Outline of Decommissioning, Contaminated Water and Treated Water Management

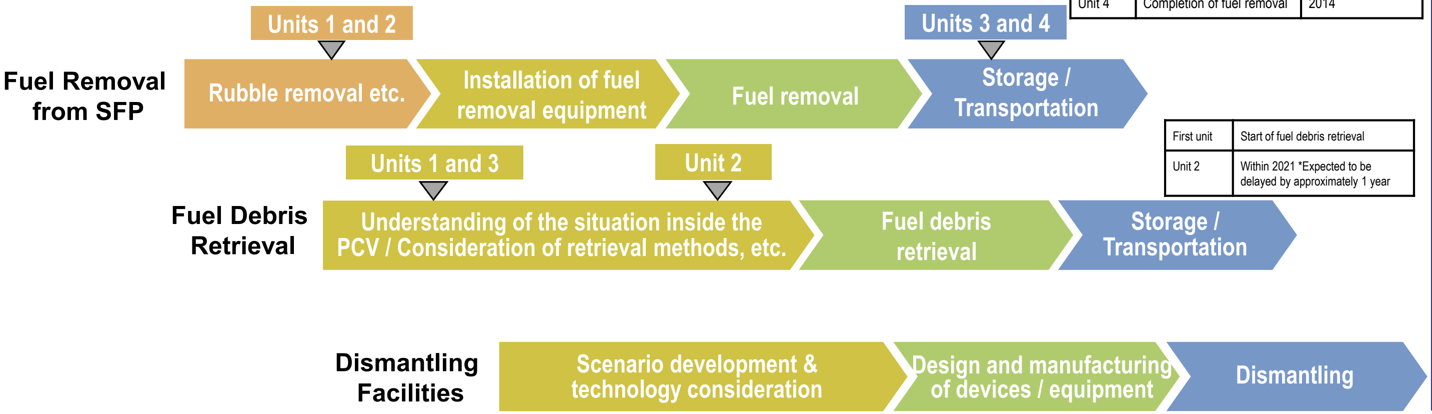
April 27, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

Main decommissioning work and steps

Fuel removal from the spent fuel pool was completed in December 2014 at Unit 4 and on February 28, 2021 at Unit 3.
Work continues sequentially toward the start of fuel removal from Units 1 and 2 and debris (Note 1) retrieval from Units 1-3.

(Note 1) Fuel assemblies having melted through in the accident.

Units 1-6	Completion of fuel removal	Within 2031
Unit 1	Start of fuel removal	FY2027 - FY2028
Unit 2	Start of fuel removal	FY2024 - FY2026
Unit 3	Completion of fuel removal	Within FY2020
Unit 4	Completion of fuel removal	2014

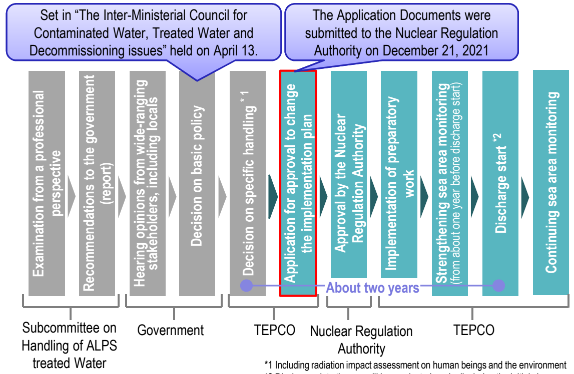


First unit	Start of fuel debris retrieval
Unit 2	Within 2021 *Expected to be delayed by approximately 1 year

Measures of treated water

Handling of ALPS treated water

Regarding the discharge of ALPS treated water into the sea, TEPCO must comply with regulatory and other safety standards to safeguard the public, the surrounding environment and agricultural, forestry and fishery products. To minimize adverse impacts on reputation, monitoring will be further enhanced and objectivity and transparency ensured by engaging with third-party experts and having safety checked by the IAEA. Moreover, accurate information will be disseminated with full transparency on an ongoing basis.



*1 Including radiation impact assessment on human beings and the environment
*2 Discharges into the sea will be conducted gradually during the initial phase

Contaminated water management – triple-pronged efforts -

(1) Efforts to promote contaminated water management based on the three basic policies

① "Remove" the source of water contamination ② "Redirect" fresh water from contaminated areas
③ "Retain" contaminated water from leakage

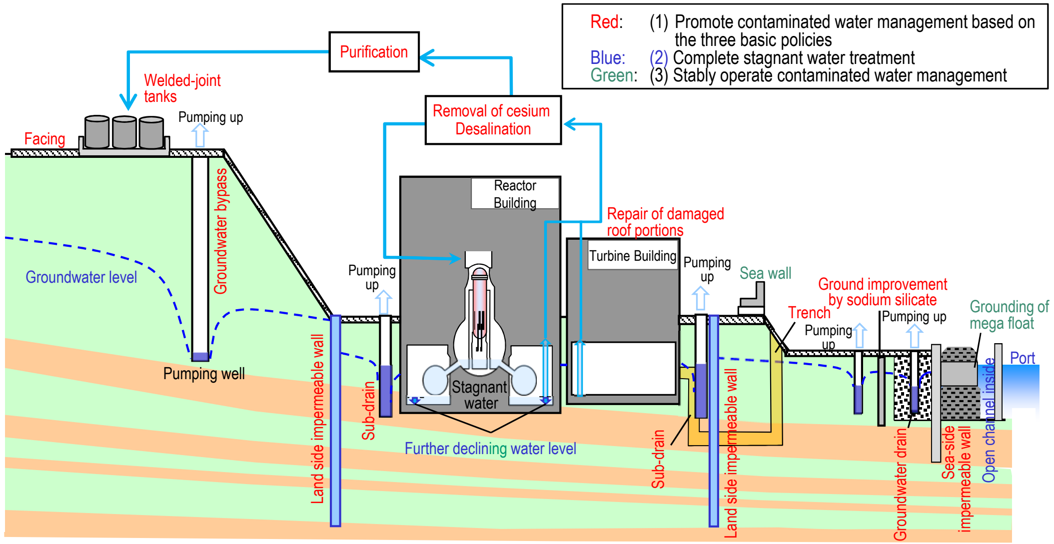
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized the groundwater at a low level and the increased contaminated water generated during rainfall is being suppressed by repairing damaged portions of building roofs, facing onsite, etc. Through these measures, the generation of contaminated water was reduced from approx. 540 m^3/day (in May 2014) to approx. 130 m^3/day (in FY2021).
- Measures continue to further suppress the generation of contaminated water to 100 m^3/day or less within 2025.

(2) Efforts to complete stagnant water treatment

- To reduce the stagnant water levels in buildings as planned, work to install additional stagnant water transfer equipment is underway. At present, the floor surface exposure condition can be maintained except for the Unit 1-3 Reactor Buildings, Process Main Building and the High-Temperature Incinerator Building.
- In 2020, treatment of stagnant water in buildings was completed, except for the Unit 1-3 Reactor Buildings, Process Main Building and High-Temperature Incinerator Building. For Reactor Buildings, the amount of stagnant water there will be reduced to about half the amount at the end of 2020 during the period FY2022-2024.
- For zeolite sandbags on the basement floors of the Process Main Building and High-Temperature Incinerator Building, measures to reduce the radiation dose are being examined with stabilization in mind.

(3) Efforts to stably operate contaminated water management

- Various measures are underway to prepare for tsunamis. For heavy rain, sandbags are being installed to suppress direct inflow into buildings while work to close openings in buildings and install sea walls to enhance drainage channels and other measures is being implemented as planned.



Progress Status and Future Challenges of the Mid-and-Long-Term Roadmap toward Decommissioning of TEPCO Holdings Fukushima Daiichi Nuclear Power Station (Outline)

Progress status

◆ The temperatures of the Reactor and the Primary Containment Vessel of Units 1-3 have been maintained stable.
There was no significant change in the concentration of radioactive materials newly released from Reactor Buildings into the air. It was concluded that the comprehensive cold shutdown condition had been maintained.

FY2021 evaluation on the amount of contaminated water generated and the status of examination about measures to suppress groundwater into the buildings

After implementing muti-layered contaminated water management measures, including repairing building roofs and facing around the buildings, the amount of contaminated water generated within FY2021 declined to approx. 130 m^3/day and the groundwater inflow into the buildings is considered suppressed.

Subsequently, measures including facing on the mountain side of Units 1-4 and repairing of the Unit 1 R/B roof will be implemented as part of ongoing efforts to suppress the amount of contaminated water generated to 100m^3/day or less within 2025.

As measures to further suppress inflow, local water stoppage measures will be implemented for units with significant groundwater inflow. Beginning with Unit 3, an investigation into building penetrations or others and operation tests on water stoppages are being considered.

In work to extend Drainage Channel D, drilling for the propulsion pipe was completed

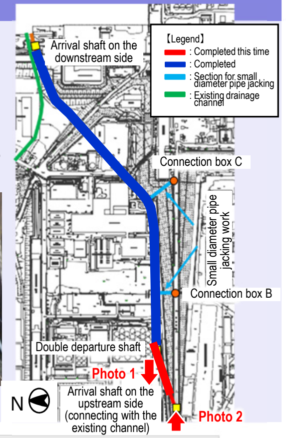
To eliminate the risk of heavy rain from an early stage, work to extend Drainage Channel D is underway.

Drilling started from September 2021, reached the arrival shaft on the downstream side in January and the upstream side on April 21.

Work, including installing monitoring facilities, will continue to proceed safely toward an operational launch.


<(1) Inside the upstream side propulsion pipe>


<(2) Upstream side propulsion pipe reached>



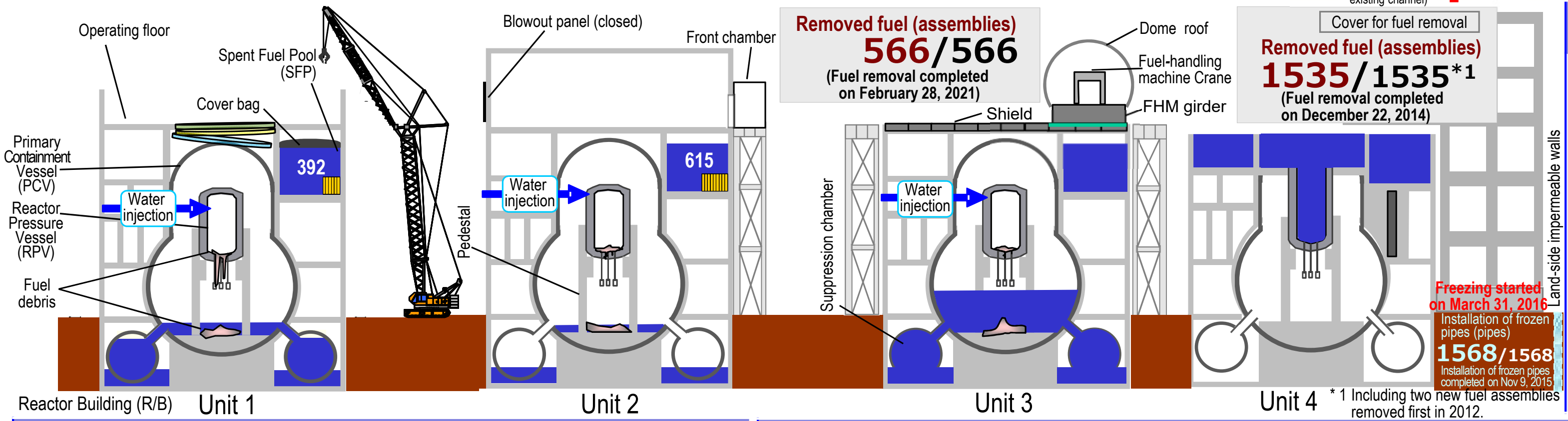
Unit 1 Progress of the internal investigation into the Primary Containment Vessel (PCV)

The internal investigation into the Unit 1 PCV was suspended because the PCV water level declined after the earthquake on March 16.

Subsequently, images could no longer be transmitted properly due to water infiltrating the camera mounted on the submersible ROV-A2. An investigation into the cause identified damage to a wrinkle formed on the cable coating.

To prevent recurrence, part of the investigative route will be changed and work procedures will be revised to suppress wrinkles on cable coating.

At present, adjustment is underway to stably maintain the necessary PCV water level and resume the investigation.



Unit 2 Progress of trial fuel debris retrieval

As preliminary work for the trial retrieval of Unit 2 fuel debris, an isolation room is being installed.

When the installation status of the isolation room was checked, damage was detected in the rubber housing the handle of the X-6 penetration. Moreover, when the shielding door of the isolation room was opened and closed, a malfunction was also detected.

As the opening of the X-6 penetration hatch will start after the isolation room is installed, response to the damage detected in that room is being examined.

Unit 1 Progress of work to help fuel removal

Before installing a large cover, the investigation of external walls on the western, northern and eastern sides of the Reactor Building was completed. Subsequently, from April 13, drilling to install an anchor in the building started.

To reduce the exposure risk of workers, work proceeds carefully using a remotely-operated anchor drilling equipment and suctioning dust.

Moreover, during work, the dust concentration is monitored by on-site dust monitors to check for any significant fluctuation.

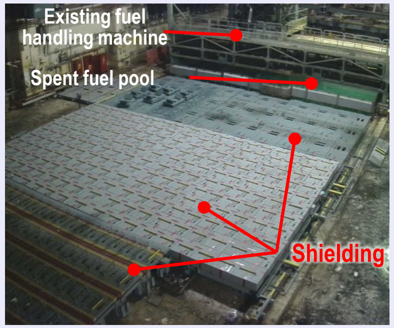
<On-site status (from northwest)>
(photo: April 12, 2022)

Unit 2 Progress of work to help fuel removal

Around the building, from October 2021, ground improvement work started before installing the gantry for fuel removal and was completed on April 19. Subsequently, work to install the gantry foundation will proceed.

Outside the site, work to prepare a yard for ground assembly of steel frames was completed on March 18. Before the ground assembly from July, preliminary work will proceed.

Inside the building, work to install shielding over the reactor is underway and will be completed by the end of May.



