Outline of Decommissioning, Contaminated Water and Treated Water Management

March 30, 2023
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

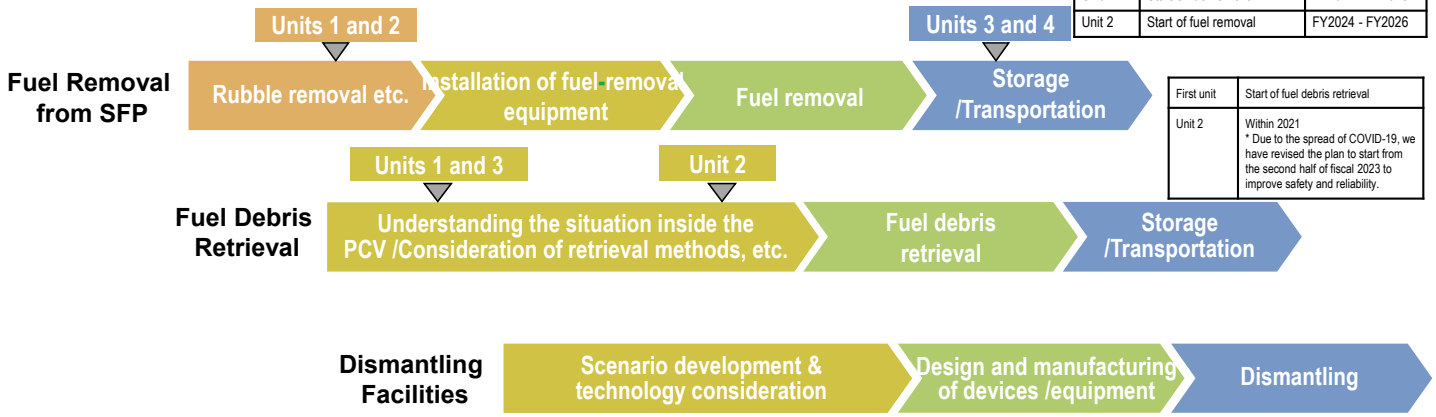
Main decommissioning work and steps

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.

<Milestones in the Mid-and-Long-Term Roadmap>

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

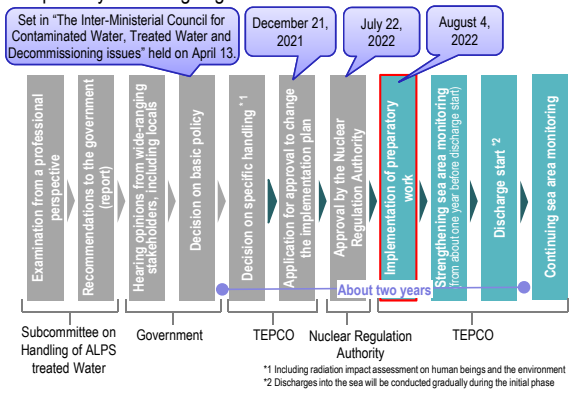


First unit	Start of fuel debris retrieval
Unit 2	Within 2021 * Due to the spread of COVID-19, we have revised the plan to start from the second half of fiscal 2023 to improve safety and reliability.

Measures for 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.



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

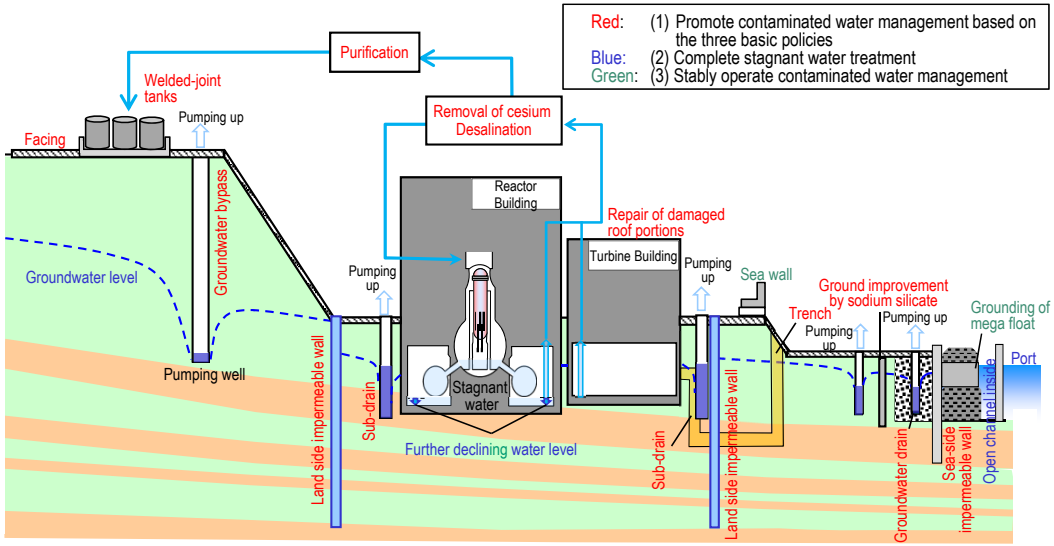
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized 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)

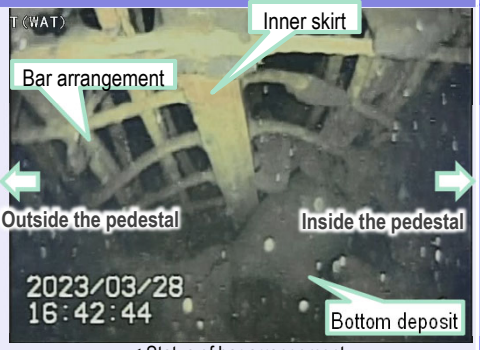
Progress status

◆ 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.

Unit 1 Status of the Primary Containment Vessel (PCV) internal investigation (the latter half)

During the period March 4-7, 2023, an investigation was conducted at 34 points to create a deposit 3D-mapping by ROV-B.

From March 28, an investigation inside the pedestal by ROV-A2 started, in which exposure of a portion of bar arrangement was confirmed at the foundation inside the pedestal. Regarding the soundness of the pedestal, based on a past earthquake-resistant evaluation conducted by the International Research Institute for Nuclear Decommissioning (IRID), it is evaluated that serious risk will not occur, even if a portion of the pedestal is lost. However, as the present information is limited, the investigation will continue to acquire as much information as possible.



< Status of bar arrangement on the left side of the pedestal opening >
Provided by International Research Institute for Nuclear Decommissioning (IRID)

Status of transfer of HIC slurry

Waste (slurry) generated with the contaminated water treatment in ALPS has been contained and stored in the High Integrity Container (HIC). Among HIC affected by irradiation of beta rays from slurry, after implementing measures to reduce exposure, work for the target to transfer 45 units in FY2022 started and completed on March 23.

Measures to reduce the risk of decommissioning continue.

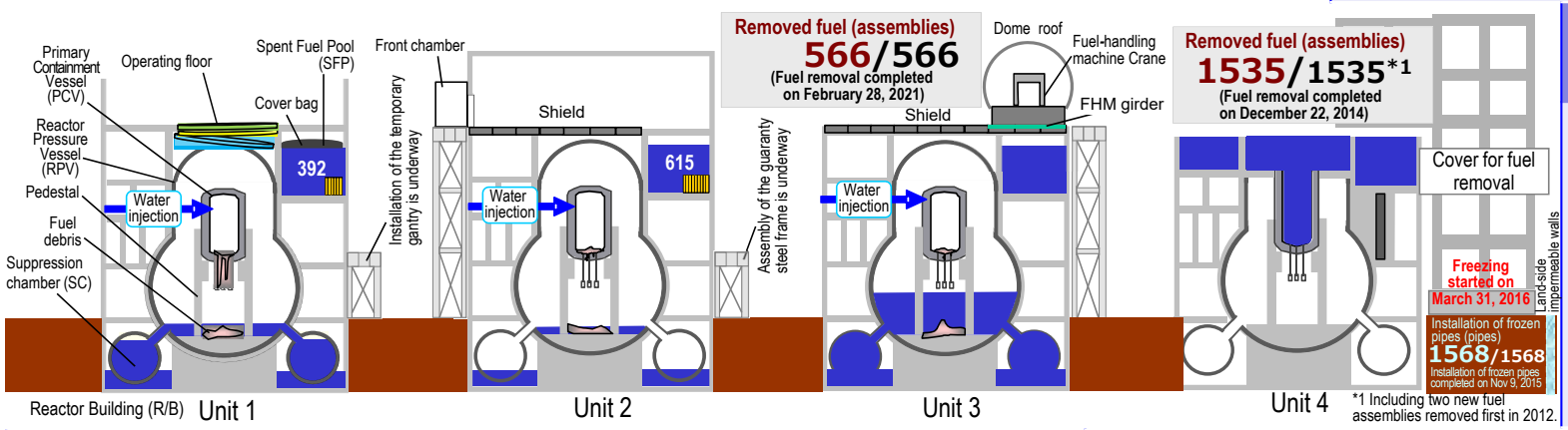
Circulation and stirring operation of the ALPS treated Water Dilution/Discharge Facility

Among the ALPS treated Water Dilution/Discharge Facility, for the measurement and confirmation facilities, a pre-service inspection certificate was granted by the Nuclear Regulation Authority (NRA) on March 15 and to homogenize the concentration of radioactive nuclides, circulation and stirring operation started for the measurement and confirmation tank area B on March 17.

On March 19, as water-level decline was detected in the tank area A (A10) in which circulation and stirring operation was not conducted, the outlet valve of that area was closed immediately. As no further decline was noticed, it was considered attributable to the seat pass of the isolation valve. No leakage to the outside of the system or external influence was identified.

After the time required for homogenization had elapsed from March 19 when the containment function was secured, sampling was conducted on March 27 in the presence of the national government and local municipalities. During the next phase, analysis will be conducted to verify compliance with the discharge criteria.

An investigation of the cause of the seat pass of the isolation valve is underway and efforts to prevent recurrence will be made.



*1 Including two new fuel assemblies removed first in 2012.

Milestone for contaminated water treatment in buildings in the Mid-and-Long-Term Roadmap was achieved

To reduce the risk of contaminated water in the Reactor Buildings leaking outside of the system, treatment of contaminated water has been conducted.

While checking the influence of dust, measures have been implemented to reduce the water level. In March 2023, the water level in each building reached the target and for Units 1-3 Reactor Buildings, the milestone in the Mid-and-Long-Term Roadmap of "reducing the contaminated water in the Reactor Buildings to approx. half of the level at the end of 2020 in FY2022-2024" was achieved.

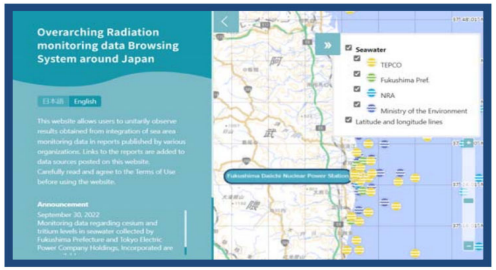
Overarching Radiation-monitoring data Browsing System (ORBS) is opened

In accordance with the government's Comprehensive Monitoring Plan, Fukushima Prefecture, the Nuclear Regulation Authority, the Ministry of the Environment and TEPCO have strengthened sea area monitoring by increasing the number of measurement locations and the frequency of measurements.

The monitoring results had been published by each organization. This time the Overarching Radiation-monitoring data Browsing System in the coastal ocean of Japan (ORBS) is opened on March 13*, which is a website that gathers sea-area monitoring measurements disclosed by each organization and displays them on a map format for easy viewing thereby providing objective and comprehensive data on sea conditions.

TEPCO will continue to provide easy-to-understand information.

