Outline of Decommissioning, Contaminated Water and Treated Water Management

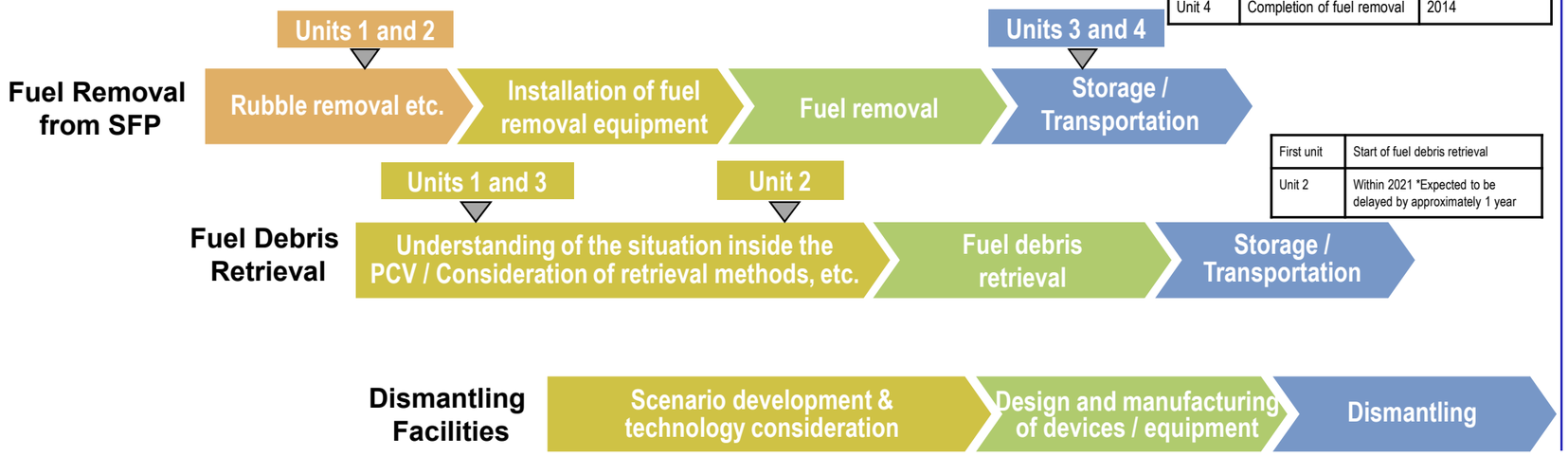
May 26, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

Main decommissioning work and steps

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

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

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

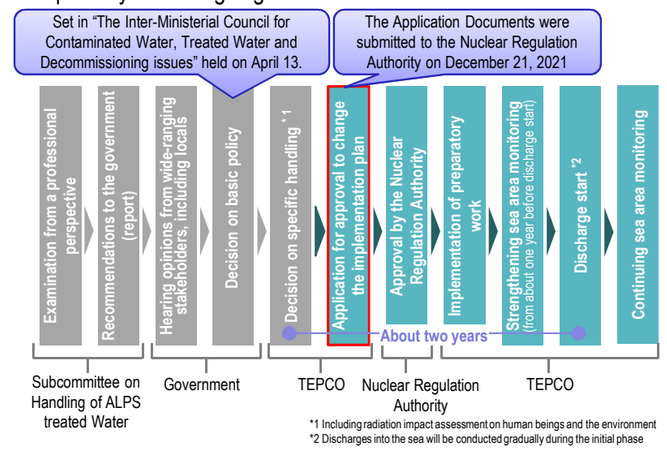


First unit	Start of fuel debris retrieval
Unit 2	Within 2021 *Expected to be delayed by approximately 1 year

Measures of treated water

Handling of ALPS treated water

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



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

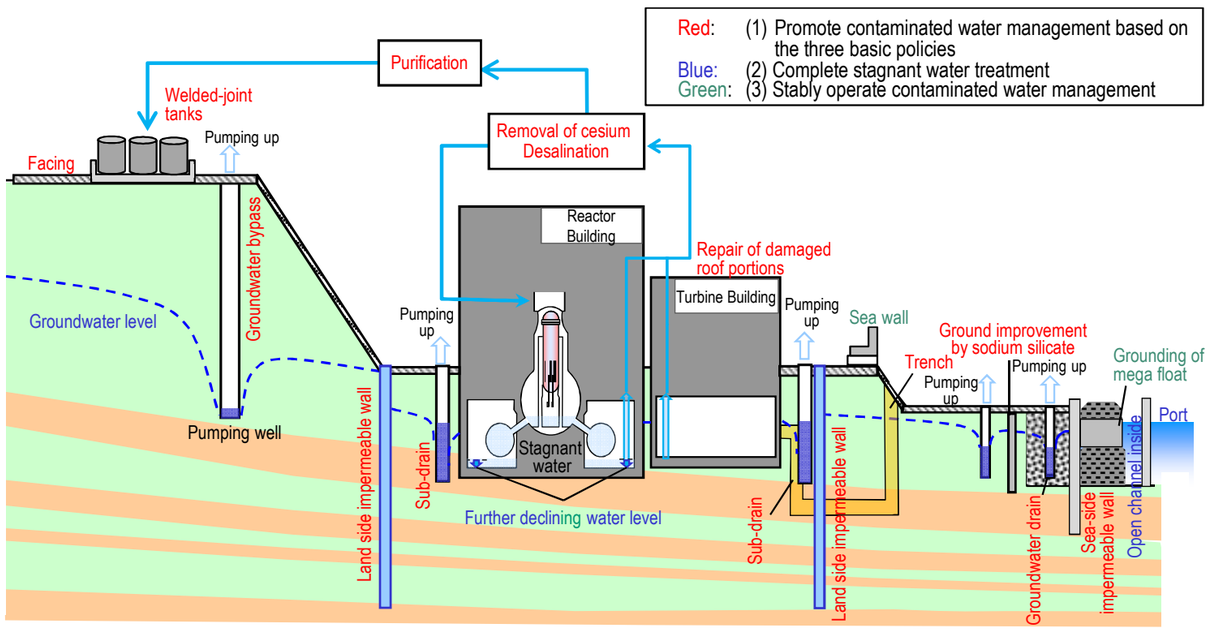
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized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

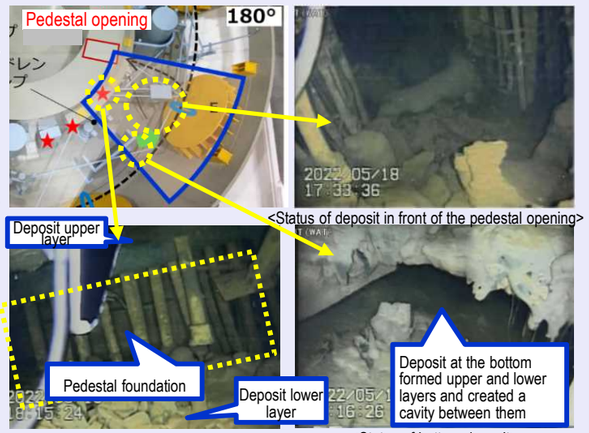
◆ The temperatures of the Reactor and the Primary Containment Vessel of Units 1-3 have been maintained stable.
There was no significant change in the concentration of radioactive materials newly released from Reactor Buildings into the air. It was concluded that the comprehensive cold shutdown condition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

Resumption of the Unit 1 PCV internal investigation

The internal investigation of the Unit 1 Primary Containment Vessel (PCV) has been suspended since the Fukushima Offshore Earthquake on March 16. After securing the necessary PCV water level and implementing countermeasures to resolve the loss of image transmission, the detailed visual investigation of the pedestal periphery resumed from May 17.

This investigation confirmed the status of deposit spreading, including detecting lump- and layer-type deposits and exposure of steel reinforcement inside the pedestal and others. To narrow down the investigative scope for the "deposit debris detection," which is scheduled in the future investigation, the neutron flux measurement was conducted.

The status confirmed in this investigation will be evaluated and preparation will continue toward the next investigation into the deposit thickness.



Provided by International Research Institute for Nuclear Decommissioning (IRID)

Release of the report from the IAEA Review of Safety Related Aspects of Handling ALPS treated water

On April 29, the IAEA publicly released its report on its review of safety related aspects of the handling of ALPS treated water that was conducted in February.

The report states that in regards to the safety, the IAEA has found that, TEPCO successfully incorporated prevention measures in the design of the facility as well as in the associated operating procedures.

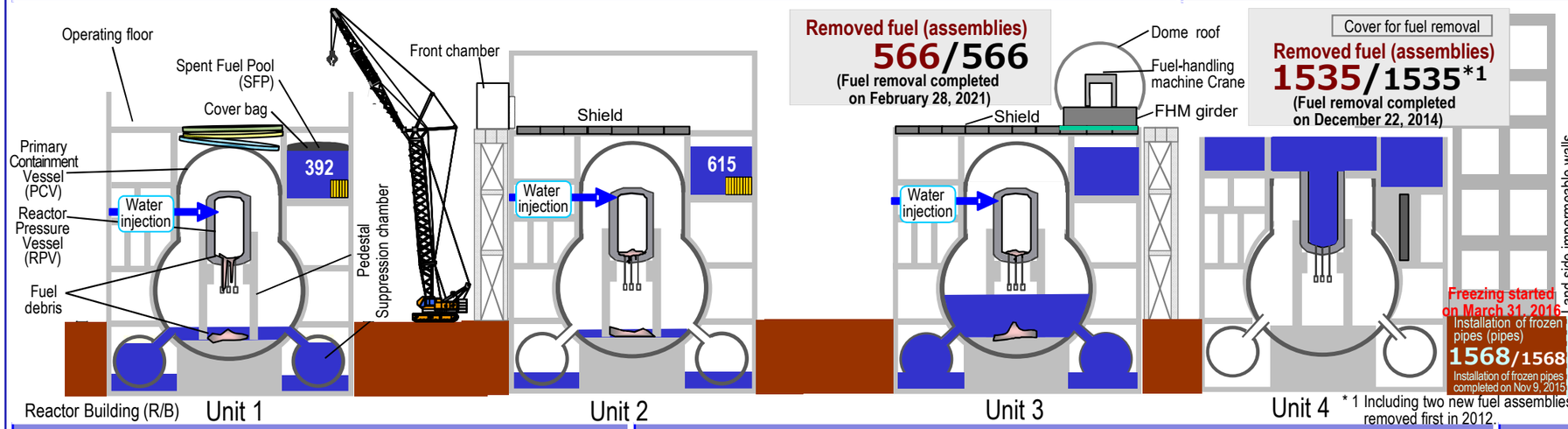
Also, in regards to the Radiological Environmental Impact Assessment, it acknowledged the comprehensive and detailed assessment, and the doses to the assumed representative person are expected to be very low and significantly below the dose constraint set by the Japanese regulatory body.