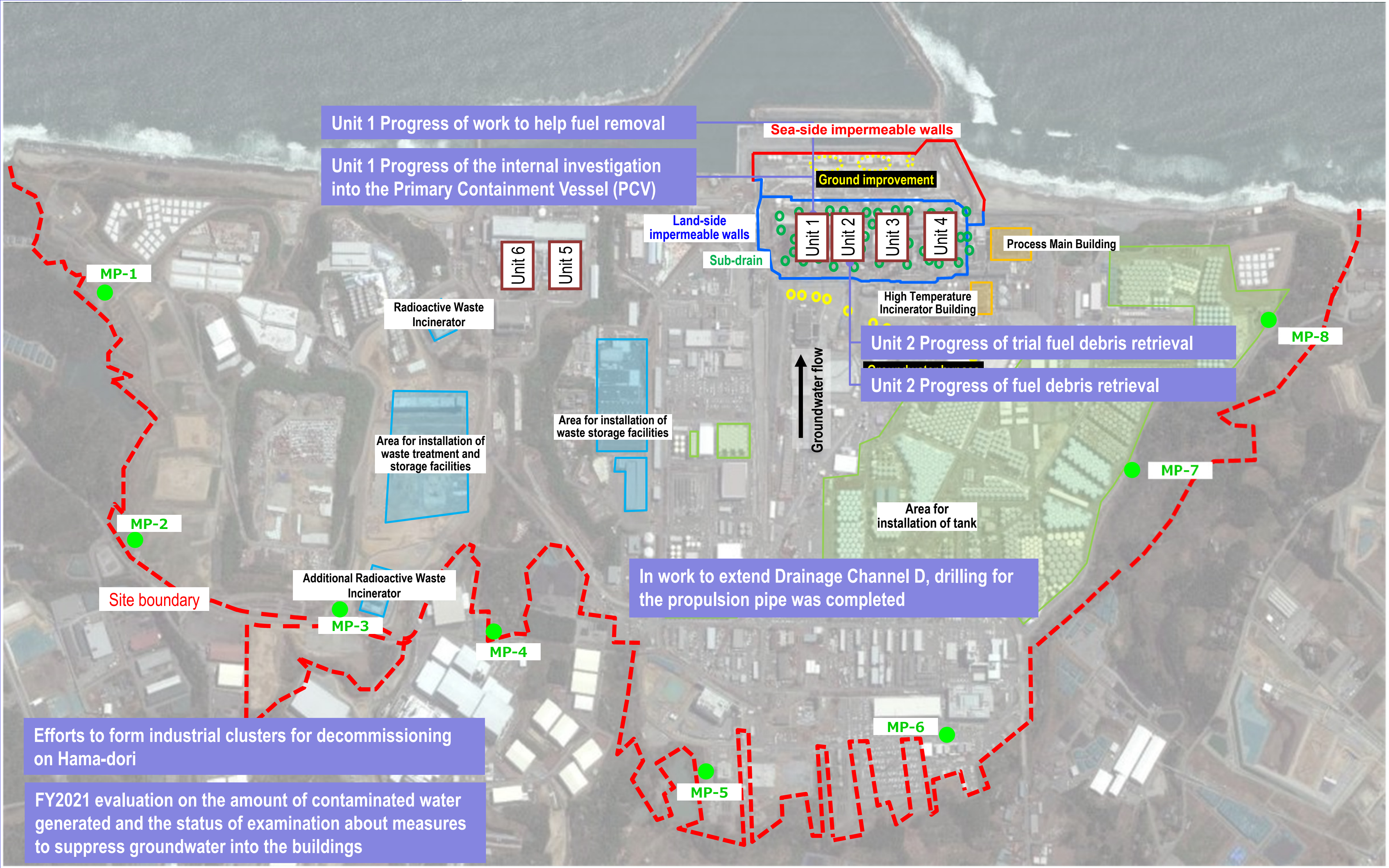
<Installation of shielding>

Efforts to form industrial clusters for decommissioning on Hama-dori

TEPCO HD and its partner companies concluded a basic agreement on a "Fuel Debris Retrieval Engineering Company" and a "Decommissioning Related Products Factory" to be established in the 2020s. TEPCO HD plans to integrate the development, manufacturing, operation, storage, and recycling necessary for the decommissioning on Hama-dori to achieve both reconstruction and decommissioning.

By establishing various decommissioning-related facilities on an ongoing basis, TEPCO HD is committed to helping promote the economy, create employment, develop human resources, and create property in Hama-dori.

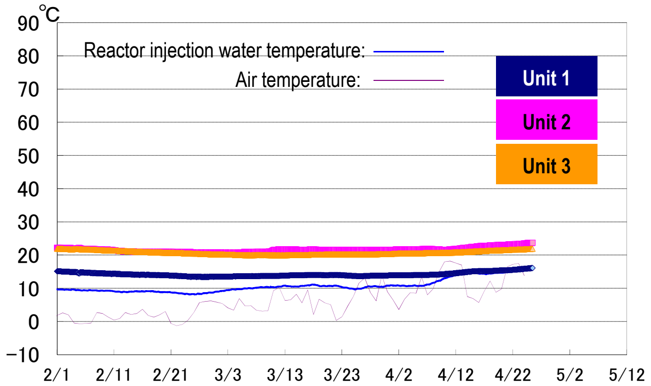
Major initiatives – Locations on site



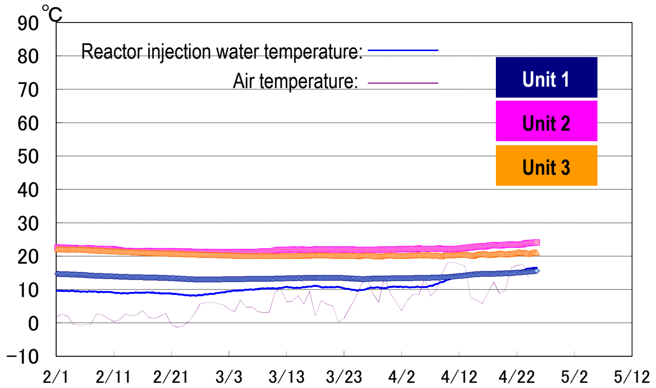
I. Confirmation of the reactor conditions

Temperatures inside the reactors

Through continuous reactor cooling by water injection, the temperatures of the Reactor Pressure Vessel (RPV) bottom and the Primary Containment Vessel (PCV) gas phase were maintained within the range of approx. 15 to 30°C for the past month, though it varied depending on the unit and location of the thermometer.

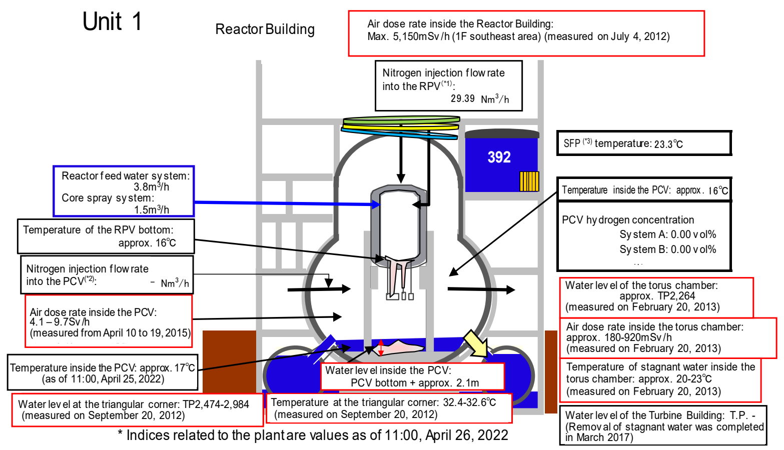


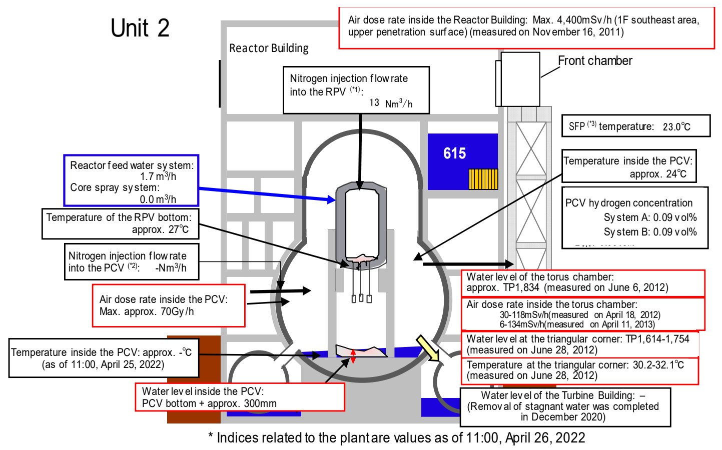
RPV bottom temperatures (recent quarter)

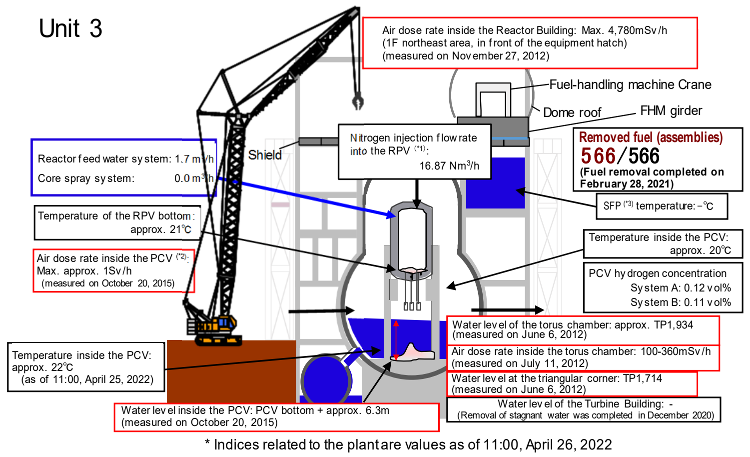


PCV gas phase temperatures (recent quarter)

*1 The trend graphs show part of the temperature data measured at multiple points.
*2 A part of data could not be measured due to maintenance and inspection of the facility and other work.





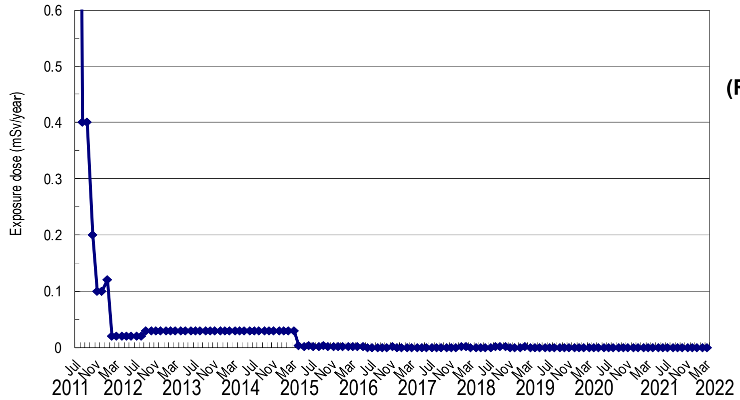


(*1) RPV (Reactor Pressure Vessel)
(*2) PCV (Primary Containment Vessel)
(*3) SFP (Spent Fuel Pool)

Release of radioactive materials from the Reactor Buildings

As of March 2022, the concentration of radioactive materials newly released from Reactor Building Units 1-4 into the air and measured at the site boundary was evaluated at approx. 2.2×10^{-12} Bq/cm³ and 2.0×10^{-12} Bq/cm³ for Cs-134 and -137 respectively, while the radiation exposure dose due to the release of radioactive materials there was less than 0.00004 mSv/year.

Annual radiation dose at site boundaries by radioactive materials (cesium) released from Reactor Building Units 1-4



(Reference)

* The concentration limit of radioactive materials in the air outside the surrounding monitoring area:
  [Cs-134]: 2 x 10^{-5} Bq/cm³
  [Cs-137]: 3 x 10^{-5} Bq/cm³
* Data of Monitoring Posts (MP1-MP8).
  Data of Monitoring Posts (MPs) measuring the air dose rate around the site boundary showed 0.336 – 1.078 μSv/h (March 30 – April 25, 2022).
  To measure the variation in the air dose rate of MP2-MP8 more accurately, work to improve the environment (trimming trees, removing surface soil, and shielding around the MPs) was completed.

Note 1: Different formulas and coefficients were used to evaluate the radiation dose in the facility operation plan and monthly report. The evaluation methods were integrated in September 2012. As the fuel removal from the spent fuel pool (SFP) commenced for Unit 4, the radiation exposure dose from Unit 4 was added to the items subject to evaluation since November 2013. The evaluation has been changed to a method considering the values of continuous dust monitors since FY2015, with data to be evaluated monthly and announced the following month.

Note 2: Radiation dose was calculated using the evaluation values of release amount from Units 1-4 and Units 5 and 6. The radiation dose of Unit 5 and 6 was evaluated based on expected release amount during operation until September 2019 but the evaluation method was reviewed and changed to calculate based on the actual measurement results of Units 5 and 6 from October.

Other indices

There was no significant change in indices, including the pressure in the PCV and the PCV radioactivity density (Xe-135) for monitoring criticality, nor was any anomaly in the cold shutdown condition or criticality sign detected.

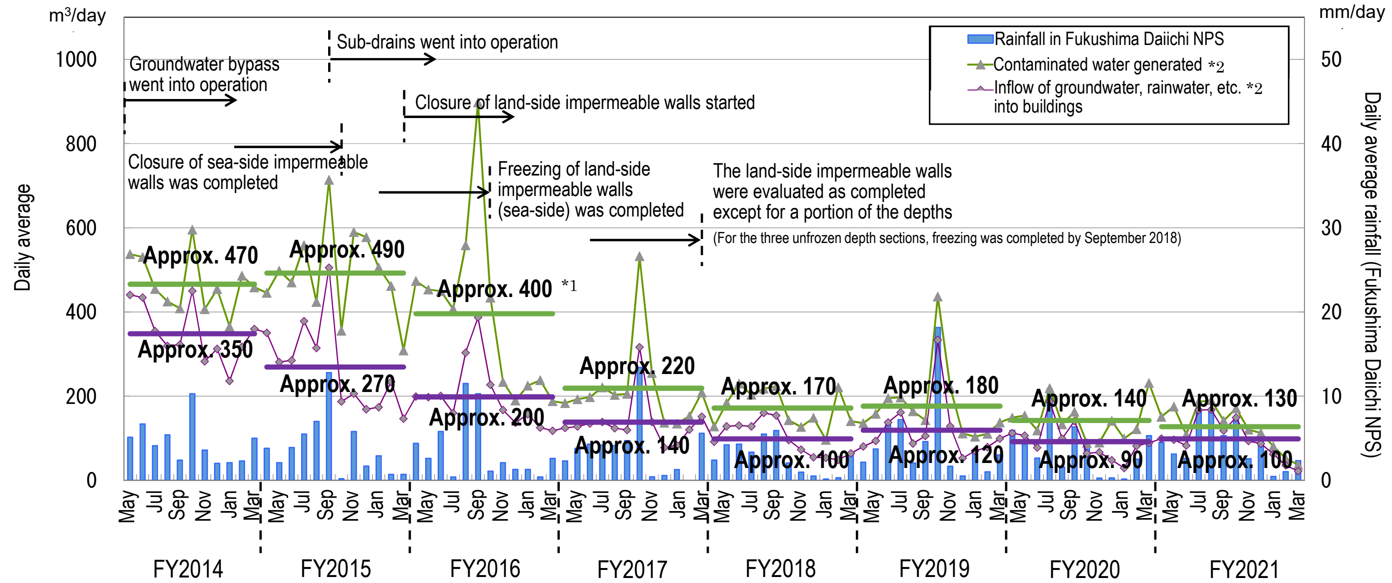
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

II. Progress status by each plan

Progress and others concerning ALPS treated water and others

➢ Status of contaminated water generated

- Multi-layered measures, including pumping up by sub-drains and land-side impermeable walls, which were implemented to control the continued generation of contaminated water, suppressed the groundwater inflow into buildings.
- After implementing "redirecting" measures (groundwater bypass, sub-drains, land-side impermeable walls and others) and rainwater prevention measures, including repairing damaged portions of building roofs, the amount of contaminated water generated within FY2021 declined to approx. 130 m³/day.
- Measures will continue to further reduce the amount of contaminated water generated.



*1 Values differ from those announced at the 20th Committee on Countermeasures for Contaminated Water Treatment (held on August 25, 2017) because the method of calculating the contaminated water volume generated was reviewed on March 1, 2018. Details of the review are described in the materials for the 50th and 51st meetings of the Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment.
*2: The monthly daily average is derived from the daily average from the previous Thursday to the last Wednesday, which is calculated based on the data measured at 7:00 on every Thursday.

Figure 1: Changes in contaminated water generated and inflow of groundwater and rainwater into buildings

Operation of the Water-Treatment Facility special for Sub-drain & Groundwater drains

- At the Water-Treatment Facility special for Sub-drain & Groundwater drains, release started from September 14, 2015 and up until April 18, 2022, 1,820 releases had been conducted.
- The water quality of all temporary storage tanks satisfied the operation target.

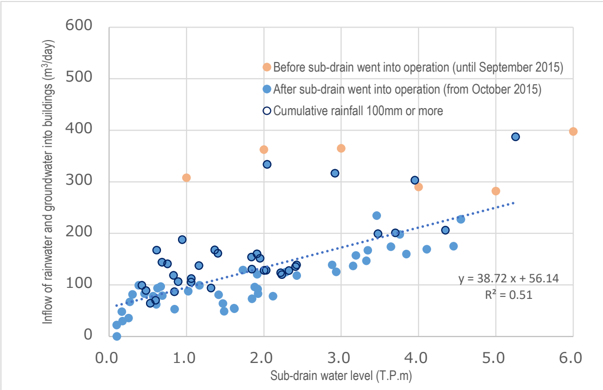


Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

Implementation status of facing

- Facing is a measure involving asphalting the on-site surface to reduce the radiation dose, prevent rainwater infiltrating the ground and reduce the amount of underground water flowing into buildings. As of the end of March 2022, 95% of the planned area (1,450,000 m² on site) had been completed. For the area inside the land-side impermeable walls, implementation proceeds appropriately after constructing a yard from implementable zones that leave the decommissioning work unaffected. As of the end of March 2022, 30% of the planned area (60,000 m²) had been completed.

