forth by WHO (World Health Organization).

I want to tell you about ALPS treated water

9 At nuclear facilities in the world, tritium is discharged in compliance with safety standards.

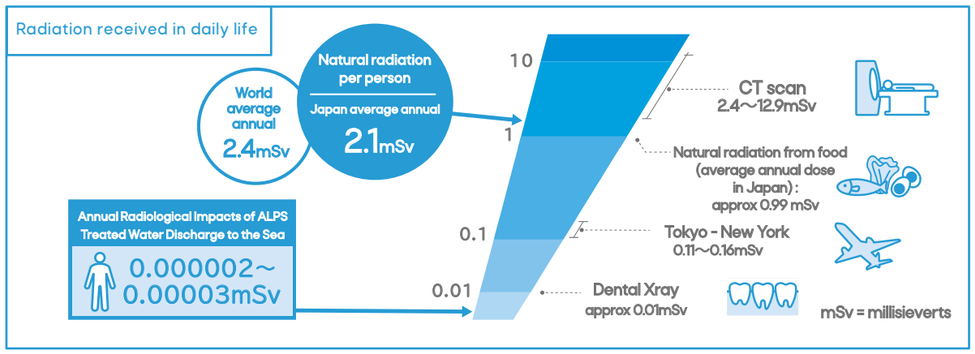
Nuclear facilities around the world handle tritium in compliance with safety standards. No effects attributable to tritium have been found around these facilities.

The total amount of tritium in ALPS treated water discharged at the Fukushima Daiichi NPS is below 22 trillion becquerels per year (the same as the operational target value prior to the accident), which is a low level compared to the amount discharged from many nuclear power stations in Japan and overseas.



10 The radiological impact from the discharge into the sea is negligible on people and the environment.

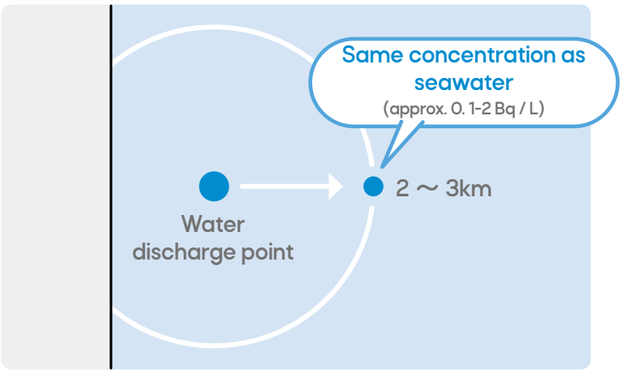
When the ALPS treated water is discharged into the sea, the radiation effect for one year is extremely small and is much smaller than the effect from the natural world.



Source: Prepared by the Agency for Natural Resources and Energy based on data from the National Institute of Radiological Sciences, National Institutes for Quantum and Radiological Science and Technology, and Chapter 2 "Radiation Exposure" in the Ministry of the Environment's "Comprehensive Basic Data on Health Effects of Radiation (2022 Edition)"

11 When the water is sufficiently diluted with seawater and separated by two to three kilometers from the water discharge point, the tritium concentration will be the same as that of the surrounding seawater.

After the concentration of radioactive materials has been confirmed, the ALPS treated water is mixed with a large amount of seawater in a dilution facility and diluted more than 100 times. The diluted ALPS treated water is discharged at a point about one kilometer away from the coastline of the Fukushima Daiichi NPS. It is evaluated that the concentration of tritium will be the same as that of the surrounding seawater at a distance of two to three kilometers from the discharge point.



12 The International Atomic Energy Agency (IAEA) has been reviewing thoroughly the discharge of ALPS treated water into the sea.

Before the start of the discharge of ALPS treated water into the sea, the IAEA published a comprehensive report incorporating conclusions stating that the discharge of ALPS treated water "consistent with relevant international safety standards" and "will have a negligible radiological impact on people and the environment". The IAEA will continue its safety review of the discharge of ALPS treated water into the sea not only before but also during and after the discharge for the long term.

IAEA Director General Grossi Presents a Comprehensive Report to Prime Minister Kishida

IAEA Onsite Visits

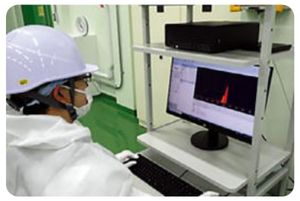
Glossary

IAEA… A global forum promoting scientific and technological cooperation for the peaceful uses of nuclear energy. Established in 1957 as an autonomous organization under the umbrella of the United Nations, the forum is headquartered in Vienna.

I want to tell you about ALPS treated water

13 To ensure safer handling of ALPS treated water, a third-party organization (JAEA) also verifies the water before it is discharged.

In order to conduct accurate and transparent measurements of radioactive substances contained in ALPS treated water, analysis is also carried out by a third-party organization, JAEA (Japan Atomic Energy Agency), before the discharge. Third-party analysis involves analyzing the concentration of tritium and nuclides other than tritium in ALPS treated water before the discharge, and confirming that non-tritium nuclides meet the standards. The process of third-party analysis involves sampling, analysis, and reporting/publication of analysis results for ALPS treated water, with the results reported to the government (Ministry of Economy, Trade and Industry) and also published on the JAEA website.

