

## Main decommissioning work and steps

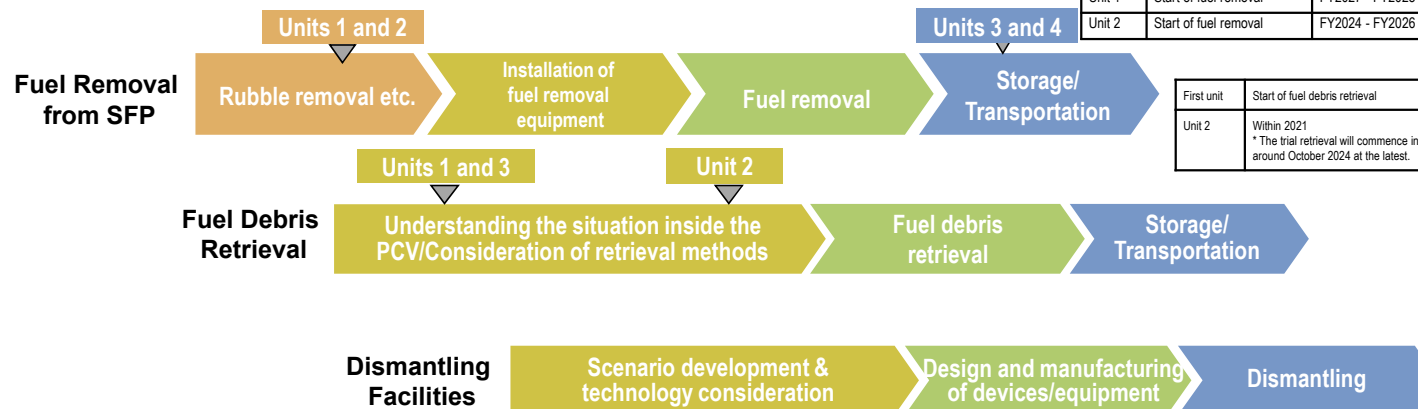
Fuel removal from the spent fuel pool was completed in December 2014 at Unit 4 and on February 28, 2021 at Unit 3. Work continues sequentially toward the start of fuel removal from Units 1 and 2 and debris (Note 1) retrieval from Units 1-3.

(Note 1) Fuel assemblies having melted through in the accident with nearby metal materials etc.

<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

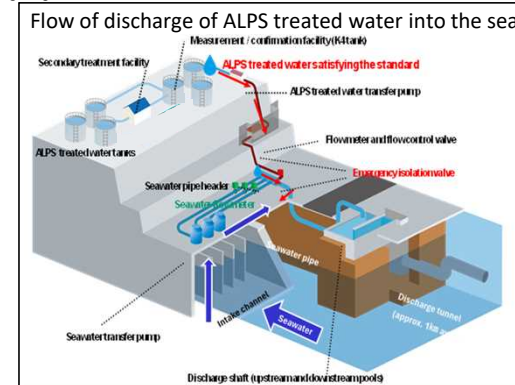
First unit	Start of fuel debris retrieval
Unit 2	Within 2021 * The trial retrieval will commence in around October 2024 at the latest.



## 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

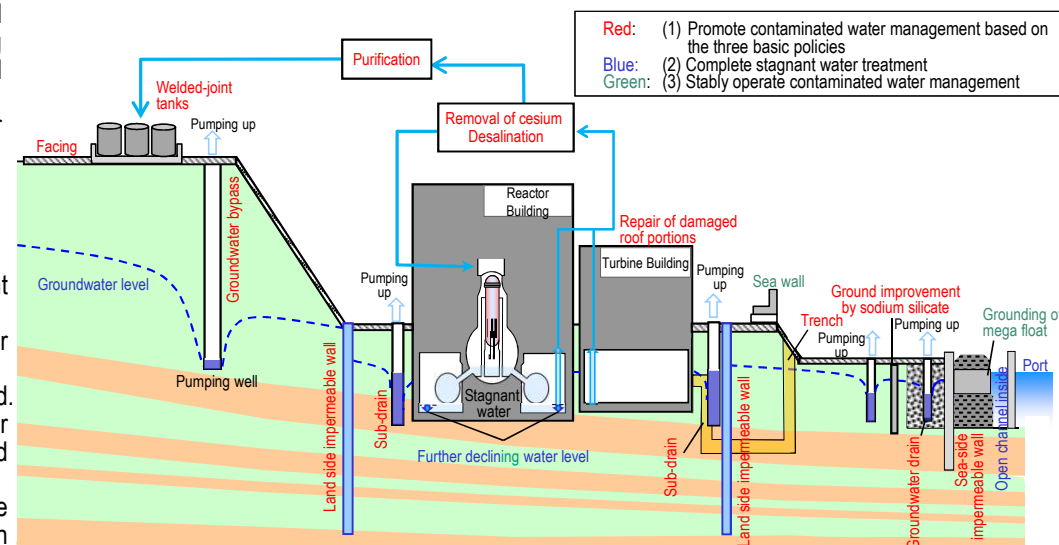
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized 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. Through these measures, the generation of contaminated water was reduced from approx. 540 m<sup>3</sup>/day (in May 2014) to approx. 90 m<sup>3</sup>/day (in FY2022).
- Measures continue to further suppress the generation of contaminated water to 100 m<sup>3</sup>/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.
- 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.
- While assessing the dust impact, measures to reduce the stagnant water level were implemented. In March 2023, the target water level in each building was achieved. For the Units 1-3 Reactor Buildings, "reducing stagnant water in the Reactor Buildings to about half the amount at the end of 2020 during the period FY2022-2024" was achieved.
- 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 were carried out to prepare for tsunamis. As countermeasures 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

### Status of discharge of ALPS treated water into the sea

Prior to the 4th discharge of ALPS treated water, the measurement/confirmation facility tank group B was analyzed. As a result, TEPCO and external institutions confirmed that the discharge requirements were satisfied.

Based on the result, discharge of ALPS treated water of the measurement/confirmation facility tank group B commenced from February 28.