Status of the groundwater level around buildings

- The groundwater level in the area inside the land-side impermeable walls has been declining every year. On the mountain side, however, the difference between inside and outside was maintained, despite varying during rainfall. The water level of the groundwater drain observation well has been maintained at approx. T.P. +1.4 m, sufficiently below the ground surface (T.P. +2.5 m).

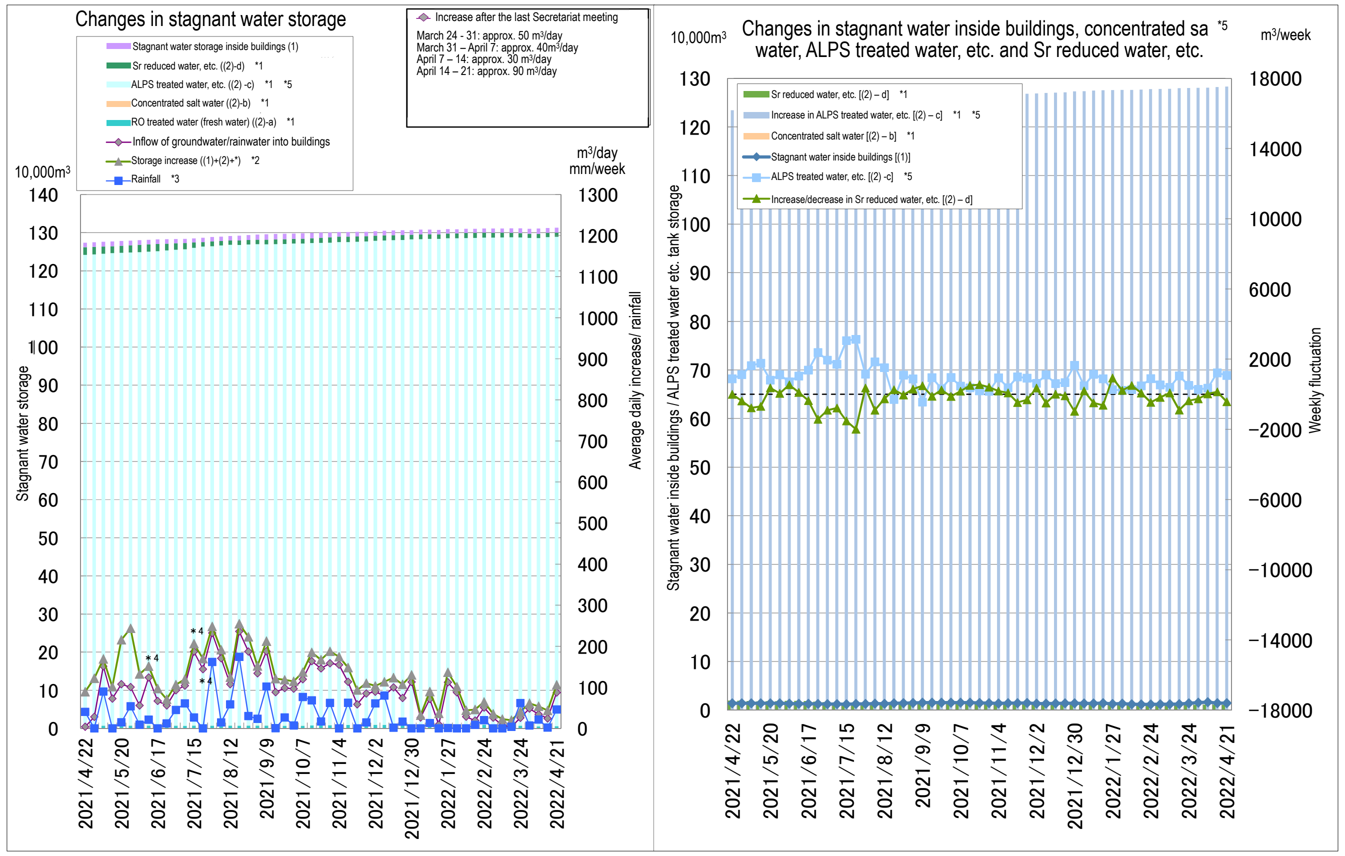
Operation of multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing), hot tests using radioactive water are conducted (System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013). On March 23, 2022, a pre-service inspection certificate was granted by the Nuclear Regulation Authority and the entire pre-service inspection was completed. The multi-nuclide removal equipment (additional) went into full-scale operation from October 16, 2017. Regarding the multi-nuclide removal equipment (high-performance), hot tests using radioactive water are underway (from October 18, 2014).
- As of April 21, 2022, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 481,000, 733,000 and 103,000 m³, respectively (including approx. 9,500 m³ stored in the J1(D) tank, which contained water with highly concentrated radioactive materials at the System B outlet of the existing multi-nuclide removal equipment).
- Treatment measures comprising the removal of strontium by cesium-adsorption apparatus (KURION), the secondary cesium-adsorption apparatus (SARRY) and the third cesium-adsorption apparatus (SARRY II) continued. Up until April 21, 2022, approx. 673,000 m³ had been treated.

Risk reduction of strontium-reduced water

- To reduce the risks of strontium-reduced water, treatment using existing, additional and high-performance multi-nuclide removal equipment is underway. Up until April 21, 2022, approx. 838,000 m³ had been treated.

As of April 21, 2022



*1: Water amount for which the water-level gauge indicates 0% or more
*2: To detect storage increases more accurately, the calculation method was reviewed as follows from February 9, 2017: (The revised method was applied from March 1, 2018) [(Inflow of groundwater/rainwater into buildings) + (other transfer) + (chemical injection into ALPS)]
*3: Changed from December 13, 2018 from rainfall in Namie to that within the site.
*4: Considered attributable to the fluctuation inflow of groundwater, rainwater, and others to buildings due to the decline in the level of contaminated water in buildings. (June 3-10 and July 8-22, 2021)
*5: The notation of treated water by the multi-nuclide removal equipment and others was reviewed in accordance with redefining of ALPS treated water by the Government (April 27, 2021)

Figure 3: Status of stagnant water storage

Status of review about the handling of zeolite sandbags

- On the second basement level (lowest floor) of the Process Main Building (PMB) and High-Temperature Incinerator Building (HTI), a high radiation dose was measured at zeolite and activated carbon sandbags, which had been installed to adsorb radioactive materials in contaminated water in buildings. In response, countermeasures are being examined, centering on underwater collection, which is expected to help provide a water-shielding effect.
- A detailed design of the facility to handle zeolite sandbags and others will be formulated in future, but the seismic class will be set to B because the estimated radiation influence on the site boundaries is 5mSv / event based on the scenario set for the time of the accident and the facility is expected to be used for a short period.
- Regarding the containment function, work to enclose in containers will be conducted in a sealed state, a house will be installed as a work area and openings to the basement will be closed. Moreover, assuming that the work is conducted inside the building, the building itself will function as a boundary.
- Measures to prevent scattering of gas containing radioactive materials in the event of leakage will be implemented, including installing exhausters equipped with filters in the house. Moreover, the dust concentration will also be managed during the work. In the plan, compressed air and other media will be exhausted via filters or discharged into the basement.
- Regarding the mockup, it was confirmed to date that zeolite can be transferred remotely without any problem. For the forthcoming detailed design, a mockup for work to collect and enclose in containers, which further simulates the on-site environment, will be conducted.

Status of response to the Unit 1/2 exhaust stack drain sump pit

- For the Unit 1/2 exhaust stack drain sump pit, in which highly concentrated contaminated water was detected, drain facilities were installed to prevent any leakage outside the system and measures implemented to suppress inflow to the pit. However, the inflow continued.

- In March, the inside of the pit was investigated by a camera and it was determined that the manhole located in the area southeast of the pit was the cause of the inflow. To suppress the inflow, the manhole lid will be replaced within April and the effectiveness of countermeasures will be verified.

Work to construct the main body of the Japan Trench Tsunami Seawall commenced

- For work to construct the Japan Trench Tsunami Seawall, work to reinforce the slope in front of Units 1-4 (installing concrete wall material and embankment), which started from June 2021, proceeded steadily. Subsequently, work to install concrete material for the main seawall body and others commenced from February, part of which reached a height of T.P. 13.0m.
- Work continues as planned with completion scheduled for late FY2023.

Fuel removal from the spent fuel pools

Work to help remove spent fuel from the pool is progressing steadily while ensuring seismic capacity and safety.

Main work to help spent fuel removal at Unit 1

- From late April 2021, work to assemble a temporary gantry and others has been underway in a yard outside the site as part of efforts to install a large cover.
- A work yard was prepared around the Reactor Building and work to install a large cover started from August 2021.
- Before installing the anchor of the large cover, the exterior walls of the Reactor Building were investigated. An investigation of representative parts on the west side of the building revealed that both cracking and concrete strength were within the assumed range and that the anchor would be installable as planned.
- From April 13, 2022, drilling to install an anchor in the building started. Work has proceeded carefully; mitigating the exposure risk of workers using a remotely operated anchor drilling equipment and suctioning dust.
- Moreover, during work, the dust concentration is monitored by on-site dust monitors to check for any significant fluctuation.

Main work to help spent fuel removal at Unit 2

- Decontamination to suppress dust scattering on the top floor of the Reactor Building was completed in December 2021. Contamination reduction was confirmed based on smear sampling results. Installation of shielding started from February within the range including the reactor well, where the highest dose was observed and will be completed at the end of May.
- From October 28, 2021, ground improvement work started before installing the gantry for fuel removal and was completed on April 19, 2022, and work to install the gantry foundation will then proceed.
- Outside the site, work to prepare a yard for ground assembly of steel frames was completed on March 18. Before the ground assembly from July, preparation will proceed.

Retrieval of fuel debris

Progress status toward Unit 1 PCV internal investigation

- To acquire information related to the construction plan to collect deposits and others toward fuel debris retrieval, a remotely operated underwater vehicle (ROV) will be inserted into the basement within the PCV from X-2 penetration to investigate inside and outside the pedestal.
- From November 5, preliminary work is underway, such as covering the work area and installing equipment and materials in the on-site headquarters and the remote operation room, before the PCV internal investigation.
- On January 12, when powering on investigative equipment such as the submersible ROV sequentially, a malfunction was detected, whereby the dosimeter data incorporated in the submersible ROV was not displayed correctly. Work was temporarily suspended.
- For February 4-7, after implementing countermeasures for the above event, the operation was verified and no recurrence was confirmed. Work to resume the investigation was conducted.
- On February 8, the submersible ROV-A was inserted into the PCV and guide rings were installed at four points by February 9.
- With these preparations completed, on March 14, the submersible ROV-A2 was inserted to commence “a detailed visual inspection of the outside pedestal perimeter.”
- After the Fukushima Prefecture Off-coast Earthquake on March 16, the PCV water level declined. To obtain the water level necessary for the investigation, the water injection rate into the reactor was increased.
- On March 29, the water level was checked by the submersible ROV-2. An increase in water level was confirmed but due to transparency loss of the mounted camera and others, the investigation was suspended.
- The investigation into the cause for the loss of image transmission due to water infiltration detected damage to a wrinkle made on the cable coating.
- To prevent recurrence, part of the investigative route will be changed and the work procedures revised to suppress wrinkles on cable coating. At present, adjustment is underway to stably maintain the necessary PCV water level for resuming the investigation.

Progress status toward Unit 2 PCV internal investigation and trial retrieval

- The trial retrieval equipment for Unit 2 fuel debris, which had been developed in the UK, arrived in Japan on July 10.
- The ongoing performance verification test in a domestic factory (Kobe), which started from August, finished on January 21.
- The equipment was transported from January 28 and the robot arm arrived on January 31 and the enclosure, on February 4, at the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA) (hereinafter referred to as the “Naraha mockup facility”).
- From February 14, the performance verification test and operational training started at the Naraha mockup facility.

Response to work for the Unit 3 PCV intake facility

- As a measure to improve earthquake resistance, there is a plan to decrease the PCV (S/C) water level gradually.
- Installation of the PCV intake facility was started from October 2021 and completed in March 2022.
- From March 28 to late April, filtered water and S/C retained water are being collected to verify the operation of the intake pumps, performance of the flow control valve and others. On April 26, the facility will undergo a system test of the pre-service inspection.
- The PCV intake facility will go into operation after the test to stop water injection into the Unit 3 reactor.

Status of work to remove a portion of the pipes of the Units 1 and 2 standby gas treatment system (SGTS)

- When cutting the Units 1/2 SGTS pipes, the wire saw blade of the cutter bit into the pipe. An investigation into the cause and examination of possible countermeasures are underway.
- The cause for the wire saw blade biting into the pipe is considered highly attributable to the upstream side (Unit 2 side) of the pipe used for cutting sinking under its own weight during the cutting process, compressive force being applied to the cut surface and the wire saw subsequently biting into the pipe.
- Countermeasures are being examined, including holding the Unit 2 side of the pipe and lifting it to the upper side by crane to reduce the compressive force. The cutter angle will also be adjusted and the cutting area around the cut part reduced to prevent biting. Outside the site, using mockup pipes, the biting event will be reproduced and countermeasures verified.

Analysis results of samples acquired in the Fukushima Daiichi Nuclear Power Station (NPS)

- In the Fukushima Daiichi NPS, with decommissioning progressing, samples can be acquired from the inside of the Units 1-3 Primary Containment Vessel (PCV) and related facilities which were previously unavailable due to issues such as the high-dose environment.
- Information obtained through detailed analysis of these samples will be utilized in future decommissioning such as examination of fuel debris distribution and the chemical properties of fission products (FP). For this purpose, a the analysis results of samples were evaluated in collaboration with the Countermeasures for Decommissioning and

Contaminated Water Management "Advancement of Comprehensive Grasping of Inner Reactor" and "Development of Technologies for Grasping and Analyzing Properties of Fuel Debris."

- To date, by analyzing and evaluating focused on U-containing particles, the fine particle formation process has been outlined.
- This time, for samples acquired from the inside of the pipe for the Units 1/2 standby gas treatment system (SGTS) which was assumed to be the main transport route during the PCV vent at the time of the accident, properties focused on fuel constituent (U) and volatile FP (Te and Cs) were evaluated based on the analysis results by the scanning and transmission electron microscopes (SEM/TEM). This evaluation allowed the inner reactor environment (temperature, atmosphere and others) at the time of particle formation and transport behavior (form and route) of volatile FP to be estimated.
- From the analysis results, limited but certain information related to a review of the accident progress was obtained, such as the environment at the time of particle formation, transport behavior of volatile FP and the existence of elements having affected the melting behavior of fuel debris.

Plans to store, process and dispose of solid waste and decommission of reactor facilities

Promoting efforts to reduce and store waste generated appropriately and R&D to facilitate adequate and safe storage, processing and disposal of radioactive waste

➢ Management status of the rubble and trimmed trees

- As of the end of March 2022, the total storage volume for concrete and metal rubble was approx. 323,300 m^3 (+4,700 m^3 compared to the end of February with an area-occupation rate of 86%). The total storage volume of trimmed trees was approx. 139,800 m^3 (-700 m^3, with an area-occupation rate of 80%). The total storage volume of used protective clothing was approx. 29,000 m^3 (+1,000 m^3, with an area-occupation rate of 55%). The increase in rubble was attributable to work around Units 1-4, general waste on-site, decontamination of flanged-tanks, work related to the port, work related to tanks, work related to the water-treatment facilities, transfer for area arrangement and others. As of the end of March 2022, there were 13 temporary deposits with storage capacity exceeding 1,000m^3 and a total storage volume of 51,800 m^3.