* At present, measurements of cesium and tritium in seawater are displayed



< Overarching Radiation-monitoring data Browsing System >

Overarching Radiation-monitoring data Browsing System (ORBS)
https://www.monitororbs.jp/index_en.html

Immediate response concerning establishment of the analysis system toward decommissioning of Fukushima Daiichi Nuclear Power Station

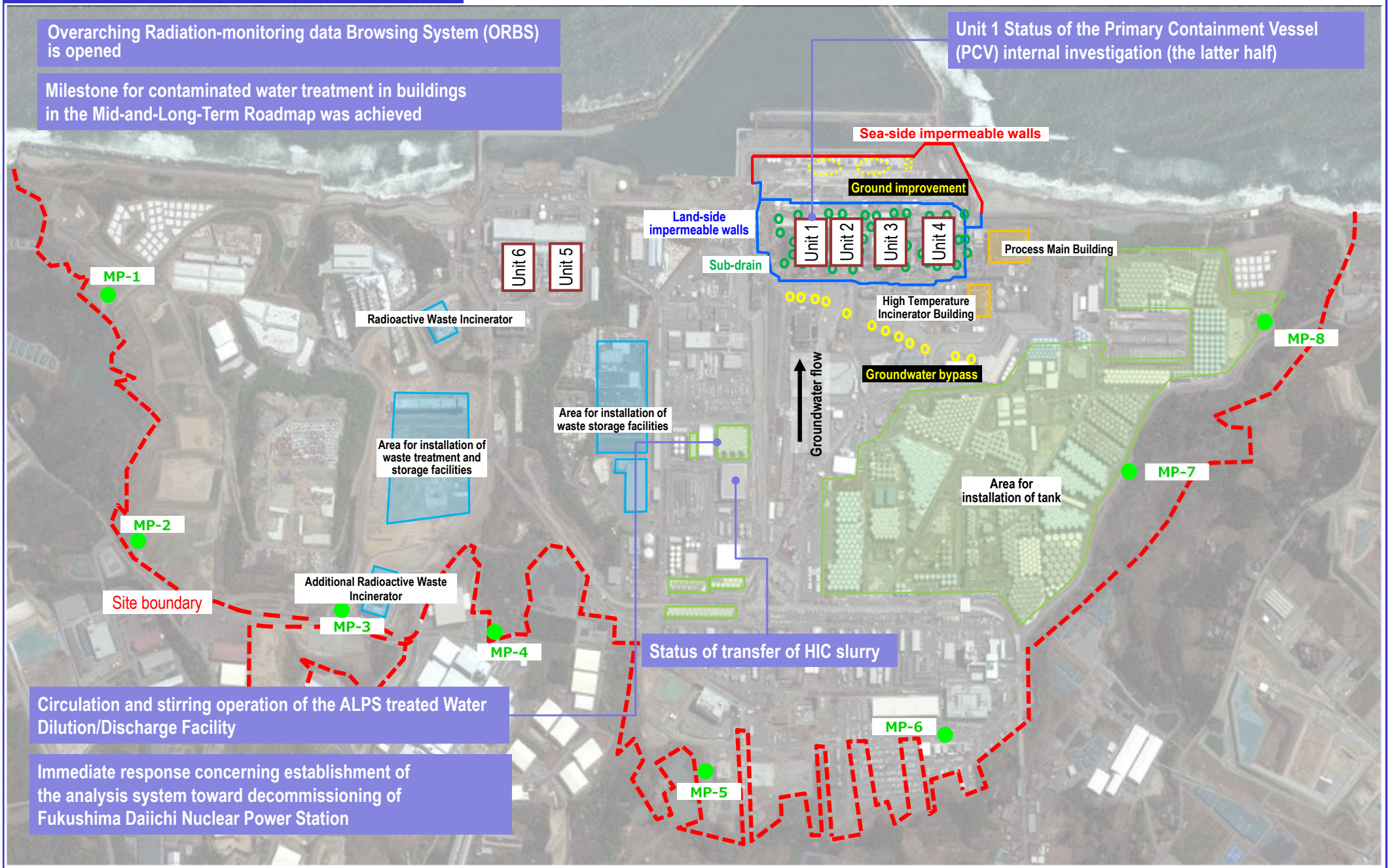
Regarding the analysis system of the Fukushima Daiichi Nuclear Power Station, TEPCO formulated an analysis plan after clarifying the analytical needs along the timeline of decommissioning.

Moreover, to smoothly implement the waste measures, based on the formulation of the analysis plan and others, an analytical system will be established. Subjects to be addressed immediately include:

- Considering the specification of human resources required in mind, personnel must be secured. As analytical practices will be carried out mainly in JAEA facilities, these opportunities must be utilized as mush as possible. (Efforts to develop and secure human resources)
- To prepare for an increase in future analysis workload, the analytical capability of the Okuma Laboratory-1 must be enhanced. Furthermore, the Okuma Laboratory-2 and TEPCO comprehensive analysis facility must be steadily constructed. (Efforts to construct analysis facilities)
- While steadily proceeding with immediate efforts, the analysis plan and system must be consistently reviewed. In the Technical Strategic Plan, based on the immediate response and the analysis plan, the analysis strategy must be enhanced. (Preparation of the framework to steadily conduct the analysis)

The whole government will consolidate the response to these efforts.

Major initiatives – Locations on site

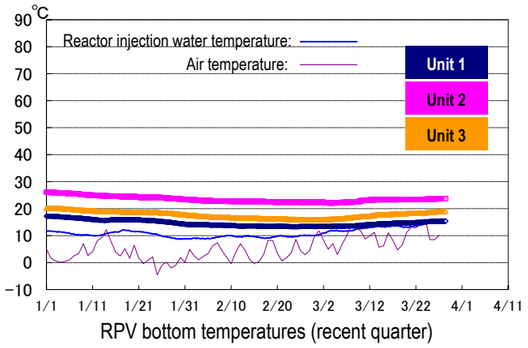


Provided by Japan Space Imaging Corp., photo taken on April 8, 2021
Product (C) [2020] DigitalGlobe, Inc., a Maxar company

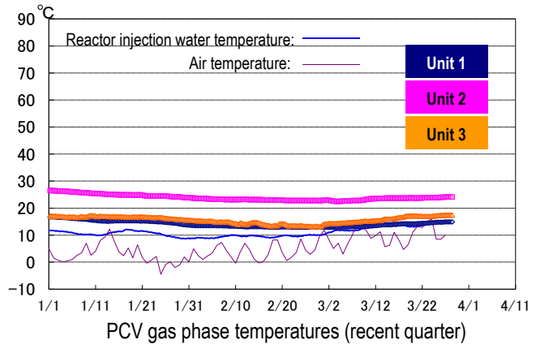
I. Confirmation of the reactor conditions

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. 10 to 25°C for the past month, though it varied depending on the unit and location of the thermometer.

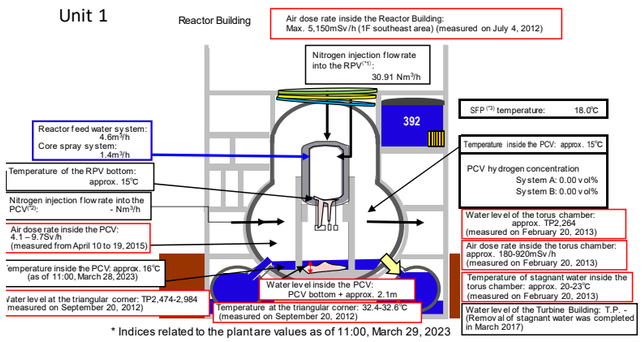


RPV bottom temperatures (recent quarter)

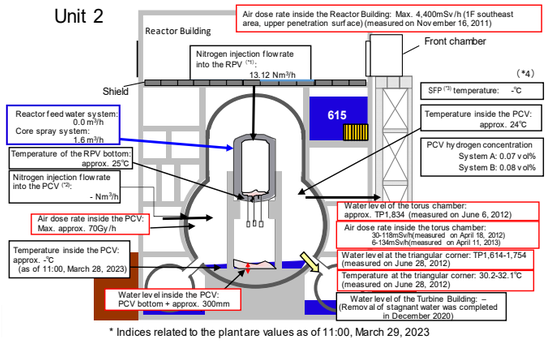


PCV gas phase temperatures (recent quarter)

*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.



* Indices related to the plant are values as of 11:00, March 29, 2023



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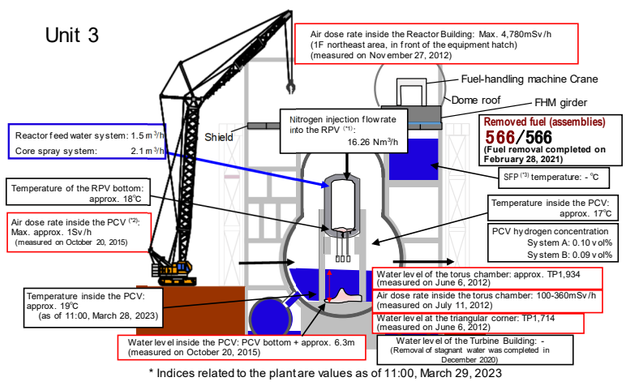


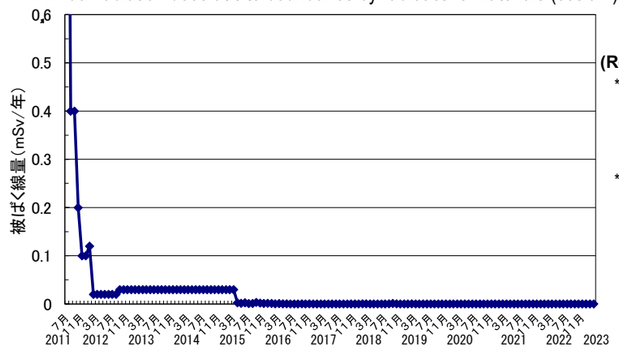
* Indices related to the plant are values as of 11:00, March 29, 2023

(*1) RPV (Reactor Pressure Vessel)
(*2) PCV (Primary Containment Vessel)
(*3) SFP (Spent Fuel Pool)
(*4) Regarding Unit 2 SFP, the system is currently suspended due to inspection

Release of radioactive materials from the Reactor Buildings

As of February 2023, 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. 1.8×10^{-12} Bq/cm^3 and 1.8×10^{-12} Bq/cm^3 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-



(Reference)

* The concentration limit of radioactive materials in the air outside the surrounding monitoring area:
[Cs-134]: 2 x 10^{-5} Bq/cm^{3}[Marc]
[Cs-137]: 3 x 10^{-5} Bq/cm^3

* Data of Monitoring Posts (MP1-MP8).
Data of Monitoring Posts (MPs) measuring the air dose rate around the site boundary showed 0.311 – 1.077 μSv/h (February 21 – March 28, 2023).
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.