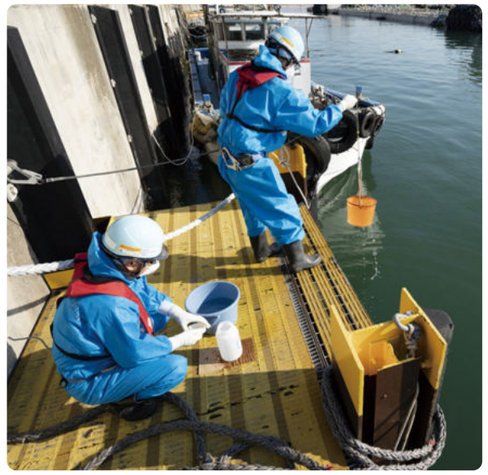


14 Thorough sea area monitoring has been and will continue to be conducted before and after the commencement of the discharge and the measurement results are published online.

TEPCO: Marine Monitoring Results

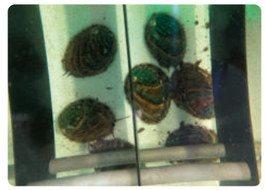
Ministry of the Environment: Ocean Monitoring Information Related to ALPS Treated Water

Thorough marine monitoring is conducted to ensure that there are no significant changes in the concentration of radioactive substances in the sea before and after the start of the discharge. Transparency is ensured for the monitoring by the involvement of third-party organizations such as the IAEA, the presence of local government officials, etc. Additionally, measurements and analysis of radioactive substance concentrations in seawater and fish are conducted not only by TEPCO but also by the national government and Fukushima Prefecture, with the results being publicly available on the web. Additionally, monitoring results so far have confirmed that the discharge has been carried out as planned and is safe.



Seawater sampling

15 Water containing the ALPS-treated water is and has been used to carry out a breeding test with flounder and other fish, and it was confirmed that tritium did not accumulate in the body.



TEPCO Marine Organism Cultivation Trial Live Camera

In order to demonstrate the safety of ALPS treated water in a visible manner, we are breeding flounder and abalone in seawater to which ALPS treated water has been added. As with knowledge obtained in Japan and overseas, tritium is not concentrated in the body, and it has been confirmed that there is no difference in growth compared to breeding in normal seawater.
The status of the breeding test is released on live camera footage, SNS, etc.

16 Updates regarding the Fukushima Daiichi NPS's situation are disseminated at the local, national, and international levels to prevent further reputational damage.

A range of information on the safety of ALPS treated water and the necessity of its discharge has been disseminated in different ways, including television, newspaper and internet advertisements as well as social media. In addition, we also provide on-site lectures to high schools throughout Japan.

Visit to Fukushima Daiichi NPS

Side event at IAEA General Conference

Local events

On-site classes

How is the waste managed?

Currently, efforts are underway to store all waste in the building by minimizing its volume as much as possible, aiming to further reduce risk.

Waste classification and storage management

Radioactive waste such as rubble from the Fukushima Daiichi Nuclear Power Station is currently stored in storage tanks and outdoor temporary storage facilities, depending on the radiation dose rate. We will reduce the volume of such waste as much as possible and consolidate it in the buildings for the purpose of shielding it and suppressing its dispersal. We are eliminating the temporary storage area by around fiscal 2028.

Additional miscellaneous solid waste incineration facility
[Completed: May 2022]

Volume reduction treatment facility
[Completed February 2024]

Large-scale waste storage building 1 (under construction)
[Scheduled completion: FY2025 or later]

Status of waste storage

More than 30mSv/h

Solid waste storage

30～1mSv/h

Soil-covered temporary storage facilities, etc.

1～0.1mSv/h

Sheet curing

Less than 0.1mSv/h

Open storage

Felled trees

Branches and leaves: Temporary storage bunker
Roots and trunks: Open storage

Waste generation prediction for about 10 years in the future

In order to systematically manage and store waste, TEPCO predicts the amount of waste generated for approximately the next ten years and revises its Storage Management Plan annually. As of November 2023, it is projected that approximately 760,000㎥ of waste will be generated by March 2035, including waste already generated. However, by utilizing the existing waste incineration and volume reduction facilities, it is anticipated that the volume of waste can be reduced by one-third of the projected amount.

Prediction of Waste Generation and Storage Volume in Approximately 10 Years

Storage volume as of March 2023
Approx. 520,000 ㎥

→

Projected Generation Volume as of March 2034
Approx. 760,000 ㎥

Incineration treatment
Reduction treatment

→

Projected storage volume as of March 2034:
Approx. 290,000 ㎥

*See page 28 for details on the status after decommissioning

Glossary

Volume reduction treatment facility… A facility for reducing the volume of metal and concrete waste among radioactive solid waste generated after the accident by crushing or cutting them into small pieces for their efficient storing.

Tell me more about decommissioning

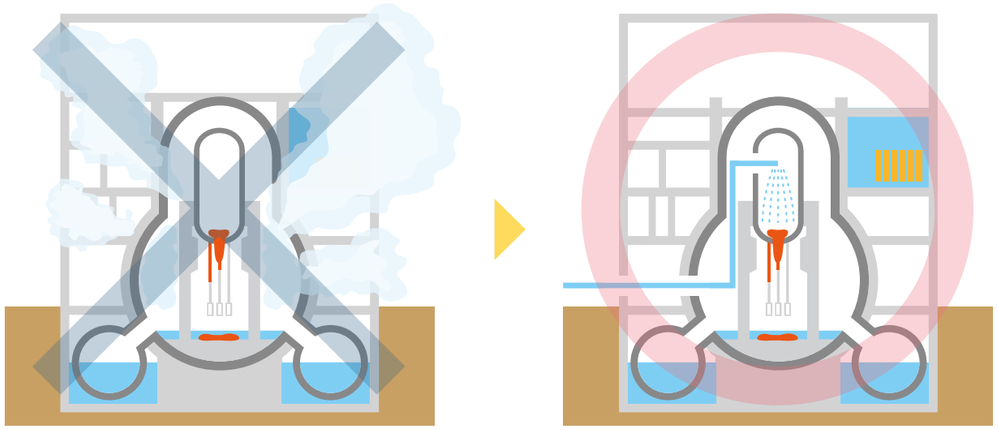
Isn't there a possibility of another accident?