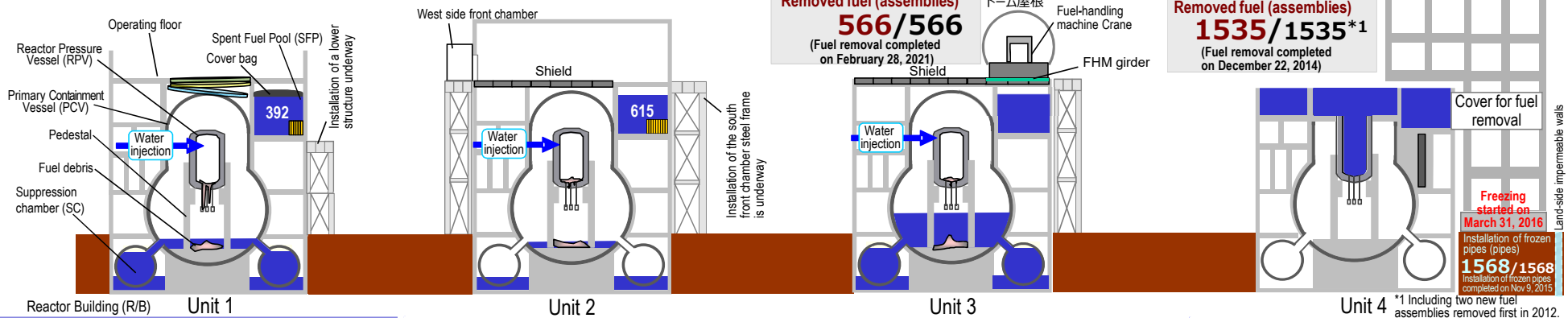
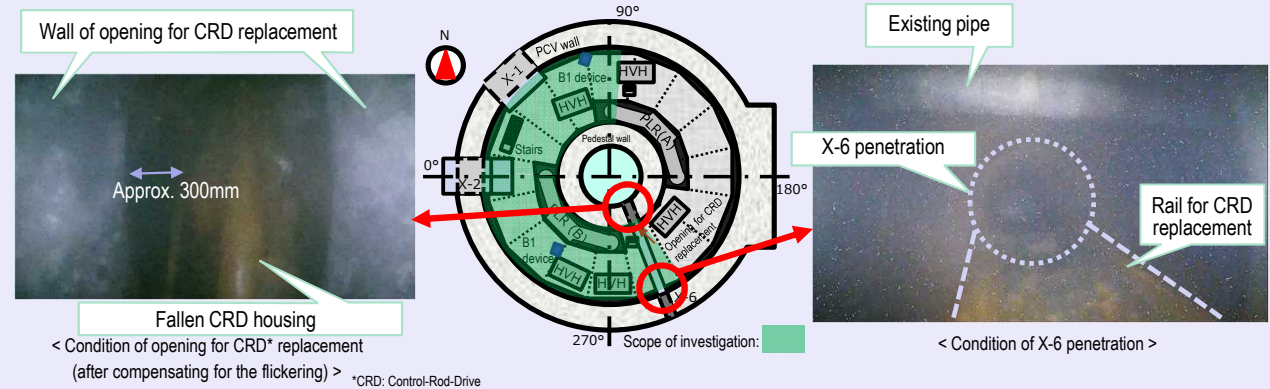
Monitoring of tritium concentration in seawater will continue based on the results of a daily quick analysis conducted by TEPCO confirm that the discharge satisfies the requirements and is being conducted safely as planned.

- ◆ 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 PCV internal investigation (aerial survey)

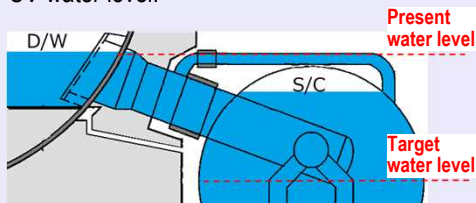
From February 28, an aerial survey inside the Unit 1 PCV by drone commenced and images outside the pedestal were acquired.

The investigation continues with a safety-first approach. Information acquired from the survey results will be utilized in the examination for fuel debris retrieval.



### Unit 1 Decrease in the PCV water level

At Unit 1, as measures to increase the seismic resistance of the Primary Containment Vessel (PCV), the water level will be decreased gradually. Work will commence from late March and will be implemented carefully, while confirming the impact of the decrease in the PCV water level.

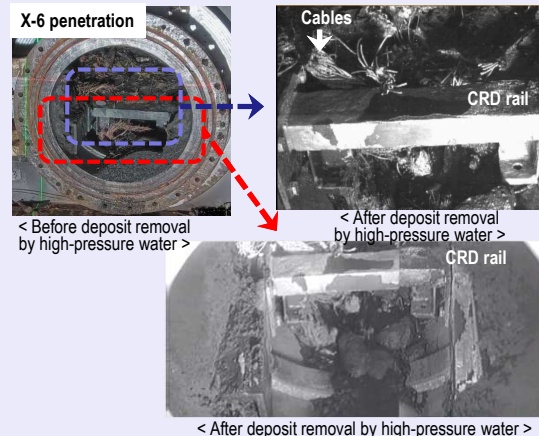


< Image of decrease in PCV water level >

### Unit 2 Status of preparation for trial retrieval

At the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA), an access test to the pedestal bottom by remote operation of the robot arm is underway. In the next phase, a test combining the robot arm and a dual arm manipulator will be conducted.

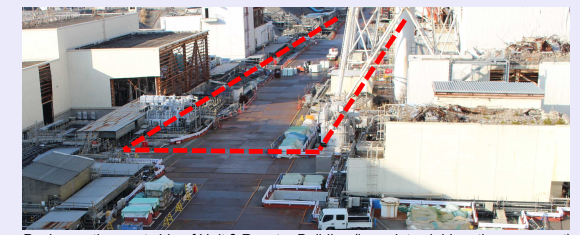
At the PCV penetration (X-6 penetration), removal of deposit by high-pressure water of the deposit removal equipment has been underway since February 21. Deposit removal will continue with a safety-first approach.