➢ Management status of secondary waste from water treatment

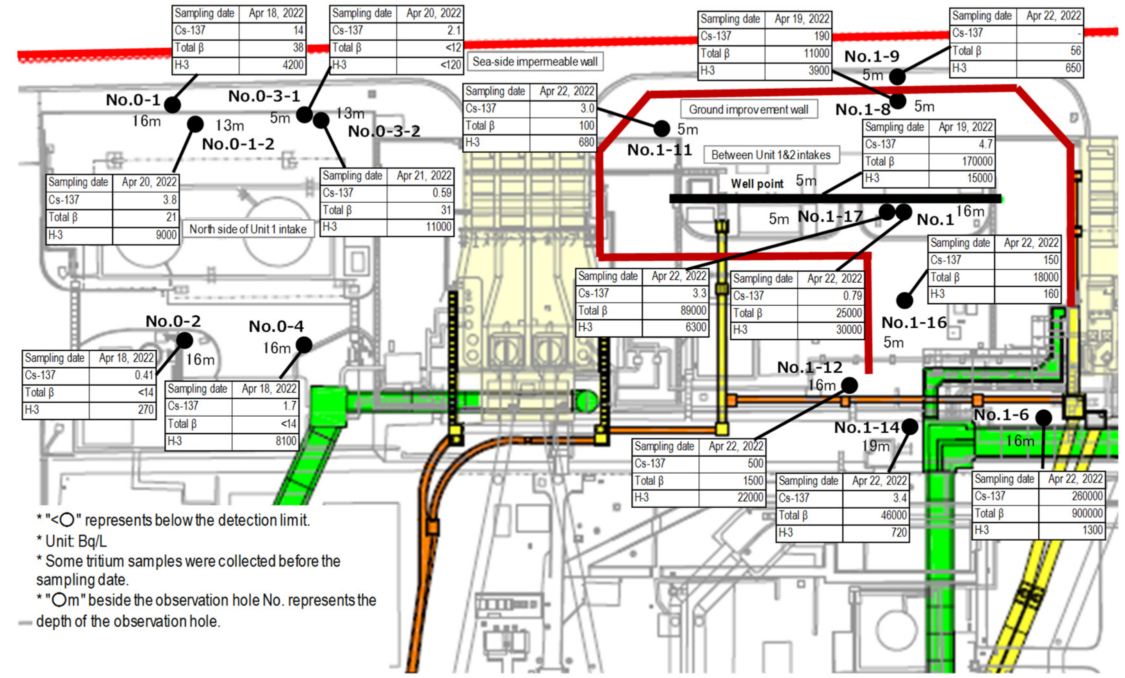
- As of March 31, 2022, the total storage volume of waste sludge was 472 m^3 (area-occupation rate: 67%), while that of concentrated waste fluid was 9,323 m^3 (area-occupation rate: 91%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment and other vessels, was 5,328 (area-occupation rate: 84%).

Reduction in radiation dose and mitigation of contamination

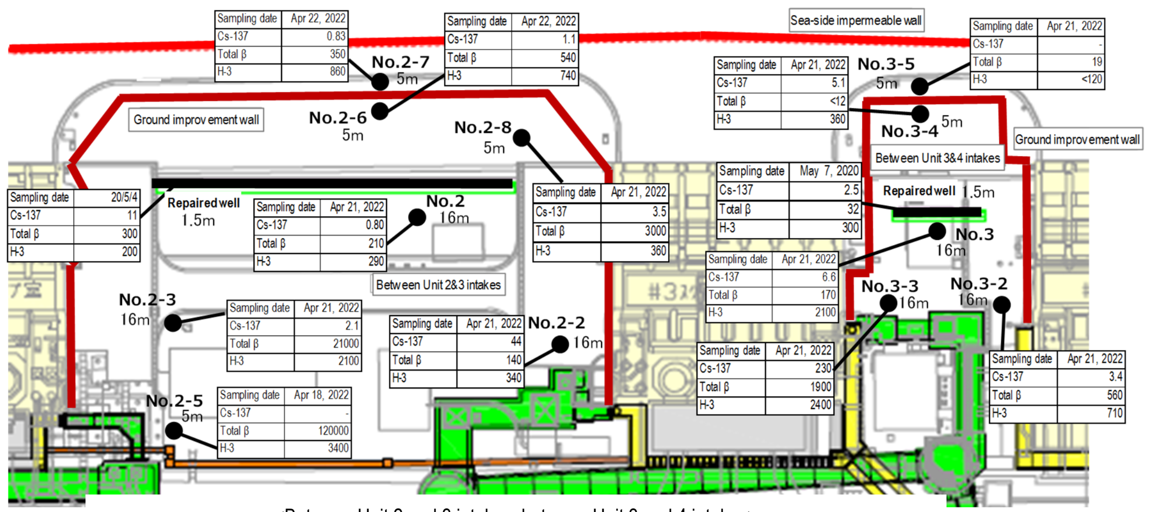
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

➢ Status of groundwater and seawater on the east side of Turbine Building Units 1-4

- In the Unit 1 intake north side area, the H-3 concentration was below the legal discharge limit of 60,000 Bq/L at all observation holes and remained constant or has been declining overall. The concentration of total β radioactive materials has remained constant overall but increased temporarily from April 2020 and is even increasing or declining at many observation holes at present, including Nos. 0-1-2, 0-3-1, 0-3-2 and 0-4. The trend continues to be monitored carefully.
- In the area between the Unit 1 and 2 intakes, the H-3 concentration has remained below the legal discharge limit of 60,000 Bq/L at all observation holes. It has been increasing or declining at Nos. 1-14 and 1-17 but has otherwise remained constant or been declining overall. The concentration of total β radioactive materials has remained constant overall but been increasing at No. 1-6 and increasing or declining at many observation holes, including Nos. 1-9, 1-11, 1-12, 1-14, 1-16 and 1-17. The trend continues to be monitored carefully.
- In the area between the Unit 2 and 3 intakes, the H-3 concentration has been below the legal discharge limit of 60,000 Bq/L at all observation holes. It has been increasing and declining at Nos. 2-3 and 2-5 but has remained constant overall. The concentration of total β radioactive materials has remained constant overall but been increasing or declining at Nos. 2-3, 2-5 and 2-6. The trend continues to be monitored carefully.
- In the area between the Unit 3 and 4 intakes, the H-3 concentration has been below the legal discharge limit of 60,000 Bq/L at all observation holes. It has remained constant or been declining overall. The concentration of total β radioactive materials has remained constant overall but has been increasing or declining at many observation holes, including Nos. 3-4 and 3-5. The trend continues to be monitored carefully.
- In the groundwater on the east side of the Turbine Buildings, as with the total β radioactive materials, the concentration of cesium has also remained constant but been increasing or declining and exceeded the previous highest record at some observation holes. Investigations are underway.
- The concentration of radioactive materials in drainage channels has remained constant overall, despite increasing during rainfall.
- In the open channel area of seawater intake for Units 1 to 4, the concentration of radioactive materials in seawater has remained below the legal discharge limit and been declining long term, despite temporary increases in Cs-137 and Sr-90 noted during rainfall. They have also been declining following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls. The concentration of Cs-137 has remained slightly higher in front of the south side impermeable walls and slightly lower on the north side of the east breakwater since March 20, 2019, when the silt fence was transferred to the center of the open channel due to mega float-related construction.
- In the port area, the concentration of radioactive materials in seawater has remained below the legal discharge limit and been declining long term, despite temporary increases in Cs-137 and Sr-90 observed during rainfall. They have remained below the level of those in the Units 1-4 intake open channel area and been declining following the completed installation and connection of steel pipe sheet piles for the sea-side impermeable walls.
- In the area outside the port, regarding the concentration of radioactive materials in seawater, those of Cs-137 and Sr-90 declined and remained low after steel pipe sheet piles for the sea-side impermeable walls were installed and connected. Regarding the concentration of Cs-137, a temporary increase was sometimes observed on the north side of the Unit 5 and 6 outlets and near the south outlet due to the influence of weather, marine meteorology and other factors. Regarding the concentration of Sr-90, variation has been observed since last year in the area outside the port (north and south outlets). Monitoring of the tendency continues, including the potential influence of the weather, marine meteorology and others.



<Unit 1 intake north side, between Unit 1 and 2 intakes>



<Between Unit 2 and 3 intakes, between Unit 3 and 4 intakes>

Figure 4: Groundwater concentration on the Turbine Building east side

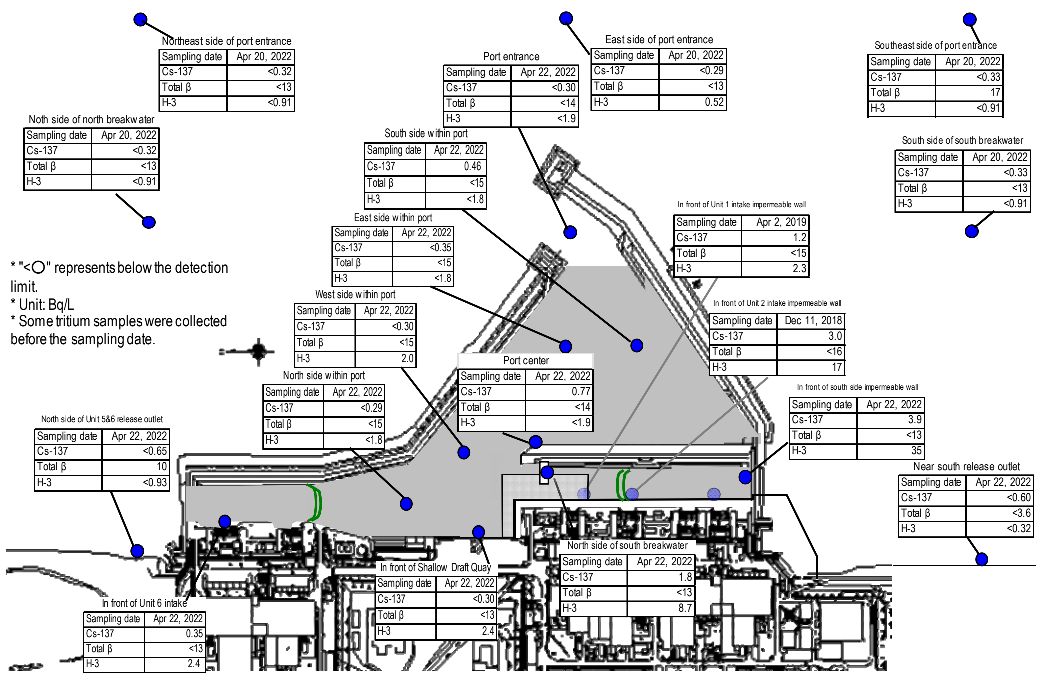


Figure 5: Seawater concentration around the port

➢ Dose status in the Fukushima Daiichi Nuclear Power Station (NPS)

- To improve the work environment in the Fukushima Daiichi NPS, measures to remove surface soil, install shielding and others have been implemented sequentially from areas where many workers are involved to reduce the dose.
- In terms of dose distribution on the on-site main roads, the dose rate has been declining year by year. In particular, in the area on the east side of the Turbine Buildings, the dose rate has declined by facing related to installation of the seawall as a countermeasure to the Japan Trench Tsunami.
- Efforts to improve the on-site work environment will continue by periodically measuring the dose and determining the status.

Outlook of the number of staff required and efforts to improve the labor environment and conditions

Adequate number of staff will be secured in the long-term, while firmly implementing radiation control of workers. The work environment and labor conditions will be continuously improved by responding to the needs on the site.

➢ Staff management

- The monthly average total of personnel registered for at least one day per month to work on site during the past quarter from December 2021 to February 2022 was approx. 9,000 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 6,800). Accordingly, sufficient personnel are registered to work on site.
- It was confirmed with the prime contractors that the estimated manpower necessary for the work in May 2022 (approx. 4,000 workers per day: cooperating company workers and TEPCO HD employees) would be secured at present. The average numbers of workers per day for each month (actual values) for the most recent 2 years were maintained, with approx. 3,000 to 4,200.
- The number of workers both from within and outside Fukushima Prefecture increased slightly. The local employment ratio (cooperating company workers and TEPCO HD employees) as of March 2022 remained constant to around 70%.
- The average exposure doses of workers were at approx. 2.44, 2.54 and 2.60 mSv/person-year during FY2018, 2019 and 2020, respectively. (The legal exposure dose limits are 100 mSv/person and 50 mSv/person-year over five years, the TEPCO HD management target is 20 mSv/person-year).
- For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.

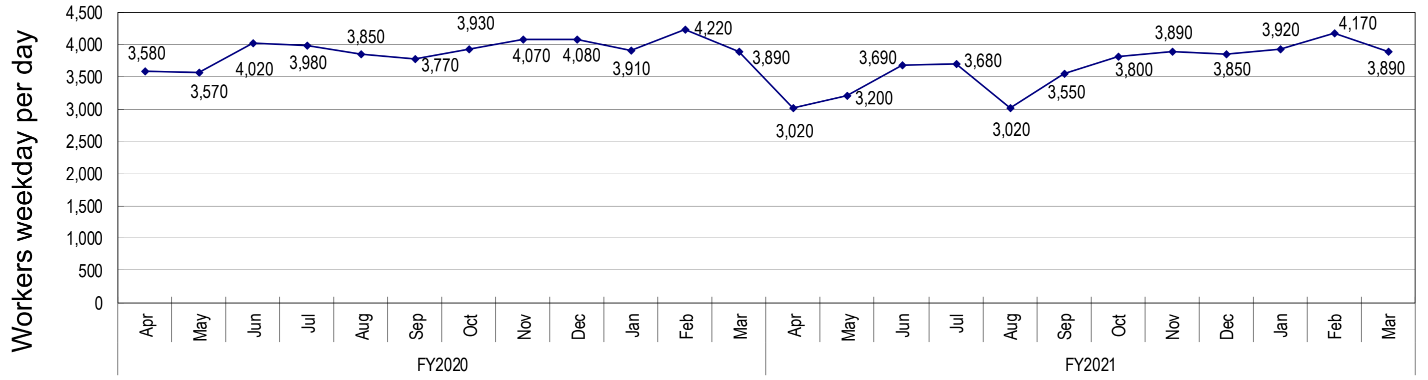


Figure 6: Changes in the average number of workers weekday per day for each month of the past 2 years (actual values)

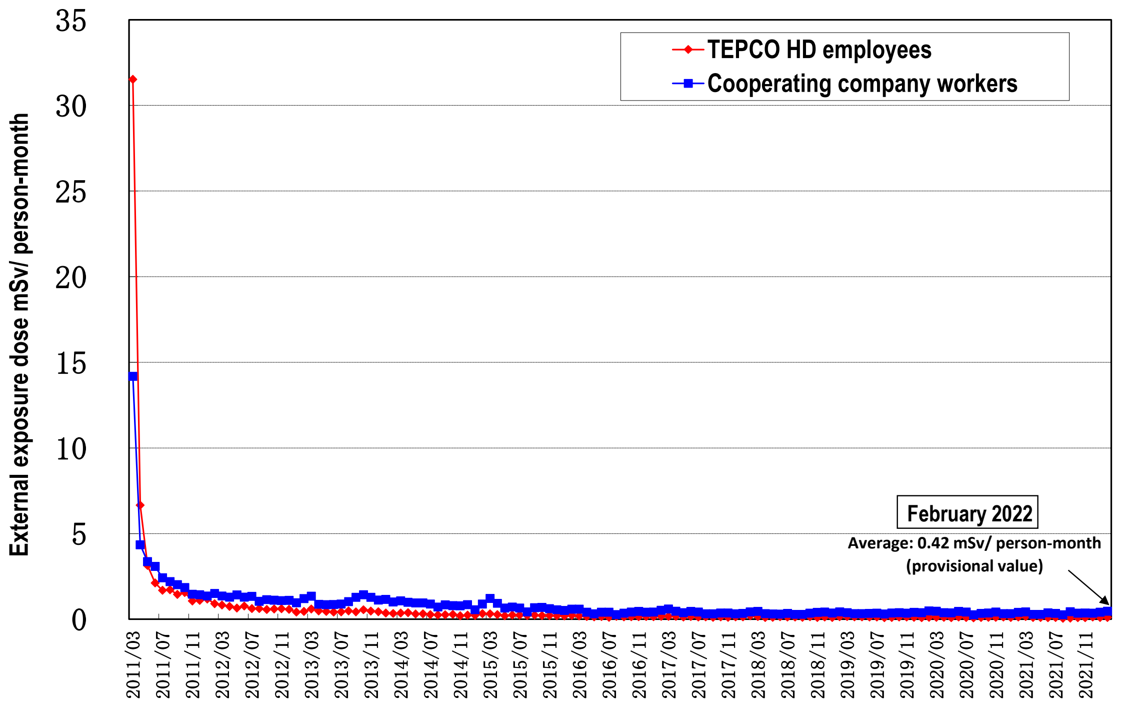


Figure 7: Changes in monthly average exposure dose of individual worker
(monthly exposure dose since March 2011)

FY2021 accident occurrence status and FY2022 safety activity plan

- The number of work accidents in FY2021 decreased to 22 from 27 the previous fiscal year. The number of accidents decreased but still remained high. Issues need to be analyzed and ongoing accident prevention measures must continue to be reviewed and improved. There were three serious injuries (incapacitating the workers for 14 days or more).
- The number of heat stroke cases in FY2021 decreased to 8 from 11 in the previous fiscal year. In FY2021, as in the previous year, heat-stroke rules were followed, heat-stroke prevention measures customized to each company site were implemented and new ice packs which tripled the cooling effect of conventional equivalents were introduced. Consequently, there were no serious heat stroke cases of degree-II or more. Furthermore, as a characteristic in FY2021, full-face masks were worn in all areas of work. The strengthened management for work with full-face mask or others will be reflected in the heat-stroke prevention plan.
- In FY2022, setting the focused activities as “efforts to thoroughly ensure safety actions” and “efforts to conduct safety activities together with the company,” safety awareness will be raised, safety education enhanced and dangerous places eliminated to prevent accidental injuries or fatalities.