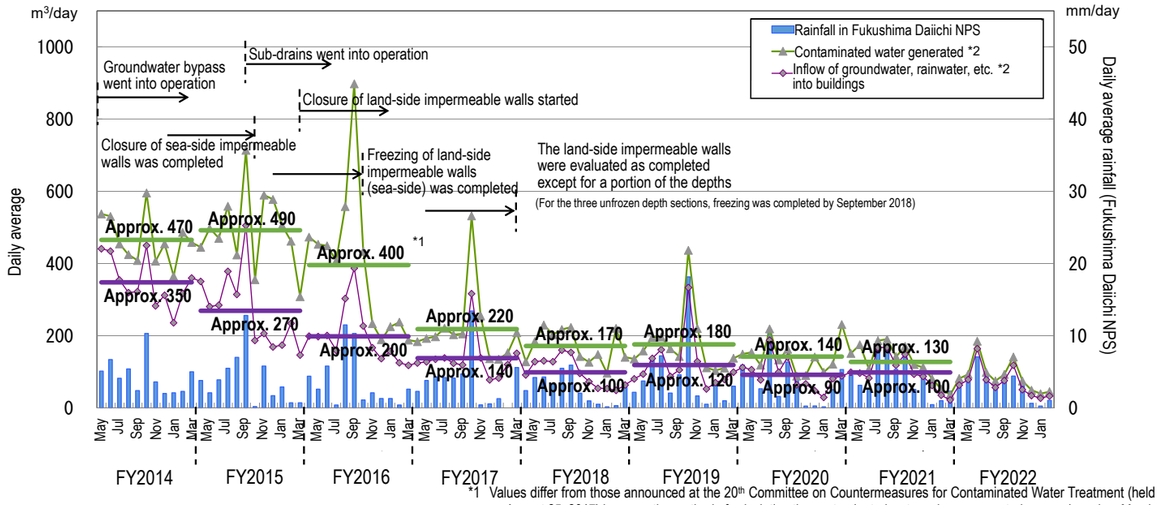
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

II. Progress status by each plan

Measures for contaminated water and treated water

➢ 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 m^3/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 March 16, 2023, 2,112 release operations had been conducted.
  The water quality of all temporary storage tanks satisfied the operational target.

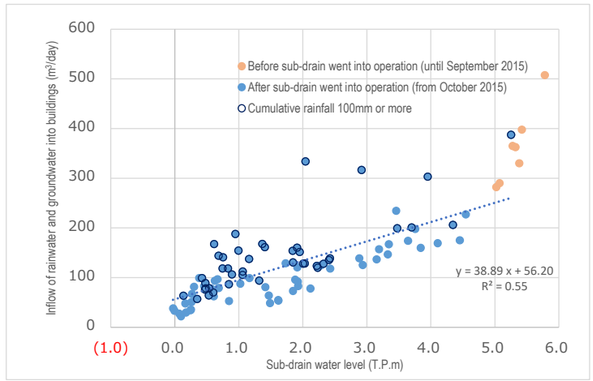


Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

➢ Implementation status of facing

- Facing is a measure that involves 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 February 2023, 95% of the planned area (1,450,000 m^2 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 February 2023, 40% of the planned area (60,000 m^2) 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 each year due to the land-side impermeable walls and the decline in the set water level of the sub-drains. On the mountain side, the average difference between the inside and outside has remained at 4-5 m. The water level in the bank area has also remained low (T.P. 1.4 m) relative to the ground surface (T.P. 2.5 m).
- As the set water level of the sub-drains declined slightly (T.P. -0.55 ⇒ -0.65 m) and others in FY2021, the groundwater level on the sea side of the Unit 1-4 buildings remained low (except during heavy rainfall) compared to the T.P. 2.5 m area.

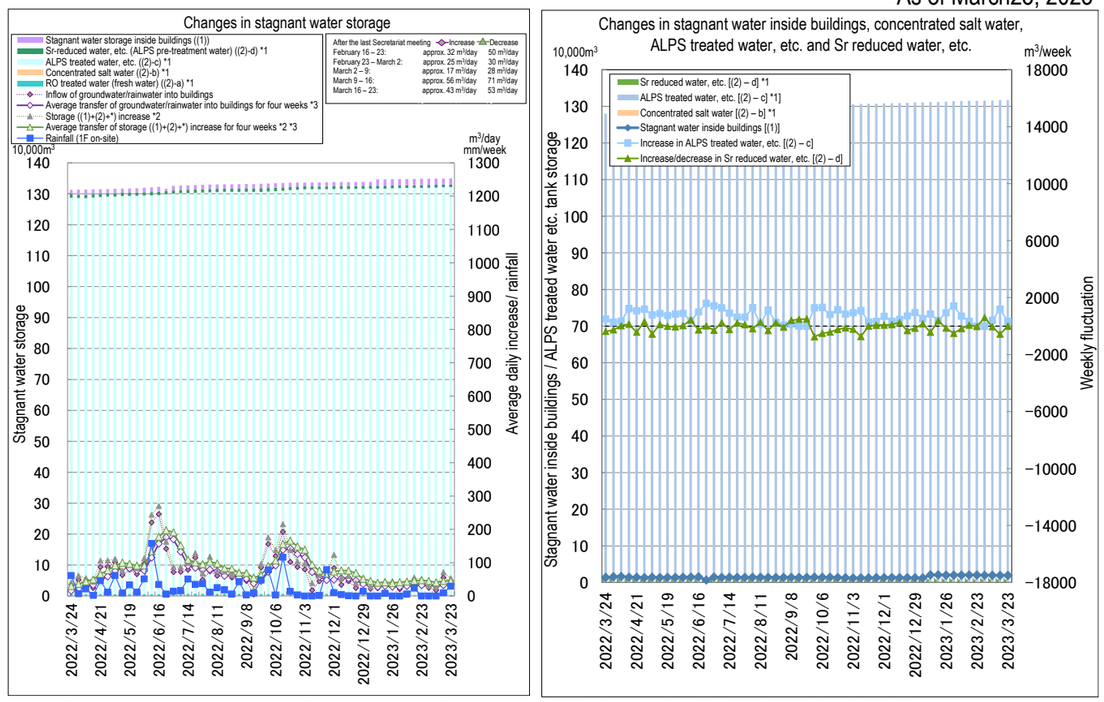
➢ Operation of the multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing), hot tests using radioactive water had been 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 (NRA) and the entire pre-service inspection was completed. The (additional) multi-nuclide removal equipment went into full-scale operation from October 16, 2017. Regarding the (high-performance) multi-nuclide removal equipment, hot tests using radioactive water had been conducted from October 18, 2014. On March 2, 2023, a pre-service inspection certificate was granted by the NRA and the entire pre-service inspection was completed.
- As of March 23, 2023, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 494,000, 753,000 and 104,000 m^3, respectively (including approx. 9,500 m^3 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 March 23, 2023, approx. 708,000 m^3 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 March 23, 2023, approx. 876,000 m^3 had been treated.

As of March23, 2023



(1): Stagnant water storage inside buildings (Units 1-4, Process Main Building, High Temperature Incinerator Building, Waste Liquid Supply Tank, SPT (A), SPT (B), Units 1-3 CST, buffer tank)
(2): Units 1-4 tank storage ([(2)-a RO treated water (fresh water)] + [(2)-b Concentrated salt water] + [(2)-c ALPS treated water, etc.] + [(2)-d Sr-reduced water, etc. (ALPS pre-treatment water)]
*: Water amount from tank bottom to water-level gauge 0% (DS)
*1: Water amount for which the water-level gauge indicates 0% or more
*2: Calculated in the method of contaminated water generated [(Inflow of groundwater/rainwater into buildings) + (other transfer) + (chemical injection into ALPS)]
*3: Average transfer of storage increase and groundwater/rainwater into buildings for four weeks was added (November 24, 2022)

Figure 3: Status of stagnant water storage

➢ Status of freshwater storage

- With the progress of contaminated water management, contaminated water generated in this fiscal year has been significantly suppressed. (This may also be attributable to less frequent intensive rainfall such as typhoon)
- On the other hand, with the reduction in the amount of contaminated water generated, the amount of purified freshwater to be used for reactor water injection has been reduced. The amount of the freshwater storage tank in the area of 33.5 m above sea level has declined compared with past years.
- As countermeasures, from February 13, 2023, a portion of “treated water to be re-purified” stored in the ALPS treated water tank has been temporarily transferred (150 m^3/day) to the waste liquid supply tank and subject to RO treatment to secure the amount of the freshwater storage tank.
- It was confirmed that the amount of freshwater storage was being recovered. If the status remains constant, storage of approx. 4,500m^3 will be secured by around the end of March 2023.
- By this procedure, a portion of transferred “treated water to be re-purified” began to be treated by ALPS, which will subsequently help reduce “treated water to be re-purified” subject to secondary treatment.

➢ Sum of concentration ratios required by law after transfer and storage to reused tanks in the Category (3) (previously reported) and source tanks

- From tanks storing strontium-reduced water and others to tanks storing ALPS treated water and others, the reuse of welded-joint tanks is underway.
- To minimize the sum of concentration ratios required by law, based on the condition inside the tanks after treating residual water and the storage record, reused tank areas are classified into three categories (1)-(3), with measures

being implemented and examination underway in each category.

- Regarding tanks in the Category (3), “treated water to be re-purified with which the sum of concentration ratios required by law is 1 or higher” and subject to secondary treatment will be transferred and source tanks will receive ALPS treated water to minimize the sum of concentration ratios required by law.
- After completing the reception of “treated water to be re-purified” to tanks in the Category (3) and “ALPS treated water” to source tanks, analysis was conducted. The analytical results showed that, as initially planned, the sum of concentration ratios required by law was less than 1 for the source tanks.

➢ Status of sea-area monitoring related to the handling of ALPS treated water

- The concentration of tritium in seawater within 2km of the port has remained constant over the past year and was also low at new measurement points within the fluctuation range of seawater in Japan*. The concentration of Cesium-137 increased temporarily, which was considered due to rainfall, as applied to the past fluctuation in seawater around the Fukushima Daiichi Nuclear Power Station. However, it remained constant relative to measurement benchmarks for the past year and at new measurement points, also low within the fluctuation range of seawater in Japan*. For tritium, monitoring with a lower detection limit has been conducted since April 18, 2022.
- Both concentrations of tritium and Cesium-137 in seawater within 20km of the coast had remained constant for the past year and low within the fluctuation range of seawater in Japan*.
- The concentration of tritium in seawater further than 20km from the coast remained low, including at new measurement points, within the fluctuation range of seawater in Japan*. The concentration of Cesium-137 remained constant over the past year within the fluctuation range of seawater in Japan*.

  * : The range of the minimum – maximum values detected during April 2019 – March 2021 were as follows in the database below:

  In Japan (including off the coast of Fukushima Prefecture):

  Tritium concentration: 0.043 - 20 Bq/L

  Cesium-137 concentration: 0.0010 - 0.45 Bq/L

  Off the coast of Fukushima Prefecture

  Tritium concentration: 0.043 – 2.2 Bq/L

  Cesium-137 concentration: 0.0010 - 0.45 Bq/L

  Source: Environmental Radioactivity and Radiation in Japan, Environmental Radiation Database

  https://www.kankyo-hoshano.go.jp/data/database/

- The concentration of tritium in fish sampled at the sampling point T-S8 had remained constant for the past year. The concentration of tritium in fish sampled at new sampling points, including those for which the analytical value was verified, remained low within a similar fluctuation range for seawater in Japan*. Other measurement data of fish is being verified.

  * : The range of the minimum – maximum values detected during April 2019 – March 2021 was as follows in the database above:

  In Japan (including off the coast of Fukushima Prefecture)

  Tritium concentration (tissue free water type): 0.064 – 0.12 Bq/L

- The concentration of iodine 129 in seaweed sampled since July 2022 had been below the lower detection limit (< 0.1 Bq/kg (raw)). The concentration of tritium had not been analyzed due to a lack of sufficient sample population for reanalysis via the improved method following a review of the analytical procedures based on the verification results of fish tritium analysis data. The fluctuation range of iodine 129 in seaweed in Japan had been within the range of minimum – maximum values detected during April 2019 – March 2021 in the database below.

  In Japan Iodine 129 concentration: 0.00013 Bq/Kg (raw) – 0.00075 Bq/Kg (raw)

➢ Progress of the rearing test of marine organisms in the Fukushima Daiichi Nuclear Power Station

- To eliminate concerns and reassure those in society, a rearing test of marine organisms (flounder and abalones) in seawater with ALPS treated water added and normal seawater for comparison is underway.
- Regarding the test of flounder, since February 11, 2023, no death or abnormality was detected (as of March 22).
- Regarding the test of abalones, since the test started on October 25, 2022, 37 deaths were detected in “normal seawater” and 58 deaths, in “ALPS treated water diluted by seawater” (as of March 22).
- The timing for starting the rearing test of seaweed will be announced as soon as it has been decided.
- Subsequently, the tritium concentration will be measured for abalones having been reared in diluted ALPS treated water (less than 1,500 Bq/L) in October - November 2022 and flounder, (approx. 30 Bq/L) in November - December 2022.