Since a stable state is maintained, the possibility that an accident occurs again is extremely low.

Currently, units 1 to 3 are being continuously injected with water. As a result, the heat from the fuel debris has been greatly reduced since the accident, and a stable state has been maintained.

At present, the temperature in the nuclear reactor is maintained at about 15 to 35℃ . Even if water in jection is stopped, it is expected to take about two weeks to reach the TEPCO's operational control limit temperature (80℃), and thus it is possible to cope with the situation with a time margin.

Further, monitoring is constantly performed in order to detect "recriticality" in which "criticality" in the uranium contained in the fuel undergoes nuclear fission in a chain reaction again. By any chance, even if re-criticality occurs, facilities are in place to suppress nuclear fission.



At the time of the accident

The inability to inject water into the reactor caused the fuel to overheat, resulting in a hydrogen explosion.

Today

Reactors are kept stable.

How are you prepared for disasters such as earthquakes and tsunamis?

We are taking various measures in both hard and soft aspects. We will continue to expand the facilities to make the measures more complete.

Earthquake

Computer analysis has confirmed that even if an earthquake of the magnitude of the Great East Japan Earthquake occurs, important buildings will not collapse.

The facility for taking out the fuel from the spent fuel pool is also designed to be earthquake-resistant, and the influence on the decommissioning work can be suppressed.

On the basis of the lessons learned from the earthquakes that occurred off the coast of Fukushima Prefecture in February, 2021, we will continuously try to secure safety and thoroughly transmit information quickly and with high transparency.

Tsunami

Additional seawalls against tsunamis expected to be generated by a Chishima trench earthquake were completed in 2020. We are continuing to implement additional measures, such as raising the height of the seawall, to be prepared for tsunamis caused by a Japan Trench earthquake. (Scheduled for completion in March 2024)
Work has also been completed to build doors to block openings in each building to prevent water from entering.

Measures against inundation by tsunami

Chishima Trench-related tsunami seawall

Before measures implemented

After measures implemented

Installation of watertight Doors

Equipment and drills

Fire engines, power supply vehicles, and other equipment needed in the event of a disaster are always available on high ground, where a tsunami cannot reach, so that a quick response is possible.

We continue to conduct drills that assume various situations, such as the station blackout, in the event of a disaster.

Ensuring the cooling function in an emergency

Water injection drill

Power supply vehicle

Fire engines

Glossary

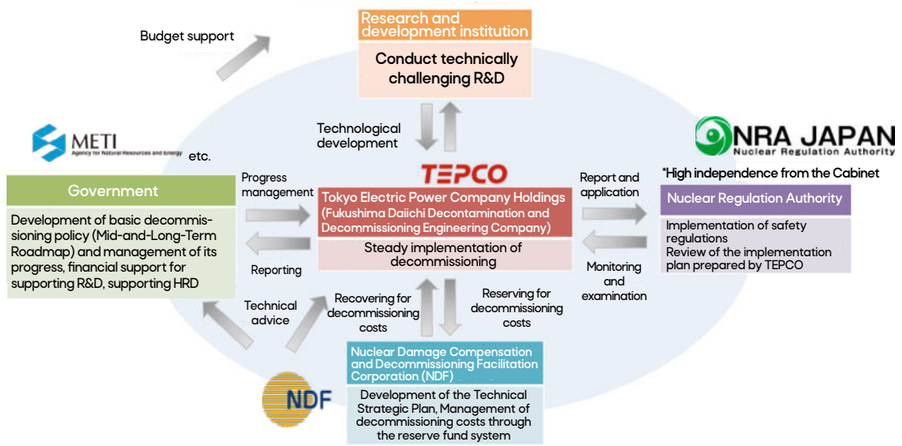
Criticality… A state in which nuclear fission continues in a chain reaction. In a nuclear power station, power is generated while maintaining this chain reaction at a constant level (output) in the reactor.

Who is involved in decommissioning?

In addition to bringing together the wisdom of people in Japan and overseas, we have also enlisted the cooperation of local residents.

The decommissioning of Fukushima Daiichi NPS, which caused a severe accident, is an unprecedented effort in the world. In addition to the national government and TEPCO, various universities, R&D institutes, and overseas companies are working together to bring together the wisdom of Japan and overseas.

Division of Roles among Relevant Organizations for the Decommissioning of Fukushima Daiichi NPS



The decommissioning work, which is a major premise for the reconstruction of Fukushima, will continue for 30 to 40 years. Therefore, it is important to involve local residents in various ways, including local industries such as accommodations and restaurants that support decommissioning, site workers, and engineers.

We are proceeding with the decommissioning of the Fukushima Daiichi NPS with the cooperation of the local people, including local companies. Based on the technological capabilities that have developed in this way, we aim to further revitalize this area and advance the reconstruction of Fukushima and the decommissioning of Fukushima Daiichi NPS in tandem.