Meeting between Minister Hagiuda and the IAEA Director General Grossi

On May 18, Minister Hagiuda of METI had a meeting with the IAEA Director General Grossi.

In the meeting, they confirmed that they would continue to closely collaborate, including to review the safety-related aspects of handling ALPS treated water. They also exchanged opinions concerning how to further enhance cooperation between the Japanese Government and the IAEA.

Director General Grossi said that the IAEA review could help convince people worldwide that ALPS treated water would not adversely affect public health and the environment.



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

Unit 2 Preparation status for the PCV internal investigation and trial retrieval of fuel debris

Regarding the damage to the rubber housing the handle of the X-6 penetration inside the isolation room and the malfunction of the isolation room shielding door, the causes are being investigated and countermeasures are being examined.

In addition, regarding the points expected to be improved, which were detected in the performance verification test for the robot arm and others at the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA), adjustment will continue.

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

In March 2022, as the responsible organization for the discharge of ALPS treated water, to enhance the monitoring of sea areas, TEPCO formulated a plan to add measurement points and subjects and increase the frequency.

Based on this sea area monitoring plan, sampling started from April 20 to determine the status of tritium and marine organisms at the normal time.

Near the nuclear power station and on the coastline, levels of both Tritium and Cesium-137 showed no change from the analytical values in the previous year. At the new measurement points, concentrations remain low and within the normal scope of fluctuation of seawater around Japan.

The monitoring results will be communicated clearly and carefully.

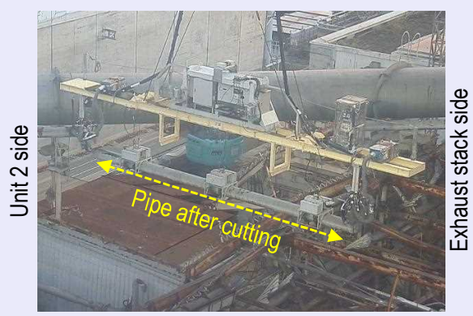
Resumption of work to cut the pipes of the Units 1/2 standby gas treatment system (SGTS)

In March, as the wire saw blade of the cutter bit into the pipe, the cutting work was suspended. After implementing countermeasures and confirming that cutting could be done without biting, the work was resumed.

By May 23, cutting of one of 16 sections was completed.

The cutting work proceeds carefully after implementing measures to prevent dust scattering and it was confirmed that the values indicated on the dust monitors were less than the control standard values.

Work continues carefully while monitoring the dust concentration and prioritizing safety above all.



<Pipe cutting work>

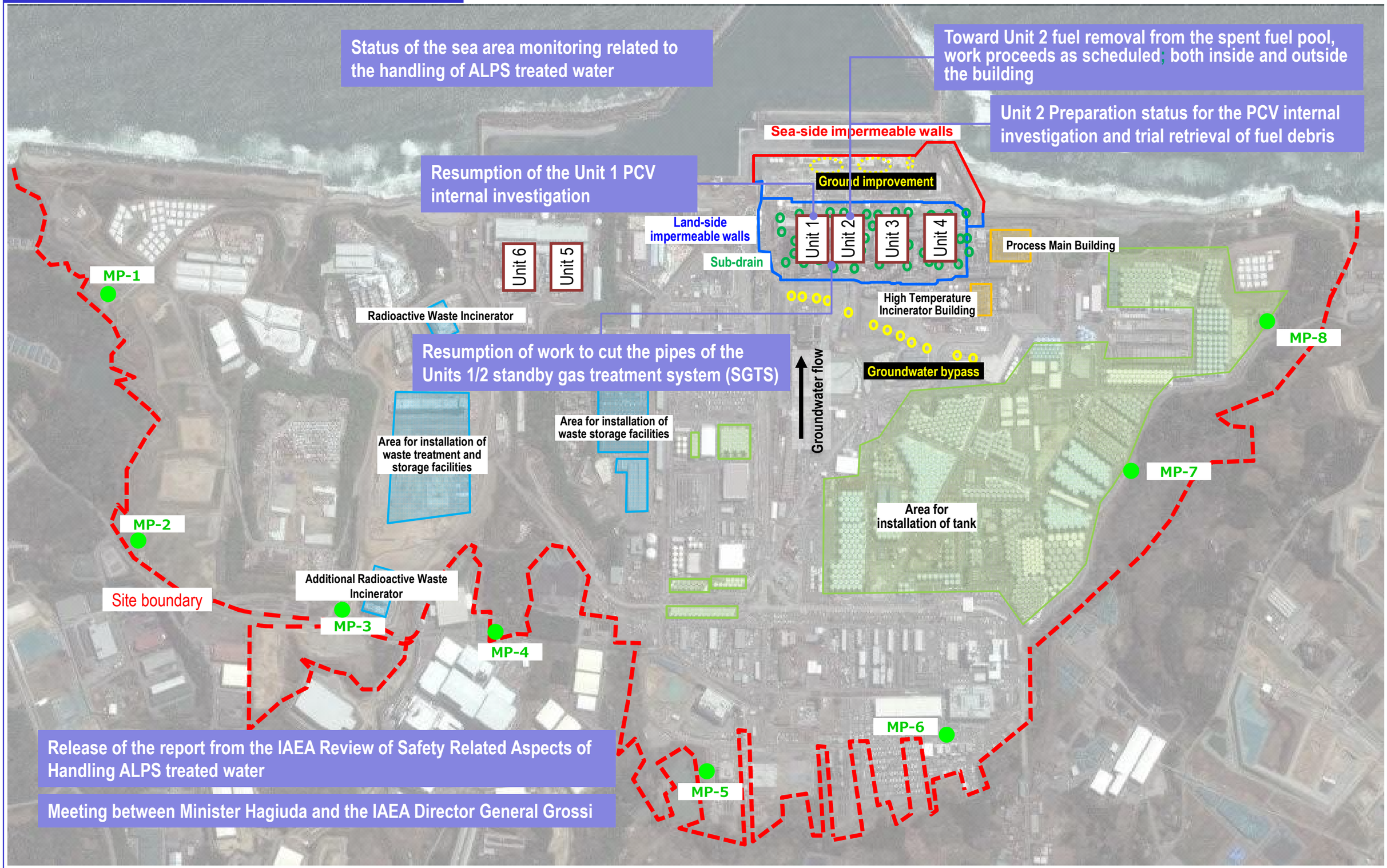
Toward Unit 2 fuel removal from the spent fuel pool, work proceeds as scheduled both inside and outside the building

Inside the building, installation of shielding over the reactor well, where the highest was observed and the northeast side of the Reactor Building was completed on May 12. The dose measurement confirmed that the dose above the reactor well where shielding was installed declined from 88 mSv/h before installation to 9 mSv/h after installation and also validated the reduction effects as planned at other measurement points.

Moreover, there are plans to move the existing fuel-handling machine to the north side of the building. The feasibility of moving the machine is being verified by a mockup facility of the actual machine.

Outside the site, before installing the gantry foundation, work to evacuate the range for installing the foundation in the south-side yard of the building started from May 9 and will be scheduled for completion in early June.

Major initiatives – Locations on site

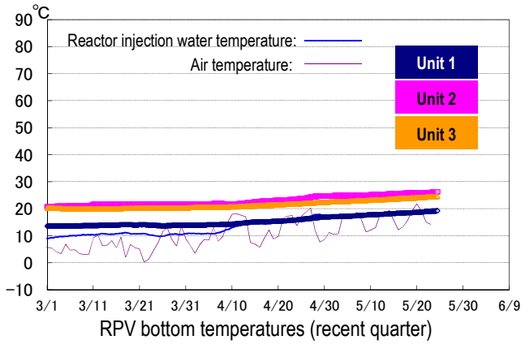


Provided by Japan Space Imaging Corp., photo taken on April 8, 2021
Product (C) [2020] DigitalGlobe, Inc., a Maxar company

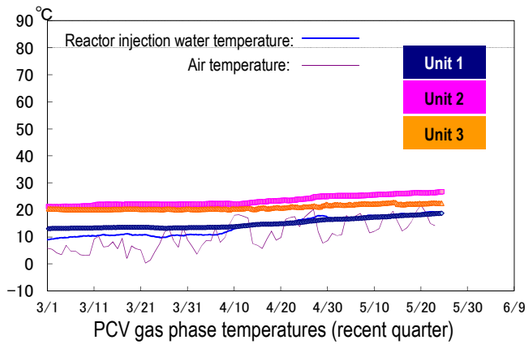
I. Confirmation of the reactor conditions

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. 15 to 30°C for the past month, though it varied depending on the unit and location of the thermometer.

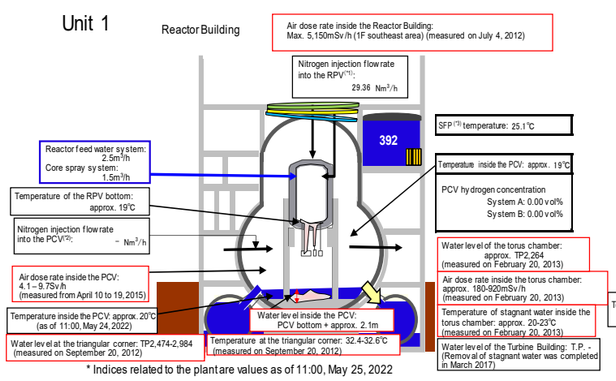


RPV bottom temperatures (recent quarter)

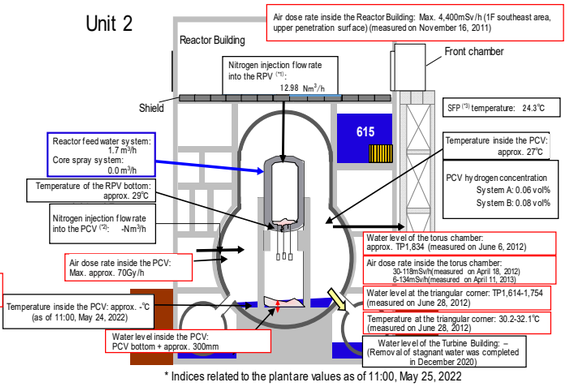


PCV gas phase temperatures (recent quarter)

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



* Indices related to the plant are values as of 11:00, May 25, 2022



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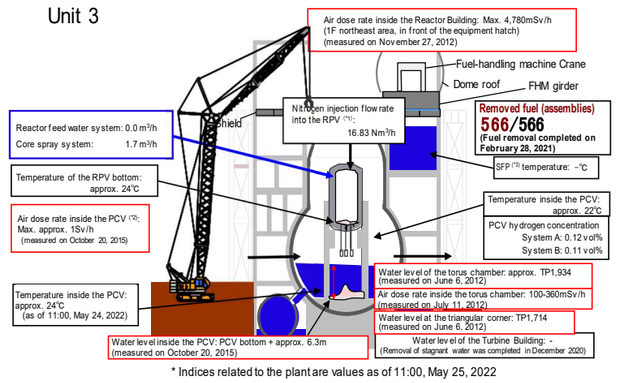


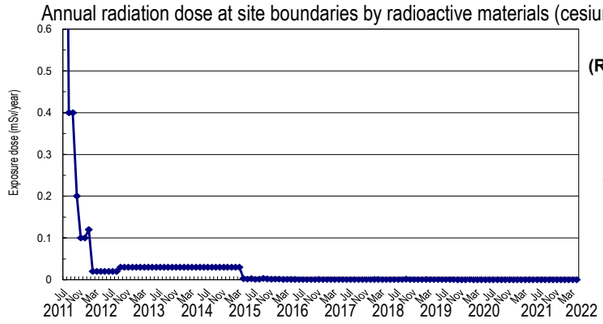
* Indices related to the plant are values as of 11:00, May 25, 2022

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

Release of radioactive materials from the Reactor Buildings

As of April 2022, the concentration of radioactive materials newly released from Reactor Building Units 1-4 into the air and measured at the site boundary was evaluated at approx. 1.7×10^{-12} Bq/cm^3 and 1.4×10^{-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 0.00003 mSv/year.