➢ Progress status of work to install the ALPS treated Water Dilution/Discharge Facility and related facilities

- For the measurement and confirmation/transfer facilities, work to install a pipe support, piping and others for these facilities started from August 4, 2022 from around the K4 area tanks. The pre-service test started from January 16, 2023. On March 15, 2023, a pre-service inspection certificate was granted for the measurement and confirmation facilities. During the period March 17-27, circulation and stirring operation was conducted and on March 27, tank area B sampling.
- For the discharge facility, test operation of the shield tunnel started from April 1, 2023 and if there is no further problem after that, tunnel excavation will be resumed. As the tunnel excavation includes work to connect to the outlet caisson and requires careful drilling, the period required until completion of the drilling will continue to be refined. Construction of the main frame of the downstream pool started from December 18, 2022 and was completed on March 23, 2023.
- For the dilution facility, placing of the foundation pile for seawater transfer pipes was completed and work to construct the foundation frame and install the pipe support, piping and others started.
- In the seaside area for Units 5 and 6, scaffolding for heavy-duty machines was completed on December 29, 2022 and the scaffold has been utilized, mainly to construct the upper stream pool from January 5 2023. Sedimentation inside the intake open channels is being removed simultaneously and after installing the partition weir, anti-permeation work will be removed.
- At sea, the temporary surveying tower, which is equipped with the outlet caisson, is being removed.

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 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. The ground assembly was completed for the temporary gantry and lower structure and approx. 83%, for the upper structure.
- A work yard was prepared around the Reactor Building and preliminary work to install a large cover started from August 2021.
- A temporary gantry is being installed from the portion where anchors and base plates near the top of the temporary gantry are installed.
- Before the forthcoming drilling of anchors near the operating floor level, removal of rubble which interferes with the drilling will start from March 2023.

➢ Main work to help spent fuel removal at Unit 2

- Work to remove the control room of the fuel-handling machine (hereinafter FHM control room), which started from August 2022, was completed in November 2022. (Work to transport dismantled rubble was completed on January 31)
- From February 6, 2023, work to dismantle the existing facility on the south side commenced and was completed in March 20. Work to collect and transfer of dismantled rubble continues.
- Outside the building, the erection of a steel structure commenced from January 23, 2023.

- Outside the site, before erecting the steel structure on-site, ground assembly continues.

Retrieval of fuel debris

➢ Unit 1 PCV internal investigation (the latter half)

- During the period March 4-7, 2023, investigation for deposit 3D-mapping by ROV-B was conducted at 34 points. The investigation was completed on March 8 by uninstalling ROV-B.
- From March 28, the investigation inside the pedestal by ROV-A2 started. The investigation will be conducted from parts where the risk of ROV cable snagging is low, with the aim of acquiring as much information as possible.

➢ Progress status toward Unit 2 PCV internal investigation and trial retrieval

- Regarding the robot arm, by correcting the difference between the information acquired through the ongoing Naraha mockup test simulating the site, which had been conducted since February 2022 and the pre-simulation results, to reduce the contact risk during the fuel debris retrieval, correction of the control program and other improvements (*) are currently underway. (* Improvements: correcting and improving the accuracy of the control program, increasing the arm operation speed, improving the cable mounting tool, increasing visibility, improving the gripper, etc.)
- As preliminary work of the Unit 2 site, work to install the isolation room toward opening the X-6 penetration hatch commenced from November 2021. In response to the damage to the rubber box in the isolation room, bending of the guide roller (earthquake response) and others having occurred during the work, countermeasures were completed. At present, inspection, adjustment and others of the isolation room pressing mechanism are underway. (Simultaneously, remanufacturing of the isolation room is being examined.) Subsequently, opening of X-6 penetration hatch, removal of deposits inside X-6 penetration and other work are scheduled. Work needs to proceed safely and carefully.

➢ Sampling of the Unit 1 RCW heat exchanger and response to stagnant hydrogen

- Regarding the Reactor Building Closed Cooling Water System (RCW), which is a high-dose source inside the Unit 1 Reactor Building (R/B), work related to inclusive water sampling to reduce dosage has been underway since October 2022.
- Regarding the inlet header of the RCW heat exchanger to be used for the sampling, the pipe was subject to electrolytic perforation to check for stagnant gas and hydrogen (approx. 72%) was detected.
- To ensure safety during work, stagnant gas of the pipe purged (nitrogen injection). After confirming that the hydrogen concentration had decreased below the inflammability limit, perforation was conducted for sampling and draining. As the perforated part was exposed to the atmosphere after perforation, the dust monitor, PCV parameters and others were checked to confirm no abnormality.
- Since February 22, 2023, inclusive water sampling has been underway. At present, sampling of the inlet pipe is completed. Draining of the inlet pipe, analysis and subsequent sampling of inclusive water in the heat exchanger will follow. After perforation, it was confirmed that the hydrogen concentration inside the pipe was 0%.
- In addition to checking the tendency, hydrogen gas inside the pipe will also be checked for a certain period.

➢ Progress toward resuming work to remove a portion of the Unit 1/2 SGTS pipes

- Regarding the cutting equipment (lifting beam) for removing the pipes of the Standby Gas Treatment System (SGTS), a mockup test was completed outside the prefecture on March 3.
- By sea/land transportation, the equipment arrived within the site of the Fukushima Daiichi Nuclear Power Station and the test site in Fukushima Prefecture on March 9. Subsequently, at the test site, the land-transported equipment was adjusted.
- At night on March 13, as a fatal accident occurred during the ongoing work within the power station to remove urethane on the surface of the SGTS pipes, all work related to removal of the SGTS pipes was suspended.
- Subsequently, after conducting a cause analysis of the accident occurrence and implementing recurrence prevention measures, preliminary work resumed from March 27.

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 rubble and trimmed trees

- As of the end of February 2023, the total storage volume for concrete and metal rubble was approx. 327,000m^3 (-700 m^3 compared to the end of January with an area-occupation rate of 87%). The total storage volume of trimmed trees was approx. 118,900m^3 (-1,900 m^3 with an area-occupation rate of 68%). The total storage volume of used protective clothing was approx. 14,800m^3 (+800m^3, with an area-occupation rate of 28%). The decrease in rubble was attributable to transfer for area arrangement. As of the end of February 2023, there were five temporary deposits with storage capacity exceeding 1,000m^3, storage 62,900m^3.

➢ Management status of secondary waste from water treatment

- As of March 2, 2023, the total storage volume of waste sludge was 468 m^3 (area-occupation rate: 67%), while that of concentrated waste fluid was 9,386 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 5,523 (area-occupation rate: 88%).

➢ Status of trouble shooting of the Radioactive Waste Incinerator

- On February 10 and 11, during the annual inspection, deposit of a rust-like powder was detected in the lower part of the exhaust gas filter casing and corrosion and thinning were also detected in the casing base material under the powder. Moreover, in one of these filters, one hole penetrating the casing was detected.
- Analytical results of the powder confirmed sulfuric acid and chloride ion in addition to iron oxide of the base material. It was considered that the corrosion had progressed due to condensation containing acid having generated in parts where exhaust gas temperature tended to decrease.
- As an investigation in similar parts, pipes and equipment on the upstream and downstream sides of the exhaust gas filter casing were inspected. In response to paint stripping and rust detected in the inspection, cleaning, repair, paint and other responses were implemented.
- After completing the repair, the filter performance will be verified and inspection and test operation of the remaining parts of the annual inspection to restore the Radioactive Waste Incinerator within June.

Reduction in radiation dose and mitigation of contamination

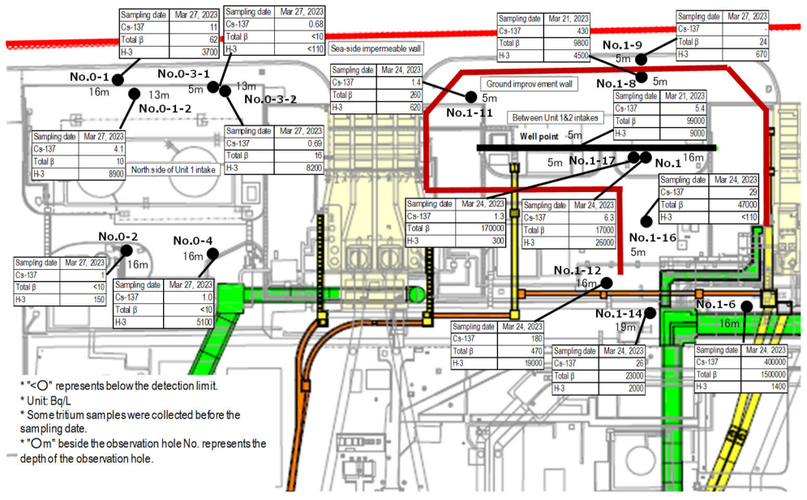
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

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

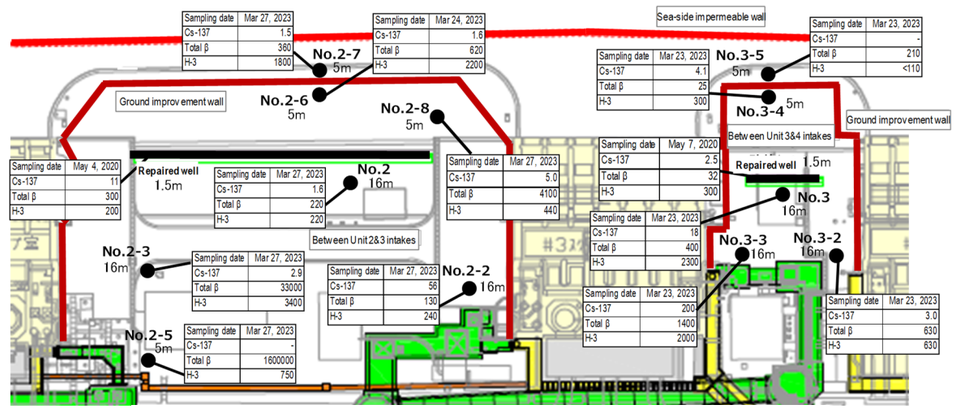
- In the Unit 1 intake north side area, the H-3 concentration was below the legal discharge limit of 60,000 Bq/L at all observation holes and remained constant or has been declining overall. The concentration of total β radioactive materials has remained constant overall but increased temporarily from 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 or declining at many observation holes, including Nos. 1-6, 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, 2-5, 2-6 and 2-7 but has remained constant overall. The concentration of total β radioactive materials has remained constant overall but been increasing or declining at No. 2-5. 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 and 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 as the overall area but been increasing or declining and exceeded the previous highest record at some observation holes. Investigations into the fluctuation are underway for Nos. 0-3-2, 1, 1-6, 2-5, 2-6 and 3-3.
- The concentration of radioactive materials in drainage channels has remained constant overall, despite increasing during rainfall. In Drainage Channel D, drainage of the low-dose area on the west side of the site started to pass from August 30, 2022 and the concentration has remained low. From November 29, 2022, continuous monitors were installed and drainage around the Units 1 and 2 switch yard started to pass.
- 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 was observed in FY2021 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