Through independent and objective reviews by the International Atomic Energy Agency (IAEA) and other opportunities, we have been using global knowledge and experience in the decommissioning of nuclear facilities as well as disseminating information on the decommissioning of the Fukushima Daiichi NPS to the international community. The IAEA has provided evaluation and advice regarding decommissioning work on five occasions.

Collaborative Laboratories for Advanced Decommissioning Science (Tomioka Town)

Okuma Analysis and Research Center (Okuma Town)

Naraha Center for Remote Technology Development (Naraha Town)

ABLE Co., Ltd. (Dismantle the exhaust stack for Units 1 and 2)

Canyonworks, Ltd. (Produces the protective clothes used at the Fukushima Daiichi NPS)

What happens after the decommissioning?

The appearance after decommissioning will continue to be examined in the future while firmly inquiring about the opinions of everyone in the local area.

At present, the situation in the nuclear reactor, the handling of waste, and the like, are often uncertain. Therefore, it has not yet been possible to present a concrete picture of the situation after decommissioning.

The appearance after decommissioning is an important study subject, which is also related to the future view of the region.

The GoJ will continue to study the issue while communicating with local residents.

I want to know the situation inside the Fukushima Daiichi Nuclear Power Station

The environment on the premises has greatly improved, and observations by residents and groups are also being accepted.
In addition, we have prepared a virtual tour to show the decommissioning site to many people.

Residents observing the site

Since November 2018, residents and other visitors have been able to visit the elevated area overlooking Units 1 to 4 wearing their daily attire. Residents of Fukushima Prefecture or those who lived there at the time of the accident are invited to visit and inquire about future decommissioning work.

Scan here to take a virtual tour of the decommissioning site

INSIDE Fukushima Daiichi
https://www.tepco.co.jp/en/insidefukushimadaiichi/index-e.html

Glossary

JAEA... The abbreviation for the Japan Atomic Energy Agency. Its activities include analyses and studies on the treatment and handling of fuel debris and other radioactive materials and the provision of opportunities for the development and demonstration of remote-control equipment for that purpose.

How has decommissioning been carried out so far?

Let me tell you about the progress of decommissioning so far.

Measures against contaminated and treated water

2011
- The construction of the sea-side impermeable wall was started (April).
  Total length: 800m
  Piles: Approx. 600

2012
- Multi-nuclide removal system (ALPS) started the test flow (From March)
- Large leakage of contaminated water from flanged tank (Approx. 300 tons) (August)
- Determine three basic principles of countermeasures against contaminated water “Redirecting” “Preventing” and “Removing”(December)

2013


- Groundwater bypass pumping and drainage started (April)
- Full-scale construction of frozen soil type land-side impermeable wall started (June)
  Total length: approx. 1500m
  Freezing pipes: 1568, Depth: 30m

2014
- Sub-drain pumping and drainage started (September)
- Construction of the sea-side impermeable wall completed (October)

2015


- Frozen soil type land-side impermeable wall started to freeze (March)
- Completed wide-area site paving (facing) (March)

2016
- Unit 1: Removal of stagnant water in the turbine building completed (March)

Removal of fuel from the spent fuel pool

2011


- Unit 4: Removal of rubble from the reactor building completed (October)

2012


- Unit 4: Removal of fuel from the spent fuel pool started / Transferred to the common pool (November)

2013


- Unit 4: Removal of fuel from the spent fuel pool completed / 1535 assemblies (December)

2014

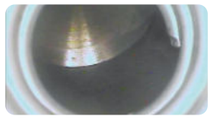

- Unit 3: Completed removal of large scale rubble (fuel exchangers) from the spent fuel pool (August)

2015


- Unit 1: Completed removal of building cover wall panels

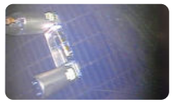
2016
- Unit 1: Surveyed the first basement floor of the reactor containment vessel using a self-propelled robot (March)
- Unit 2: The lower part of the reactor pressure vessel was examined by a self-propelled robot (February)
- Unit 3: No fuel debris was found in the reactor core as a result of a debris location survey using muons (cosmic rays) (May)
- Unit 3: Investigated the lower part of the reactor pressure vessel (July)

Fuel debris retrieval

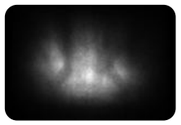
2011


- Unit 1: Video of reactor containment vessel confirmed with an endoscope (October)
- Unit 2: Video of reactor containment vessel confirmed with an endoscope for the first time (January)

2015
- Unit 1: Debris location survey using muons (cosmic rays)
  No fuel found in reactor core (February)
- Unit 1: Robot probe of the first floor of the reactor containment vessel (April)



- Unit 3: Video of reactor containment vessel confirmed (October)



- Unit 2: Conducted a debris location survey using muons (cosmic rays)
  Most of the fuel debris was located at the bottom of the reactor pressure vessel (March)

Waste treatment

2016
- Started operation of the miscellaneous solid waste incineration facility (March)

2011
- Earthquake (March)
- Cold shutdown achieved (December)

Other activities/ working environment, etc.