### Status of site-paving around Units 1-4

To suppress the generation of contaminated water, paving is underway around Units 1-4 Building. This fiscal year, areas on the west side of Unit 3 Reactor Building and approx. 50% around the building were paved.

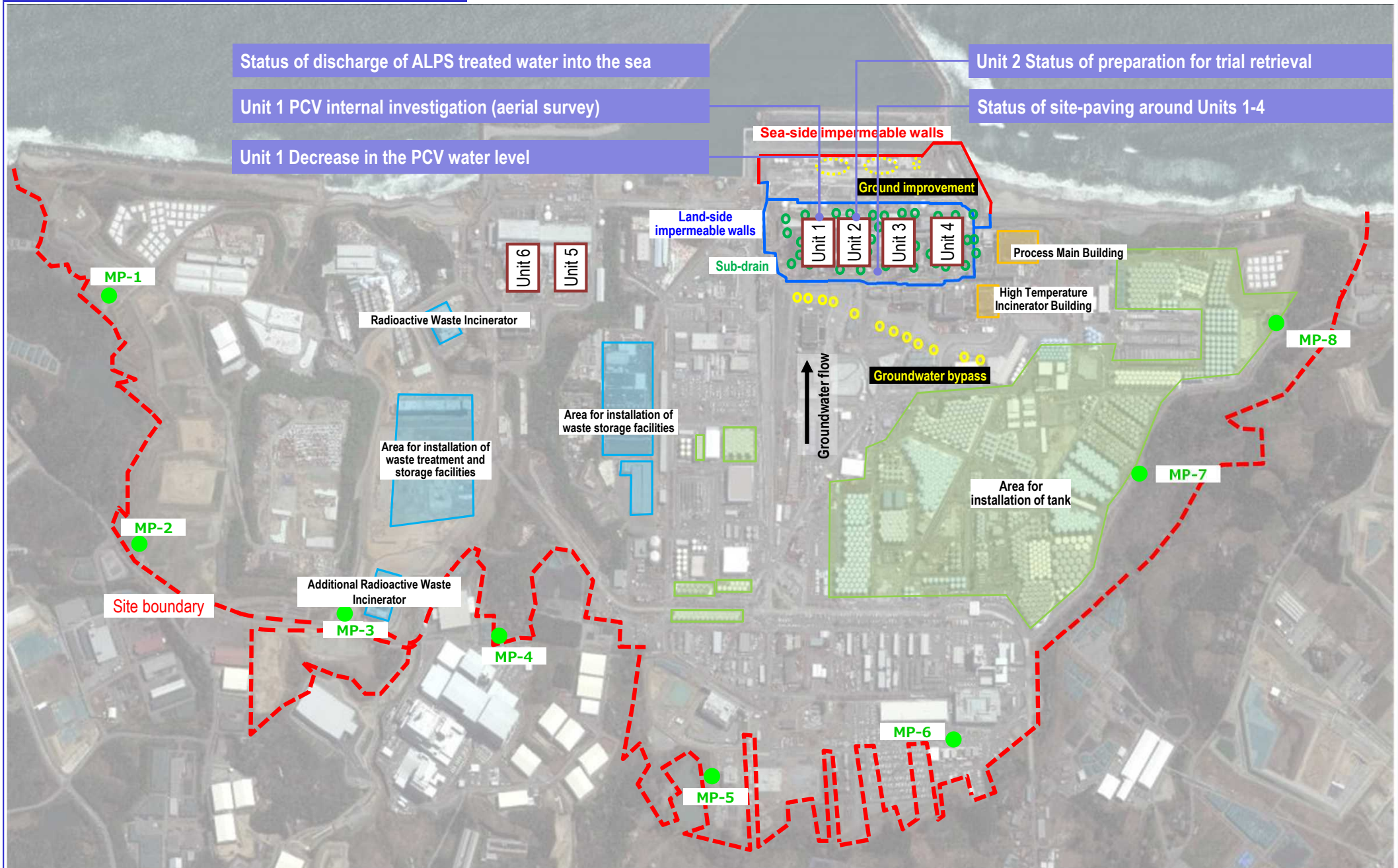
Multi-layered contaminated water management continues to suppress the generation of contaminated water.



< Paving on the west side of Unit 3 Reactor Building (iron plates laid on the pavement) >