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



(Reference)

* The concentration limit of radioactive materials in the air outside the surrounding monitoring area:
[Cs-134]: 2×10^{-5} Bq/cm$^{3\text{Marc}}$
[Cs-137]: 3×10^{-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 0.336 – 1.073 μSv/h (April 26 – May 24, 2022).
To measure the variation in the air dose rate of MP2-MP8 more accurately, work to improve the environment (trimming trees, removing surface soil, and shielding around the MPs) was completed.

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

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

Other indices

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

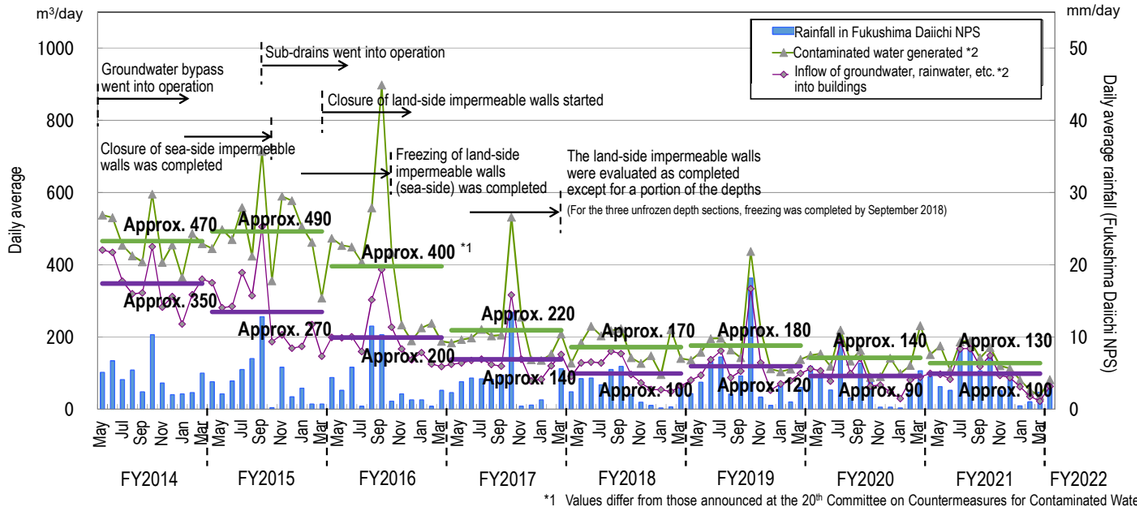
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

II. Progress status by each plan

Progress and others concerning ALPS treated water and others

➢ Status of contaminated water generated

- Multi-layered measures, including pumping up by sub-drains and land-side impermeable walls, which were implemented to control the continued generation of contaminated water, suppressed the groundwater inflow into buildings.
- After implementing “redirecting” measures (groundwater bypass, sub-drains, land-side impermeable walls and others) and rainwater prevention measures, including repairing damaged portions of building roofs, the amount of contaminated water generated within FY2021 declined to approx. 130 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 May 16, 2022, 1,848 releases had been conducted.
- The water quality of all temporary storage tanks satisfied the operation target.

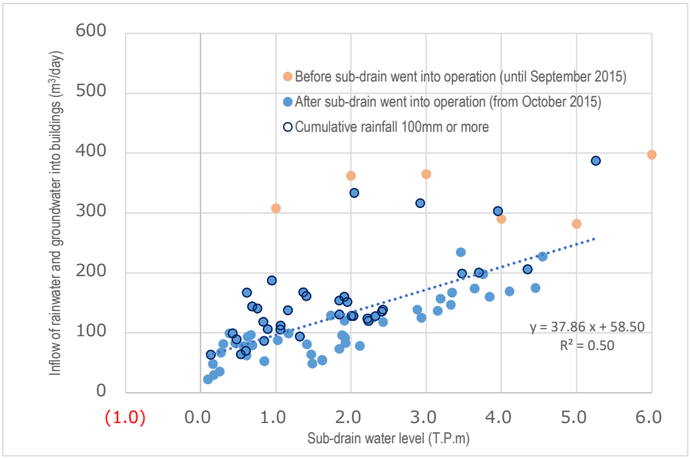


Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

➢ Implementation status of facing

- Facing is a measure involving asphalting the on-site surface to reduce the radiation dose, prevent rainwater infiltrating the ground and reduce the amount of underground water flowing into buildings. As of the end of April 2022, 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 April 2022, 30% 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 every year. On the mountain side, however, the difference between inside and outside was maintained, despite varying during rainfall. The water level of the groundwater drain observation well has been maintained at approx. T.P. +1.4 m, sufficiently below the ground surface (T.P. +2.5 m).

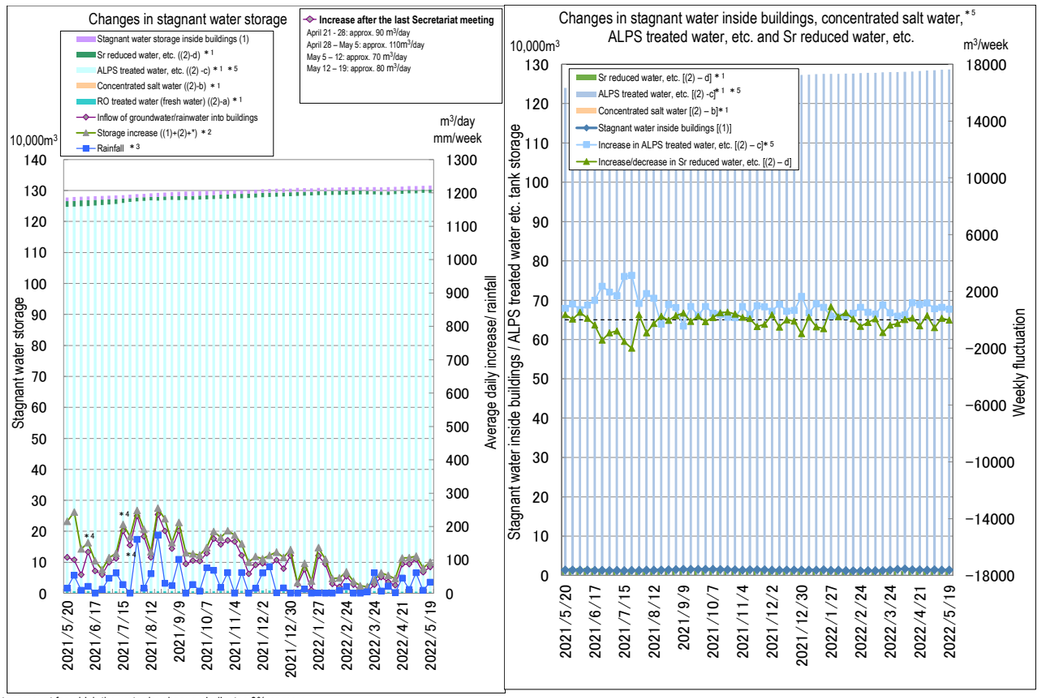
➢ Operation of multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing), hot tests using radioactive water are conducted (System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013). On March 23, 2022, a pre-service inspection certificate was granted by the Nuclear Regulation Authority and the entire pre-service inspection was completed. The (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 are underway (from October 18, 2014).
- As of May 19, 2022, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 481,000, 736,000 and 103,000 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 May 19, 2022, approx. 676,000 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 May 19, 2022, approx. 841,000 m^3 had been treated.

As of May 19, 2022



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

Figure 3: Status of stagnant water storage

➢ Measures to reduce contamination of reused tanks

- From tanks to store strontium-reduced water and others to tanks to store ALPS treated water and others, the reuse of welded-joint tanks proceeds.
- 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 case.
- Among them, tanks in the Category (2) (removal of sludge inside the tank + repainting + replacement of connecting pipes and valves) area became full and the analytical results of the stored water showed that a portion of tanks exceeded 1 in the sum of concentration ratios required by law of 7 nuclides (water undergoing treatment).
- Before being discharged into the sea, the water will be purified until the sum of 62 nuclides + Carbon-14 becomes less than 1.

➢ Progress report toward the pre-service inspection of the high-performance ALPS

- For the continued generation of contaminated water, from the viewpoint of the amount of water that can be processed and the ease of adjustment, and other factors in mind, the additional and existing ALPSs were operated to date and the high-performance ALPS was on stand-by.
- Given the considerable time having elapsed since the performance verification operation in FY2015, toward future secondary treatment of “water treated with multi-nuclide removal equipment, etc.,” to optimize facility operation, including the high-performance ALPS, as well as the additional and the existing ALPSs, preparation to operate the

high-performance ALPS proceeded from November 2021.

- In February 2022, to refine the system operation of the high-performance ALPS and collect more data regarding the configuration of adsorption vessels, after reconfiguring some adsorption vessels, the removal performance was verified. As the sum of concentration ratios required by law for the treated water exceeded 1 (evaluation of 7 major nuclides), it was decided to modify the configuration of adsorption vessels to that in FY2015 when the sum was less than 1.
- After reconfiguring the adsorption vessels, the adjustment operation, including verification of the water flow status on April 27, confirmed that the sum of concentration ratios required by law of treated water had been reduced to less than 1 (evaluation of the 7 major nuclides).
- Based on this result, in the treatment operation of the high-performance ALPS on May 17 and 18, a positive operational state was confirmed and water was sampled. Toward pre-service inspection, preparation for verifying the performance to remove the radioactivity of 62 nuclides* including 7 major nuclides proceeds.
  * In addition to 62 nuclides, analysis will also be conducted for Carbon-14 and tritium.