2012
- Masks may be omitted from all areas except around Units 1 to 4, the tank area, and the rubble storage area (May)
- Regular work clothes allowed up to Fukushima Daiichi NPS (June)

2013
- New administrative building started operation (Started work on the 1st floor;
  before that, worked in the back office on the 2nd floor) (October)

2014


- Started providing hot meals at cafeteria (April)
- Started operation of a large rest house (capable of handling 1200 people) (May)
- The non-wearing area of the full-face mask was enlarged to 90% (65% in the past) (May)

2015


- Opened a convenience store in a large rest house (March)
- Expanded areas where coveralls are not required due to the progress of measures to reduce environmental radiation dose (March)
- Achieved 1 mSv / year at site boundary (March)
- Started operation of new administrative building (October)

2016


- G-Zone area (general clothing area) expanded to 95% of the site area due to improvement of work environment (March)

Reconstruction

2011
- Started fishing for sale off the coast of Fukushima for the first time since the earthquake

2013
- Non-experimental rice farming resumes for the first time in the former restricted zone (Tamura City)

2014
- The evacuation order was lifted for the first time in the area where the evacuation order was issued by the government (Tamura City)

2015
- The entire Joban Expressway has opened

Glossary

Cold shutdown state...

In a state where the temperature at the bottom of the RPV is roughly 100℃ or less, the emission of radioactive materials is controlled, and the medium-term safety of the cooling system can be ensured.

Measures against contaminated and treated water

2018
- Construction of frozen soil-type land-side impermeable wall completed
  Created a water level difference of 5 to 6 meters
  The amount of contaminated water generated was reduced to 1/3 of the initial level by various measures (Before the measures: 540 ㎥ / day → 170 ㎥ / day)

2019


- Completed transfer of treated water by the multinuclide removal system from flange tanks to welded tanks (March)

2020
- A subcommittee report on handling of the ALPS treated water was issued.
- Achieved the following targets set forth in the Mid-and-Long-Term Roadmap
  ・Removal/treatment of stagnant water in buildings* completed.*
  ・The amount of contaminated water generated per day is suppressed to 150 or less (140 / day on average in 2020)
  *Reactor buildings of Unit 1 - 3, process main buildings, and high-temperature incineration buildings are excluded.

2021
- Basic policy on the handling of ALPS treated water was announced (April)
- Interim measures for the handling of ALPS treated water (August) was announced
- Action plan for the continuous implementation of the basic policy on the handling of ALPS treated water (December)

2022
- Announced the Concept to strengthen and expand measures on handling of ALPS treated water (August)
- Revised the Action Plan for the Continuous Implementation of the Basic Policy on Handling of ALPS Treated Water(August)

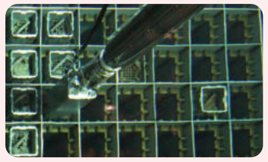
2023
- Achieved the following target set forth in the Mid-and-Long-Term Roadmap.
  Reduced the amount of water retained in reactor buildings to approximately half of the level by the end of fiscal year 2020, achieved between fiscal years 2022 and 2024 (March).
- Revised the Action Plan for the Continuous Implementation of the Basic Policy on the Handling of ALPS Treated Water (January).
- Announced actions and future measures regarding the Basic Policy on handling ALPS Treated Water (August).
- Commenced the discharge of ALPS treated water into the sea (August).

Removal of fuel from the spent fuel pool

2018
- Unit 1: Removal of rubble on the north side of the reactor building started (January)
- Unit 2 : Examination of the upper part of the reactor building, removal of the rubble started (July)
- Unit 3: Installation of fuel removal cover completed (March)

2019


- Unit 3: Started removing fuel from the spent fuel pool (April)

2021


- Unit 3: Removal of all 566 fuel assemblies completed (February)

Fuel debris retrieval

2018
- Unit 2: The lower part of the reactor pressure vessel was inspected (January)

2019


- Unit 2: A deposit considered to be fuel debris was grasped for the first time (February)
- Decided to start removing fuel debris (Started from Unit 2 in 2021) (December)

2021


- Robot arm for trial retrieval from the United Kingdom arrived in Japan, and performance verification tests and other activities began (July)

2022
- Started testing a robotic arm at a mock-up facility in Naraha town (February)

2023


- Conducted investigation inside the containment vessel pedestal of Unit 1 (March)
- Conducted opening operation of X6 penetration hatch of Unit 2 reactor containment vessel (October)

Waste treatment

2018
- Started operation of No. 9 solid waste storage facility (February)
- Started operation of large-scale equipment decontamination facilities (May)

2020
- Started preparatory work for volume reduction treatment facility (September)

2022
- Started operation of the additional miscellaneous solid waste incineration facility (May)
- Opened JAEA Okuma Analysis and Research Center (October)

Other activities/ working environment, etc.

2018


- Self-driving EV buses started operating (April)
- The G-zone area expanded to 96% of the site area due to improvements in the work environment (May)

2019


- Units 1 and 2: Started dismantling of exhaust stack (completed in May 2020) (August)

Reconstruction

2018


- Resumed operation of J village (resumed except for some facilities; fully opened in 2019)

2019
- The evacuation order was lifted in a part of Okuma Town, and the work started at the new town hall office.
- Opened Fukushima Hydrogen Energy Research Field (March)

2020
- Evacuation orders were lifted in parts of the towns of Futaba, Okuma, and Tomioka (in all areas except for difficult-to-return zones) in March

- Operation of entire JR Joban Line resumed (March)
- The Great East Japan Earthquake and Nuclear Disaster Memorial Museum opened (September)

2022
- Lifted evacuation orders in specified reconstruction and revitalization bases (Katsurao Village: June, Okuma Town: June, Futaba Town: August) 2022

- Futaba Town - New Town Hall - opened (August)