## Major initiatives – Locations on site

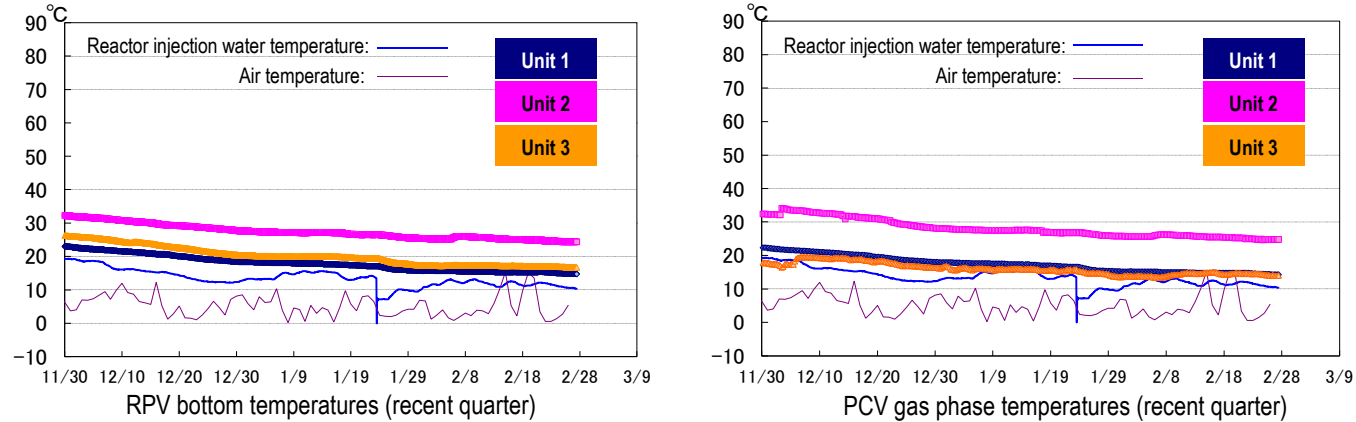


Provided by Japan Space Imaging Corp., photo taken on April 8, 2021  
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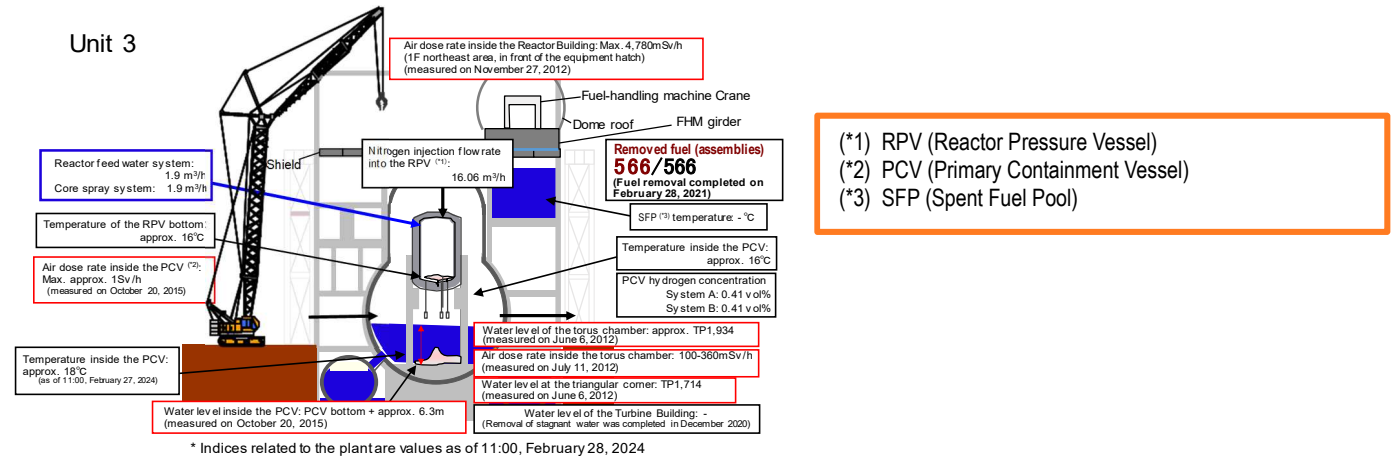
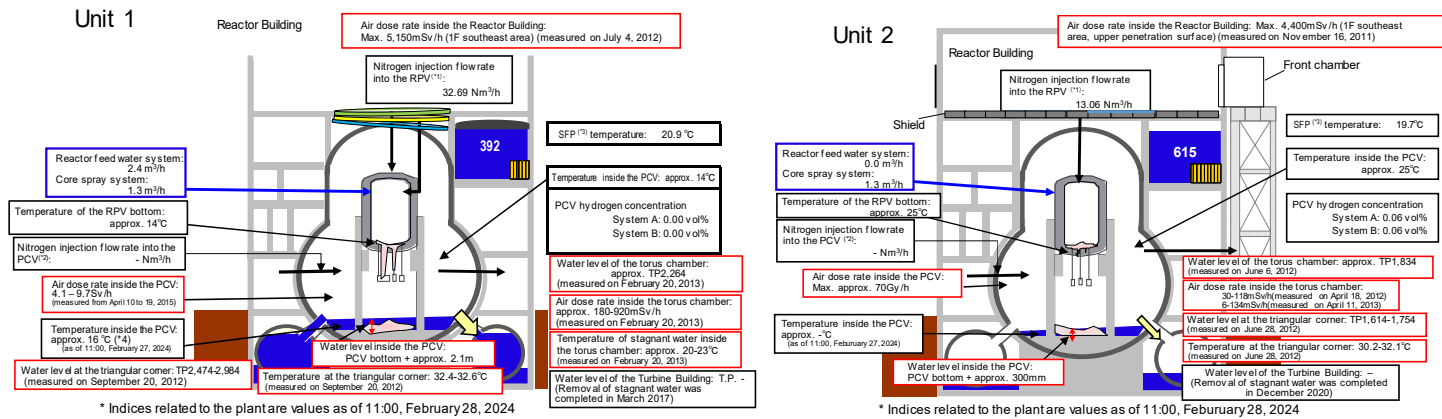
## I. Confirmation of the reactor conditions

### 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 as shown below for recent, though it varied depending on the unit and location of the thermometer.



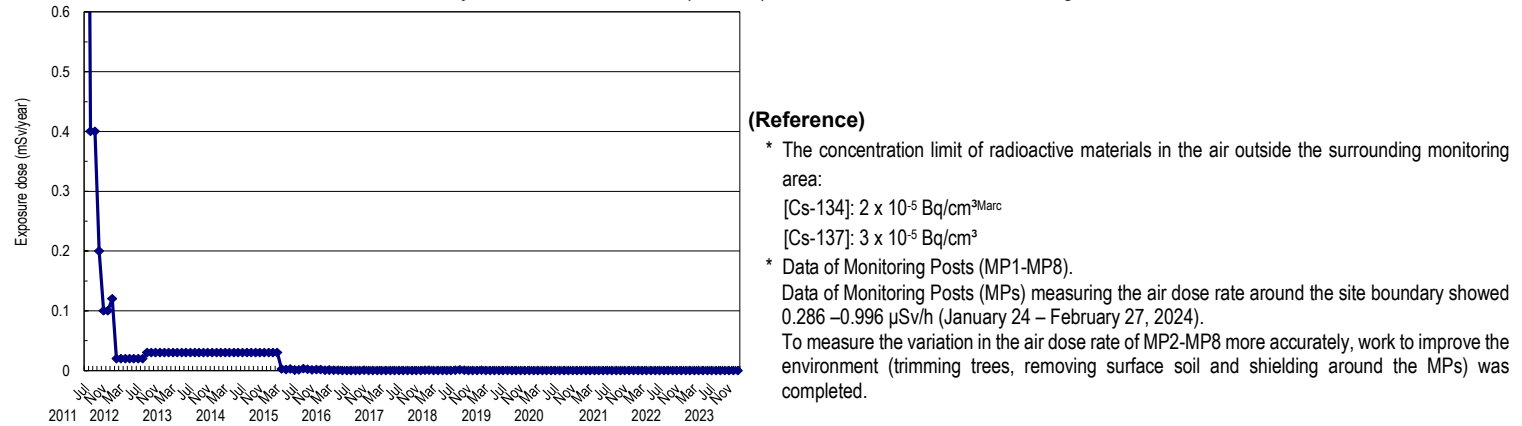
\*1 The trend graphs show part of the temperature data measured at multiple points.  
\*2 A part of data could not be measured due to maintenance and inspection of the facility and other work.