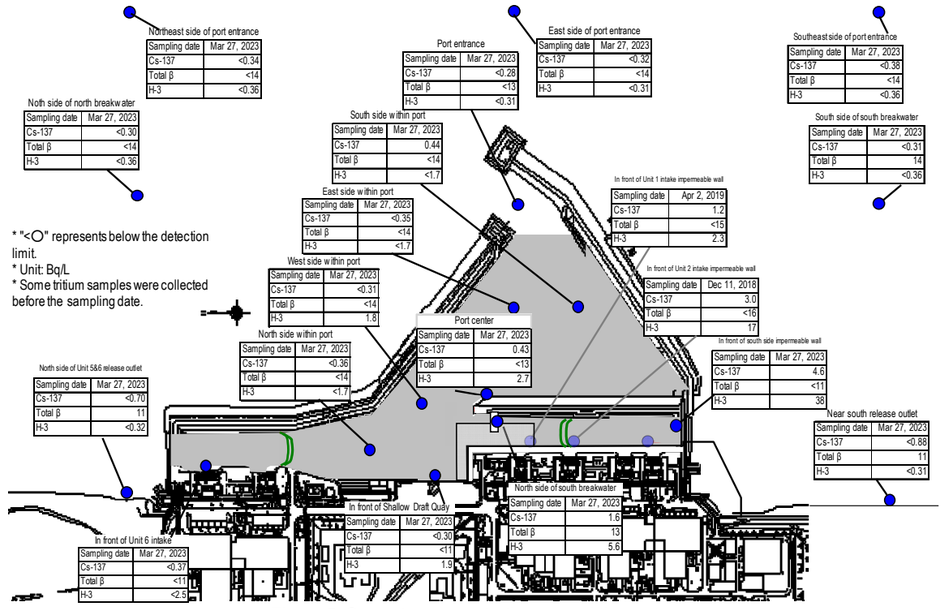


Figure 5: Seawater concentration around the port

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 November 2022 to January 2023 was approx. 9,700 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 7,700). Accordingly, sufficient personnel were registered to work on site.
- It was confirmed with the prime contractors that the estimated manpower necessary for the work in April 2023 (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 4,600.
- The number of workers from both within and outside Fukushima Prefecture remained constant. The local employment ratio (cooperating company workers and TEPCO HD employees) as of February 2023 remained constant at around 70%.

- The average exposure doses of workers were approx. 2.54 and 2.60 and 2.51 mSv/person-year during FY2019, 2020 and 2021, 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.

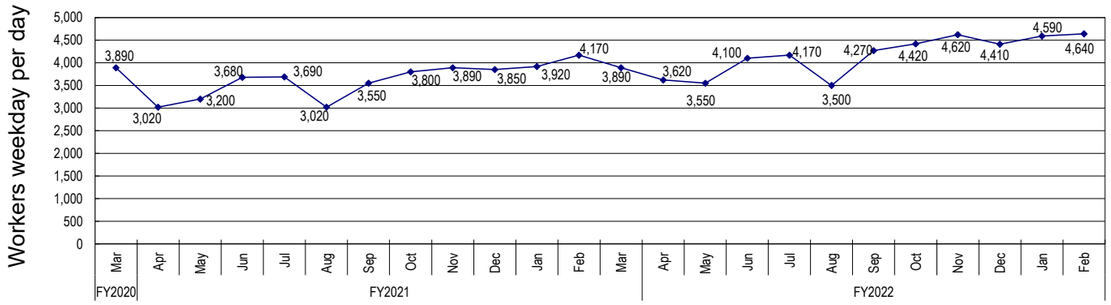


Figure 6: Changes in the average number of workers weekday per day for each month of the most recent 2 years (actual values)

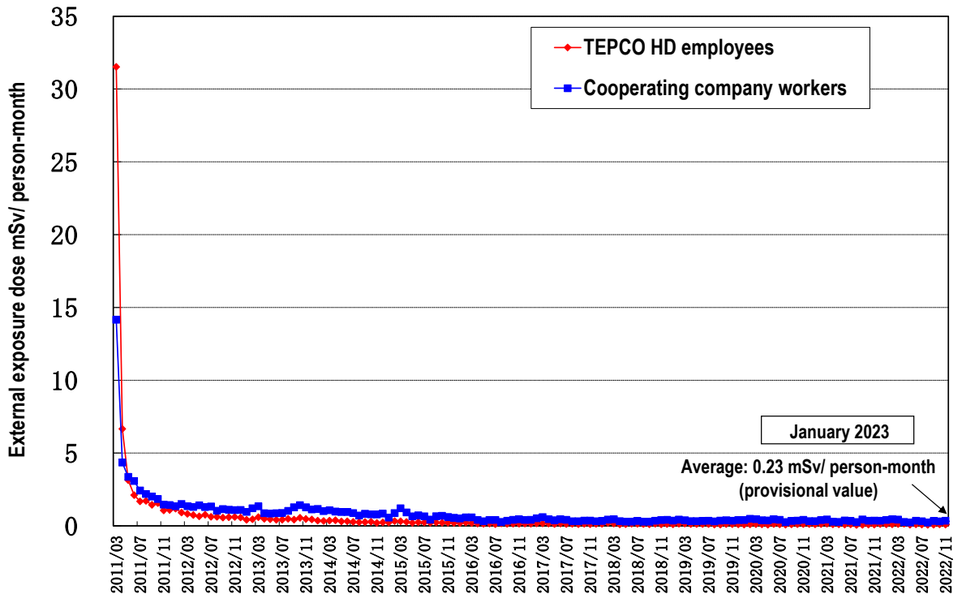


Figure 7: Changes in monthly average exposure dose of individual worker
(monthly exposure dose since March 2011)

➢ Countermeasures to suppress the spread of COVID-19 infections

- Regarding mask wearing, the government has showed a policy "to leave to individual judgment" since March 13, 2023. However, at the Fukushima Daiichi Nuclear Power Station, mask wearing continues as part of basic infection prevention measures in accordance with the TEPCO HD policy.
- On the other hand, based on the condition that infections have been decreasing across Japan and Fukushima Prefecture and the fact that the COVID-19 infection status has also stabilized at the Fukushima Daiichi Nuclear Power Station (see the section below), the operation of the antigen test, which had been required when moving from and to Fukushima Prefecture, has been reviewed and shifted since March 13, 2023 to that which checks either "three or more COVID-19 vaccinations" or "negative confirmation by PCR test or others" before entering the power station and business travel from and to the location prefecture.
- Ongoing basic countermeasures to prevent infection spreading, such as requiring employees to take their temperature before coming to the office, wear masks at all times, avoid the "Three Cs" by using the rest house in shifts, eat silently and carefully select business travel, have been continued to be properly implemented to proceed with decommissioning work, prioritizing safety above all.
- As of March 29, 2023, 1,751 workers (including 280 TEPCO HD employees, 1,466 cooperating company workers, 3 business partner company employees and 2 temporary workers) of the Fukushima Daiichi Nuclear Power Station had been infected by COVID-19, an increase in 8 workers (including 2 TEPCO HD employees and 6 cooperating company workers) from the figures in the previous published material (as of February 21, 2023).
- No significant influence on decommissioning work, such as a corresponding delay to work processes due to this infection, had been identified.

➢ Measures to prevent infection and expansion of influenza and norovirus

- Since November 2022, 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, 2022 to January 28, 2023) for cooperating company workers. As of January 28, 2023, a total of 4,696 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 12th week of 2023 (March 20-26, 2023), 25 influenza and four norovirus infections were recorded. The totals for the same period for the previous season also showed no influenza and six norovirus infections.

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 Units 5 and 6

➢ Status of spent fuel storage in Units 5 and 6

- Regarding Unit 5, fuel removal from the reactor was completed in June 2015. A total of 1,374 spent and 168 non-irradiated fuel assemblies, respectively, were stored in the spent fuel pool (storage capacity: 1,590 assemblies).
- Regarding Unit 6, fuel removal from the reactor was completed in November 2013. Removal of Unit 6 spent fuel started from August 30, 2022, and a total of 68 transportations will be conducted, including two in FY2022, 22 in June to August 2023 and the remaining 44 after January 2024.
- A total of 1,412 spent and 198 non-irradiated fuel assemblies (180 of which transferred from the Unit 4 spent fuel pool) are stored in the spent fuel pool (storage capacity: 1,654), while 230 non-irradiated fuel assemblies are stored in the storage facility of non-irradiated fuel assemblies (storage capacity: 230).

➢ Status of stagnant water treatment in Units 5 and 6

- Stagnant water in Units 5 and 6 buildings is transferred from Unit 6 Turbine Building to the outdoor tanks and sprinkled after undergoing oil separation and RO treatment and confirming the concentration of the radioactive materials.

Others

➢ Mid- and Long-Term Decommissioning Action Plan 2023

- The "Mid-and-Long-Term Decommissioning Action Plan" was created by TEPCO for indicating the main work processes involved in decommissioning as a whole, to achieve the goals laid out in the Mid-and-Long-Term Roadmap and the Risk Map of the Nuclear Regulation Authority (NRA). Based on the FY2022 progress, the plan was revised.
- The points revised in the Mid-and-Long-Term Decommissioning Action Plan 2023 include for the contaminated water management, revising a target of "reducing contaminated water generation to about 50-70 m^3/day (by the end of FY2028), for the spent fuel removal from pools, specifying processes to remove highly radioactive equipment, for the fuel debris retrieval, accelerating the study to further expand the scale of retrieval and for the waste management, adding the installation plan of the melting facility.
- Based on the Mid-and-Long-Term Decommissioning Action Plan 2023, a procurement plan will be formulated to expand the entry of and procurement from local companies.

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 March 13-27)"; unit (Bq/L); ND represents a value below the detection limit

Summary of TEPCO data as of March 28, 2023

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.

Cesium-134	:	ND(0.30)		
Cesium-137	:	0.43		
Total β	:	ND(13)		
Toritium	:	ND(1.7)	*1	

Cesium-134	:	3.3 (H25/12/24)	→	ND(0.31)	Below 1/10
Cesium-137	:	7.3 (H25/10/11)	→	ND(0.28)	Below 1/20
Total β	:	69 (H25/8/19)	→	ND(13)	Below 1/5
Toritium	:	68 (H25/8/19)	→	ND(0.31)	Below 1/200

Cesium-134	:	3.3 (H25/10/17)	→	ND(0.36)	Below 1/9
Cesium-137	:	9 (H25/10/17)	→	ND(0.35)	Below 1/20
Total β	:	74 (H25/8/19)	→	ND(14)	Below 1/5
Toritium	:	67 (H25/8/19)	→	ND(1.8)	Below 1/30