2023
- Lifted evacuation orders in specified reconstruction and revitalization bases (Namie Town: March, Iitate Village: May, Tomioka Town: April, November)

- Okuma Town - Manabiya Yumenomori - Completion (June)

2018 2019 2020 2021 2022 2023

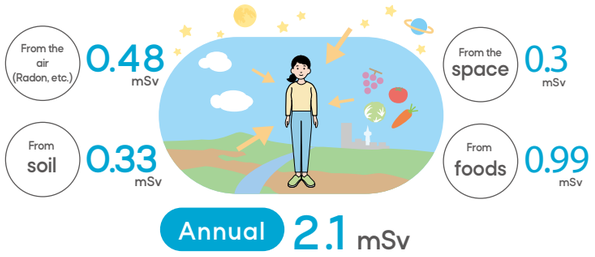
Glossary

Welded tanks... Tanks storing purified water. Their joints are welded to reduce the risk of the stored water leaking out. Flanged tanks built from steel materials connected together with bolts were once used for storage, but they have been replaced with weld-joint tanks to lower the risk of leakage.

I want to know more about the types, effects, and sources of radiation

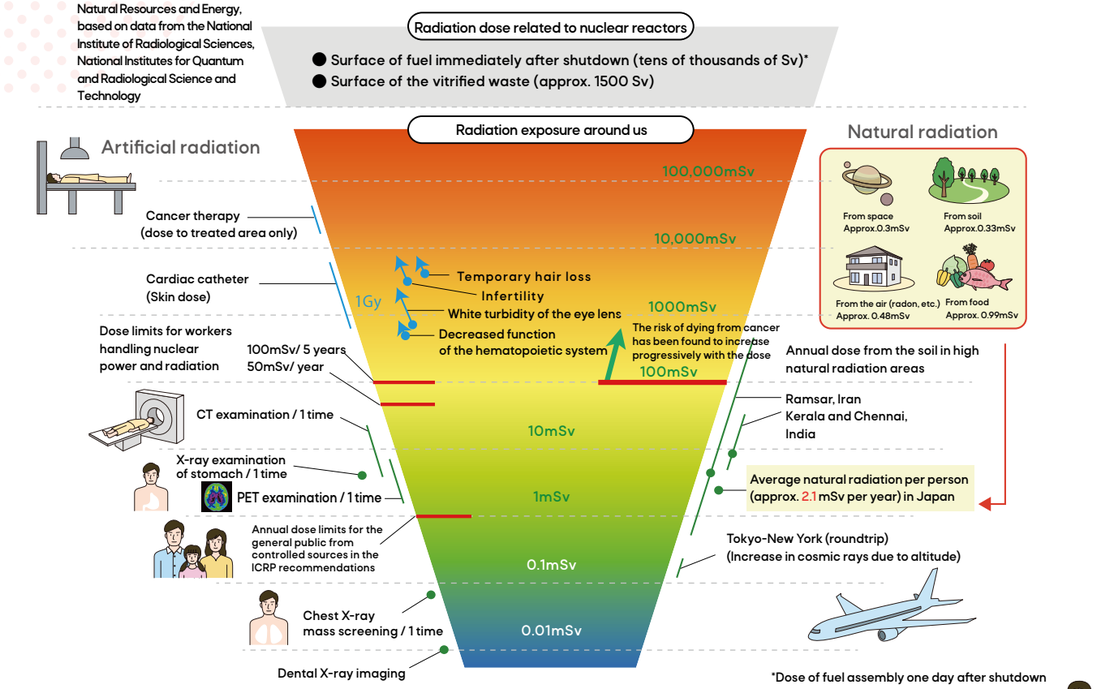
Radiation in daily life

In our daily lives, we are exposed to various types of radiation. It originally exists in nature, and radiation exists not only in specific places such as nuclear power stations and hospitals. The health effects of radiation depend not on the existence of radiation itself but on the amount of radiation, we are exposed to.



Radiation exposure chart

Source: Amended by the Agency for Natural Resources and Energy, based on data from the National Institute of Radiological Sciences, National Institutes for Quantum and Radiological Science and Technology



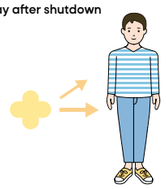
What is the difference between radioactive substances, radioactivity, and radiation? What are becquerels and sieverts?

Becquerel (Bq)

is a unit that shows the amount of radioactivity, which is the ability to emit radiation.

Sievert (Sv)

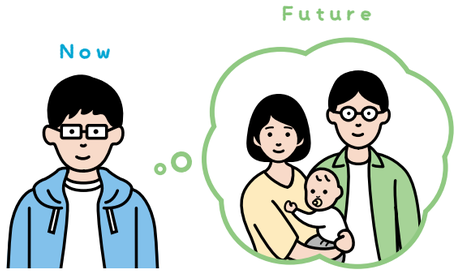
is a unit that represents the degree to which radiation affects the human body. Since the influence differs depending on the nuclear species even if it is the same Becquerel, it is important to judge by Sievert (effective dose) when comparing the health effects.



I want to know the current situation in Fukushima

Effects on health

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) noted in its 2020 report that there have been no reports of adverse health effects that could be directly attributed to radiation exposure from the Fukushima Daiichi NPS accident, and that health effects are unlikely to be seen in the future as well.