➢ Results of investigation into malfunction of the cross flow filter (CFF) for the Additional ALPS

- Regarding the white turbidity in the CFF-filtered water of the Additional ALPS (B) detected in October 2020, the cause was investigated to prevent recurrence.
- The results detected a degraded gasket by chemical cleaning and wear of the filter element due to contamination with a foreign substance. In response, the chemical injection port will be changed, the frequency of gasket replacement will be configured and strainers installed to prevent foreign substances.
- It was confirmed that during the period when the malfunction was detected and after the operation resumed, the performance to remove nuclides from ALPS treated water was unaffected.

➢ Environmental preparation for the facility to dilute and discharge ALPS treated water at the Fukushima Daiichi Nuclear Power Station (NPS)

- In the review meeting concerning the implementation plan regarding ALPS treated water (12th), an explanation was given to the Nuclear Regulation Authority (NRA). The environmental preparation (installation of buoys and others, evacuation of seabed, cover by rubble stone and others) across the sea area until approx. 1 km from the nuclear power station has been underway since April 25.
- Regarding the evacuation, work started from May 5 when weather and marine meteorology conditions had recovered and as of May 26, approx. 3,000m^3 had been evacuated. Work continues while monitoring the weather, marine meteorology and others; prioritizing safety above all.
- During the environmental preparation at sea, seawater in the surrounding sea area is sampled, its turbidity measured and evacuated seabed soil is sampled. At present, no anomalies were detected in the seawater sampling, seawater turbidity measurement and analysis of the evacuated seabed soil.
- This environmental preparation is not applicable to facility construction which requires a revised implementation plan. Facilities, including construction of the water discharge tunnel, will be installed contingent on approval of the revised implementation plan and others.

Fuel removal from the spent fuel pools

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

➢ Main work to help spent fuel removal at Unit 1

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

➢ Main work to help spent fuel removal at Unit 2

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

Retrieval of fuel debris

➢ Progress status toward Unit 1 PCV internal investigation

- To acquire information related to the construction plan to collect deposits and others toward fuel debris retrieval, a remotely operated underwater vehicle (ROV) will be inserted into the basement within the PCV from X-2 penetration to investigate inside and outside the pedestal.
- After the Fukushima Prefecture Off-coast Earthquake on March 16, the PCV water level declined. To obtain the water level necessary for the investigation, the water injection rate into the reactor was increased.
- On March 29, the water level was checked by the submersible ROV-2. An increased water level was confirmed but due to transparency loss of the mounted camera and others, the investigation was suspended.
- To resume the investigation, after securing the necessary PCV water level and implementing countermeasures to resolve the loss of image transmission, the detailed visual investigation of the pedestal periphery resumed for the period May 17-22.

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

- The trial retrieval equipment for Unit 2 fuel debris, which had been developed in the UK, arrived in Japan on July 10, 2021.
- The ongoing performance verification test in a domestic factory (Kobe), which started from August 2021, finished on January 21, 2022.
- The equipment was transported from January 28, 2022 and the robot arm arrived on January 31 and the enclosure, on February 4, at the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA) (hereinafter referred to as the “Naraha mockup facility”).
- From February 14, 2022 the performance verification test and operational training started at the Naraha mockup facility.

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

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

➢ Management status of the rubble and trimmed trees

- As of the end of April 2022, the total storage volume for concrete and metal rubble was approx. 325,400 m^3 (+2,200 m^3 compared to the end of March with an area-occupation rate of 87%). The total storage volume of trimmed trees was approx. 140,000 m^3 (+200 m^3, with an area-occupation rate of 80%). The total storage volume of used protective clothing was approx. 29,600 m^3 (+700 m^3, with an area-occupation rate of 56%). The increase in rubble was attributable to work around Units 1-4, work related to the port, transfer for area arrangement and others. As of the end of April 2022, there were 11 temporary deposits with storage capacity exceeding 1,000m^3 and a total storage volume

of 51,400 m³.

➢ Management status of secondary waste from water treatment

- As of May 5, 2022, the total storage volume of waste sludge was 422 m³ (area-occupation rate: 60%), while that of concentrated waste fluid was 9,346 m³ (area-occupation rate: 91%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment and other vessels, was 5,359 (area-occupation rate: 84%).

➢ Status of inspection and restoration regarding the Radioactive Waste Incinerator after the influence of the earthquake on March 16 and others

- Regarding the Radioactive Waste Incinerator, multiple damage were detected due to the influence of the earthquake on March 16, for which detailed inspection and restoration are underway.
- Moreover, as the response to light oil leakage from the light oil line pressure-reducing valve, which occurred in April, remains ongoing, restoration will take time.
- By rescheduling the annual inspection for the crane from July as previously planned to the present stoppage, the process was coordinated to secure longer for operation after the resumption.
- The resumption is scheduled in early July for System B and mid-July for System A after coordinating with other works.

➢ Operation status of the additional Radioactive Waste Incinerator

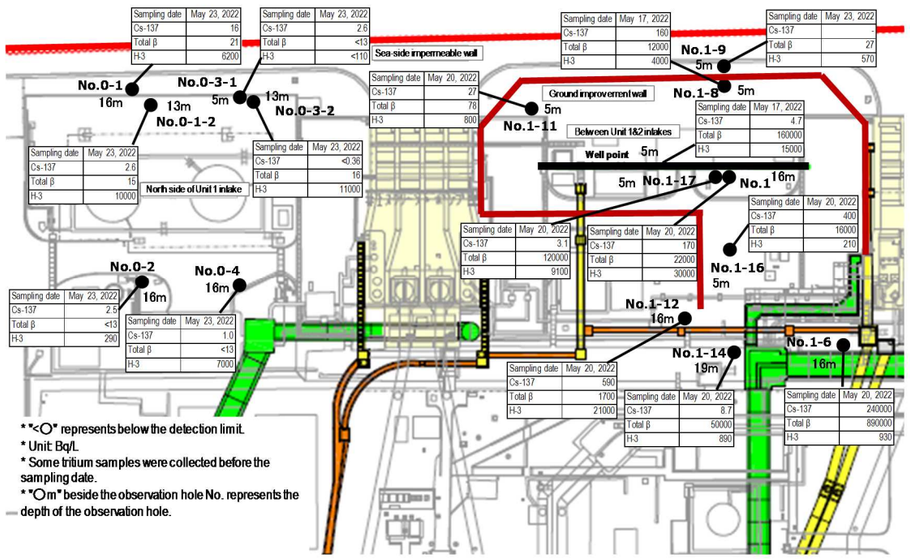
- Regarding the Additional Radioactive Waste Incinerator, as damage was detected in a portion of the facilities and buildings due to the Fukushima Prefecture Off-coast Earthquake on March 16, the operation start time scheduled in March was reviewed.
- As by the subsequent restoration, construction of the incinerator was completed on March 31 and the restoration of the building was also completed on May 10, operation started from May 11.
- On May 13, clogging of incinerator ash was detected near the main ash removal part of the stoker and the incineration operation was suspended. Investigation inside the incinerator detected an ash lump blocking the elimination route from the shoot part under the main ash removal box to the stoker ash removal part.
- It was considered attributable to insufficient combustion ash in the stoker forming a lump and subsequently clogging. As countermeasures, by operating the stoker burner continuously and waste oil mixed combustion, the temperature inside the furnace will be maintained at a high level (approx. 800°C) for sufficient combustion. Moreover, by monitoring the inside of the furnace and the ash removal system, when ash is deposited, chip injection was suspended and ash combustion awaited to prevent clogging.
- As ash clogging was removed and preparation for resumption of incineration operation was completed by May 20, incineration operation of the additional Radioactive Waste Incinerator resumed from May 23.

Reduction in radiation dose and mitigation of contamination

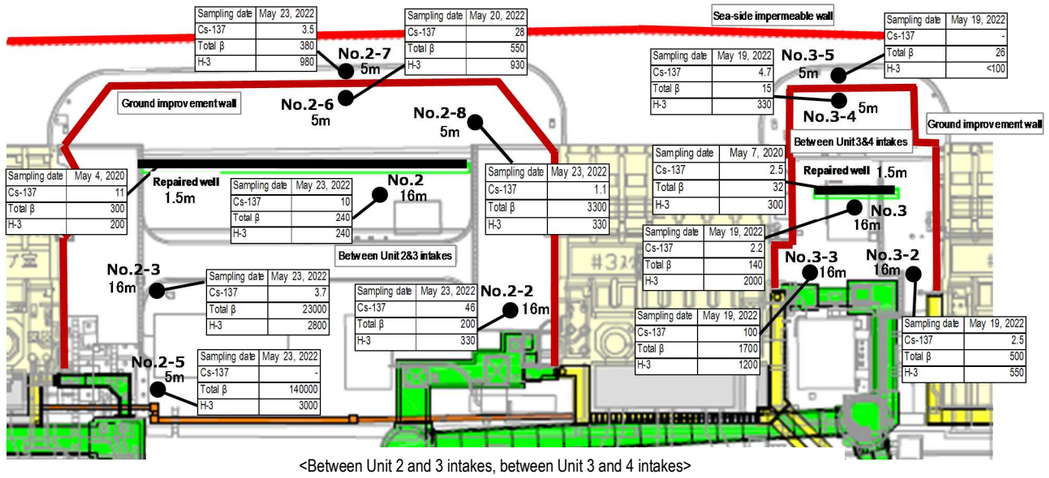
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

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

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



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



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

Figure 4: Groundwater concentration on the Turbine Building east side

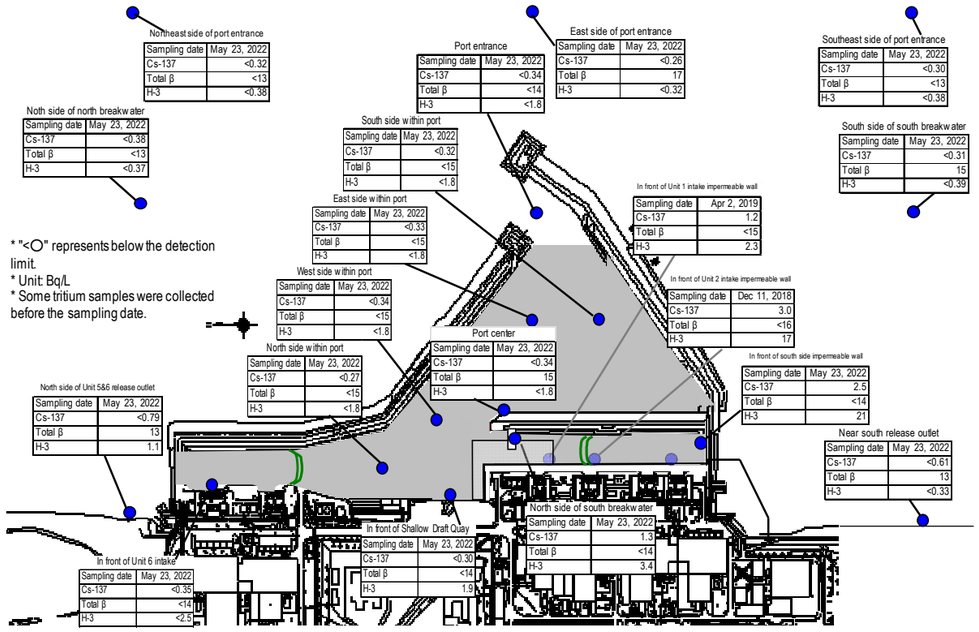


Figure 5: Seawater concentration around the port

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 January to March 2022 was approx. 9,100 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 6,800). Accordingly, sufficient personnel are registered to work on site.
- It was confirmed with the prime contractors that the estimated manpower necessary for the work in June 2022 (approx. 3,900 workers per day: cooperating company workers and TEPCO HD employees) would be secured at present. The average numbers of workers per day for each month (actual values) for the most recent 2 years were maintained, with approx. 3,000 to 4,200.
- The number of workers from within Fukushima Prefecture decreased slightly and outside, remained constant. The local employment ratio (cooperating company workers and TEPCO HD employees) as of April 2022 decreased slightly at around 65%.
- The average exposure doses of workers were at 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.