Health management of workers in the Fukushima Daiichi NPS

- As health management measures in line with the guidelines of the Ministry of Health, Labour and Welfare (issued in August 2015), a scheme was established and operated, whereby prime contractors confirmed reexamination at medical institutions and the subsequent status of workers who were diagnosed as requiring “detailed examination and treatment” in the health checkup, with TEPCO confirming the operation status by the prime contractors.
- The recent report on the management status of the health checkup during the third quarter (October – December) in FY2021 confirmed that the prime contractors had provided appropriate guidance and managed operations properly under the scheme. The report on the follow-up status during the second quarter in FY2021 and before confirmed that responses to workers, which had not been completed by the time of the previous report, were being provided on an ongoing basis and checking of operations will continue.

Countermeasures to suppress the spread of COVID-19 infections

- The semi-state of emergency COVID-19 measures applied to 18 prefectures including Tokyo was totally lifted on March 21. However, for TEPCO HD employees and cooperating company workers at the Fukushima Daiichi Nuclear Power Station, countermeasures to prevent the infection spreading, such as requiring employees to take their temperature before coming to the office, wear masks at all times, avoid the “Three Cs” (Closed spaces, Crowded places, Close-contact settings) by using the rest house in shifts, eat silently and carefully select business travel, will continue to be properly implemented. In addition, they must strictly check their physical conditions, including of their family members, before coming to the company at the beginning of the week, report to their supervisors and managers whether they have contact of “Three Cs,” many people or an unspecified number of people or not and undergo an antigen test when they return to Fukushima prefecture from the outside (scheduled to be required until the Golden Week holidays) to proceed decommissioning work with safety first.
- As of 15:00, April 26, 2022, 284 workers (including 43 TEPCO HD employees, 1 temporary worker, 238 cooperating company workers and 2 business partner company employees) of the Fukushima Daiichi NPS had contracted COVID-19. Since January 2022, a total of 180 workers (including 33 TEPCO HD employees, 146 cooperating company workers and 1 business partner company employee) had contracted COVID-19.
- No significant influence on decommissioning work, such as a corresponding delay to work processes due to this infection, had been identified.
- The third workplace vaccination of COVID-19 was implemented for the period March 28 – April 15, 2022 to a total of 2,739 workers (including 662 TEPCO HD employees and 2,077 cooperating company workers).
- Acceptance of inspectors resumed from March 22.

Measures to prevent infection and expansion of influenza and norovirus

- Since November 2021, measures for influenza and norovirus have been implemented, including free influenza vaccinations (subsidized by TEPCO HD) at medical clinics around the site (from October 11, 2021 to January 29, 2022) for cooperating company workers. As of January 29, 2022, a total of 4,866 workers had been vaccinated. In addition, a comprehensive range of other measures is also being implemented, including daily actions to prevent infection and expansion (measuring body temperature, health checks and monitoring infection status) and response after detecting possible infections (swift exit of possible patients and control of entry, mandatory wearing of masks in working spaces, etc.).

Status of influenza and norovirus cases

- Until the 16th week of 2022 (April 18-24, 2022), no influenza and seven norovirus infections were recorded. The totals for the same period for the previous season showed one influenza and one norovirus infection respectively.

Note: The above data is based on reports from TEPCO HD and cooperating companies, which include diagnoses at medical clinics outside the site.
The subjects of this report were cooperating company workers and TEPCO HD employees in Fukushima Daiichi and Daini Nuclear Power Stations.

Status of seawater monitoring within the port (comparison between the highest values in 2013 and the latest values)

"The highest value" → "the latest value (sampled during April 11-20)"; unit (Bq/L); ND represents a value below the detection limit

Note: The Total β measurement values include natural potassium 40 (approx. 12 Bq/L).
They also include the contribution of yttrium 90, which radioactively balance strontium 90.

Summary of TEPCO data as of April 21, 2022

Cesium-134	:	ND(0.25)
Cesium-137	:	ND(0.29)
Total β	:	13
Tritium	:	3.5 ※1

Cesium-134	: 3.3	(H25/12/24)	→	ND(0.32)	Below 1/10
Cesium-137	: 7.3	(H25/10/11)	→	ND(0.29)	Below 1/20
Total β	: 69	(H25/8/19)	→	ND(13)	Below 1/5
Tritium	: 68	(H25/8/19)	→	ND(1.7)	Below 1/40

Cesium-134	: 3.3	(H25/10/17)	→	ND(0.29)	Below 1/10
Cesium-137	: 9	(H25/10/17)	→	ND(0.25)	Below 1/30
Total β	: 74	(H25/8/19)	→	ND(13)	Below 1/5
Tritium	: 67	(H25/8/19)	→	2.1	Below 1/30

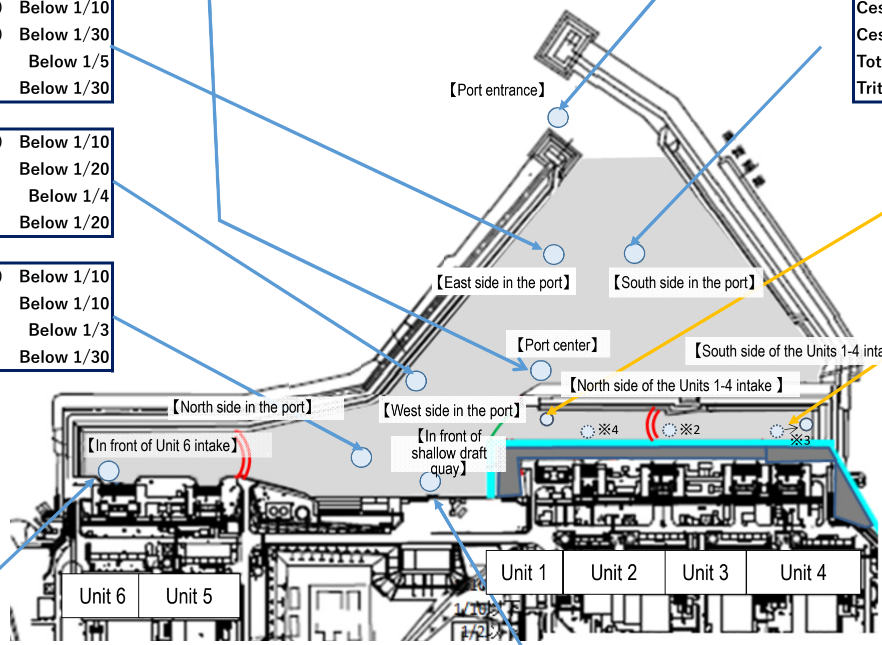
Cesium-134	: 3.5	(H25/10/17)	→	ND(0.30)	Below 1/10
Cesium-137	: 7.8	(H25/10/17)	→	ND(0.31)	Below 1/20
Total β	: 79	(H25/8/19)	→	ND(13)	Below 1/6
Tritium	: 60	(H25/8/19)	→	ND(1.7)	Below 1/30

Cesium-134	: 4.4	(H25/12/24)	→	ND(0.30)	Below 1/10
Cesium-137	: 10	(H25/12/24)	→	0.39	Below 1/20
Total β	: 60	(H25/7/4)	→	ND(13)	Below 1/4
Tritium	: 59	(H25/8/19)	→	2.4	Below 1/20

Cesium-134	: 32	(H25/10/11)	→	ND(0.28)	Below 1/100
Cesium-137	: 73	(H25/10/11)	→	1.7	Below 1/40
Total β	: 320	(H25/8/12)	→	15	Below 1/20
Tritium	: 510	(H25/9/2)	→	3.7	Below 1/100

Cesium-134	: 5	(H25/12/2)	→	ND(0.30)	Below 1/10
Cesium-137	: 8.4	(H25/12/2)	→	0.58	Below 1/10
Total β	: 69	(H25/8/19)	→	18	Below 1/3
Tritium	: 52	(H25/8/19)	→	ND(1.7)	Below 1/30

Cesium-134	:	ND(0.30)
Cesium-137	:	6.0
Total β	:	15
Tritium	:	28 ※1



Sea side impermeable wall
Silt fence
Silt fence for construction

※1: Monitoring commenced in or after March 2014. Monitoring inside the sea-side impermeable walls was finished because of the landfill.

※2: For the point, monitoring was finished from December 12, 2018 due to preparatory work for transfer of mega float.

※3: For the point, monitoring point was moved from February 6, 2019 due to preparatory work for transfer of mega float.

※4: For the point, monitoring was finished from April 3, 2019 due to preparatory work for transfer of mega float.

	Legal discharge limit	WHO Guidelines for Drinking Water Quality
Cesium-134	60	10
Cesium-137	90	10
Strontium-90 (strongly correlate with Total β)	30	10
Tritium	60,000	10,000

Cesium-134	: 2.8	(H25/12/2)	→	ND(0.28)	Below 1/10
Cesium-137	: 5.8	(H25/12/2)	→	ND(0.33)	Below 1/10
Total β	: 46	(H25/8/19)	→	ND(14)	Below 1/3
Tritium	: 24	(H25/8/19)	→	3.5	Below 1/6

Cesium-134	: 5.3	(H25/8/5)	−	ND(0.26)	Below 1/20
Cesium-137	: 8.6	(H25/8/5)	−	1.6	Below 1/5
Total β	: 40	(H25/7/3)	−	ND(14)	Below 1/2
Tritium	: 340	(H25/6/26)	-	ND(1.7)	Below 1/200

Source: TEPCO website Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station http://www.tepco.co.jp/decommision/planaction/monitoring/index-j.html

Status of seawater monitoring around outside of the port
(comparison between the highest values in 2013 and the latest values)

Unit (Bq/L); ND represents a value below the detection limit; values in ( ) represent the detection limit; ND (2013) represents ND throughout 2013

(The latest values sampled during April 11-20)

Summary of TEPCO data as of April 21, 2022

	Legal discharge limit	WHO Guidelines for Drinking Water Quality
Cesium-134	60	10
Cesium-137	90	10
Strontium-90 (strongly correlate with Total β)	30	10
Tritium	60,000	10,000

【Northeast side of port entrance (offshore 1 km)】

Cesium-134 :	ND	(H25)	→	ND(0.30)	
Cesium-137 :	ND	(H25)	→	ND(0.32)	
Total β :	ND	(H25)	→	ND(13)	
Tritium :	ND	(H25)	→	ND(0.91)	

【East side of port entrance (offshore 1 km)】

Cesium-134 :	ND	(H25)	→	ND(0.27)	
Cesium-137 :	1.6	(H25/10/18)	→	ND(0.29)	Below 1/2
Total β :	ND	(H25)	→	ND(13)	
Tritium :	6.4	(H25/10/18)	→	ND(0.91)	Below 1/7

【Southeast side of port entrance (offshore 1 km)】

Cesium-134 :	ND	(H25)	→	ND(0.35)	
Cesium-137 :	ND	(H25)	→	ND(0.33)	
Total β :	ND	(H25)	→	17	
Tritium :	ND	(H25)	→	ND(0.91)	

【North side of north breakwater (offshore 0.5 km)】

Cesium-134 :	ND	(H25)	→	ND(0.33)	
Cesium-137 :	ND	(H25)	→	ND(0.32)	
Total β :	ND	(H25)	→	ND(13)	
Tritium :	4.7	(H25/8/18)	→	ND(0.91)	Below 1/5

【Port entrance】

Cesium-134 :	3.3	(H25/12/24)	→	ND(0.32)	Below 1/10
Cesium-137 :	7.3	(H25/10/11)	→	ND(0.29)	Below 1/20
Total β :	69	(H25/8/19)	→	ND(13)	Below 1/5
Tritium :	68	(H25/8/19)	→	ND(1.7)	Below 1/40

【South side of south breakwater (offshore 0.5 km)】

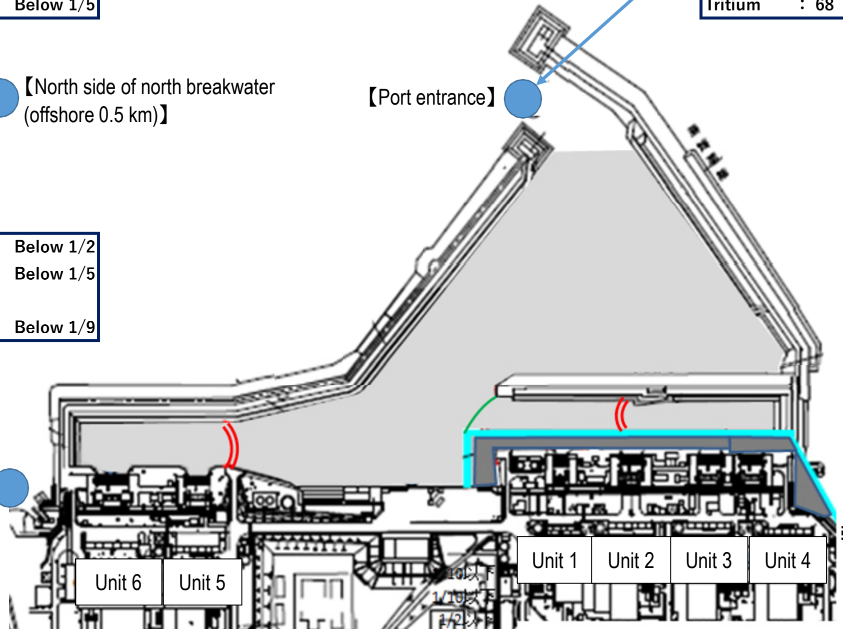
Cesium-134 :	ND	(H25)	→	ND(0.28)	
Cesium-137 :	ND	(H25)	→	ND(0.33)	
Total β :	ND	(H25)	→	ND(13)	
Tritium :	ND	(H25)	→	ND(0.91)	

【North side of Unit 5 and 6 release outlet】

Cesium-134 :	1.8	(H25/6/21)	→	ND(0.83)	Below 1/2
Cesium-137 :	4.5	(H25/3/17)	→	ND(0.76)	Below 1/5
Total β :	12	(H25/12/23)	→	10	
Tritium :	8.6	(H25/6/26)	→	ND(0.93)	Below 1/9

【Near south release outlet】

Cesium-134 :	ND	(H25)	→	ND(0.74)	
Cesium-137 :	3	(H25/7/15)	→	ND(0.69)	Below 1/4
Total β :	15	(H25/12/23)	→	6.3	Below 1/2
Tritium :	1.9	(H25/11/25)	→	ND(0.93)	Below 1/2



Sea side impermeable wall

Silt fence

Silt fence for construction

Note: The Total β measurement values include natural potassium 40 (approx. 12 Bq/L). They also include the contribution of yttrium 90, which radioactively balance strontium 90.