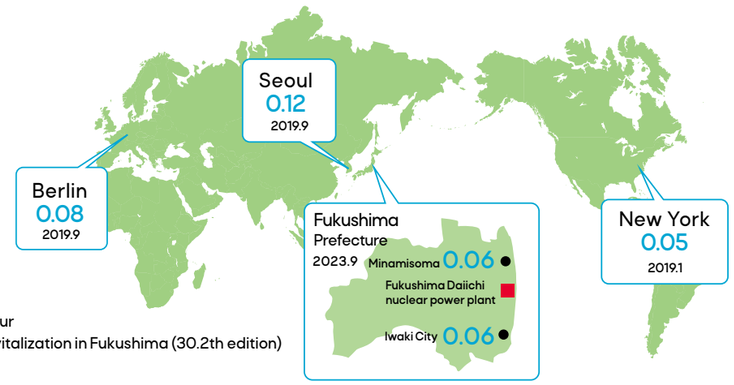
Food produced in Fukushima

Inspections for radioactive substances in food and drinking water from Fukushima Prefecture are conducted under the strictest standards in the world to ensure safety. All prefectural products on the market meet the standards. Additionally, after the accident, 55 countries and regions initially imposed import restrictions, but subsequently, 48 countries and regions have completely lifted them, and deregulation is progressing.

*As of January 2024

Air dose rate in Fukushima

The air dose rate in Fukushima Prefecture is almost at the same level as that of major cities and representative tourist spots in Japan and overseas.



*Dose rates is μSv/hour
Source: Steps for Revitalization in Fukushima (30.2th edition)

Glossary

Air dose rate... The amount of radiation present in a given space converted to a value per unit of time. This includes more than radiation derived from the accident. It is also affected by radioactive materials derived from nature. Therefore, due to geological differences, th ere are rate gaps among regions, and weather conditions also influence the air dose rate.

I want to know more about the glossary used

1. Operating floor P.7
The uppermost floor of the reactor building, where tasks such as fuel exchange are carried out using the fuel handling machine during periodic inspections.

2. Air dose rate P.33/34
The radiation dose present in a certain space is converted to a value per unit of time. This includes more than radiation derived from the accident. It is also affected by radioactive materials derived from nature. Therefore, due to geological differences, there are rate gaps among regions, and weather conditions also influence the air dose rate.

3. Reactor pressure vessel(RPV) P.7/31
A metal vessel housing fuel, control rods, and other components. This vessel is installed in the primary containment vessel. In the operating power station, heat is produced in this vessel due to the nuclear fission reaction.

4. Primary containment vessel(PCV) P.7/8/10/29-32
A steel vessel housing the reactor and associated cooling system equipment, etc. Its function is to prevent the diffusion of radioactive material to the surrounding area in case of fuel damage.

5. Sub-drain P.3-4/11/30
A well was installed near a building to lower the level of groundwater around the building and thereby suppress the influx of groundwater into the building and efflux of groundwater to the area on the sea side of the building. Groundwater pumped up from the sub-drain is purified and discharged after checking that the operational targets are met.

6. Spent fuel P.7/9/15/26/37
Nuclear fuel which has been used in a nuclear reactor and whose fission ability has weakened. At the Fukushima Daiichi NPS, retrieval of fuel from spent fuel pools in reactor buildings has been proceeding in order to reduce future risk. (Retrieval from Units 3 and 4 has been finished.)

7. Shield plug P.7
The top lid of the primary containment vessel. It has been found that the underside of the lid is highly contaminated. Although this is not considered to affect the decommissioning work directly, future decommissioning activities will be flexibly reviewed based on such findings.

8. Turbine building P.9/31
A building housing the turbine generator. At Fukushima Daiichi NPS, the turbine building is located on the sea side of the reactor building.

9. Groundwater bypass P.30
One of the measures for "redirecting" groundwater from contaminated sources. The facility pumps up groundwater flowing from the mountain-side to the sea-side through wells set apart from reactor buildings and other facilities and checks that the discharge standards are met before discharging the water into the sea.

10. Frozen-soil wall P.12
One of the measures for "redirecting" groundwater from contamination sources. It is built around the reactor buildings and turbine buildings for Units 1 to 4 and blocks the groundwater flowing from the mountainside to the seaside.

11. Tritium(T) P.12-18/20-21
Tritium, a type of hydrogen (hydrogen-3), is naturally present in our environment every day. It can be found in tap water, rainwater, and even in our bodies. Tritium is considered a radioactive substance that exists widely in nature. The radiation emitted by tritium is weak and can be stopped by a single sheet of paper.

12. Fuel debris P.5/7-8/10-11/15/25/27/29-32/37
Nuclear fuel melted down and mixed with various pieces from structures that solidified inside the reactor.

13. Blowout panel P.8
Equipment that prevents building damage by automatically failing and releasing pressure when the pressure in the reactor building has increased.

14. Main process building P.32
A common facility for radioactive waste treatment and storage for all reactors. Since the accident, it has been used as temporary storage for stagnant water that has been transferred from the reactor buildings before being treated.

15. Pedestal P.7
A concrete structure supporting the reactor pressure vessel.

16. Radioactive cesium (Cs-134, Cs-137) P.6/11
This is produced during the fission of uranium fuel. It was one of the primary radioactive materials emitted into the environment due to the accident at the Fukushima Daiichi NPS. The half-life of Cs-134 is 2.1 years, and Cs-137 is 30 years. Food safety is measured using radioactive cesium as a standard. (The standard for general foods in Japan is 100 Bq/kg.)

17. Monitoring post P.6
A system for continuously measuring the radiation dose in the atmosphere. These posts are mainly located on the site of the nuclear power station and surrounding municipalities. Real-time measurement data is publicly released on a website.