### Release of radioactive materials from the Reactor Buildings

As of January 2024, the concentration of radioactive materials newly released from Reactor Building Units 1-4 into the air and measured at the site boundary was evaluated at approx.  $2.9 \times 10^{-12}$  Bq/cm<sup>3</sup> and  $5.4 \times 10^{-12}$  Bq/cm<sup>3</sup> for Cs-134 and -137 respectively, while the radiation exposure dose due to the release of radioactive materials there was less than 0.00008 mSv/year.

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



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.

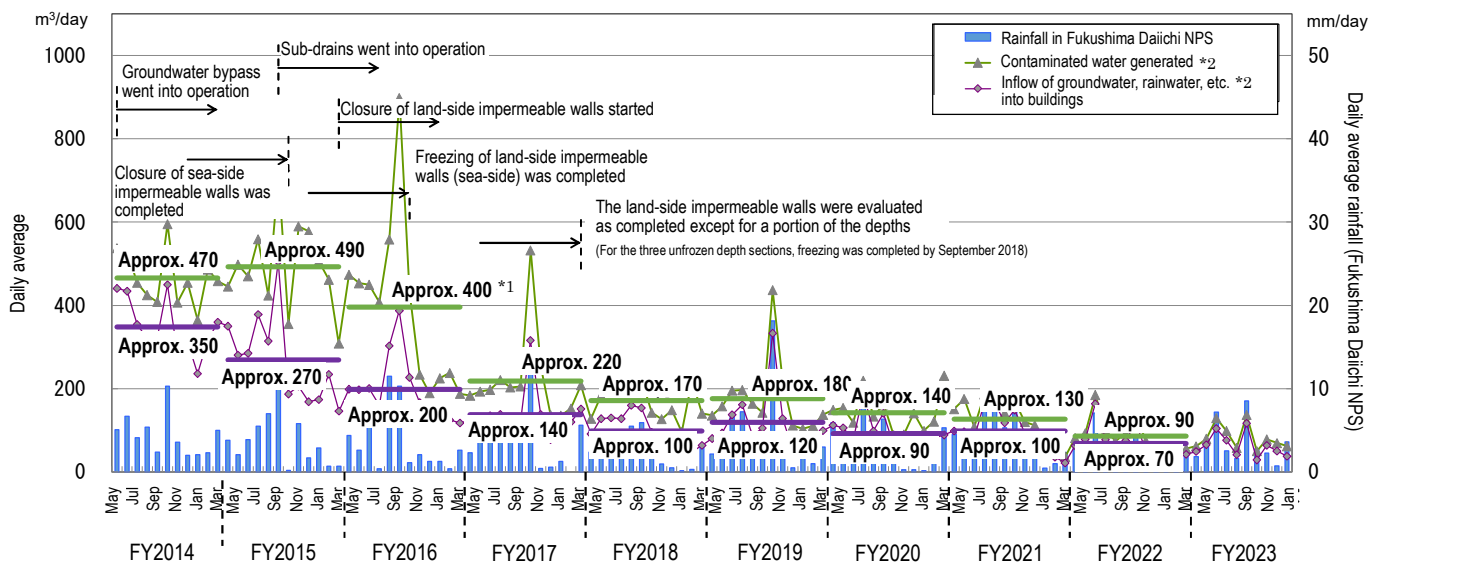
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

## 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 and due to less rainfall than in previous normal years without concentrated heavy rain of 100 mm/day or more, the amount of contaminated water generated within FY2022 declined to approx. 90 m<sup>3</sup>/day.
- Measures will continue to further reduce the amount of contaminated water generated.



\*1 Values differ from those announced at the 20<sup>th</sup> 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 50<sup>th</sup> and 51<sup>st</sup> 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 February 18, 2024, 2,374 release operations had been conducted. The water quality of all temporary storage tanks satisfied the operational target.

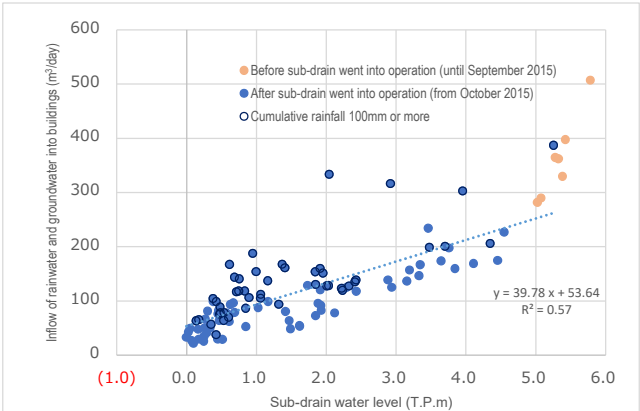


Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

- Implementation status of facing
  - Facing is a measure that involves asphaltting 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 January 2024, 95% of the planned area (1,450,000 m² on site) had been completed. For the area inside the land-side impermeable walls, implementation proceeds appropriately after constructing a yard from implementable zones that leave the decommissioning work unaffected. As of the end of January 2024, 40% of the planned area (60,000 m²) had been completed.

