Videos on the present state of decommissioning

A video showing the progress of decommissioning at the Fukushima Daiichi Nuclear Power Station and developments expected in the future is available. It gives you a visual tour of the facilities in a way that makes you feel as if you were visiting the site.

There are also other videos focusing on people working behind the scenes toward decommissioning.

TEPCO Decommissioning Archive Center

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

Address: 378 Aza-Chuo, Daza-Kobama, Tomioka-machi, Futaba-gun, Fukushima
Hours: 9:30 - 16:30 (closed on the third Sunday of every month, and during the year-end and New Year’s holidays)
Admission fee: Free (free parking)
Telephone: +81-(0)120-50-2957
Note: Reservations may be required to prevent the spread of COVID-19.

Important Stories on Decommissioning

Fukushima Daiichi Nuclear Power Station, now and in the future

2021
Introduction

At the TEPCO Fukushima Daiichi Nuclear Power Station, thanks to the daily efforts of on-site personnel, decommissioning work is progressing step by step with safety as the top priority.

This booklet provides answers to questions regarding Fukushima in an easy-to-understand manner, as well as information about the current status and future actions regarding the decommissioning process, together with recent topics.

Table of Contents

Fukushima Daiichi Nuclear Power Station site map ............................................. P.3-4
Current status at the Fukushima Daiichi Nuclear Power Station ..................... P.5-6
What is decommissioning of the Fukushima Daiichi Nuclear Power Station? .... P.7-8
Fuel removal ................................................................................................. P.9
Fuel debris retrieval ..................................................................................... P.10
Management of contaminated water .............................................................. P.11-12
Handling of ALPS-treated water ................................................................. P.13-14
Decommissioning Q&A

Q1: What is the current situation at the Fukushima Daiichi Nuclear Power Station? P.15
Q2: Are there any effects on people’s living environment in the areas surrounding the Fukushima Daiichi Nuclear Power Station? P.16
Q3: Is there any possibility of another accident? ................................................. P.17
Q4: How is the site prepared for natural disasters, such as earthquakes and tsunamis? P.18
Q5: Who is responsible for the decommissioning? ........................................ P.18
Q6: Who is involved in the decommissioning? .................................................. P.19
Q7: What will eventually be done with the retrieved fuel debris and radioactive waste? P.20
Q8: What will happen after the decommissioning is completed? ....................... P.20
History of 10 years of decommissioning ......................................................... P.21-28
Step-by-step progress toward the future of Fukushima .................................. P.29-30
Basic knowledge about radiation ................................................................. P.31-32
Terminology .................................................................................................. P.33-34

1. About 4,000 local people visited the site for observation in FY2020 (as of the end of February 2021).

2. Thousands of origami cranes were sent from different parts of Japan. Many people have shown warm support.

3. There are more than 1,000 tanks on the premises.

4. The dismantling work finished in May 2020, with the upper half removed in cooperation with local company.

5. A robot created by the college won the top prize.

(The photo shows the robot created by the college.)
**Current status at the Fukushima Daiichi Nuclear Power Station**

**Status of the site**

**Unit 1**  
At the time the accident occurred | Today  
--- | ---  
A cover that is large enough to spread over the entire building will be installed to prevent dust scattering during planned fuel removal.

**Unit 2**  
At the time the accident occurred | Today  
--- | ---  
Preparations are underway to install a gantry on the south side prior to fuel removal.

**Unit 3**  
At the time the accident occurred | Today  
--- | ---  
Fuel removal began in 2019 and finished in February 2021, marking the first completion of the task for a reactor left with fuel debris.

**Unit 4**  
At the time the accident occurred | Today  
--- | ---  
All fuel assemblies have been removed and transferred to the common pool or other places, and they are stored and managed safely.

**Working conditions for workers**

A cafeteria and a convenience store available at the large rest house  
Emergency physicians are on duty 24/7  
Protective clothes  
Ordinary working clothes

**Effects on surrounding areas**

**Sea**

From the efforts that have been made so far, major progress has been made in management of contaminated water, and water quality in the sea around the plant has been greatly improved. Contamination levels have been confirmed to fully meet the international quality standards for drinking water.