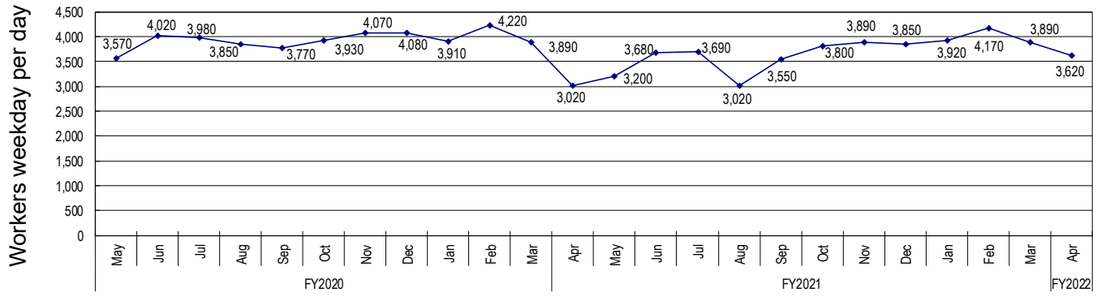


Figure 6: Changes in the average number of workers weekday per day for each month of the past 2 years (actual values)

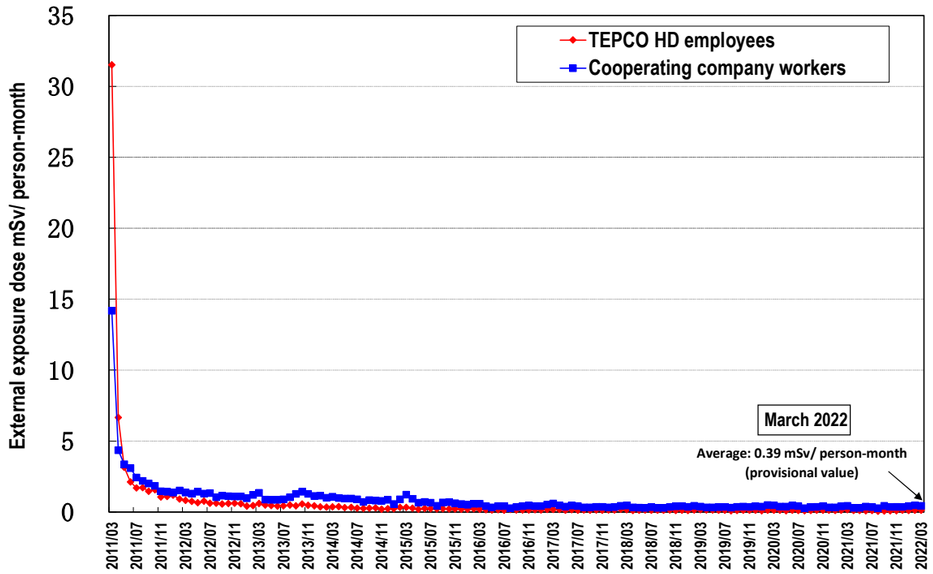


Figure 7: Changes in monthly average exposure dose of individual worker
(monthly exposure dose since March 2011)

➢ Countermeasures to suppress the spread of COVID-19 infections

- The semi-state of emergency COVID-19 measures applied to 18 prefectures, including Tokyo, was totally lifted on March 21. However, for TEPCO HD employees and cooperating company workers at the Fukushima Daiichi Nuclear Power Station (NPS), countermeasures to prevent the infection spreading, such as requiring employees to take their temperature before coming to the office, wear masks at all times, avoid the “Three Cs” (Closed spaces, Crowded places, Close-contact settings) by using the rest house in shifts, eat silently and carefully select business travel, will continue to be properly implemented. In addition, they must appropriately observe the rules, including reporting to their supervisors and managers if their own physical condition or that of their family members is poor before coming

to the company at the beginning of the week to proceed with decommissioning work, prioritizing safety above all.

- AS of 15:00, May 25,
  (1) 319 workers (including 54 TEPCO HD employees, 1 temporary worker, 262 cooperating company workers and 2 business partner company employees) of the Fukushima Daiichi NPS had contracted COVID-19. Since January 2022, a total of 215 workers (including 44 TEPCO HD employees, 170 cooperating company workers and 1 business partner company employee) had contracted COVID-19.
  (2) The third workplace vaccination of COVID-19 was implemented (from March 28, 2022) to a total of 2,743 workers (including 666 TEPCO HD employees and 2,077 cooperating company workers).
- No significant influence on decommissioning work, such as a corresponding delay to work processes due to this infection, had been identified.
- Acceptance of inspectors resumed from March 22.

➢ Status of influenza and norovirus cases (conclusion of infection and expansion-preventive measures)

- As there have been no further cases of influenza infections since the measures started in November 2021, the measures to prevent infection and expansion were concluded at the end of April 2022. During this season (2021-2022), there were no influenza infection and seven norovirus infections, while the totals for the entire previous season (2020-2021) showed one influenza infection and one norovirus infection, respectively.

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

- The number declined by one for influenza cases and increased by six for norovirus cases compared to the previous season.
- As in the previous season, the number of influenza cases was unprecedentedly low, even nationwide, which is considered attributable to the continued effectiveness of countermeasures to prevent COVID-19 infection. The number of norovirus cases also remained low compared to the year before the COVID-19 pandemic and no outbreak was confirmed, nor any case of food poisoning. These results demonstrate the effectiveness of measures to prevent infection and expansion.

➢ Status of heat stroke cases

- In FY2022, measures to further prevent heat stroke commenced from April to cope with the hottest season.
- In FY2022, no workers suffered heat stroke due to work up until May 23 (in FY2021, 2 workers up until the end of May). Continued measures will be taken to prevent heat stroke.

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 May 16-23)"; unit (Bq/L); ND represents a value below the detection limit

Summary of TEPCO data as of May 24, 2022

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.

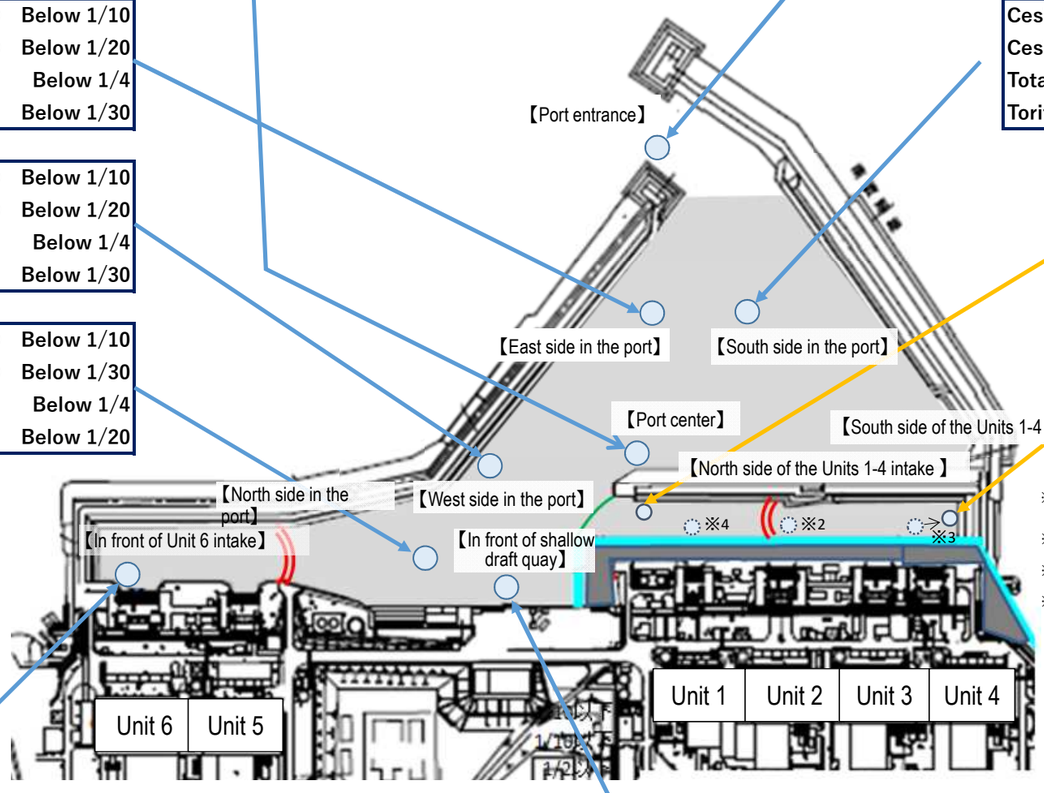
Cesium-134	ND(0.27)			
Cesium-137	ND(0.34)			
Total β	15			
Toritium	ND(1.8)	※1		

Cesium-134	: 3.3	(H25/10/17)	→	ND(0.28)	Below 1/10
Cesium-137	: 9	(H25/10/17)	→	ND(0.33)	Below 1/20
Total β	: 74	(H25/8/19)	→	ND(15)	Below 1/4
Toritium	: 67	(H25/8/19)	→	ND(1.8)	Below 1/30

Cesium-134	: 4.4	(H25/12/24)	→	ND(0.32)	Below 1/10
Cesium-137	: 10	(H25/12/24)	→	ND(0.34)	Below 1/20
Total β	: 60	(H25/7/4)	→	ND(15)	Below 1/4
Toritium	: 59	(H25/8/19)	→	ND(1.8)	Below 1/30