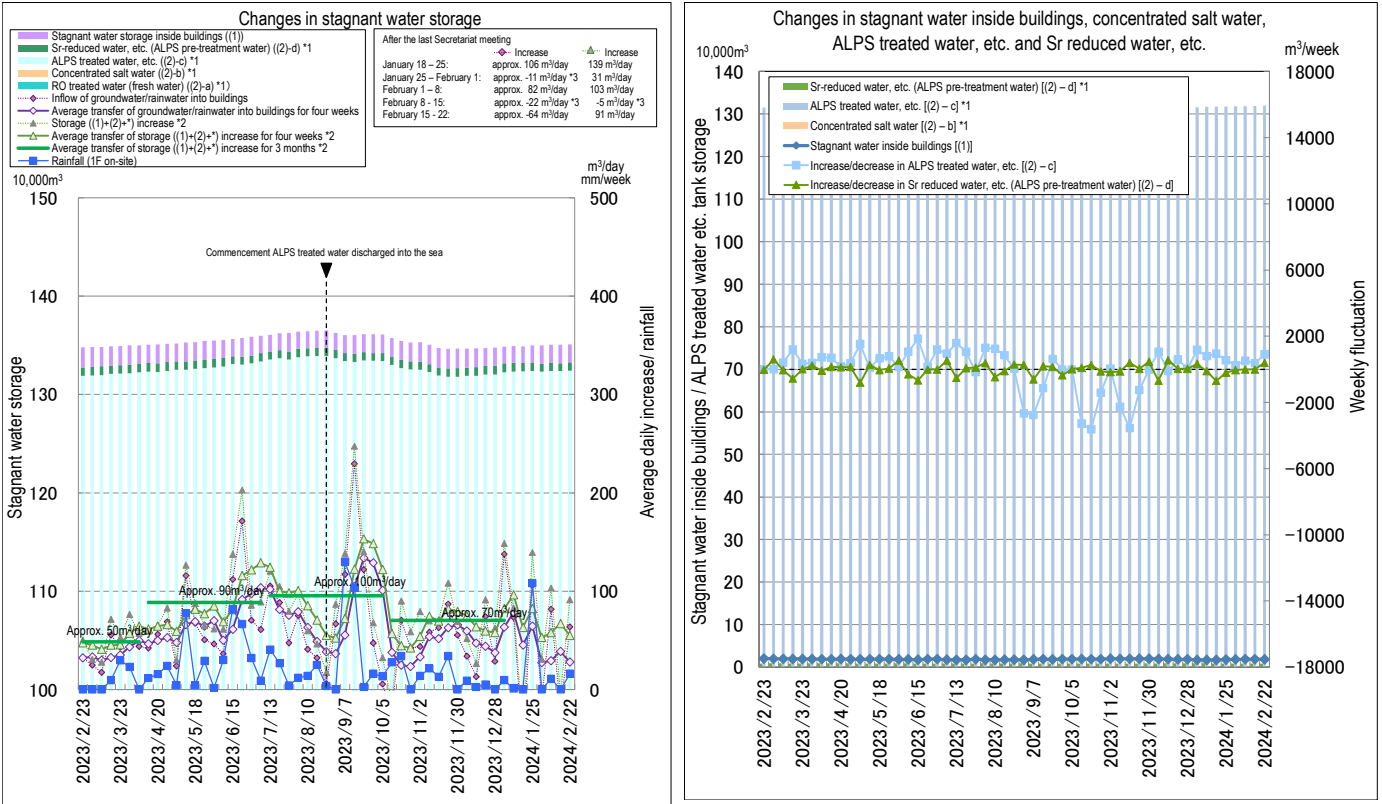
- Status of the groundwater level around buildings
  - Regarding the groundwater level in the area inside the land-side impermeable walls, the difference between the inside and outside has remained constant though the groundwater level on the mountain side varied due to rainfall. The groundwater level of the groundwater drain observation well has remained sufficiently lower from the ground surface, at around T.P.+1.4m (the height of the ground surface: T.P.+2.5m).
  - Regarding the Units 1-4 subdrains, the pumping amount varied depending on the precipitation. The pumping amount in the T.P.+2.5m area has remained constant after the facing in this area was completed.

- Operation of the multi-nuclide removal equipment and other water-treatment facilities
  - 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. For the multi-nuclide removal equipment (additional), a pre-service inspection certificate was granted by the NRA on October 12, 2017. Regarding the multi-nuclide removal equipment (high-performance), hot tests using radioactive water were 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.
  - 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 February 22, 2024, approx. 747,000 m³ had been treated.

- Risk reduction of strontium-reduced water
  - To reduce the risks of strontium-reduced water, treatment using existing, additional and high-performance multi-nuclide removal equipment is underway. Up until February 22, 2024, approx. 915,000 m³ had been treated.

- Storage status of contaminated water and amount of ALPS treated water, etc. stored in tanks

- The amount of ALPS treated water, etc. was approx. 1,322,310 m³ as of February 22, 2024.
- The amount of ALPS treated water discharged into the sea was approx. 23,353 m³ as of February 27, 2024.



(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)], amount of ALPS-treated water discharged was not taken into account.  
\*3: "Inflow of groundwater/rainwater into buildings" and "Storage (1)+(2)+\*" increase" may be negative values due to error included during calculation.

Figure 3: Status of stagnant water storage

- Status of discharge of ALPS treated water

As of February 27, 2024

Measurement object	Requirement and operation target	Measurement results	Satisfaction of requirement
[TEPCO] Attributes of the treated water from Tank Group B (Concentration of the 29 types of radionuclides within the measurement / evaluation scope and regulatory requirements)	• Sum of the ratios to regulatory concentrations: less than 1 • 1 million Bq/L	• 0.34 • 170,000 Bq/L	○ ○
[TEPCO] Tritium concentration in seawater (sea-area monitoring at 4points within 3 km from the Power Station)	• Discharge suspension level: 700 Bq/L or less • Investigation level: 350 Bq/L or less	(Sampled on February 26) • 700 Bq/L or less • 350 Bq/L or less	○ ○
[TEPCO] Tritium concentration in seawater (sea-area monitoring at 1 point within 10 km square from the Power Station)	• Discharge suspension level: 30 Bq/L or less • Investigation level: 20 Bq/L or less	(Sampled on February 21) • 30 Bq/L or less • 20 Bq/L or less	○ ○
[Ministry of the Environment] Tritium concentration in seawater (3 points off the coast of Fukushima Prefecture)	• National safety requirement: 60,000 Bq/L • WHO drinking water guidelines: 10,000 Bq/L	(Sampled on February 8) • Below the lower detection limit (less than 7 Bq/L)	○ ○
[Fisheries Agency] Tritium concentration in marine products (flounder and others)	-	(Sampled on February 19) • Below the lower detection limit (less than 7.3 Bq/kg)	○
[Fukushima Prefecture] Tritium concentration in seawater (9 points off the coast of Fukushima Prefecture)	• National safety requirement: 60,000 Bq/L • WHO drinking water guidelines: 10,000 Bq/L	(Sampled on February 15) • Below the lower detection limit (less than 3.7 – 3.9 Bq/L)	○ ○