<table>
<thead>
<tr>
<th>Concentration of radioactive materials in the waters around the plant (Cs-137)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2011</td>
</tr>
<tr>
<td>Approx. 10,000 Bq/L</td>
</tr>
</tbody>
</table>

* 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

**Air**

The amount of emissions of radioactive materials from reactor buildings are limited, and there are no effects even at the site boundary. Dust is also constantly measured at the site boundary, and is far below the standard value where an alert is issued.

**Site inspection is available from a hill near the buildings without wearing protective clothes.**

**Ordinary working clothes are allowed in about 96% of the site.**
Efforts are focused primarily on the following 5 types of work.

- **Fuel removal**
- **Fuel debris retrieval**
- **Management of contaminated water**
- **Handling of ALPS treated water**
- **Treatment and disposal of radioactive waste/Dismantling of reactor facilities, etc.**

**What is decommissioning of the Fukushima Daiichi Nuclear Power Station?**

The process of lowering risks to the local community and the environment caused by radioactive materials, etc., and dismantling of reactor facilities, and other tasks.

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

**Overall process of decommissioning**

- **Fuel removal**
  - Bubble removal → Installation of fuel removal equipment → Fuel removal → Storage / Transportation
  - Units 1 and 2 → Units 3 and 4
- **Fuel debris retrieval**
  - Fuel debris retrieval → Storage / Transportation
  - Units 1 and 3 → Unit 2
- **Handling of ALPS treated water**
  - Consideration of scenarios and technologies → Preparation to start handling → Start of handling
  - Units 1 to 4
- **Treatment and disposal of radioactive waste/Dismantling of reactor facilities, etc.**
  - Consideration of scenarios and technologies → Treatment, disposal, dismantling, etc.

**Status of each unit**

The implementation procedure for measures and the progress vary between reactors because each unit is in a different status.

- **Fuel removal**
  - Start in FY2027-2028 → Start in FY2024-2026
  - Completed in Feb. 2021 (566 assemblies) → Completed in December 2014 (1535 assemblies)

**Retrieve fuel debris**

- *Fuel debris: Solidified fused materials composed of fuel, structures, etc.*

---

*The development of trial retrieval equipment has been delayed due to the COVID-19 situation. Efforts will be made to minimize the delay to one year or so.*

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

There are fuel assemblies remaining in the reactor buildings. Removing them requires the tasks of recovering them with handling equipment from the spent fuel pool where they are stored and transporting them to the common pool at the site.

Progress of fuel removal work

The work must be performed carefully to prevent radioactive material from scattering. Considering the difference in the internal situation of each reactor, the removal work is being carried out through a process optimized for each reactor. While the removed fuel is stored at the site and analyzed in terms of properties, methods to treat and dispose of them will be studied.

Unit 1

- Removal completed in February 2021
- Large cover installation to be completed in FY2023
- Fuel removal to start in FY2024-2026, aiming to finish removal in about two years

Unit 2

- Removal completed in December 2014
- Fuel removal to start in FY2024-2026, aiming to finish removal in about two years

Unit 3

- Removal to be carried out as soon as ready while considering the progress at Units 1 and 2

Unit 4

- Removal completed in February 2021

Fuel debris retrieval

Fuel debris removal is one of the most challenging tasks in decommissioning. Activities are underway to conduct trial retrieval first while bringing together wisdom from Japan and abroad.

Findings from past investigations for fuel debris retrieval

Investigations that have been made so far have clarified the fuel debris distribution* and the structural damage situation inside the primary containment vessel, and conditions such as the presence of deposits believed to be fuel debris have been confirmed. In an investigation of Unit 2 carried out on February 2019, we were able to grip deposits believed to be fuel debris and lift it up.

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 progress.

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

Fuel debris retrieval will be carried out with safety as the top priority, using a phased approach in which work is flexibly reviewed based on investigation results. Trial retrieval will start at Unit 2 and then be gradually expanded in scale.