Cesium-134	: 5	(H25/12/2)	→	ND(0.29)	Below 1/10
Cesium-137	: 8.4	(H25/12/2)	→	ND(0.27)	Below 1/30
Total β	: 69	(H25/8/19)	→	ND(15)	Below 1/4
Toritium	: 52	(H25/8/19)	→	ND(1.8)	Below 1/20

Cesium-134	: 2.8	(H25/12/2)	→	ND(0.29)	Below 1/9
Cesium-137	: 5.8	(H25/12/2)	→	ND(0.35)	Below 1/10
Total β	: 46	(H25/8/19)	→	ND(14)	Below 1/3
Toritium	: 24	(H25/8/19)	→	ND(2.5)	Below 1/9



Cesium-134	: 5.3	(H25/8/5)	→	ND(0.32)	Below 1/10
Cesium-137	: 8.6	(H25/8/5)	→	ND(3.0)	Below 1/2
Total β	: 40	(H25/7/3)	→	ND(14)	Below 1/2
Toritium	: 340	(H25/6/26)	→	1.9	Below 1/100

Cesium-134	: 3.3	(H25/12/24)	→	ND(0.27)	Below 1/10
Cesium-137	: 7.3	(H25/10/11)	→	ND(0.34)	Below 1/20
Total β	: 69	(H25/8/19)	→	ND(14)	Below 1/4
Toritium	: 68	(H25/8/19)	→	ND(1.8)	Below 1/30

Cesium-134	: 3.5	(H25/10/17)	→	ND(0.33)	Below 1/10
Cesium-137	: 7.8	(H25/10/17)	→	ND(0.32)	Below 1/20
Total β	: 79	(H25/8/19)	→	ND(15)	Below 1/5
Toritium	: 60	(H25/8/19)	→	ND(1.8)	Below 1/30

Cesium-134	: 32	(H25/10/11)	→	ND(0.28)	Below 1/100
Cesium-137	: 73	(H25/10/11)	→	1.3	Below 1/50
Total β	: 320	(H25/8/12)	→	ND(14)	Below 1/20
Toritium	: 510	(H25/9/2)	→	3.4	Below 1/100

Cesium-134	:	ND(0.31)	
Cesium-137	:	2.5	
Total β	:	ND(14)	
Toritium	:	21	※1

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

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

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

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

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

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 May 16-23)

Summary of TEPCO data as of May 24, 2022

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

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

Cesium-134	ND	(H25)	→	ND(0.30)
Cesium-137	ND	(H25)	→	ND(0.32)
Total β	ND	(H25)	→	ND(13)
Toritium	ND	(H25)	→	–

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

Cesium-134	ND	(H25)	→	ND(0.27)	
Cesium-137	1.6	(H25/10/18)	→	ND(0.26)	Below 1/2
Total β	ND	(H25)	→	17	
Toritium	6.4	(H25/10/18)	→	–	

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

Cesium-134	ND	(H25)	→	ND(0.29)
Cesium-137	ND	(H25)	→	ND(0.30)
Total β	ND	(H25)	→	ND(13)
Toritium	ND	(H25)	→	–

Cesium-134	ND	(H25)	→	ND(0.31)
Cesium-137	ND	(H25)	→	ND(0.38)
Total β	ND	(H25)	→	ND(13)
Toritium	4.7	(H25/8/18)	→	–

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

Cesium-134	3.3	(H25/12/24)	→	ND(0.27)	Below 1/10
Cesium-137	7.3	(H25/10/11)	→	ND(0.34)	Below 1/20
Total β	69	(H25/8/19)	→	ND(14)	Below 1/4
Toritium	68	(H25/8/19)	→	ND(1.8)	Below 1/30

【Port entrance】

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

Cesium-134	ND	(H25)	→	ND(0.32)
Cesium-137	ND	(H25)	→	ND(0.31)
Total β	ND	(H25)	→	15
Toritium	ND	(H25)	→	–

Cesium-134	1.8	(H25/6/21)	→	ND(0.76)	Below 1/2
Cesium-137	4.5	(H25/3/17)	→	ND(0.79)	Below 1/5
Total β	12	(H25/12/23)	→	13	
Toritium	8.6	(H25/6/26)	→	1.1	Below 1/7

Cesium-134	ND	(H25)	→	ND(0.49)	
Cesium-137	3	(H25/7/15)	→	ND(0.61)	Below 1/4
Total β	15	(H25/12/23)	→	13	
Toritium	1.9	(H25/11/25)	→	ND(0.32)	Below 1/2

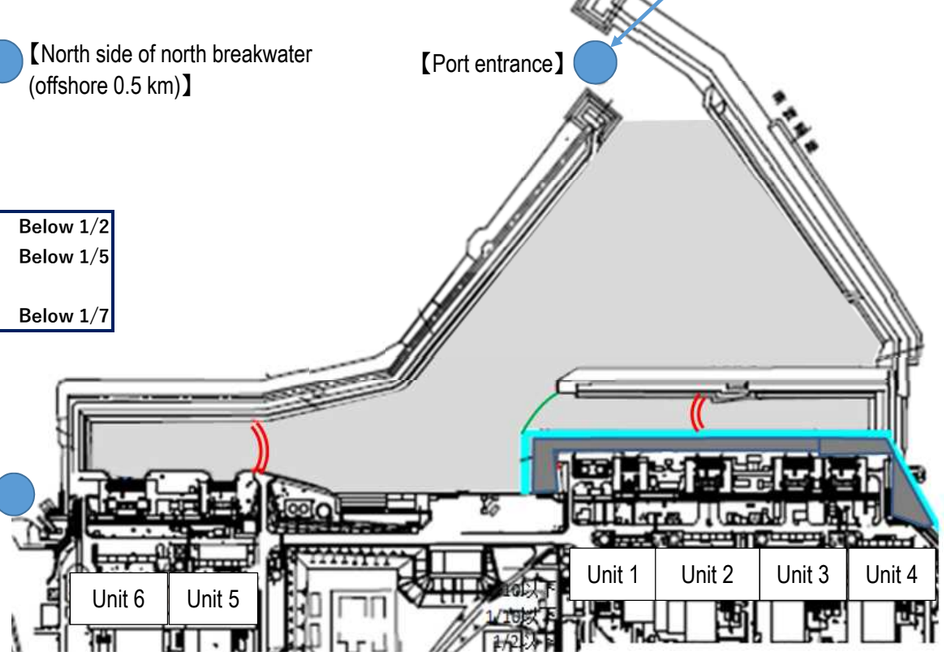
【North side of Unit 5 and 6 release outlet】

【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

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout

Appendix 2

May 26, 2022

- 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 (planned)
- 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)

Tank installation status

Spent adsorption vessel temporary storage facility

Temporary waste sludge storage

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

Temporary trimmed trees storage pool

Rubble

Used protective clothing

Trimmed trees

Additional Radioactive Waste Incinerator

Large Waste Storage

Radioactive Waste Incinerator

Futaba town

Unit 6

Unit 5

Unit 1

Unit 2

Unit 3

Unit 4

Town boundary

Vehicles maintenance site

Water treatment facility for Sub-drain

Water treatment facility for Sub-drain and others

Periodical Inspection Material Storage (cutting of flanged-tanks)

Main Anti-Earthquake Building

Temporary Cask Custody Area

K1, K2, K3, K4

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

Spent absorption vessel temporary storage

Large equipment decontamination facility

Land-side impermeable walls with frozen soil

Land-side impermeable walls freezing plant

Mega float

Okuma town

Pipe route

Sea side impermeable wall

Water desalinations (RO)

Cesium absorption apparatus (Incineration Workshop Building)

Decontamination instruments (Process Building)

3rd cesium adsorption apparatus (Onsite Bunker Building)

2nd cesium adsorption apparatus

Cesium absorption vessel temporary storage

Underground reservoirs

Common pool

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)

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

Site boundary

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

0m 100m 500m 1000m

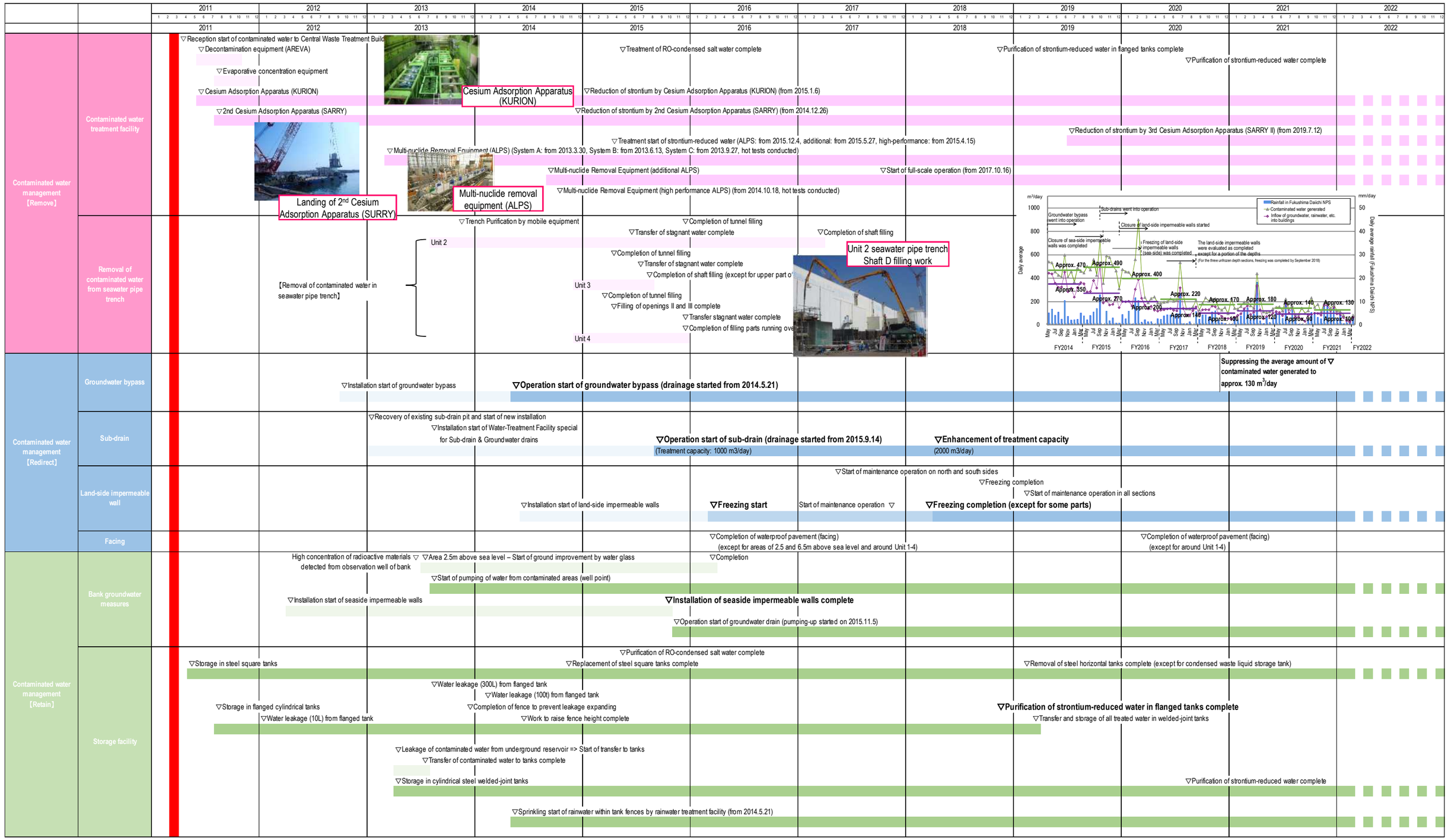
1-1 Contaminated water management

- 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)