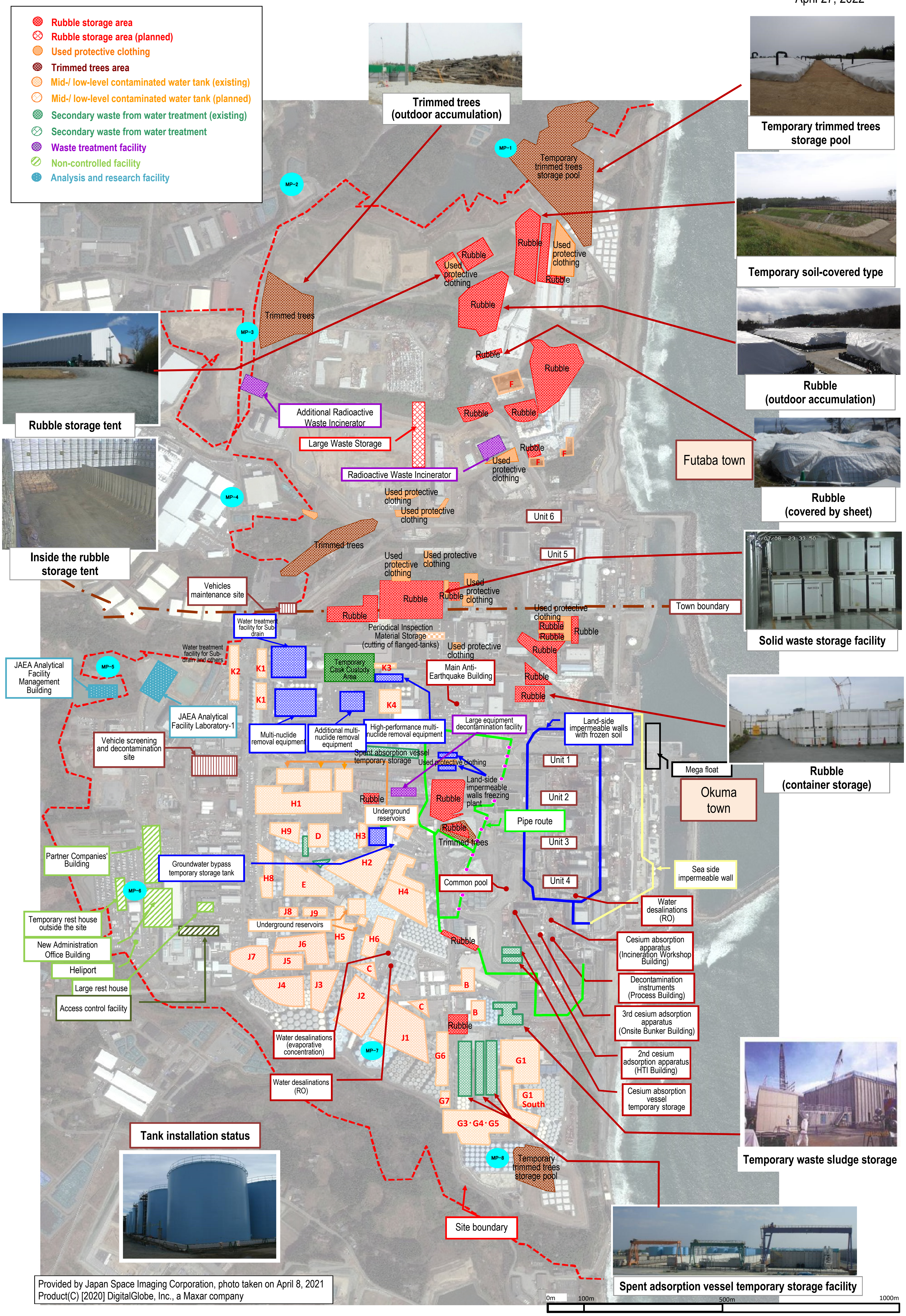
Note: Because safety of the sampling points was unassured due to the influence of Typhoon No. 10 in 2016, samples were taken from approx. 330 m south of the Unit 1-4 release outlet. Samples were also taken from a point approx. 280m south from the same release outlet from January 27, 2017 and approx. 320m from March 23, 2018.

Source: TEPCO website, Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station http://www.tepco.co.jp/decommision/planaction/monitoring/index-j.html

Appendix 2

April 27, 2022

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout



Provided by Japan Space Imaging Corporation, photo taken on April 8, 2021
Product(C) [2020] DigitalGlobe, Inc., a Maxar company

1-1 Contaminated water management

- Efforts to promote contaminated water management based on three basic policies:
  ① "Remove" the source of water contamination ② "Redirect" fresh water from contaminated areas
  ③ "Retain" contaminated water from leakage

Milestones of the Mid- and-Long-Term Roadmap (major target processes)
- [Completed] Suppressing the amount of contaminated water generated to 150 m^3/day or less (within 2020)
- Suppressing the amount of contaminated water generated to 100 m^3/day or less (within 2025)

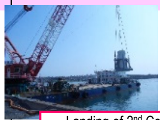
Timeline: 2011 – 2012 – 2013 – 2014 – 2015 – 2016 – 2017 – 2018 – 2019 – 2020 – 2021 – 2022

Contaminated water management 【Remove】

Contaminated water treatment facility

- ▽Reception start of contaminated water to Central Waste Treatment Build...
- ▽Decontamination equipment (AREVA)
- ▽Evaporative concentration equipment
- ▽Cesium Adsorption Apparatus (KURION)
- ▽2nd Cesium Adsorption Apparatus (SARRY)
- ▽Treatment of RO-condensed salt water complete
- ▽Purification of strontium-reduced water in flanged tanks complete
- ▽Purification of strontium-reduced water complete
- ▽Reduction of strontium by Cesium Adsorption Apparatus (KURION) (from 2015.1.6)
- ▽Reduction of strontium by 2nd Cesium Adsorption Apparatus (SARRY) (from 2014.12.26)
- ▽Reduction of strontium by 3rd Cesium Adsorption Apparatus (SARRY II) (from 2019.7.12)
- ▽Treatment start of strontium-reduced water (ALPS: from 2015.12.4, additional: from 2015.5.27, high-performance: from 2015.4.15)
- ▽Multi-nuclide Removal Equipment (ALPS) (System A: from 2013.3.30, System B: from 2013.6.13, System C: from 2013.9.27, hot tests conducted)
- ▽Multi-nuclide Removal Equipment (additional ALPS)
- ▽Start of full-scale operation (from 2017.10.16)
- ▽Multi-nuclide Removal Equipment (high performance ALPS) (from 2014.10.18, hot tests conducted)


Cesium Adsorption Apparatus (KURION)


Landing of 2nd Cesium Adsorption Apparatus (SURRY)


Multi-nuclide removal equipment (ALPS)

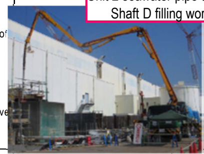
Removal of contaminated water from seawater pipe trench

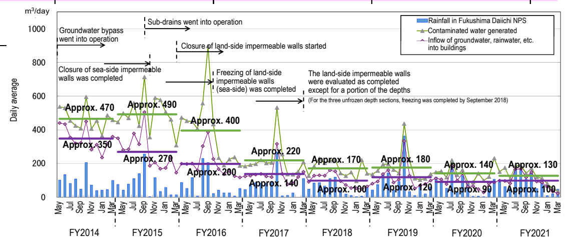
【Removal of contaminated water in seawater pipe trench】

Unit 2
- ▽Trench Purification by mobile equipment
- ▽Completion of tunnel filling
- ▽Transfer of stagnant water complete
- ▽Completion of shaft filling

Unit 3
- ▽Completion of tunnel filling
- ▽Transfer of stagnant water complete
- ▽Completion of shaft filling (except for upper part of ...)

Unit 4
- ▽Completion of tunnel filling
- ▽Filling of openings II and III complete
- ▽Transfer stagnant water complete
- ▽Completion of filling parts running ove...


Unit 2 seawater pipe trench Shaft D filling work



Contaminated water management 【Redirect】

Groundwater bypass

- ▽Installation start of groundwater bypass
- **▽Operation start of groundwater bypass (drainage started from 2014.5.21)**
- **Suppressing the average amount of contaminated water generated to approx. 130 m^3/day ▽**

Sub-drain

- ▽Recovery of existing sub-drain pit and start of new installation
- ▽Installation start of Water-Treatment Facility special for Sub-drain & Groundwater drains
- **▽Operation start of sub-drain (drainage started from 2015.9.14)** (Treatment capacity: 1000 m3/day)
- **▽Enhancement of treatment capacity** (2000 m3/day)

Land-side impermeable wall

- ▽Installation start of land-side impermeable walls
- **▽Freezing start**
- Start of maintenance operation ▽
- ▽Start of maintenance operation on north and south sides
- ▽Freezing completion
- ▽Start of maintenance operation in all sections
- **▽Freezing completion (except for some parts)**

Facing

- ▽Completion of waterproof pavement (facing) (except for areas of 2.5 and 6.5m above sea level and around Unit 1-4)
- ▽Completion of waterproof pavement (facing) (except for around Unit 1-4)

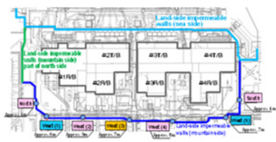
Contaminated water management 【Retain】

Bank groundwater measures

- High concentration of radioactive materials detected from observation well of bank ▽
- ▽Area 2.5m above sea level – Start of ground improvement by water glass
- ▽Completion
- ▽Start of pumping of water from contaminated areas (well point)
- ▽Installation start of seaside impermeable walls
- **▽Installation of seaside impermeable walls complete**
- ▽Operation start of groundwater drain (pumping-up started on 2015.11.5)

Storage facility

- ▽Purification of RO-condensed salt water complete
- ▽Storage in steel square tanks
- ▽Replacement of steel square tanks complete
- ▽Removal of steel horizontal tanks complete (except for condensed waste liquid storage tank)
- ▽Water leakage (300L) from flanged tank
- ▽Water leakage (100ℓ) from flanged tank
- ▽Storage in flanged cylindrical tanks
- ▽Completion of fence to prevent leakage expanding
- **▽Purification of strontium-reduced water in flanged tanks complete**
- ▽Water leakage (10L) from flanged tank
- ▽Work to raise fence height complete
- ▽Transfer and storage of all treated water in welded-joint tanks
- ▽Leakage of contaminated water from underground reservoir => Start of transfer to tanks
- ▽Transfer of contaminated water to tanks complete
- ▽Storage in cylindrical steel welded-joint tanks
- ▽Purification of strontium-reduced water complete
- ▽Sprinkling start of rainwater within tank fences by rainwater treatment facility (from 2014.5.21)



Legend	Range	Start day
	1st Stage Phase 1 freezing range	Mar. 31, 2016
	1st Stage Phase 2 freezing range	Jun. 6, 2016
	2nd Stage partial closure (I) freezing range	Dec. 3, 2016
	2nd Stage partial closure (II) freezing range	Mar. 3, 2017
	3rd Stage freezing range	Aug. 22, 2017

Closure parts of the land-side impermeable walls (on the mountain side)


Pumping well


Sub-drain purification system


Land-side impermeable wall brine (refrigerant) circulation pipe


Construction of welded-joint tanks


Placement of seaside impermeable walls complete


Flanged and welded-joint tanks

1-2 Contaminated water management

Milestones of the Mid- and-Long-Term Roadmap (major target processes)
- [Completed] Treatment of contaminated water in buildings* (within 2020)
  - * Except for Unit 1-3 Reactor Buildings, Process Main Building and High-Temperature Incinerator Building
- Reducing contaminated water in Reactor Buildings to about half the amount at the end of 2020 (FY2022-2024)

		Timeline 2011–2022
Treatment of stagnant water		▽Installation of stagnant water transfer equipment/transfer start; ▽Completion of work to improve reliability of transfer line (replacement with PE pipes); ▽Start to maintain water-level difference with sub-drain water level; ▽Transfer start from each building to Central Rw Building; ▽Floor exposure of Unit 1 T/B; ▽Separation of stagnant water between Units 3 and 4; ▽Separation of stagnant water between Units 1 and 2; ▽Floor exposure of Unit 1 Rw/B; ▽Floor exposure of Unit 2 T/B, Rw/B; ▽Floor exposure of Unit 3 T/B, Rw/B; ▽Floor exposure of Unit 4 R/B, T/B, Rw/B; ▽Treatment of stagnant water in buildings complete
Countermeasures to tsunami risks	Closure of openings	▽Examination start of measures to close building openings; complete; ▽Work for Units 1 and 2 T/B complete; ▽Work for HTI building complete; ▽Work for Process Main Building complete; ▽Work for Unit 3 T/B complete; ▽Work for Unit 1-3 R/B complete; ▽Closure of openings complete; ▽Work of Unit 1-4 Rw/B complete
	Seawall	▽Installation of outer-rise tsunami seawall complete; ▽Construction start of Tsushima Trench Tsunami Seawall; Japan Trench tsunami seawall; ▽Completion of installation; ▽on-site start
	Mega float	▽Start of marine construction; Temporary grounding of mega float▽; ▽Internal filling complete (reduction of tsunami risks)

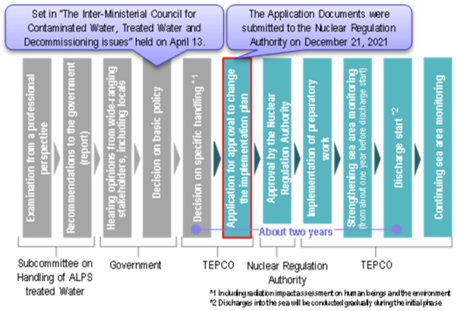
Chishima Trench Tsunami Seawall complete

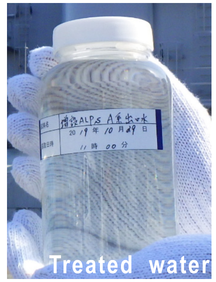
Construction of Japan Trench Tsunami Seawall

2 Handling of ALPS treated water

In "The Inter-Ministerial Council for Contaminated Water, Treated water and Decommissioning" held on April 13, the basic policy on how to handle ALPS treated water was set. Based on this, the response of TEPCO was announced on April 16.

Regarding the discharge of ALPS treated water into the sea, TEPCO must comply with regulatory and other safety-related standards to ensure the safety of the public, surrounding environment and agricultural, forestry and fishery products. To minimize adverse impacts on reputation, monitoring will be further enhanced, objectivity and transparency ensured by engaging with third-party experts and safety checked by the IAEA. Moreover, accurate information will be disseminated continuously and in a highly transparent manner.