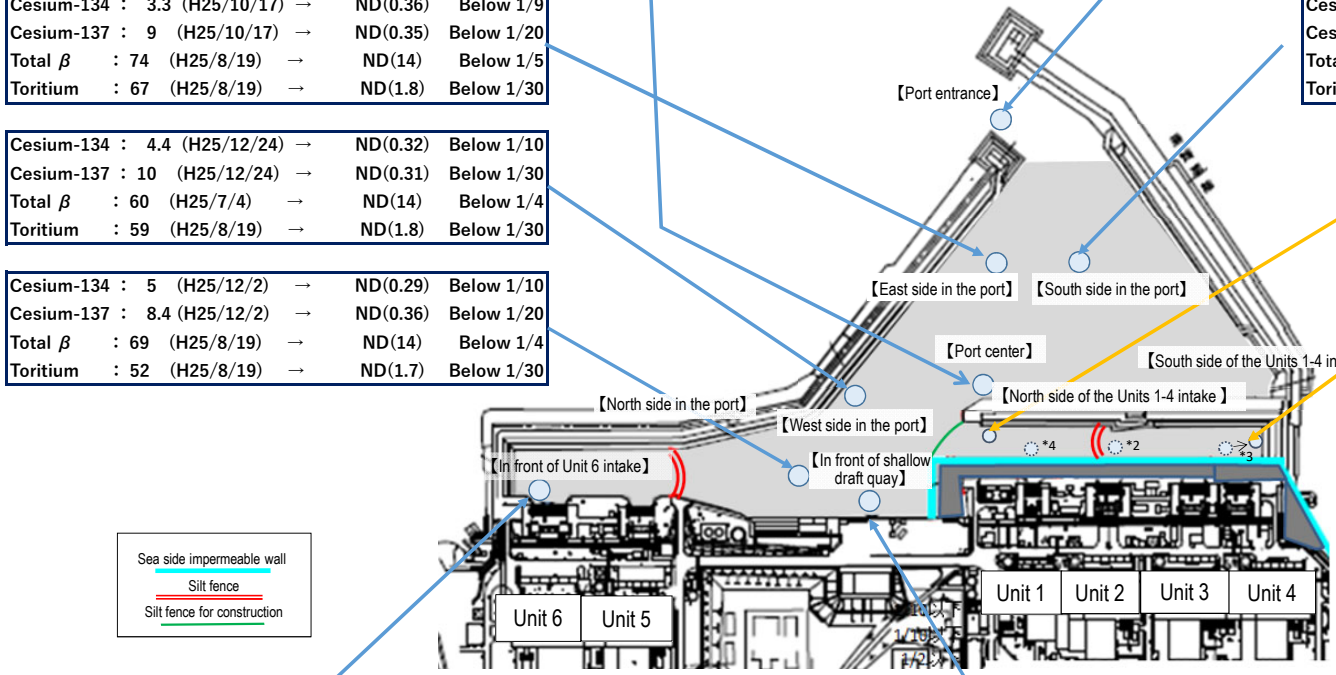
Cesium-134	:	3.5 (H25/10/17)	→	ND(0.36)	Below 1/9
Cesium-137	:	7.8 (H25/10/17)	→	0.44	Below 1/10
Total β	:	79 (H25/8/19)	→	ND(14)	Below 1/5
Toritium	:	60 (H25/8/19)	→	ND(1.7)	Below 1/30

Cesium-134	:	4.4 (H25/12/24)	→	ND(0.32)	Below 1/10
Cesium-137	:	10 (H25/12/24)	→	ND(0.31)	Below 1/30
Total β	:	60 (H25/7/4)	→	ND(14)	Below 1/4
Toritium	:	59 (H25/8/19)	→	ND(1.8)	Below 1/30

Cesium-134	:	32 (H25/10/11)	→	ND(0.29)	Below 1/100
Cesium-137	:	73 (H25/10/11)	→	1.6	Below 1/40
Total β	:	320 (H25/8/12)	→	13	Below 1/20
Toritium	:	510 (H25/9/2)	→	6.0	Below 1/80

Cesium-134	:	5 (H25/12/2)	→	ND(0.29)	Below 1/10
Cesium-137	:	8.4 (H25/12/2)	→	ND(0.36)	Below 1/20
Total β	:	69 (H25/8/19)	→	ND(14)	Below 1/4
Toritium	:	52 (H25/8/19)	→	ND(1.7)	Below 1/30

Cesium-134	:	ND(0.32)	
Cesium-137	:	4.6	
Total β	:	ND(11)	
Toritium	:	13	※1



Cesium-134	:	2.8 (H25/12/2)	→	ND(0.36)	Below 1/7
Cesium-137	:	5.8 (H25/12/2)	→	ND(0.37)	Below 1/10
Total β	:	46 (H25/8/19)	→	ND(11)	Below 1/4
Toritium	:	24 (H25/8/19)	→	1.9	Below 1/10

Cesium-134	:	5.3 (H25/8/5)	→	ND(0.32)	Below 1/10
Cesium-137	:	8.6 (H25/8/5)	→	ND(0.30)	Below 1/20
Total β	:	40 (H25/7/3)	→	ND(11)	Below 1/3
Toritium	:	340 (H25/6/26)	→	ND(1.7)	Below 1/200

*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. The point was further moved to the outside of the silt fence from January 20, 2023, to install the silt fence to the Drainage Channel K outlet as a measure for fish in the port. (The sampling point was moved to approx.. 3m east side)

*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

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 March 13-27)

Summary of TEPCO data as of March 28, 2023

	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(0.34)
Total β	ND	(H25)	→	ND(14)
Toritium	ND	(H25)	→	–

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

Cesium-134	ND	(H25)	→	ND(0.32)	
Cesium-137	1.6	(H25/10/18)	→	ND(0.32)	Below 1/2
Total β	ND	(H25)	→	ND(14)	
Toritium	6.4	(H25/10/18)	→	–	

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

Cesium-134	ND	(H25)	→	ND(0.36)
Cesium-137	ND	(H25)	→	ND(0.38)
Total β	ND	(H25)	→	ND(14)
Toritium	ND	(H25)	→	–

Cesium-134	ND	(H25)	→	ND(0.33)
Cesium-137	ND	(H25)	→	ND(0.30)
Total β	ND	(H25)	→	ND(14)
Toritium	4.7	(H25/8/18)	→	–

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

Cesium-134	3.3	(H25/12/24)	→	ND(0.31)	Below 1/10
Cesium-137	7.3	(H25/10/11)	→	ND(0.28)	Below 1/20
Total β	69	(H25/8/19)	→	ND(13)	Below 1/5
Toritium	68	(H25/8/19)	→	ND(0.31)	Below 1/200

【Port entrance】

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

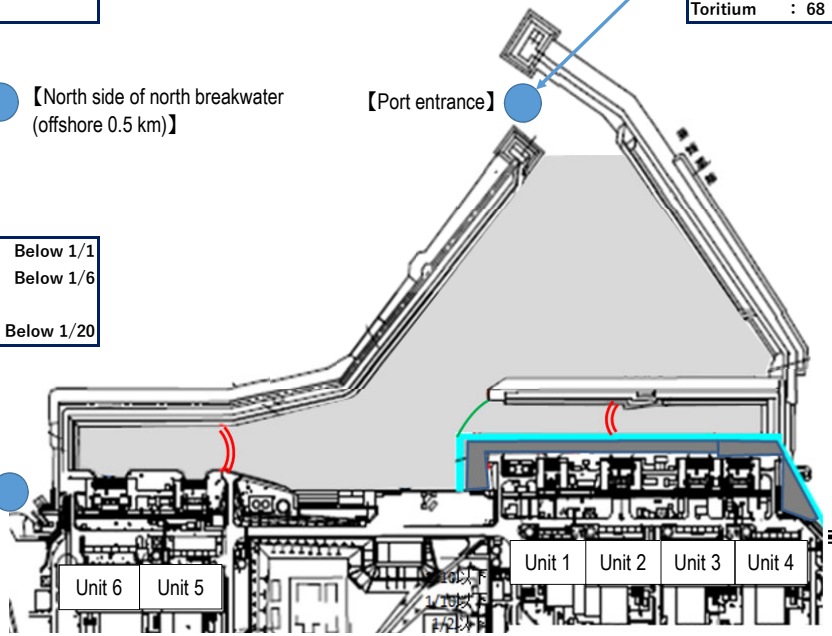
Cesium-134	ND	(H25)	→	ND(0.29)
Cesium-137	ND	(H25)	→	ND(0.31)
Total β	ND	(H25)	→	14
Toritium	ND	(H25)	→	–

Cesium-134	1.8	(H25/6/21)	→	ND(0.91)	Below 1/1
Cesium-137	4.5	(H25/3/17)	→	ND(0.70)	Below 1/6
Total β	12	(H25/12/23)	→	11	
Toritium	8.6	(H25/6/26)	→	ND(0.32)	Below 1/20

【North side of Unit 5 and 6 release outlet】

Cesium-134	ND	(H25)	→	ND(0.91)	
Cesium-137	3	(H25/7/15)	→	ND(0.88)	Below 1/3
Total β	15	(H25/12/23)	→	11	
Toritium	1.9	(H25/11/25)	→	ND(0.31)	Below 1/2

【Near south release outlet (*)】



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

March 30, 2023

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout

- Rubble storage area
- Rubble storage area (planned)
- Used protective clothing
- Trimmed trees area
- Mid-/ low-level contaminated water tank (existing)
- Mid-/ low-level contaminated water tank (planned)
- Secondary waste from water treatment (existing)
- Secondary waste from water treatment
- Waste treatment facility
- Non-controlled facility
- Analysis and research facility

Trimmed trees (outdoor accumulation)

Temporary trimmed trees storage pool

Temporary soil-covered type

Rubble (outdoor accumulation)

Rubble storage tent

Inside the rubble storage tent

Rubble (covered by sheet)

Solid waste storage facility

Rubble (container storage)

Temporary waste sludge storage

Spent adsorption vessel temporary storage facility

Tank installation status

Futaba town

Okuma town

Rubble

Trimmed trees

Used protective clothing

Temporary trimmed trees storage pool

Additional Radioactive Waste Incinerator

Large Waste Storage

Radioactive Waste Incinerator

Unit 6

Unit 5

Unit 1

Unit 2

Unit 3

Unit 4

Mega float

Land-side impermeable walls with frozen soil

Land-side impermeable walls freezing plant

Pipe route

Sea side impermeable wall

Common pool

Water desalinations (RO)

Cesium absorption apparatus (Incineration Workshop Building)

Decontamination instruments (Process Building)

3rd cesium adsorption apparatus (Onsite Bunker Building)

2nd cesium adsorption apparatus (HTI Building)

Cesium absorption vessel temporary storage

Vehicles maintenance site

Town boundary

Water treatment facility for Sub-drain

Water treatment facility for Sub-drain and others

Periodical Inspection Material Storage (cutting of flanged-tanks)

Temporary Cask Custody Area

Main Anti-Earthquake Building

JAEA Analytical Facility Management Building

JAEA Analytical Facility Laboratory-1

Vehicle screening and decontamination site

Multi-nuclide removal equipment

Additional multi-nuclide removal equipment

High-performance multi-nuclide removal equipment

Large equipment decontamination facility

Spent absorption vessel temporary storage

Underground reservoirs

Groundwater bypass temporary storage tank

Partner Companies' Building

Temporary rest house outside the site

New Administration Office Building

Heliport

Large rest house

Access control facility

Water desalinations (evaporative concentration)

Water desalinations (RO)

Site boundary

MP-1 MP-2 MP-3 MP-4 MP-5 MP-6 MP-7 MP-8

K1 K2 K3 K4

H1 H2 H3 H4 H5 H6 H8 H9

J1 J2 J3 J4 J5 J6 J7 J8 J9

B C D E F

G1 G1 South G3・G4・G5 G6 G7

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

0m 100m 500m 1000m

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 m³/day or less (within 2020)
- Suppressing the amount of contaminated water generated to 100 m³/day or less (within 2025)
- [Completed] Treatment of contaminated water in buildings was completed* (within 2020) *Except for Units 1-3 Reactor Buildings, Process Main Building and High Temperature Incinerator Building.
- [Completed] Contaminated water in Reactor Buildings was reduced to about a half of the level at the end of 2020 (FY2022-FY2024)

March 30, 2023
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Contaminated water management [Remove]

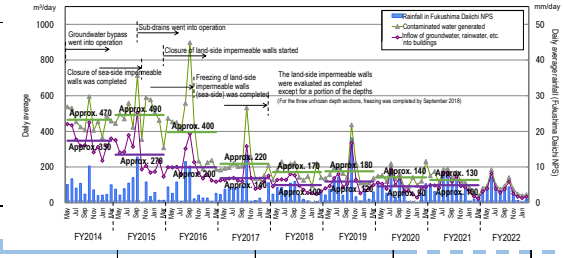
Contaminated water treatment facility
- ▽Reception start of contaminated water to Central Waste Treatment Building
- ▽Decontamination equipment (AREVA)
- ▽Evaporative concentration equipment
- ▽Cesium Adsorption Apparatus (KURION)
- ▽2nd Cesium Adsorption Apparatus (SARRY)
- Cesium Adsorption Apparatus (KURION)
- ▽Treatment of RO-condensed salt 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)
- ▽Purification of strontium-reduced water in flanged tanks complete
- ▽Purification of strontium-reduced water complete
- ▽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)
- ▽Pre-service inspection granted (2023.3.2)