Plans for the future

Fuel debris retrieval will be carried out with safety as the top priority, using a phased approach in which work is flexibly reviewed based on investigation results. Trial retrieval will start at Unit 2 and then be gradually expanded in scale.

* The distribution situation differs depending on each unit.

Work schedule

- Activities will continue with the goal of completing fuel removal from all the reactors by the end of 2031.
- The removed fuel will be stored at the site for the time being and assessed for long-term integrity to determine optimal treatment and disposal methods.
Management of contaminated water

Mechanism of generation of contaminated water

Water for cooling fuel debris comes into contact with that debris and thereby becomes contaminated with highly concentrated radioactive materials. New contaminated water is generated due to mixing of this highly contaminated water with groundwater and rainwater that flow into buildings.

Due to various efforts we have made so far, significant progress has been made in management of contaminated water as well as in improvement of sea water quality around the plant. In line with three basic principles, various measures will continue to be taken, in order to further reduce risk.

Three principles and the effectiveness of countermeasures

1.Redirecting groundwater from contamination sources
   - Major reduction in the amount of contaminated water generated

2. Preventing leakage of contaminated water
   - Meets drinking water standards

3. Removing contamination sources
   - 1 mSv/year attained at the site boundary

Examples of key countermeasures under the three principles

We will work to reduce radiation risk from contaminated water

- We will further reduce the amount of contaminated water generated, which is a source of risk, through continuous implementation of countermeasures for rainwater.
- The goal is to reduce the amount of contaminated water generated per day to 100 m³ by the end of 2025.
Handling of ALPS* treated water

What is ALPS treated water? Where does it come from?

ALPS treatment process

Contaminated water

ALPS treated water

ALPS* treatment process

ALPS treated water

* Water containing any radioactive materials other than tritium is purified again until their concentrations meet the regulatory standards.

Why does ALPS treated water have to be handled?

Although safely handling ALPS treated water is technically possible, the water has been stored in the tanks at the site to wait for discussions on reputational damage and other social impacts.

In the meantime, the number of tanks has continued to increase and today they take up a large part of the site. The site is expecting the main steps of decommissioning coming into full operation, such as fuel debris retrieval and fuel removal. Making the most of the available land space is essential in these activities, and it highlights the importance of handling ALPS treated water and reducing the number of tanks.

Some people also say that the presence of the large number of tanks has a negative impact on reputation.

Examples of facilities needed to be built at the site

- Storage facilities for spent fuel
- Storage and analysis facilities for fuel debris and radioactive waste
- Mockups and training facilities for work simulations

Is ALPS treated water safe?

Purification by ALPS removes most of radioactive materials contained in water. Therefore, contaminated water and ALPS treated water are two different things in terms of safety.

Meanwhile, purification by ALPS is unable to remove a radioactive material called tritium (hydrogen-3) and it remains in ALPS treated water. However, it is believed that tritium is unlikely to affect human health and the environment as long as its level meets the regulatory standards.

The amount of tritiated water is

1.25 million tons

16g

1.25 million t = Volume of the Tokyo Dome stadium

16 g = About a tablespoonful

Characteristics of tritium

1. Tritium emits very weak radiation and it normally exists in nature.

The emitted radiation is so weak that it can be blocked with only a sheet of paper and cannot go through human skin. Tritium normally exists in nature because it can be produced by radiation from space.

For this reason, people take in tritium through water and food.

2. Tritium is actually discharged from nuclear facilities in Japan and elsewhere.

Tritium is routinely discharged from nuclear facilities in Japan and abroad in accordance with the regulatory standards. No impact attributable to tritium has been commonly seen among these nuclear facilities.

The handling of ALPS treated water

Japan has been studying the issue for about seven years, taking into account social aspects, such as potential impacts on reputation, and decided to discharge it into the sea.

Discharge into the sea is a method that has been used in Japan and elsewhere.

The International Atomic Energy Agency (IAEA) acknowledges the discharge of tritiated water into the sea as technologically and socially acceptable.