Reference
May 26, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water



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

Pumping well


Sub-drain purification system


Land-side impermeable wall brine (refrigerant) circulation pipe


Construction of welded-joint tanks

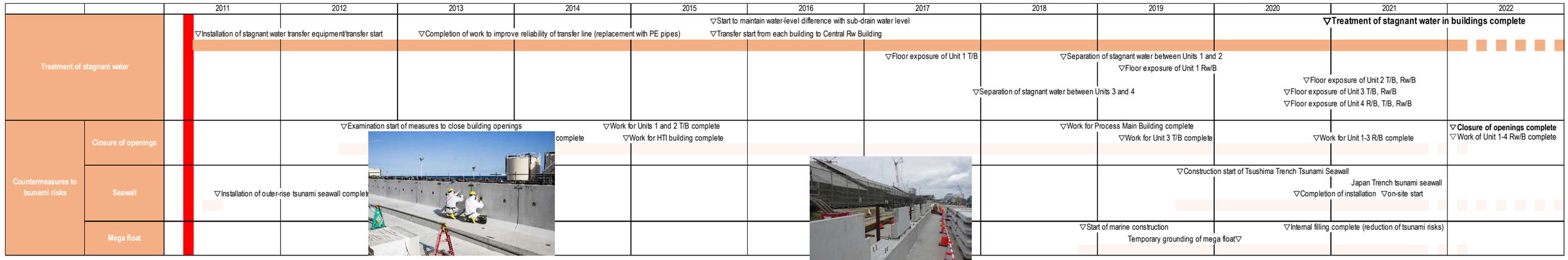

Placement of seaside impermeable walls complete


Flanged and welded-joint tanks

1-2 Contaminated water management

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

Reference
May 26, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water
2／6



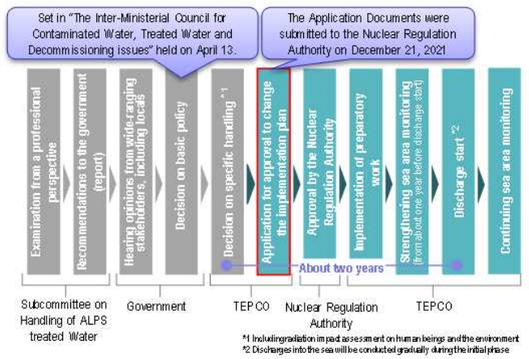
Chishima Trench Tsunami Seawall complete

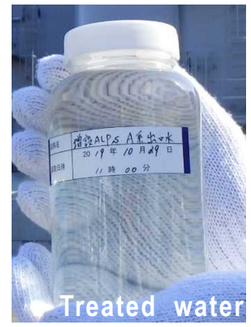
Construction of Japan Trench Tsunami Seawall

2 Handling of ALPS treated water

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

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





Examination concerning handling of ALPS treated water

2016.6 Report of Tritiated Water Taskforce

Tritiated Water Taskforce (2013.12 – 2016.5, 15 meetings)

Tank area viewed from the Large Rest House (2015.10.29)

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)

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

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

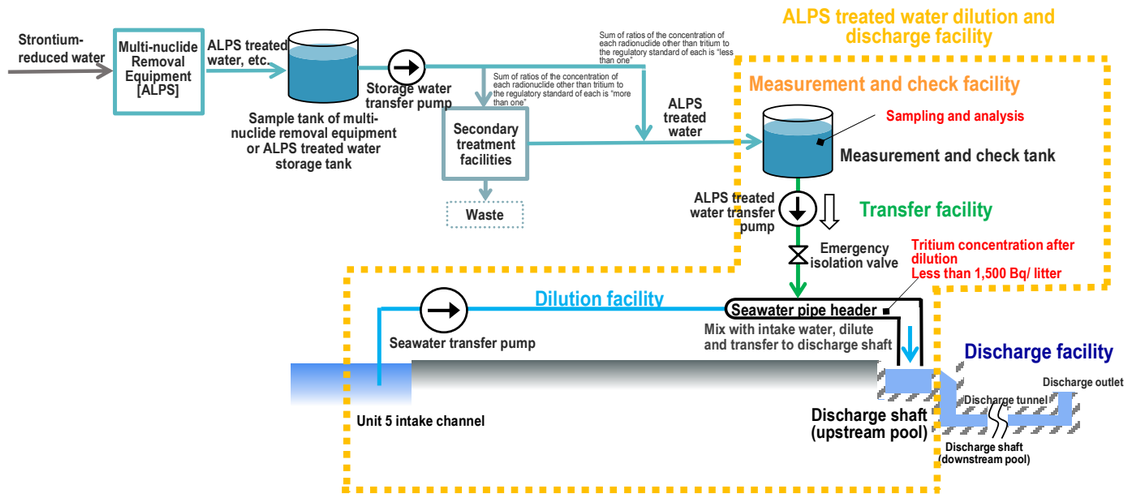
Review meeting concerning the implementation plan on handling of ALPS treated water (from 2021.7)

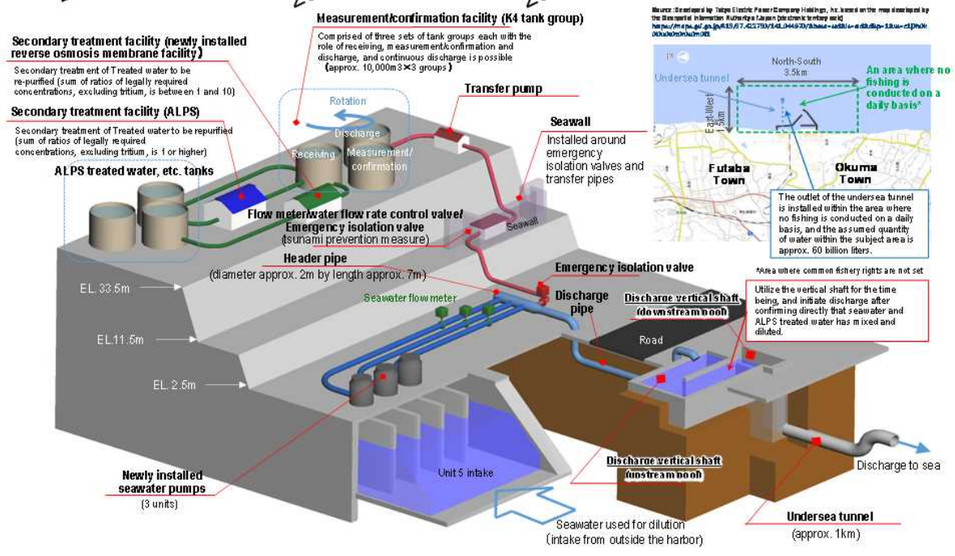
2022.4.28, 5.13 Application to partially revise the Application Documents for Approval to Amend the Implementation Plan was submitted

2021.4.13 The basic policy on the handling of ALPS treated water was set
2021.4.16 The response of TEPCO was announced

2014 2015 2016 2017 2018 2019 2020 2021 2022

【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)

Reference
May 26, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water
3／6

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

▼ 2011.11- 2012.7 Removal of rubble on the Reactor Building top floor
▼ 2012.4-2013.3 Ground improvement and foundation work
▼ 2013.4-2013.7 Installation of external walls and roof panels
▼ 2013.6-2013.10 Installation of overhead crane and fuel-handling machine
▼ 2013.8-2013.10 Removal of rubble inside the reactor well and pool
▼ 2013.11.18 Start of fuel removal
▼ 2014.12.22 Fuel removal was completed (1533 assemblies)

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


<Unit 4 Cover for fuel removal>

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


Fuel removal

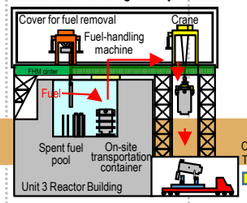
Unit 4

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

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

▼ 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)

Overview of the fuel-handling facility inside the cover

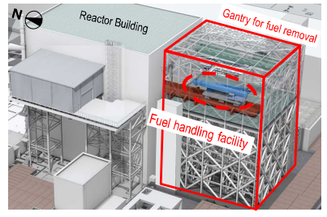


<Unit 3 Cover for fuel removal (dome roof) 2019.2.21>

Unit 3

▼ 2015.3-2016.11 Yard construction
▼ 2016.9-2017.4 West-side gantry installation work
▼ 2017.5 Opening a hole in the west-side external wall
▼ 2018.8-2020.12 Moving and containment of remaining objects
▼ 2020.6 Investigation inside the spent fuel pool
▼ 2021.10-2022.4 Ground improvement work


<Unit 2 Construction of gantry for fuel removal>



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

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.

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

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

Unit 2

▼ 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
▼ 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
▼ 2021.8 Start of large cover pre-work

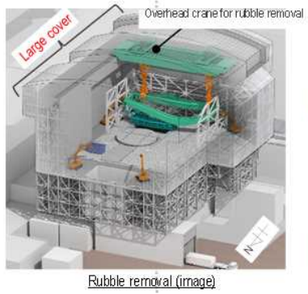
For Unit 1, a large cover will be installed over the whole building, within which rubble will be removed.