- From February 28, 2024, the fourth discharge of ALPS treated water into the sea in FY2023 was conducted.
- Regarding Tank Group B discharged, the concentration of the 29 types of radionuclides (excluding tritium) within the measurement and assessment scope was 0.34 in terms of the sum of the ratios to regulatory concentrations and satisfied the national government's requirement of less than 1. The concentration of tritium was 170,000 Bq/L. Regarding 39 nuclides for which no significant existence was voluntarily confirmed, the absence of any significant presence was confirmed and 44 general water quality benchmarks (compliance with which was voluntarily confirmed) satisfied the requirements.
- Regarding the status of sea-area monitoring on handling ALPS treated water, more tritium measurement points for seawater and fish were established near the power station and off the coast of Fukushima Prefecture and measurements of tritium and Iodine-129 of seaweed near the power station were added from April 20, 2022. As of February 22, 2024, no significant variation had been detected.
- Regarding sea-area monitoring conducted by TEPCO at 4 points within 3 km from the power station, quick measurements taken of the tritium concentration in the seawater sampled on February 26 showed concentrations under the detection limit (less than 7.9 Bq/L) at all points, which was below the TEPCO operation indices of 700 Bq/L (discharge suspension level) and 350 Bq/L (investigation level).
- Regarding sea-area monitoring conducted by TEPCO at 1 point within 10 km square from the power station, quick measurements taken of the tritium concentration in the seawater sampled on February 21 showed concentrations under the detection limit (less than 5.5 Bq/L) at all points, which was below the TEPCO operation indices of 30 Bq/L (discharge suspension level) and 20 Bq/L (investigation level).
- The quick measurement results obtained by each organization were as follows:  
Ministry of the Environment: The analytical results (obtained via quick measurements) for seawater sampled on February 8 at 3 points off the coast of Fukushima Prefecture showed tritium concentrations below the lower detection limit (less than 7 Bq/L) at all sampling points, which would have no adverse impact on human health and the environment.  
Fisheries Agency: Quick analytical results for tritium in flounder sampled on February 19 showed tritium concentrations below the lower detection limit (approx. less than 7.3 Bq/kg) in all samples.  
Fukushima Prefecture: On February 15, tritium concentrations in seawater at 9 sampling points off the coast of Fukushima Prefecture below the lower detection limit were recorded (less than 3.7 – 3.9 Bq/L) at all sampling points, which would have no adverse impact on human health and the environment.

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

- To eliminate concerns and reassure the public, a rearing test for marine organisms (flounder) in seawater with ALPS treated water added and normal seawater for comparison is underway.
- Regarding the flounder and abalones, in both series of tanks ("normal seawater" and "ALPS treated water diluted with seawater"), no mass death or abnormality was detected (as of February 22).
- Rearing of flounder and others in diluted ALPS treated water (less than 1,500 Bq/L) will continue.
- The Organically Bound Tritium (OBT) concentration test on flounder (less than 1,500 Bq/L) will continue.

#### 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 remove spent fuel at Unit 1

- Before installing a large cover over the Unit 1 Reactor Building (R/B), high-dose parts were detected on the south-side wall. As a countermeasure to reduce exposure, shielding will be installed in the high-dose parts.
- Installation of a large cover is likely to be completed around summer in FY2025 based on impact assessment results of the coordination with work around the Unit 1 R/B (removal of SGTS pipes and others) and due to need for safety measures for high-dose parts.
- For Unit 1 fuel removal, by reviewing the processes after installing the large cover, this is likely to have no impact on the milestone "the start of Unit 1 fuel removal (FY2027-2028)" of the Mid-and-Long-Term Roadmap.

#### ➤ Main work to remove spent fuel at Unit 2

- Inside the building, installation of shielding on the east side of the operating floor was completed on January 16, 2024. From January 17, 2024, installation of shielding (including process change) on the west side of the operating floor continues.
- Outside the building, on the Reactor Building south side, the installation of front room exterior materials commenced from November 22, 2023 and was completed on the north, east and south sides. On the west side, installation was completed on February 22. Inside the front room, to reduce the air dose rate, installation of the south side opening shielding door and shielding steel plates continues.

#### Retrieval of fuel debris

#### ➤ Analytical results of deposits detected in the Unit 1 RCW system

- Regarding RCW-inclusive water, which is a high-dose source inside the Unit 1 Reactor Building (R/B), work related to inclusive water sampling toward dose reduction was conducted from October 2022 to July 2023.
- After work to purge hydrogen gas inside the inlet header pipe was completed, the inside of the pipe was checked by a remote-control camera and deposits were detected at the bottom of the RCW inlet header pipe. A small amount was sampled and analyzed (eluted component analysis and elemental analysis by SEM-EDS).
- In the eluted component analysis, deposit was injected and stirred in pure water and the quality of the extracted water was analyzed. Ionic species were slightly detected but the low concentration, accordingly the principal component could not be identified.
- Elemental analysis by SEM-EDS revealed a principal component of Fe at all measurement points, which pointed to deposits of iron oxide. In addition, as the iron oxide was black at room temperature, it was thought to be magnetite (Fe<sub>3</sub>O<sub>4</sub>).

#### ➤ Unit 2 Progress status toward PCV internal investigation and trial retrieval

- At the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA), an access test to the pedestal bottom by remote operation of the robot arm is underway. The next phase will include a test combining the robot arm and a dual arm manipulator.
- At the PCV penetration (X-6 penetration), work to remove deposits via high-pressure water of deposit removal equipment has been underway from February 21. Deposit removal will continue with a safety-first approach.