In the meantime, the number of tanks has continued to increase and today they take up a large part of the site. The site is expecting the main steps of decommissioning coming into full operation, such as fuel debris retrieval and fuel removal.

Actions to prevent reputational damage

Support fisheries and other industries potentially affected by reputational damage in their efforts to cultivate and expand markets

Before discharge, the water will be sufficiently diluted until its tritium concentration becomes well below the regulatory standard. The total annual amount of discharged tritium will be kept below the control values set before the accident. Monitoring will also be enhanced in cooperation with international agencies.

The International Atomic Energy Agency (IAEA) acknowledges the discharge of tritiated water into the sea as technologically and socially acceptable.

Thorough implementation of safety-oriented procedure

The handling of ALPS treated water into the sea is expected to have a very small impact.

With the determination not to cause additional adverse impacts on reputation due to the discharge of the ALPS treated water into the sea, the Government will take every measures to respond to all issues that may arise.

ALPS treated water refers to water generated by the purification equipment by removing most of radioactive materials from contaminated water coming from the reactor buildings every day. The government has decided to discharge it into the sea because of the need to secure land space, and the discharge will be carried out after a preparation period. Various measures will be taken to prevent reputational damage associated with discharges.

1. Tritium emits very weak radiation and it normally exists in nature.

The emitted radiation is so weak that it can be blocked with only a sheet of paper and cannot go through human skin. Tritium normally exists in nature because it can be produced by radiation from space.

For this reason, people take in tritium through water and food.

2. Tritium is actually discharged from nuclear facilities in Japan and elsewhere.

Tritium is routinely discharged from nuclear facilities in Japan and abroad in accordance with the regulatory standards. No impact attributable to tritium has been commonly seen among these nuclear facilities.

The handling of ALPS treated water

Japan has been studying the issue for about seven years, taking into account social aspects, such as potential impacts on reputation, and decided to discharge it into the sea.

Discharge into the sea is a method that has been used in Japan and elsewhere.

The International Atomic Energy Agency (IAEA) acknowledges the discharge of tritiated water into the sea as technologically and socially acceptable.

In the meantime, the number of tanks has continued to increase and today they take up a large part of the site. The site is expecting the main steps of decommissioning coming into full operation, such as fuel debris retrieval and fuel removal.

Actions to prevent reputational damage

Support fisheries and other industries potentially affected by reputational damage in their efforts to cultivate and expand markets

Before discharge, the water will be sufficiently diluted until its tritium concentration becomes well below the regulatory standard. The total annual amount of discharged tritium will be kept below the control values set before the accident. Monitoring will also be enhanced in cooperation with international agencies.

Thorough implementation of safety-oriented procedure

The handling of ALPS treated water into the sea is expected to have a very small impact.

With the determination not to cause additional adverse impacts on reputation due to the discharge of the ALPS treated water into the sea, the Government will take every measures to respond to all issues that may arise.

ALPS treated water refers to water generated by the purification equipment by removing most of radioactive materials from contaminated water coming from the reactor buildings every day. The government has decided to discharge it into the sea because of the need to secure land space, and the discharge will be carried out after a preparation period. Various measures will be taken to prevent reputational damage associated with discharges.
Are there any effects on people’s living environment in areas surrounding the Fukushima Daiichi Nuclear Power Station?

Radiation leakage is very limited and unlikely to affect the surrounding environment. Thorough radiation monitoring is implemented just in case.

- Radiation leaking outside the reactors is very limited, and no effects are expected from radiation exposure even at the site boundary.
- Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.
- The generation of contaminated water has reduced significantly. With strict measures taken to prevent leakage, water quality in the sea around the plant has improved so much that it meets the world standards for drinking water.
- The environment at the site has improved so much that workers may wear ordinary working clothes in most areas. Even visitors do not have to change their clothes.

As of the end of February 2021, the scale and frequency of visits by local people were reduced from the levels in the previous year due to the impact of COVID-19.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material.