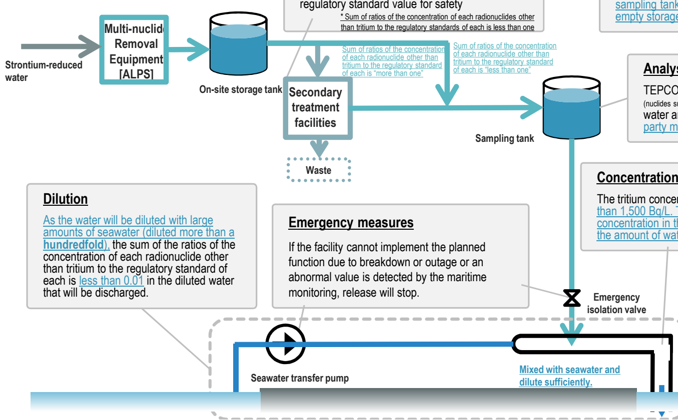
Examination concerning handling of ALPS treated water

- 2016.6 Report of Tritiated Water Taskforce
- Tritiated Water Taskforce (2013.12 – 2016.5, 15 meetings)
- 2018.8 Explanatory and hearing meeting, receiving opinions
- 2020.2 Report of Subcommittee on Handling of ALPS treated water
- Subcommittee on Handling of ALPS treated water (2016.11 – 2020.1, 17 meetings)
- Opportunity for receiving opinions from parties concerned concerning handling of ALPS treated water (2020.4 – 2020.10, 7 meetings)
- 2021.4.13 The basic policy on the handling of ALPS treated water was set
- 2021.4.16 The response of TEPCO was announced
- 2021.12.21 The "Application Documents for Approval to Amend the Implementation Plan for Fukushima Daiichi Nuclear Power Station Specified Nuclear Facility" regarding ALPS treated water were submitted to the Nuclear Regulation Authority
- 2021.12.28 "The Action Plan concerning the Continuous Implementation of the Basic Policy on Handling of ALPS Treated Water" was formulated
- Review meeting concerning the implementation plan on handling of ALPS treated water (from 2021.7)

2014 2015 2016 2017 2018 2019 2020 2021 2022

Tank area viewed from the Large Rest House (2015.10.29)

[Conceptual diagram of facilities for releasing ALPS treated water into the sea]



Secondary treatment
Secondary treatment will be conducted as necessary to ensure the level of radioactive materials, excluding tritium, is lower* than the regulatory standard value for safety
* Sum of ratios of the concentration of each radionuclides other than tritium to the regulatory standards of each is less than one

Site use plan
To stably discharge ALPS treated water and construct facilities necessary for decommissioning, construction of sampling tanks and alternative tanks and dismantling of empty storage tanks and others will be examined.

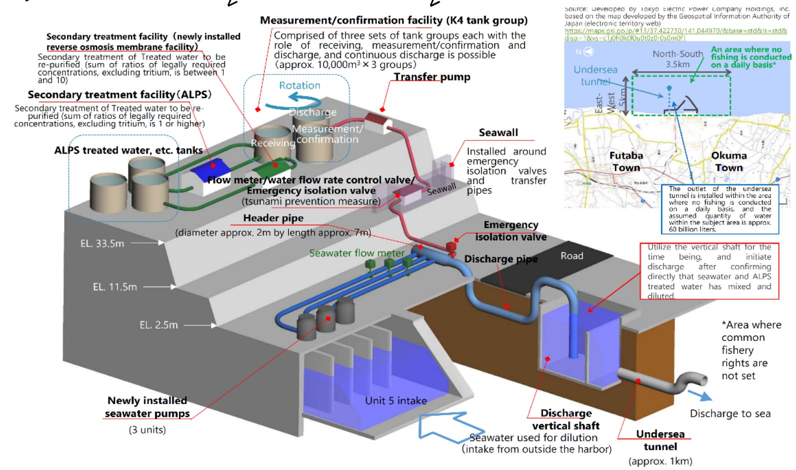
Analysis of ALPS treated water
TEPCO will publish the concentration of tritium, 62 nuclides (nuclides subject to removal by ALPS) and carbon-14 in ALPS treated water and the results of assessments as well as the third-party measurement and assessment results.

Concentration of tritium inside discharged water
The tritium concentration of the discharged water will be less than 1,500 Bq/L. This will be assessed based on the tritium concentration in the ALPS treated water before discharge and the amount of water it was diluted by.

Dilution
As the water will be diluted with large amounts of seawater (diluted more than a hundredfold), the sum of the ratios of the concentration of each radionuclide other than tritium to the regulatory standard of each is less than 0.01 in the diluted water that will be discharged.

Emergency measures
If the facility cannot implement the planned function due to breakdown or outage or an abnormal value is detected by the maritime monitoring, release will stop.

Amount discharged
In the near term, discharge amounts will be within the threshold of 22 trillion Bq/year which was the target discharge management value for Fukushima Daiichi before the accident. This amount will be reviewed as needed based on decommissioning progress made.



3 Removal of fuel from spent pool

Milestones of the Mid- and-Long-Term Roadmap (major target processes)

- Completion of Unit 1-6 fuel removal (within 2031)
- Completion of installation of Unit 1 large cover (around FY2023), start of Unit 1 fuel removal (FY2027-2028)
- Start of Unit 2 fuel removal (FY2024-2026)

Legend: Rubble removal, etc. | Installing a fuel removal machine | Fuel removal | Storage and handling of fuel

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

Unit 4

▼ 2011.11- 2012.7 Removal of rubble on the Reactor Building top floor

▼ 2012.4-2013.3 Ground improvement and foundation work

▼ 2013.4-2013.7 Installation of external walls and roof panels

▼ 2013.6-2013.10 Installation of overhead crane and fuel-handling machine

▼ 2013.8-2013.10 Removal of rubble inside the reactor well and pool

▼ 2013.11.18 Start of fuel removal

▼ 2014.12.22 Fuel removal was completed (1533 assemblies)

All fuel assemblies from Unit 4 had been removed by December 2014.


<Unit 4 Cover for fuel removal>

In the Mid- and-Long-Term Roadmap, the Phase 1 target involved starting to remove fuel from inside the spent fuel pool (SFP) of the 1st Unit within two years of completing Step 2 (by December 2013).
On November 18, 2013, fuel removal from Unit 4, namely the first Unit, got underway and Phase 2 of the roadmap started.
On November 5, 2014, within a year of commencing fuel removal work, all 1,331 spent fuel assemblies in the pool had been transferred. The transfer of the remaining non-irradiated fuel assemblies to the Unit 6 SFP was completed on December 22, 2014. (two of the non-irradiated fuel assemblies were removed in advance in July 2012 for fuel checks)
This marks the completion of fuel removal from the Unit 4 Reactor Building.

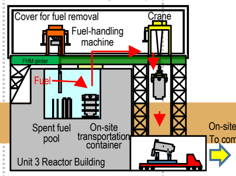

Fuel removal

Unit 3

All fuel assemblies from Unit 3 had been removed by February 2021.

Before installing a cover for fuel removal, the process of removing large rubble from the spent fuel pool was completed in November 2015. To ensure safe and steady fuel removal, training via remote control was conducted at the factory using the actual fuel-handling machine to be installed on site (February – December 2015). Installation of the fuel removal cover was completed on February 23, 2018.
With fuel removal in mind, rubble retrieval training inside the pool, which was scheduled in conjunction with fuel removal training, started from March 15, 2019 and fuel removal started from April 15, 2019. Fuel removal was completed on February 28, 2021.

Overview of the fuel-handling facility inside the cover



▼ 2013.10 Completion of removal of large rubble on the Reactor Building top floor

▼ 2015.8 Completion of removal of the fuel-handling machine B within the spent fuel pool

▼ 2016.12 Completion of shielding on the Reactor Building top floor

▼ 2017.1 Installation start of a cover for fuel removal

▼ 2019.4.15 Start of fuel removal

▼ 2021.2.28 Fuel removal completed (566 assemblies)

<Unit 3 Cover for fuel removal (dome roof) 2019.2.21>

Unit 2

For Unit 2, with the removal of spent fuel in mind, a "gantry for fuel removal" (gantry and front room) will be constructed on the south side of the building.

▼ 2015.3-2016.11 Yard construction

▼ 2016.9-2017.4 West-side gantry installation work

▼ 2017.5 Opening a hole in the west-side external wall

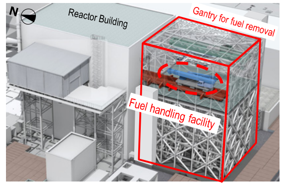
▼ 2018.8-2020.12 Moving and containment of remaining objects

▼ 2020.6 Investigation inside the spent fuel pool

▼ 2021.10 Start of ground improvement work


<Unit 2 Construction of gantry for fuel removal>

Unit 2
Overview of fuel removal
(bird's-eye view)



As part of efforts to remove fuel from the Unit 2 spent fuel pool and based on findings from internal operating floor investigations from November 2018 to February 2019, instead of fully dismantling the upper part of the building, the decision was made to install a small opening on the south side and use a boom crane. Examination continues to initiate fuel removal from FY2024 to FY2026.

<Reference> Progress to date
Previously, scope to recover the existing overhead crane and the fuel-handling machine was examined. However, the high radiation dose inside the operating floor meant the decision was taken to dismantle the upper part of the building in November 2015. Findings from internal investigations of the operating floor from November 2018 to February 2019 underlined the potential to conduct limited work there and the means of accessing from the south side was examined.

Unit 1

For Unit 1, a large cover will be installed over the whole building, within which rubble will be removed.

▼ 2017.12 Completion of building cover dismantling and windbreak fence installation

▼ 2018.1-2020.12 Rubble removal on the north side of Reactor Building

▼ 2018.9-12 Removal of X-braces

▼ 2020.3-6 Installation of spent fuel pool cover

▼ 2020.9-11 Measures to prevent and alleviate rubble falling

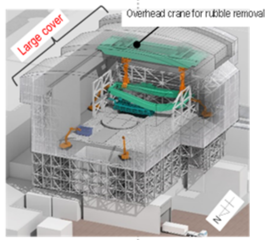
▼ 2020.11-2021.6 Dismantling of remaining cover

▼ 2021.8 Start of large cover pre-work

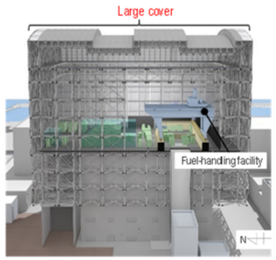
As part of efforts to remove fuel from the Unit 1 spent fuel pool, investigations are underway to ascertain the conditions of the fallen roof on the south side and the contamination of the well plug. Based on the results, "the method initially installing a large cover over the Reactor Building, then removing rubble within the cover" was selected to ensure safer and more secure removal. Work to install a large cover started from August 2021. Work to complete the installation of a large cover by around FY2023 is ongoing, with fuel removal scheduled to run from FY2027 to FY2028.

<Reference> Progress to date
Rubble removal on the north side of the operating floor started from January 2018 and has been implemented sequentially. In July and August 2019, the well plug, which was misaligned, was investigated, followed in August and September by the conditions of the overhead crane. Based on the results of these investigations, as the removal requires more careful work taking dust scattering into consideration, two methods were examined: Installing a cover after rubble removal, initially installing a large cover over the Reactor Building, then removing rubble inside the cover.


<Unit 1 Dismantling of remaining cover>



Rubble removal (image)



Fuel removal (image)

2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

* Part of the photo is corrected because it includes machine information related to nuclear material protection.

4 Work toward fuel debris retrieval

Milestones of the Mid- and-Long-Term Roadmap (major target processes)

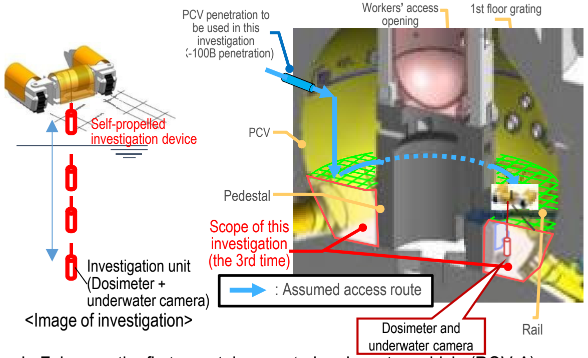
Start of fuel debris retrieval from the first unit (Unit 2). Expanding the scale in stages (within 2021 * The schedule will be extended for about 1 year due to the spread of COVID-19 infections)

Before removing fuel debris, investigations inside the Primary Containment Vessel (PCV) are conducted to inspect the conditions there, including locations of fuel debris.

Unit 1 Investigation overview

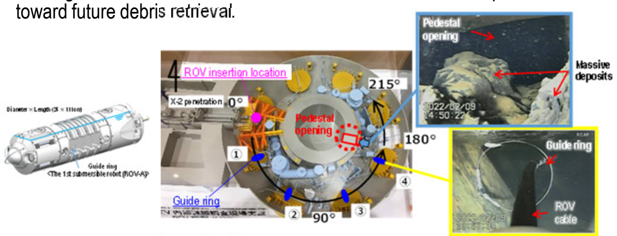
・In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:φ100 mm) collected information such as images and airborne dose inside the PCV 1st floor.

・In March 2017, an investigation using a self-propelled investigation device was conducted to inspect the spreading of debris to the basement floor outside the pedestal, with images taken of the PCV bottom status for the first time. The conditions inside the PCV will continue to be examined, based on the imagery and dose data obtained.



<Image of investigation>

In February, the first remotely operated underwater vehicle (ROV-A) was inserted to install "guide rings" which will facilitate the investigation. As installation of guide rings has been completed, then a detailed investigation will be implemented.
In this investigation, distribution of deposits outside the pedestal and their characteristics or others will also be investigated. The results of these investigations will be utilized in the examination of method and procedures toward future debris retrieval.



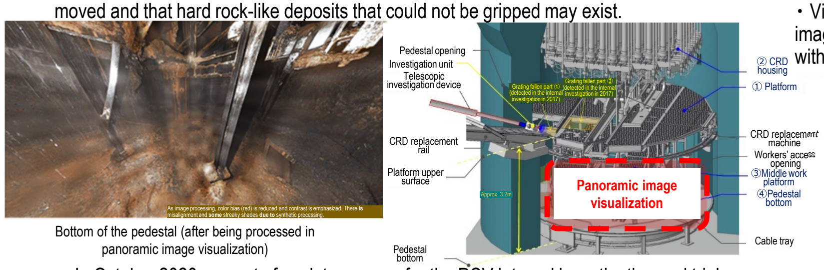
<Status inside the PCV (February 9)>

Unit 2 Investigation overview

・In January 2017, a camera was inserted from the PCV penetration to inspect the conditions of the rail on which the robot traveled. The results of a series of investigations confirmed some gratings had fallen and deformed as well as a quantity of deposit inside the pedestal.

・In January 2018, the conditions below the platform inside the pedestal were investigated. Based on the analytical results of images obtained in the investigation, deposits, probably including fuel debris, were found at the bottom of the pedestal. Moreover, multiple parts exceeding the surrounding deposits were also detected. We presumed that there were multiple instances of fuel debris falling.

・In February 2019, an investigation touching the deposits at the bottom of the pedestal and on the platform was conducted and confirmed that the pebble-shaped deposits, etc. could be moved and that hard rock-like deposits that could not be gripped may exist.



Bottom of the pedestal (after being processed in panoramic image visualization)

・In October 2020, as part of work to prepare for the PCV internal investigation and trial retrieval, a contact investigation to study deposits inside the penetration (X-6 penetration) was conducted, which involved inserting a guide pipe incorporating an investigative unit into the penetration. This confirmed that deposits inside the penetration had not deformed and come unstuck. The investigative information obtained will be utilized in the mockup test of the equipment to remove deposits inside the X-6 penetration.