Landing of the second Cesium Adsorption Apparatus (SARRY)


Multi-nuclide removal equipment (ALPS)

Removal of contaminated water from seawater pipe trench
- ▽Trench Purification by mobile equipment
- ▽Completion of tunnel filling
- ▽Transfer of stagnant water complete
- ▽Completion of shaft filling
- 【Removal of contaminated water in seawater pipe trench】
- ▽Completion of tunnel filling
- ▽Transfer of stagnant water complete
- ▽Completion of shaft filling (except for upper part of Shaft D)
- Unit 3
- ▽Completion of tunnel filling
- ▽Filling of openings II and III complete
- ▽Transfer stagnant water complete
- ▽Completion of filling parts running over drainage channel
- Unit 4


Unit 2 seawater pipe trench Shaft D filling work



Contaminated water management [Redirect]

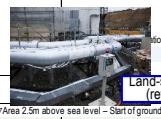
Groundwater bypass
- ▽Installation start of groundwater bypass
- ▽Operation start of groundwater bypass (drainage started from 2014.5.21)


Pumping well

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 (2000m³/day)


Sub-drain purification system

Land-side impermeable wall
- ▽Start of maintenance operation on north and south sides
- ▽Freezing completion
- ▽Start of maintenance operation in all sections
- In some temperature measurement tubes near the K drainage ▽ channel cross, temperature exceeded 0℃ locally
- ▽Freezing start
- Start of maintenance operation on east side▽
- ▽Freezing completion (except for some parts)
- Although no influence was detected on the impermeable function of the land-side impermeable walls but test investigation is underway for the stoppage effect


Land-side impermeable wall brine (refrigerant) circulation pipe

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)


Placement of seaside impermeable walls complete

Storage facility
- ▽Completion of purification treatment of RO concentrated salt water
- ▽Storage in steel square tanks
- ▽Completion of replacement of steel square tanks
- pt for condensed waste liquid
- ▽Water leakage (300L) from flanged tank
- ▽Water leakage (100l) from flanged tank
- ▽Storage in flanged cylindrical tanks
- ▽Water leakage (10L) from flanged tank
- ▽Completion of fence to prevent leakage expanding
- ▽Work to raise fence height complete
- ▽Purification of strontium-reduced water in flanged tanks 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)


Construction of welded-joint tanks


Flanged and welded-joint tanks

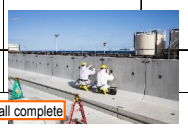
Treatment of stagnant water
- ▽Start to maintain water-level difference with sub-drain water level
- ▽Transfer start from each building to Central Rw Building
- ▽Treatment of stagnant water in buildings complete
- ▽Reduction of contaminated water in the Reactor Buildings to approx. half of the level at the end of 2020 achieved
- ▽Installation of stagnant water transfer equipment/transfer start
- ▽Completion of work to improve reliability of transfer line (replacement with PE pipes)
- ▽Floor exposure of Unit 1 T/B
- ▽Separation of stagnant water between Units 1 and 2
- ▽Floor exposure of Unit 1 Rw/B
- ▽Separation of stagnant water between Units 3 and 4
- ▽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

Countermeasures to tsunami

Closure of openings
- ▽Examination start of measures to close building openings
- ▽Work for Units 1 and 2 T/B complete
- ▽Work for common pool 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
- ▽Measures to close openings were completed
- ▽Work for Units 1-4 RwB was completed

Seawall
- ▽Installation of outer-rise tsunami seawall complete
- ▽Construction start of Chishima 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.

Information provision and communication to foster understanding

■ Measures for decommissioning, contaminated water and treated water of the Fukushima Daiichi Nuclear Power Station need efforts to reduce risks over a long term. Regarding handling of ALPS treated water as a part of decommissioning, to local residents, those who in the fishery industry and related parties, we will thoroughly explain about the policies and responses concerning the facility design, operation and management to ensure safety, monitoring of radioactive materials and others, and proceed with **efforts to sincerely face their concerns and interests and respond to each of them**.

■ Moreover, to **further deepen the understanding** of everyone in Japan and overseas, efforts to **coherently disseminate** measurement results of ALPS treated water and information concerning facility operation, radiation impact assessment and others will continue and be enhanced.

- For overseas, the was renewed. **“Treated Water portal site in English, Chinese and Korean”**
  - “Sea Area Monitoring” page in English, Chinese and Korean was published
  - “The 1st IAEA Review” explanation booklet was published in English, Chinese and Korean
- When inaccurate or misleading overseas information was detected, for maximum suppression of reputation, return call or other actions will be taken.
- A condition to deliver science-based information to overseas media and embassies in Japan will be created.
  - Approach to major media and embassies is being enhanced.
  - For accurate media coverage, regular press conferences will continue to be held.

- **Visits and Discussion Meetings of Fukushima Daiichi Nuclear Power Station**

To solve people’s questions, TEPCO invites their visits to the power station and answer their questions on site. From people who participated in the visit gave feedbacks such as “by directly seeing the decommission site and having dialogues, they could obtain deeper understanding about the present situation, issues and status of safety measures.” TEPCO will continue these efforts to invite more people including online visits.
<Visits in FY2022: 15 times, 142 participants in total>

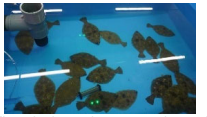
Examination concerning handling of ALPS treated water

- **Safety review of International Atomic Energy IAgency (IAEA)**

In November 2022, IAEA review team visited Japan to conduct the second review concerning safety of ALPS treated water (the first review was conducted in February 2022 and the report was published in April)
- The article of the IAEA Review concerning handling of ALPS treated water and overview of the report are published timely on the TEPCO website.
- Instructions from IAEA were reflected in the revision of the implementation plan and the radiation assessment report.
- The report of the second review will be published around early 2023.


IAEA review team arrived at the Fukushima Daiichi Nuclear Power Station

- **Rearing test of marine organisms**
  - To alleviate concerns and lead to relief of local residents, related parties and the everyone in society, marine orgasms are being reared in tanks of seawater containing ALPS treated water and the status is compared with the original seawater controls. The progress will be shown coherently and clearly.
  - Regarding behaviors of tritium and others, a lot of research has been conducted in Japan and overseas. Based on the experimental results, firstly experimental data for a half year will be collected and subsequently, the same as past experimental results, the theory “tritium in vivo is not concentrated and the concentration of tritium in vivo will not exceed the level in the growing environment” will also be reaffirmed.


Flounder in rearing preparation tank

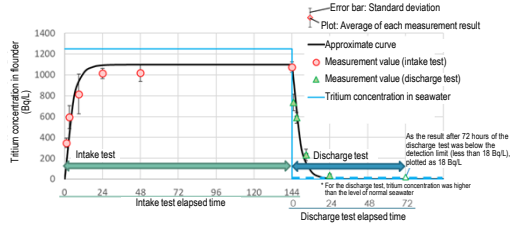

Overall view of mockup tanks

- **Measurement of tritium concentration of flounder (tritium concentration less than 1,500 Bq/L) and analysis of results**

Based on the measurement results of tritium concentration, the following was confirmed as in the past insight:

[Intake test]
- The tritium concentration did not exceed the level in the growing environment (in this test, the concentration exceeding the level in ALPS treated water diluted with seawater)
- The tritium concentration reached equilibrium in a certain period

[Discharge test]
- When flounder having reached equilibrium in the tritium concentration higher than the level of normal seawater is returned to normal seawater, the concentration decreased over time



- Daily rearing status is published in the TEPCO website and Twitter
  - TEPCO website: http://www.tepco.co.jp/decommission/information/newsrelease/breedingtest/index-j.html
  - TEPCO Twitter: https://twitter.com/TEPCOfishkeeper

Timeline

Tritiated Water Taskforce (2013.12 – 2016.5, 15 meetings)


Tank area viewed from the Large Rest House (2015.10.29)

2016.6 Report of Tritiated Water Taskforce

Subcommittee on Handling of ALPS treated water (2016.11 – 2020.1, 17 meetings)

2018.8 Explanatory and hearing meeting, receiving opinions

2020.2 Report of Subcommittee on Handling of ALPS treated water

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 to 2022.4, 15 meetings)

2022.4.28, 5.13, 7.15 Application to partially revise the Application Documents for Approval to Amend the Implementation Plan was submitted

2022.7.22 Application for the Application Documents for Approval to Amend the Implementation Plan was approved

2022.8.4 Work has commenced

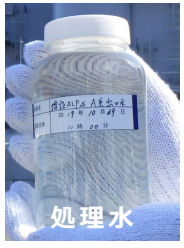
2022/8/30 The "Approach to Strengthening and Expansion of Measures in the Handling of ALPS Treated Water" was summarized

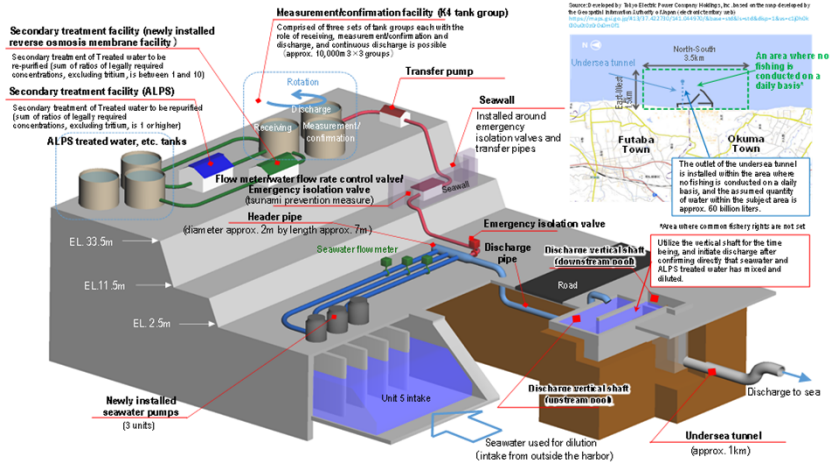
2023.2.14, 20 Application for the Application Documents for Approval to Amend the Implementation Plan was submitted (amendment of organizational structure, and nuclides to be measured and assessed, and others)

2022.11.14 Application for the Application Documents for Approval to Amend the Implementation Plan was submitted (amendment of organizational structure, and nuclides to be measured and assessed, and others)

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

【Overview of ALPS treated water dilution and discharge facility】





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)

March 30, 2023
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

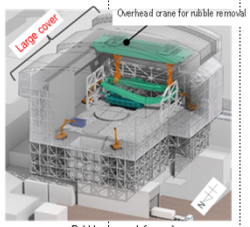
Legend: Rubble removal, etc. | Installing a fuel removal machine | Fuel removal | Storage and handling of fuel

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023～

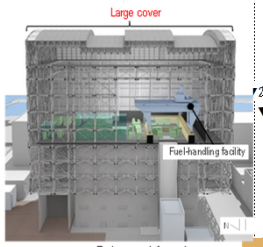
Unit 1

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

<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.



Rubble removal (image)



Fuel removal (image)

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.

▼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
▼2022.4 Start of large cover installation work

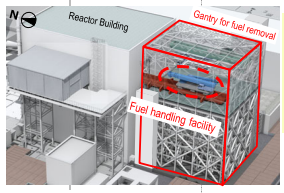

<Unit 1 northwest side 2023.2.9>

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.