Changes in radiation doses are monitored at each work site. The state of water and air is also constantly monitored at the site boundary. A system is in place to ensure immediate reporting in the event of a rise in the concentration of radioactive material. 
How is the site prepared for natural disasters, such as earthquakes and tsunamis?

Various hard and soft measures have been taken. Expansion of the equipment will continue to ensure the effectiveness of the measures.

- **Earthquake**
  - A computer analysis has confirmed the ability of critical buildings to withstand an earthquake in the class of the Great East Japan Earthquake.
  - The equipment used for fuel removal from the spent fuel pool is also resistant to earthquakes to minimize the impact on the decommissioning work.
  - We will continue efforts to ensure safety and relentlessly review our public communication to disseminate information with speed and transparency, based on lessons learned from the earthquake off Fukushima Prefecture in February 2021.

- **Tsunami**
  - An additional seawall was built in 2020. Further measures are planned, such as elevating the seawalls, to enhance safety.
  - Works are also underway to build doors to close the openings of the buildings to prevent the entry of water.

- **Equipment and drills**
  - Fire engines, power supply vehicles, and other equipment needed in an emergency are placed on a hill out of reach of tsunamis to enable quick response to a disaster situation.
  - Emergency drills are regularly conducted assuming various disaster scenarios, such as a loss of power at the site.

Who is responsible for the decommissioning?

TEPCO is responsible, but the government is also fully committed.

- To reconstruct Fukushima as early as possible, and to ensure safe and steady progress of decommissioning, the government of Japan has formulated an overall decommissioning schedule, and checks the decommissioning processes accordingly. The government is also committed to updating local people on developments and disseminating information in Japan and abroad.
What will eventually be done with the retrieved fuel debris and radioactive waste?

The government of Japan will consider this, taking full responsibility.

- The retrieved fuel debris and radioactive waste are stored safely within the premises of the Fukushima Daichi Nuclear Power Station for the time being. How to treat or dispose of them will be discussed in depth through further investigations and studies, based on a better understanding of their properties.
- This discussion will take into account opinions from local communities.

The decommissioning work, a major precondition of Fukushima reconstruction, will continue over the period of 30-40 years, and therefore involvement of local people in various ways is essential, such as through nearby businesses supporting the decommissioning (lodging facilities, restaurants, etc.) or as on-site personnel and engineers.

Local communities, including local companies, are also cooperating on decommissioning. The goal is to move the decommissioning project forward in tandem with Fukushima’s reconstruction, where local communities are invigorated as technical expertise and other skills gained through the cooperation serve as a driving force.

The project has also been working closely with IAEA and other international organizations to take advantage of their knowledge and experiences about decommissioning and actively disseminating information on the decommissioning of the Fukushima Daichi Nuclear Power Station to the international community. IAEA has provided assessments and advice on decommissioning at four occasions to date.
Ten years have passed since the accident at the Fukushima Daiichi Nuclear Power Station. In this section, the history of the decommissioning work over these ten years is provided in a chronological table. The project has been carried out safely and steadily to achieve both reconstruction and decommissioning.
The dismantling work was very challenging, requiring remote equipment operation in strong winds. Local partner ABLE, based in Fukushima Prefecture, successfully completed the task. The decommissioning work is progressing step by step with the help of local people.

- **Dec. 2014**: Dismantling of the exhaust stack for Units 1 and 2 completed
- **Nov. 2013**: Fuel removal at Unit 4 began in November 2013. The work progressed steadily, with removal of the entire 1,535 fuel assemblies completed in December 2014.
- **Oct. 2015**: The sea-side impermeable wall is important equipment that blocks contaminated groundwater from entering the sea. It greatly contributes to the stability of the surrounding waters.
- **Dec. 2011**: After more than nine months since the accident occurred, all the reactors reached a cold shutdown state. They have remained in this condition since then.
- **Feb. 2019**: During an internal investigation of Unit 2 in February 2019, deposits believed to be fuel debris were successfully lifted up. This marked a step closer to the critical phase of the decommissioning work.
- **Nov. 2018**: Seven years after the accident occurred, the site environment of the Fukushima Daiichi Nuclear Power Station has improved significantly. Workers are allowed to work in ordinary working clothes in 96% of the on-site area. Visitors to the site are no longer required to change their clothes.
- **Dec. 2018**: The decommissioning Archive Center opened.
- **Mar. 2016**: New main administration building put into service.
**Management of contaminated treated water**