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

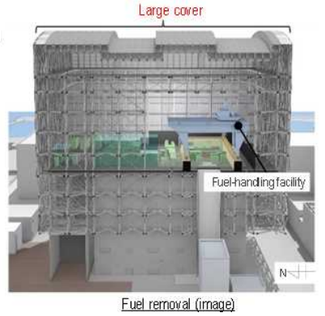
<Reference> Progress to date
Rubble removal on the north side of the operating floor started from January 2018 and has been implemented sequentially. In July and August 2019, the well plug, which was misaligned, was investigated, followed in August and September by the conditions of the overhead crane.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

Unit 1


<Unit 1 Dismantling of remaining cover>



Rubble removal (image)



Fuel removal (image)

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

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

4 Work toward fuel debris retrieval

Reference
May 26, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water
4／6

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

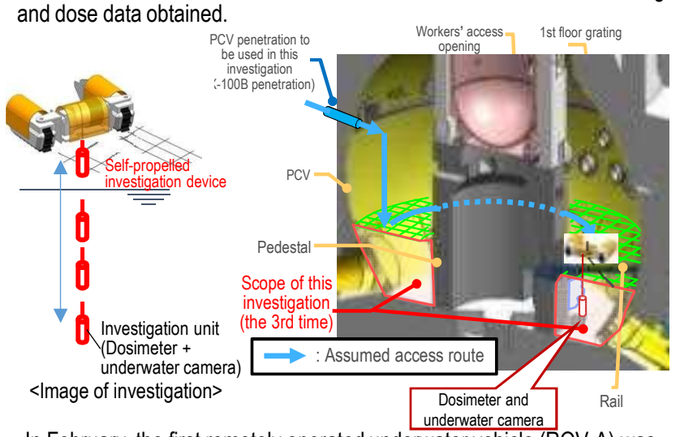
Start of fuel debris retrieval from the first unit (Unit 2). Expanding the scale in stages (within 2021 * The schedule will be extended for about 1 year due to the spread of COVID-19 infections)

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

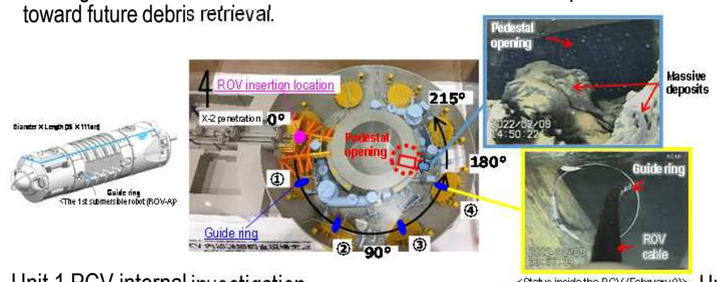
・In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:φ100 mm) collected information such as images and airborne dose inside the PCV 1st floor.

・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)>

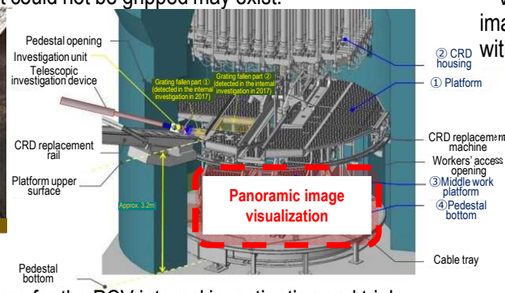
Unit 2 Investigation overview

・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.

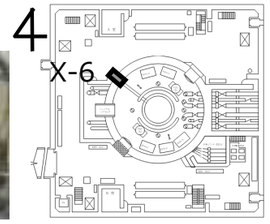

Bottom of the pedestal (after being processed in panoramic image visualization)



・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

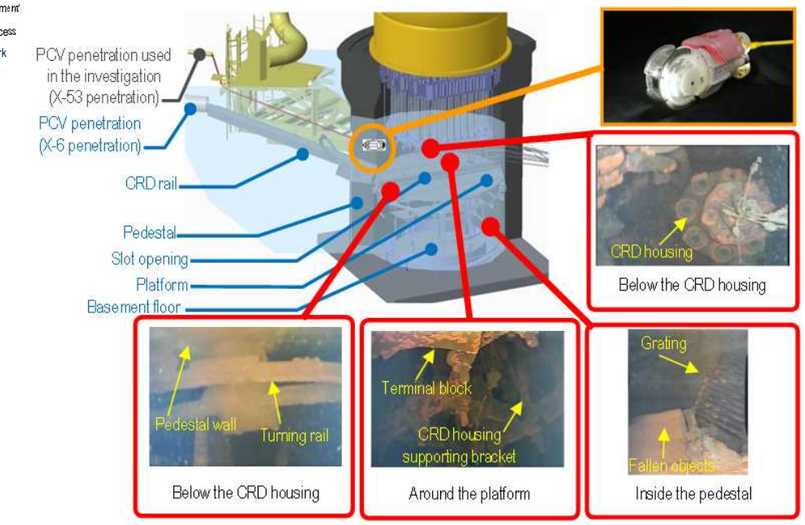
・In October 2014, the conditions of X-53 penetration, which may be under water and which is scheduled for use to investigate the inside of the PCV, was investigated via remote-controlled ultrasonic test equipment. The results showed that the penetration was not under water.

・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)

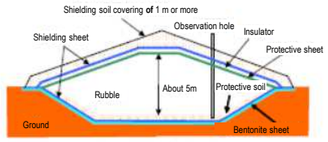
▼ 2012.9 Transfer start of rubble to the soil-covered temporary storage facility

▼ 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

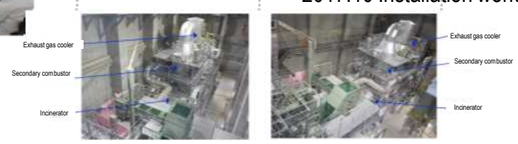
▼2022.5 Start of operation

2017.10 Installation work gets

▼ 2018.5 Operation start
Large Equipment Decontamination Facility

Site of Volume Reduction Facility

▼ 2020.9 Start of pre-work
Compaction Facility



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

Present status Note

Storage of rubble and others

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

Rubble (combustible), trimmed trees, used protective clothing

Contaminated soil (0.005 - 1 mSv/h)

Rubble (metal, concrete, others)

More than 1 mSv/h

Soil-covered temporary storage facility

Solid waste storage

0.005-1 mSv/h

Less than 0.005mSv

Storage of water treatment secondary waste

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

Approx. 290,000 m³ — To (A) (*1) — **Incineration**

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

Crusher example

Radioactive Waste Incinerator

Additional Radioactive Waste Incinerator (scheduled for completion in FY2021)

Work of main part

2021.3 The installation process was reviewed

Toward **an** operation **launch** within FY2021, installation work continues

Approx. 60,000 m³ — Stored and managed in Solid Waste Storage as done for rubble

Approx. 60,000 m³

Approx. 170,000 m³ — To (A) (*1) — **Volume reduction**

Compaction Facility (scheduled for completion in FY2022)

Concrete crusher example

Metal cutter example

Approx. 220,000 m³ — **Melting**

Melting equipment

Electric furnace example

Approx. 6,500 tanks — Treatment measures and others will be examined — To (B)

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

Status after a decade

Legend ▭: Newly installed equipment and facility

(*3) Approx. **270,000** m³ (*2)

Storage /management

Approx. 20,000 m³

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

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

(*1) Approx. 60,000 m³ (A)

(B) Approx. 60,000 m³

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

Approx. 60,000 m³

Approx. 70,000 m³ (*1)

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

Reuse will be examined

Spent Adsorption Vessel Temporary Storage

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

Work of main part

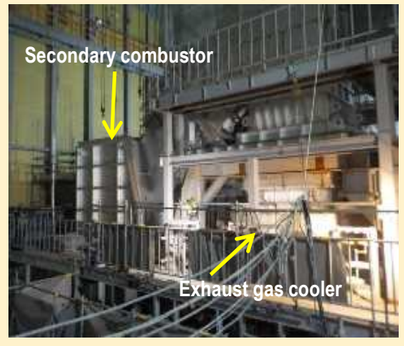
Note: Used protective clothing before incineration and BG-level concrete waste for which treatment and reuse is decided at present are not included.

- 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.

●Efforts to eliminate temporary outdoor storage of rubble and others

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

Whole view of the Additional Solid Waste Incinerator Building



Main equipment

6 Improvement of work environment

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

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

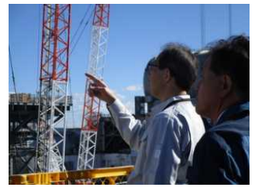
External view of Access Control Facility

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

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.

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.



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)

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.

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.

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.

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

Changes in operation of controlled area

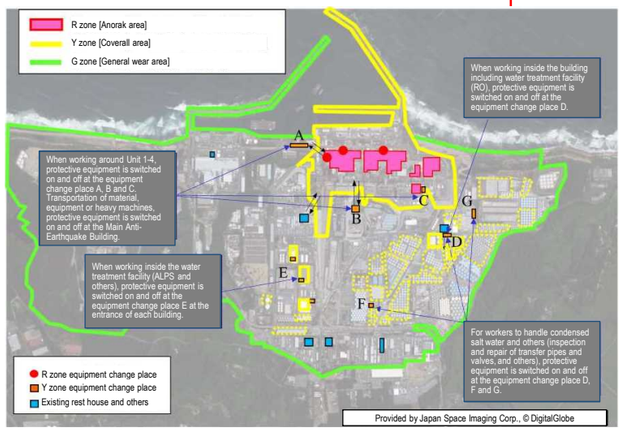
From May 2013, full-face mask unnecessary area was expanded sequentially.

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

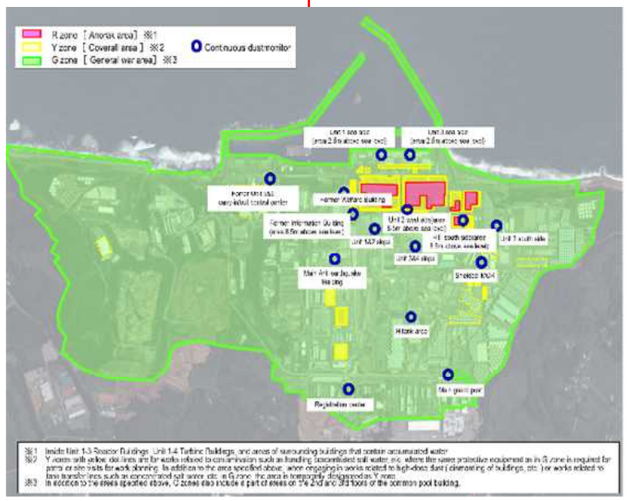
In March 2017, the G-zone area was expanded (to cover 95% of the whole site).

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.

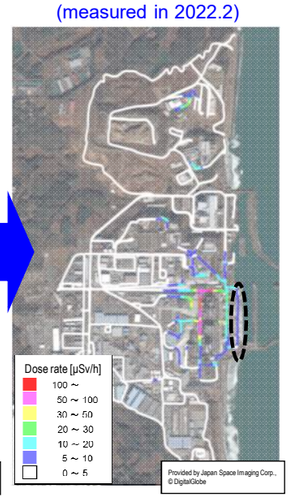


In May 2018, within about 96% of the site, workers are allowed to wear light equipment such as general workwear and disposable dust-protective masks.

<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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