For more information on the Fukushima Prefecture Radiation Monitoring Office

18. Weld-joint tanks P.12/31-32
Tanks storing purified water. Their joints are welded to reduce the risk of the stored water leaking out. Flanged tanks built from steel materials connected together with bolts were once used for storage, but they have been replaced with weld-joint tanks to lower the risk of leakage.

19.Criticality P.25
A state in which nuclear fission continues in a chain reaction. In a nuclear power station, power is generated while maintaining this chain reaction at a constant level (output) in the reactor.

20.Cold shutdown state P.8/29
In a state where the temperature at the bottom of the RPV is roughly 100℃ or less, the emission of radioactive materials is controlled, and the medium-term safety of the cooling system can be ensured.

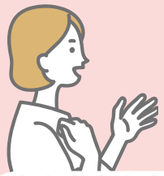
21. JAEA P.27
The abbreviation for the Japan Atomic Energy Agency. Its activities include analyses and studies on the treatment and disposal of fuel debris and other radioactive materials and the provision of opportunities for the development and demonstration of remote-control equipment for that purpose.

22. NDF P.27
The abbreviation for the Nuclear Damage Compensation and Decommissioning Facilitation Corporation. The organization was founded in September 2011 as the Nuclear Damage Compensation Facilitation Corporation to assume responsibilities such as granting compensation funds to nuclear operators. It was reorganized into the Nuclear Damage Compensation and Decommissioning Facilitation Corporation in August 2014. With the additional objective of ensuring appropriate and steady implementation of decommissioning and other activities, the NDF conducts research and development of technologies needed for decommissioning and offers associated advice, guidance, and recommendations.

23. WHO Guidelines for Drinking-water Quality P.17
Guidelines prescribing numerical targets and measures to be taken to ensure the safety of drinking water, set forth by the WHO (World Health Organization).

24.Volume reduction treatment facility P.23/32
A facility for reducing the volume of metal and concrete waste among radioactive solid waste generated after the accident by crushing or cutting them into small pieces for their efficient storing.

24.Dry cask storage P.4
A container for storing spent fuel and other materials. It plays a role in storing spent fuel removed from the common pool on high ground.



I want to know more about decommissioning

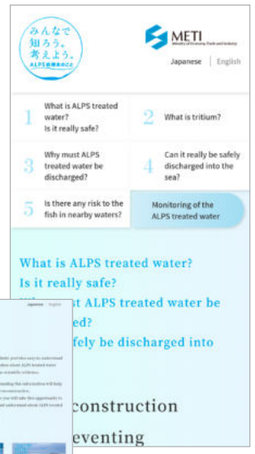
Step by step, toward the future of Fukushima

We are creating a website that compiles information about the decommissioning process and ALPS treated water.

Portal site for measures against decommissioning and contaminated / treated water

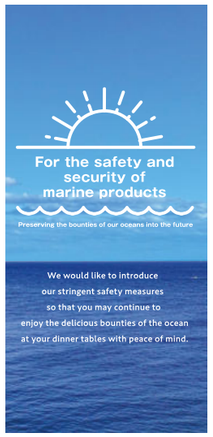
Decommissioning portal

Let's get to know and understand about ALPS treated water.



Related content (videos, brochures, etc.)

Content introducing the safety and necessity of handling of ALPS treated water



For the safety and reassurance of marine products. (Leaflet)

【What is ALPS treated water?】 Let's get to know and understand about ALPS treated water.

You can access it here.

TEPCO Decommissioning Archive Center

Here, people from areas around the nuclear power station, Fukushima Prefecture, and the general public can check relevant information, such as the facts about the accident at the Fukushima Daiichi NPS as well as the current state of decommissioning work.

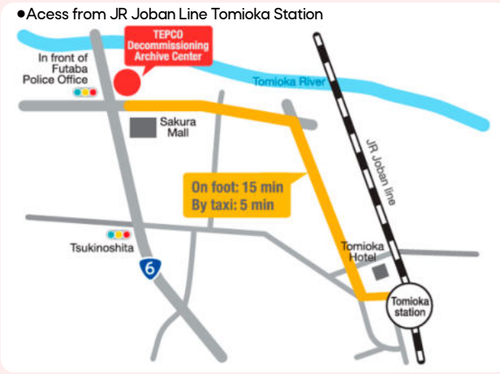
Address: 3-58 Chuo, Tomioka-machi, Futaba-gun, Fukushima Prefecture (Former address: 378 Chuo, Oaza Kobama, Tomioka-cho, Futaba-gun, Fukushima Prefecture)

Opening Hours: 9:30 AM to 4:30 PM(Closed: Every 3rd Sunday of the month and New Year's holidays)

Admission: Free (Parking is also free)

Contact: 0120-50-2957

●Acess from JR Joban Line Tomioka Station



INSIDE Fukushima Daiichi (TEPCO)

A virtual tour around the decommissioning site

Treated Water Portal Site (TEPCO)

Important Stories on Decommissioning

Decommissioning of TEPCO's Fukushima Daiichi NPS and the Discharge of ALPS Treated Water into the Sea

16 Things to Know about ALPS Treated Water

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Agency for Natural Resources and Energy
Ministry of Economy, Trade and Industry

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Photographs:
Courtesy of Tokyo Electric Power Company Holdings, Incorporated (TEPCO)
(Fukushima Daiichi NPS decommission magazine Hairomichi and other materials),
Japan Atomic Energy Agency,
and others