- Treated water re-movable wall construction started (Apr) 2011
- Construction of drainage walls (Apr) 2011
- Construction of contaminated water treatment facilities started (Jun) 2011
- Construction of contaminated water evaporation facilities started (Jun) 2011
- Construction of contaminated water evaporation facilities completed (May) 2013

**Fuel removal from spent fuel pools**

- Unit 1: 1st floor of PCV inspected with robot (May) 2013
- Unit 1: 1st floor of PCV inspected with robot (May) 2013
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2014
- Unit 1: Removal of integration cover started (May) 2014
- Unit 1: Upper part of reactor building surveyed, non-experimental rice growing resumed in fields in previously restricted areas for the first time (Mar) 2015
- Unit 3: Installation of the cover for fuel removal started (Jul) 2015
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2015
- Unit 3: Removal of large rubble (fuel handling machine) from spent fuel pools completed (Aug) 2015
- Unit 4: Fuel removal (1,535 assemblies) from spent fuel pool completed (Dec) 2015
- Unit 4: Fuel removal from spent fuel pool started (Jul) 2016
- Unit 3: Fuel removal from spent fuel pool started (Jul) 2016
- Unit 1: Basement of PCV surveyed with self-propelled machine (Mar) 2017
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2018
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2018
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2018
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2019
- Unit 1: Removal of wall panels of the building cover completed (Mar) 2019
- Unit 3: Lower part of VPP of Unit 3 completed (Aug) 2019
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2019
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2019
- Unit 3: Debris location survey started (May) 2020
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2020
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2020
- Unit 1: Lower part of VPP of Unit 1 completed (Aug) 2020

**Fuel debris retrieval**

- Unit 2: Upper part of reactor building surveyed, non-experimental rice growing resumed in fields in previously restricted areas for the first time (Feb) 2016
- Unit 3: Debris location survey conducted on core areas of Fuel debris location survey based on cosmic ray muons; No fuel found in the core (May) 2016
- Unit 3: Debris location survey conducted on core areas of Fuel debris location survey based on cosmic ray muons; No fuel found in the core (May) 2016
- Unit 3: Location survey conducted on core areas of Fuel debris location survey based on cosmic ray muons; No fuel found in the core (May) 2016
- Unit 3: Lower part of VPP of Unit 3 completed (Dec) 2017

**Other activities, working environment etc.**

- Complete the treatment of stagnant water in buildings*
- Reduce the amount of contaminated water generated from 65% (May) 2013 to one-third of the amount before countermeasures were taken
- Areas not requiring full-face masks expanded to 90%
- Areas requiring protective clothes restricted to 10%
- Commercial fishing resumed in the waters off Fukushima for the first time since the earthquake
- Government evacuation order lifted in town hall building, allowing municipal government to open some areas of Okuma town (Mar) 2013
- Government evacuation order lifted in some areas (Tamaura City)
- Joban Expressway fully opened
- Fukushima Robot Test Field and visitor entrance (fully opened in 2020 after a plagues)
- Converge area bypassing building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Converge area bypassing building building area (completed in May) 2020
- Faultless inspection of steel plate removable wall completed (Dec) 2012
- Faultless inspection of steel plate removable wall completed (Dec) 2012
- Faultless inspection of steel plate removable wall completed (Dec) 2012
- Faultless inspection of steel plate removable wall completed (Dec) 2012
- Faultless inspection of steel plate removable wall completed (Dec) 2012
Step-by-step progress toward the future of Fukushima

Ten years have passed since the accident at the Fukushima Daiichi Nuclear Power Station. The decommissioning work is progressing step by step, but we still have a long way to go. We continue to work steadily toward the reconstruction of Fukushima while putting safety first.
## Basic knowledge about radiation

### Radiation in daily life

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

<table>
<thead>
<tr>
<th>Source of Radiation</th>
<th>Dose per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the air (radon, etc.)</td>
<td>0.48 mSv</td>
</tr>
<tr>
<td>From the soil</td>
<td>0.33 mSv</td>
</tr>
<tr>
<td>From foods</td>
<td>0.99 mSv</td>
</tr>
</tbody>
</table>

Per a year: **2.1 mSv**

Radiation is not infectious.