<Conditions of deposits before and after contact> <Work in front of the penetration> <Unit 2 Reactor Building 1st floor Location of the penetration>

Unit 3 Investigation overview

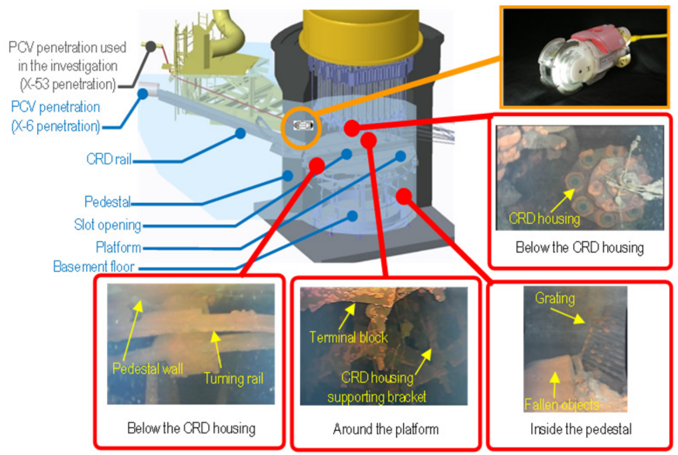
・In October 2014, the conditions of X-53 penetration, which may be under water and which is scheduled for use to investigate the inside of the PCV, was investigated via remote-controlled ultrasonic test equipment. The results showed that the penetration was not under water.

・In October 2015, to confirm the conditions inside the PCV, an investigative device was inserted into the PCV from X-53 penetration to obtain images, data on dosage and temperature and sample stagnant water. No damage to the structure and walls inside the PCV was identified and the water level was almost identical to estimated values. In addition, the dose inside the PCV was confirmed to be lower than in other Units.

・In July 2017, the inside of the PCV was investigated using the underwater ROV (remotely operated underwater vehicle) to inspect the inside of the pedestal. Analysis of the imagery obtained in the investigation identified damage to multiple structures and the supposed core internals.

・Videos obtained in the investigation were reproduced in 3D. Based on the reproduced images, the relative positions of the structures, such as the rotating platform slipping off the rail with a portion buried in deposits, were visually understood.

<Conditions inside the pedestal>



Unit 1 PCV internal investigation

Investigations inside the PCV	1st (2012.10)	- Acquiring images - Measuring the air temperature and dose rate - Measuring the water level and temperature - Sampling stagnant water - Installing permanent monitoring instrumentation
	2nd (2015.4)	Confirming the status of the PCV 1st floor - Acquiring images - Measuring the air temperature and dose rate - Replacing permanent monitoring instrumentation
	3rd (2017.3)	Confirming the status of the PCV 1st basement floor - Acquiring images - Measuring the dose rate - Sampling deposit - Replacing permanent monitoring instrumentation
Leakage points from PCV	- PCV vent pipe vacuum break line bellows (identified in 2014.5) - Sand cushion drain line (identified in 2013.11)	
Evaluation of the location of fuel debris inside the reactor by measurement using muons Confirmed that there was no large fuel in the reactor core. (2015.2-5)		

Unit 2 PCV internal investigation

Investigations inside the PCV	1st (2012.1)	- Acquiring images - Measuring the air temperature
	2nd (2012.3)	- Confirming water surface - Measuring the water temperature - Measuring the dose rate
	3rd (2013.2 – 2014.6)	- Acquiring images - Sampling stagnant water - Measuring water level - Installing permanent monitoring instrumentation
	4th (2017.1-2)	- Acquiring images - Measuring the dose rate - Measuring the air temperature
	5th (2018.1)	- Acquiring images - Measuring the dose rate - Measuring the air temperature
	6th (2019.2)	- Acquiring images - Measuring the dose rate - Measuring the air temperature - Determining characteristics of a portion of deposit
Leakage points from PCV	- No leakage from the torus chamber rooftop - No leakage from any internal/external surfaces of S/C	
Evaluation of the location of fuel debris inside the reactor by measurement using muons The existence of high-density materials, which were considered to constitute fuel debris, was confirmed at the bottom of RPV and in the lower part and outer periphery of the reactor core. It was assumed that a significant portion of fuel debris existed at the bottom of RPV. (2016.3-7)		

Unit 3 PCV internal investigation

Investigations inside the PCV	1st (2015.10-12)	- Acquiring images - Measuring the air temperature and dose rate - Measuring the water level and temperature - Sampling stagnant water - Installing permanent monitoring instrumentation (2015.12)
	2nd (2017.7)	- Acquiring images - Installing permanent monitoring instrumentation (2017.8)
Leakage points from PCV	- Main steam pipe bellows (identified in 2014.5)	
Evaluation of the location of fuel debris inside the reactor by measurement using muons The evaluation confirmed that no large lump existed in the core area where fuel had been placed and that a portion of the fuel debris potentially existed at the bottom of the RPV. (2017.5-9)		

Images are provided by the International Research Institute for Nuclear Decommissioning (IRID)

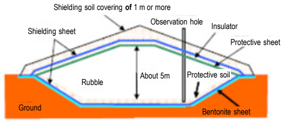
5 Management of solid radioactive waste

Milestones of the Mid- and-Long-Term Roadmap (major target processes)
Eliminating temporary outdoor storage of rubble and others * Except for secondary waste of water treatment and materials for reuse or recycling (within FY2028)

★ 2017.6 Revision ★ 2018.6 Revision ★ 2019.6 Revision ★ 2020.7 Revision ★ 2021.7 Revision

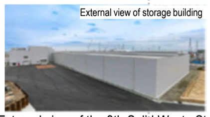
★ 2016.3 Announcement of Storage Management Plan of Solid Waste (Ver. 1)

▼ 2012.9 Transfer start of rubble to the soil-covered temporary storage facility



<Outline of soil-covered temporary storage facility>

▼ 2013.1 Start of volume reduction of trimmed trees and storage in temporary storage tank A



External view of the 9th Solid Waste Storage

▼ 2014.7 Start of pre-work

9th Solid Waste Storage

▼ 2015.6 Transfer start of rubble to the soil-covered temporary storage facility (Tank 3)


Whole view of the soil-covered temporary storage facility Tank 3

▼ 2018.2 Operation start

▼ 2019.6 Start of building construction

1st Large Waste Storage

1st Large Waste Storage Roof construction (from the inside)

2021.3 High alert issued from the Shallow Draft Quay drainage channel PS monitor ▼ (leakage from temporary storage Area W)

▼ 2021.7 Leakage of radioactive materials from a notch tank stored in temporary storage Area P

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

▼ 2013.5 Installation work gets underway

Solid Waste Incinerator

▼ 2016.3 Operation start

▲2016.8-11 Manual stop (due to pin-hole incidence)

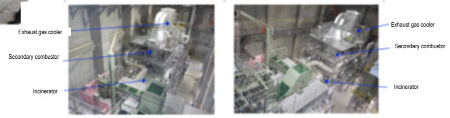
▼ 2017.4 Start of pre-work

Additional Solid Waste Incinerator


Whole view of Solid Waste Incinerator


Electrical room


Control room



Whole view of Solid Waste Incinerator (Left: System A; right: System B)

2017.10 Installation work gets

▼ 2018.5 Operation start

Large Equipment Decontamination Facility


External view of Large Equipment Decontamination Facility

▼ 2020.9 Start of pre-work

Compaction Facility

Site of Volume Reduction Facility

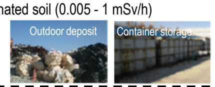
Present status Note

Storage of rubble and others

Present storage Approx.480,000 m³ (as of 2021.3)

Rubble (combustible), trimmed trees, used protective clothing)

Contaminated soil (0.005 - 1 mSv/h)



Rubble (metal, concrete, others)

More than 1 mSv/h

0.005-1 mSv/h

Less than 0.005mSv

Storage of water treatment secondary waste

Note: Used protective clothing before incineration and BG-level concrete waste for which treatment and reuse is decided at present are not included.

Estimate for the next decade (or so)
Approx.790,000 m³
(*2)

Approx. 290,000 m³
Approx. 60,000 m³
Approx. 60,000 m³
Approx. 170,000 m³
Approx. 220,000 m³
Approx. 6,500 tanks

Status after a decade

Legend ☐: Newly installed equipment and facility

Incineration

To (A)
(*1)

Incinerator Pre-treatment Facility
(scheduled for completion in FY2025)


Crusher example

Radioactive Waste Incinerator

Additional Radioactive Waste Incinerator (scheduled for completion in FY2021)


Work of main part

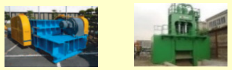
2021.3
The installation process was reviewed
Toward an operation launch within FY2021, installation work continues

Stored and managed in Solid Waste Storage as done for rubble

Volume reduction

To (A)
(*1)

Compaction Facility
(scheduled for completion in FY2022)


Concrete crusher example
Metal cutter example

Melting

Melting equipment


Electric furnace example

To (B)

Treatment measures and others will be examined

(*3) Approx. 270,000 m³ (*2)

Approx. 20,000 m³
Approx. 60,000 m³
(*1) (A) Approx. 60,000 m³
(B)
Approx. 60,000 m³
Approx. 70,000 m³
(*1)

Storage /management

Solid Waste Storage
(Storage capacity: approx. 260,000 m³)

Existing Solid Waste Storage
1st-8th (existing)
9th (Operation launch in 2018.2)

Additional Solid Waste Storage
10th-11th
(Scheduled for completion after FY2022)

Based on the estimates for the amount of waste to be generated, the storage capacity (approx. 260,000 m³) will be reached in around 2032. Scope to install an additional solid waste facility and others will be examined

Reuse will be examined

Spent Adsorption Vessel Temporary Storage

Large Waste Storage
(scheduled for completion in FY2022)
Toward an operation launch within FY2022, installation work is underway


Work of main part

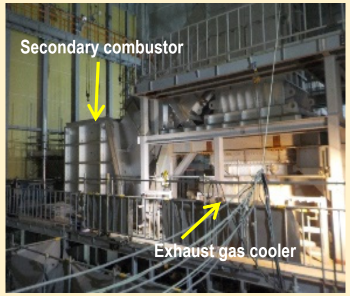
(*1) Items for which incineration, compaction, melting or reuse is difficult are stored directly in Solid Waste Storage without being treated
(*2) As values less than 10,000 m³ are rounded, they may not be consistent with the total of breakdown
(*3) In the estimate, approx. 250,000 m³ of waste will be stored in Solid Waste Storage at the end of FY2028.

- The exposure dose at the site boundaries will be reduced by aggregation to indoor storage and eliminating outdoor storage.
- The exposure dosage in exhaust gas from incinerators and at site boundaries is measured and announced on the website and others.

●Efforts to eliminate temporary outdoor storage of rubble and others

To incinerate trimmed trees and combustible rubble (woods, packing materials, paper and others), work to install the Additional Solid Waste Facility is underway.


Whole view of the Additional Solid Waste Incinerator Building



Main equipment

6 Improvement of work environment

While ensuring reliable exposure dose management for workers, sufficient personnel are secured. Moreover, while getting a handle on on-site needs, the work environment and labor conditions are continuously improved.

Regarding the site-wide reduction in the radiation dose and prevention of contamination spreading, the radiation dose on site was reduced by removal of rubble, topsoil and facing. Moreover, the operation was improved to use environmentally-improved areas as a Green Zone, within which workers are allowed to wear general work clothes and disposable dust-protective masks which are less of a physical burden.

External view of Access Control Facility

In June 2013, operation of the Access Control Facility started near the main gate of the Fukushima Daiichi NPS, to which duties conducted at J-village were shifted, including contamination examination, decontamination, switching protective equipment on and off and distribution/collection of dosimeters.

From March 12, 2011, in response to the increased airborne concentration of radioactive materials, instructions were issued to wear full-face masks throughout the Fukushima Daiichi NPS site, excluding the Main Anti-Earthquake Building and the rest house.

To help workers in the Fukushima Daiichi NPS precisely understand the conditions of their workplaces, a total of 86 dose-rate monitors were installed by January 2015. These monitors allow workers to confirm on-site dose rates at their workplaces in real time.

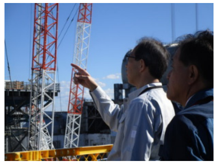
In March 2015, the Fukushima revitalization meal service center opened.

A large rest house for workers was established and its operation commenced in May 2015. Spaces in the large rest house are also installed for office work and collective worker safety checks as well as taking rest.
In March 2016, a convenience store opened in the large rest house. In April, the shower room went into operation.

In February 2017, operation started at the Partner Companies' Building next to the New Administration Office Building.

In May 2017, a heliport for emergency transport was installed inside the Fukushima Daiichi NPS and went into operation.
Compared to the previous operation (at Koriyama Coast, Futaba Town or Fukushima Daini NPS, relaying to a doctor helicopter), a faster response is available for seriously ill patients requiring treatment at external medical institutions.

From November 2018, from the west-side high-ground area, where Unit 1-4 can be viewed, visitors can see the site in their normal clothes without having to change.



Visit by Governor of Fukushima Prefecture to the Fukushima Daiichi NPS (2018.11.1)

Visit by Prime Minister Kishida to the Fukushima Daiichi NPS (2021.10.17)

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

Changes in operation of controlled area

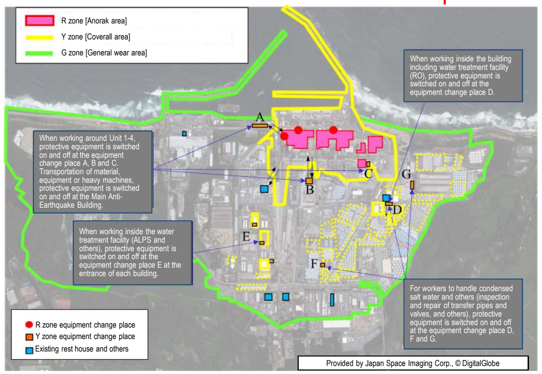
From May 2013, full-face mask unnecessary area was expanded sequentially.

In May 2015, full-face mask unnecessary area was expanded to cover about 90% of the site.

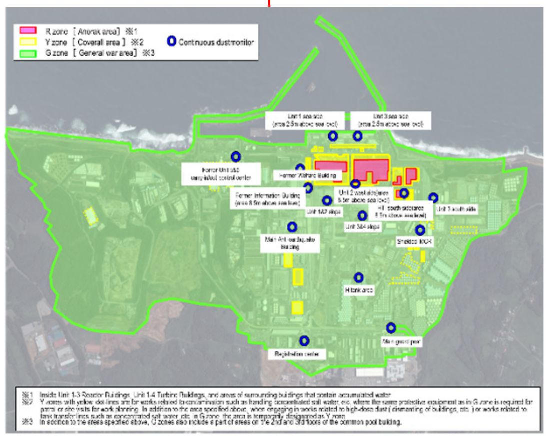
In March 2017, the G-zone area was expanded (to cover 95% of the whole site).

In August 2021, operation started while eliminating the need for the DS2 mask during light work in G-zone outside the protection area around Unit 1-4 (except for inside Units 5 and 6).

In May 2013, areas excluding those around Unit 1-4, tank areas and rubble storage areas were set to full-face mask unnecessary areas.



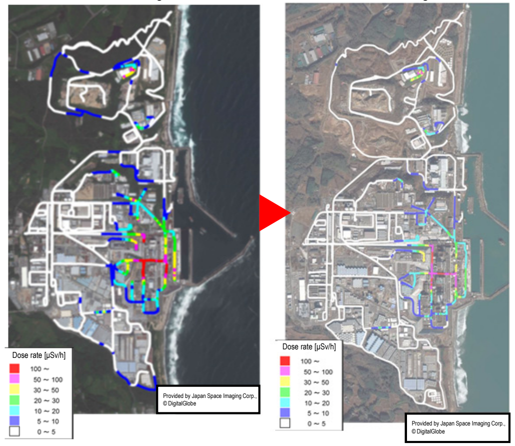
In March 2016, based on the progress of measures to reduce the environmental dosage on site, the site was categorized into two zones: Highly contaminated area around Unit 1-4 buildings, etc. and other areas where limited operation started to optimize protective equipment according to each category.



In May 2018, within about 96% of the site, workers are allowed to wear light equipment such as general workwear and disposable dust-protective masks.

<Travel survey results of major roads within the site>
The dose rate has been declining every year.

Measured in August 2016 Measured in August 2018



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