<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 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.

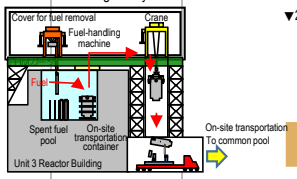
▼2015.3-2016.11 Yard construction
▼2016.9-2017.4 West-side gantry installation work
▼2017.5 Opening a hole in the west-side external wall
▼2018.8-2020.12 Moving and containment of remaining objects
▼2020.6 Investigation inside the spent fuel pool
▼2020.6 Investigation inside the spent fuel pool
▼2023.1 Start of steel erection
▼2023.2 Start of south-side existing facilities dismantling


<Unit 2 Construction of gantry for fuel removal>

Unit 3

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

Overview of the fuel-handling facility inside the cover



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.

▼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 4

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

▼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)


<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

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

4 Work toward fuel debris retrieval

March 30, 2023
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

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

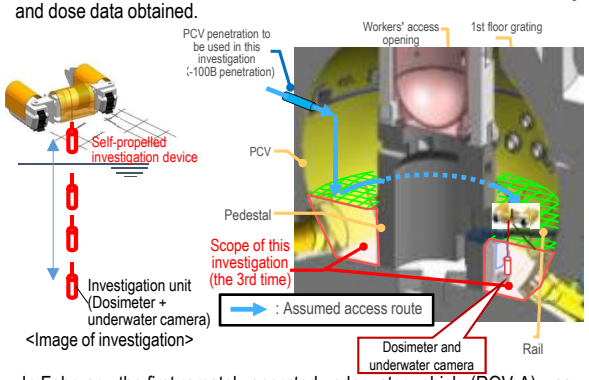
Start of fuel debris retrieval from the first unit (Unit 2). Expanding the scale in stages (within 2021 * The schedule will be extended for about 1 year due to the spread of COVID-19 infections)

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

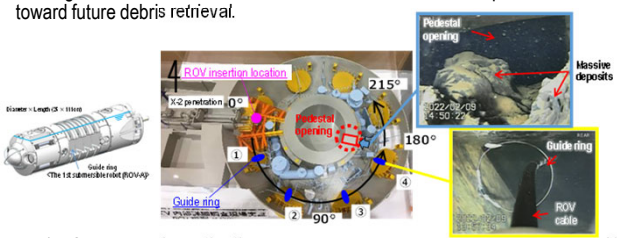
・In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:φ100 mm) collected information such as images and airborne dose inside the PCV 1st floor.

・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)>

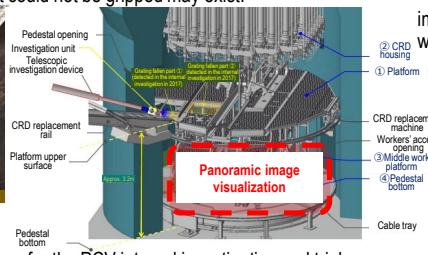
Unit 2 Investigation overview

・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.

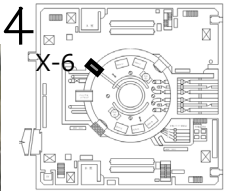

Bottom of the pedestal (after being processed in panoramic image visualization)



・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

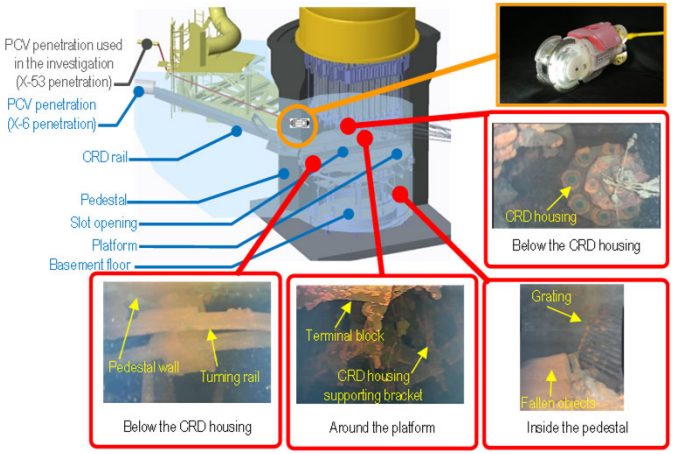
・In October 2014, the conditions of X-53 penetration, which may be under water and which is scheduled for use to investigate the inside of the PCV, was investigated via remote-controlled ultrasonic test equipment. The results showed that the penetration was not under water.

・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)

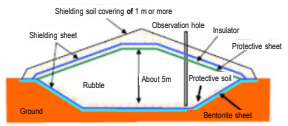
▼ 2012.9 Transfer start of rubble to the soil-covered temporary storage facility

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

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

▼ 2019.6 Start of building construction
1st Large Waste Storage

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



<Outline of soil-covered temporary storage facility>


External view of the 9th Solid Waste Storage

▼ 2014.7 Start of pre-work
9th Solid Waste Storage


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

▼ 2018.2 Operation start

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)


Whole view of Solid Waste Incinerator


Electrical room

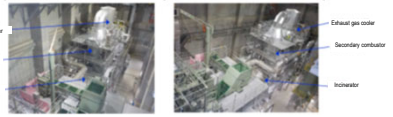

Control room

▼ 2017.4 Start of pre-work
Additional Solid Waste Incinerator

▼2022.5 Start of operation

2017.10 Installation work gets

▼ 2018.5 Operation start
Large Equipment Decontamination Facility



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

▼ 2020.9 Start of pre-work
Compaction Facility

Site of Volume Reduction Faciility

Present status Note

Storage of rubble and others

Present storage Approx.540,000 m³ (as of 2022.3)

Rubble (combustible), trimmed trees, used protective clothing)
Outdoor deposit / Trimmed trees temporary storage / Container storage

Contaminated soil (0.005 - 1 mSv/h)
Outdoor deposit / Container storage

Rubble (metal, concrete, others)
More than 1 mSv/h: Container storage / Soil-covered temporary storage facility / Solid waste storage
0.005-1 mSv/h: Outdoor storage / Container storage / Sheet covering
Less than 0.005mSv: Container storage (tank pieces after decontamination) / Outdoor deposit

Storage of water treatment secondary waste

Spent adsorption vessel temporary storage

Estimate for the next decade (or so) Approx.**810,000** m³

(*2)

Approx. 360,000 m³ — To (A) (*1) — Incineration
Approx. 70,000 m³ — Stored and managed in Solid Waste Storage as done for rubble
Approx. 60,000 m³ — (A) (*1) / (B)
Approx. 130,000 m³ — To (A) (*1) — Volume reduction
Approx. 180,000 m³ — To (A) (*1) — Volume reduction
Approx. 7,100 tanks — Treatment measures and others will be examined

Status after a decade

(*3) Approx. **270,000** m³ (*2)

Legend: : Newly installed equipment and facility

Incineration

Incinerator Pre-treatment Facility (scheduled for completion in FY2025)
Crusher example
→ Radioactive Waste Incinerator
→ Additional Radioactive Waste Incinerator (Completion in May 2022)

Volume reduction

Compaction Facility (scheduled for completion in FY2022)
Concrete crusher example / Metal cutter example

Melting

Melting equipment (under consideration)
Electric furnace example

To (B)

Storage /management

Approx. 20,000 m³ — Solid Waste Storage (Storage capacity: approx. 250,000 m³)
Existing Solid Waste Storage 1st-8th (existing) 9th (Operation launch in 2018.2)
Approx. 70,000 m³ — Approx. 70,000 m³ (*1) (A) — Approx. 60,000 m³ (B) — **Additional Solid Waste Storage** 10th-11th (Scheduled for completion after FY2024)
Approx. 50,000 m³ — Based on the estimates for the amount of waste to be generated, the storage capacity (approx. 250,000 m³) will be reached in around 2031. Scope to install an additional solid waste facility and others will be examined
(*1) — Reuse will be examined
Spent Adsorption Vessel Temporary Storage
Large Waste Storage (Scheduled for completion FY2023)
The earthquake-resistant design is being reviewed based on the Fukushima prefecture offshore earthquake in FY2021
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. 240,000 m³ of waste will be stored in Solid Waste Storage at the end of FY2028.

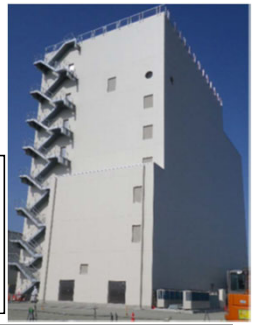
Note: Used protective clothing before incineration and BG-level concrete waste for which treatment and reuse is decided at present are not included.

- 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.

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.



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

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.

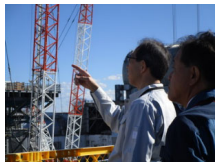
A large rest house for workers was established and its operation commenced in May 2015. Spaces in the large rest house are also installed for office work and collective worker safety checks as well as taking rest.
In March 2016, a convenience store opened in the large rest house. In April, the shower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

In 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 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.

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

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

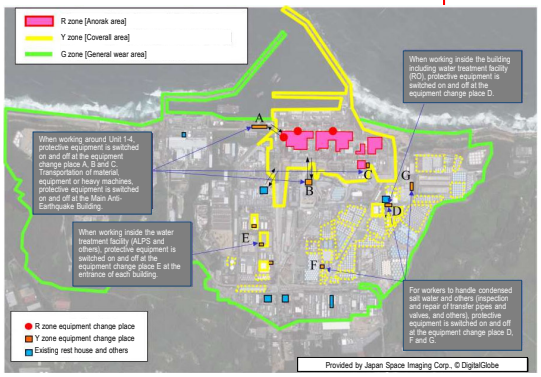
From May 2013, full-face mask unnecessary area was expanded sequentially.

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

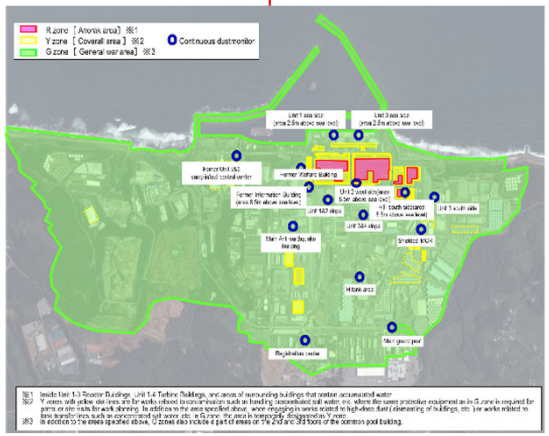
In March 2017, the G-zone area was expanded (to cover 95% of the whole site).

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.

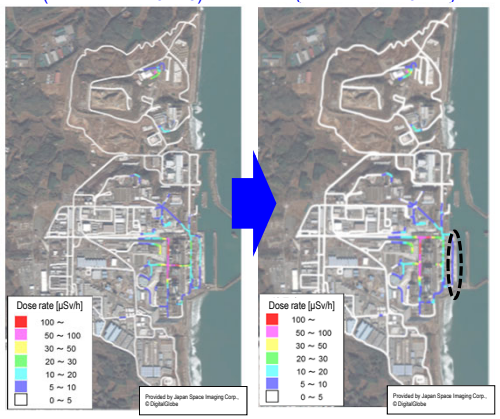


In May 2018, within about 96% of the site, workers are allowed to wear light equipment such as general workwear and disposable dust-protective masks.

<Travel survey results of major roads within the site>
The dose rate has been declining every year.
In particular, in the area on the east side of the Turbine Building shown a black dotted line, the dose rate declined by facing related to installation of the seawall as the countermeasure to the Japan Trench tsunami.

FY2020 4th Quarter (measured in 2021.3)

FY2021 4th Quarter (measured in 2022.2)



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