No genetic effects on future offspring due to radiation exposure have been confirmed.

### Quick reference chart for radiation exposure

**Radiation doses associated with nuclear reactors**
- Surface of fuel immediately after shutdown (tens of thousands of Sv)*
- Surface of vitrified materials (approx. 1,500 Sv)

**Radiation exposure in daily life**
- Man-made radiation
  - Temporary hair loss
  - Infertility
  - Cataracts on the lens of the eye
  - Impairment of the blood cell production system
  - 1 Gy: The risk of death from radiation for a healthy individual if the dose is increased 100 mSv
- Natural radiation
  - Annual dose from the soil in areas with high natural radiation
  - Average exposure to natural radiation per person (approx. 2.1 mSv annually) in Japan

**What’s the difference between radioactive materials, radioactivity, and radiation?**
- The becquerel (Bq) is a unit that shows the amount of radioactivity, which is the ability to emit radiation.
- The sievert (Sv) is a unit that shows the degree of impact of radiation on the human body. The imparted effect varies depending on the nuclide, even with the same becquerel value, and therefore it is important to make determinations using sieverts (effective dose) when comparing health effects.

### Safety of food from Fukushima Prefecture

Based on the world’s strictest standard of radioactive materials inspection on food and drinking water from Fukushima Prefecture, the safety is ensured and all products that are shipped to the market are within standard values. After the accident, 54 countries/regions imposed import restrictions on food from Fukushima. The restrictions have gradually been eased since then, with 39 countries/regions having fully lifted them. *As of January 2021*

### Air dose rates in Fukushima

Air dose rates in Fukushima are almost at the same level as those in major cities and at major sightseeing spots inside and outside Japan.
reactor buildings has been proceeding in order to reduce the fission ability has weakened. At the Fukushima Groundwater pumped up from the sub-drain is purified to prevent the influx of groundwater into the building and efflux of radioactive materials derived from nature. Therefore, due to geological difference, there are rate gaps among regions, and weather condition also fluctuates the air dose rate.

A metal vessel housing the turbine generator. The Fukushima Daiichi NPS, the building is located on the side of the reactor building.

One of the measures for "preventing leakage" of contaminated water. The facility prevents contaminated water from leaking into the sea by pumping up the groundwater blocked by the sea-side impermeable wall and purifying it before discharging it into the sea.

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

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 mountain side to the sea side.

A radioisotope of hydrogen. This is produced not only by nuclear reactors, but also in nature by contact between cosmic rays and the earth's atmosphere. It is present in rivers and the ocean in the form of "tritiated water" combined with oxygen. Tritium is also contained in rainwater, tap water, and water vapor in the atmosphere, but the radiation emitted by tritium has extremely low energy, and thus has little effect on the human body.

Equipment that prevents building damage by automatically failing and releasing pressure when pressure in the reactor building has increased.

A common facility for radioactive waste treatment and storage for all the 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.

A concrete structure supporting the reactor pressure vessel.

This is produced during fission of uranium fuel. 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 2.3 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 100Bq/kg.)

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.

Water, set forth by WHO (World Health Organization), as a standard. (The standard for general foods in Japan is 100Bq/kg.)

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.

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

A well 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.

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.)

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.

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

A container for spent fuel and other materials. It is used to store fuel removed from the common pool on a hill.

The radiation dose present in a certain space, converted to a value per unit time. This includes more than radiation derived from the accident. It is also affected by radioactive materials derived from nature.