#### 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 January 2024, the total storage volume for concrete and metal rubble was approx. 397,200 m<sup>3</sup> (+900 m<sup>3</sup> compared to the end of December with an area-occupation rate of 78%). The total storage volume of trimmed trees was approx. 82,800 m<sup>3</sup> (-3,000 m<sup>3</sup>, with an area-occupation rate of 47%). The total storage volume of used protective clothing was approx. 20,200 m<sup>3</sup> (-1,100 m<sup>3</sup>, with an area-occupation rate of 80%). The total storage volume of radioactive solid waste (incinerated ash and others) was approx. 38,200 m<sup>3</sup> (a slight increase, with an area-occupation rate of 60%). The increase in rubble was attributable to work related to the port, decontamination of flanged tanks and work related to the area around the Unit 5 and 6 buildings.

#### ➤ Management status of secondary waste from water treatment

- As of February 1, 2024, the total storage volume of waste sludge was 423 m<sup>3</sup> (area-occupation rate: 60%), while that of concentrated waste fluid was 9,470 m<sup>3</sup> (area-occupation rate: 92%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment and others, was 5,708 (area-occupation rate: 88%).

➤ Status of sludge collection equipment for the decontamination equipment

- The decontamination equipment installed in the Process Main Building was operated during the period June to September 2011 to treat contaminated water generated after the earthquake. High-dose sludge (condensed radioactive materials, hereinafter referred to as decontamination equipment sludge or waste sludge) has been stored in the granulated solidified material storage tank (D) (Storage Tank D) inside the building.
- As countermeasures for tsunami exceeding the largest record event (potentially conceivable tsunami), decontamination equipment sludge will be extracted from Storage Tank D, placed in the storage container and transferred to the high ground area (T.P. 33.5m area) exceeding the height of any potentially conceivable tsunami.
- Regarding the design of the waste sludge collection facility, the review and reevaluation of the design took time due to the need to add facilities and expand the housing with dust confinement in mind. At present, completion of the design and an application to amend the implementation plan are scheduled for late FY2024.
- Regarding the waste sludge extraction process, after the design period was extended to expand facilities due to dust containment measures, the future need to consider reliability-boosting measures and the subsequent production and installation processes, work to collect waste sludge in FY2025 will be difficult and is likely to be postponed until FY2027 at the earliest.
- For the Process Main Building, closure of inlets/outlets of openings and pipe penetrations was completed. As measures to further ease the risk of waste sludge leakage due to tsunamis, measures to close the existing opening over the Storage Tank D will be conducted within FY2025.

➤ Process change of the Large Waste Storage

- Regarding the Large Waste Storage 1, facilities already approved such as mainly buildings were completed in March 2023. After the concept to set the seismic class had been indicated by the Nuclear Regulation Authority and the need to review the seismic design had been implemented, seismic strengthening works will be implemented.
- To complete the building seismic strengthening work at an early stage and eliminate the outdoor temporary storage of all secondary cesium adsorption apparatus (SARRY) adsorption vessels at the earliest opportunity, the entire process will be changed. The start of acceptance of adsorption vessels will be delayed after the process change compared to before the change, but there are benefits from the perspective of seismic strengthening completion time, completion to accept all SARRY adsorption vessels and the working environment.
- A Large Waste Storage 2 facility will be constructed between the Large Waste Storage 1 and the Solid Waste Storage 10 facilities to store large and heavy waste such as the water treatment secondary waste generated by the contaminated water treatment equipment. At present, a conceptual consideration concerning the buildings and facilities is underway. The storage method will be decided by the commencement of the basic design (FY2024).
- The Large Waste Storage 2 will go into operation in FY2031-2032.

Reactor cooling

The cold shutdown condition will be maintained by cooling the reactor by water injection and measures to complement the status monitoring continue

➤ Status of analysis on the test to strengthen the Unit 1 PCV confinement function

- As countermeasures to prepare for circumstances where stirring of radioactive materials (dust) inside the PCV is assumed, a change the nitrogen supply flow rate to the PCV, the exhaust flow rate from the PCV and suspension of nitrogen injection are all being considered.
- Before consideration, to check the PCV status when the PCV nitrogen supply and exhaust flow rate was changed and nitrogen injection was suspended, the Unit 1 PCV confinement function (November 1-28, 2023) was tested to acquire information contributing to the consideration.
- A fact was observed in the test that the PCV pressure become negative, even if the exhaust amount was smaller than the nitrogen injection amount. When analyzing the reason of the fact, the results showed that the negative pressure was considered attributable to a portion of nitrogen injected from the JP line having leaked (the whole amount did not reach RPV and PCV) based on the results of a confinement function-strengthening test in November 2023 and the

status at the time of JP single injection in 2019.

- At present, no significant variation was detected in concentrations of hydrogen and oxygen inside the PCV, inert atmosphere has been maintained and radioactive materials did not leak from the JP line. Accordingly, there is no impact on the nuclear safety.
- Other observed facts which were not included in this report (local increase of PCV temperature) will continue to be analyzed.

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  $\beta$  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, 0-1-2, 0-2, 0-3-1, 0-3-2 and 0-4. The trend continues to be carefully monitored.
- 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, 1-16 and 1-17 but has otherwise remained constant or been declining overall. The concentration of total  $\beta$  radioactive materials has remained constant overall but has 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 carefully monitored.
- 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  $\beta$  radioactive materials has remained constant overall but has been increasing or fluctuating at No. 2-5. The trend continues to be carefully monitored.
- 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  $\beta$  radioactive materials has remained constant overall but has been increasing or declining at Nos. 3-4 and 3-5. The trend continues to be carefully monitored.
- In the groundwater on the east side of the Turbine Buildings, as with the total  $\beta$  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. It has remained low, despite increasing in concentrations of cesium and total  $\beta$  radioactive materials during rainfall. 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 the temporary increases in Cs-137 and Sr-90 observed 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 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 has 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

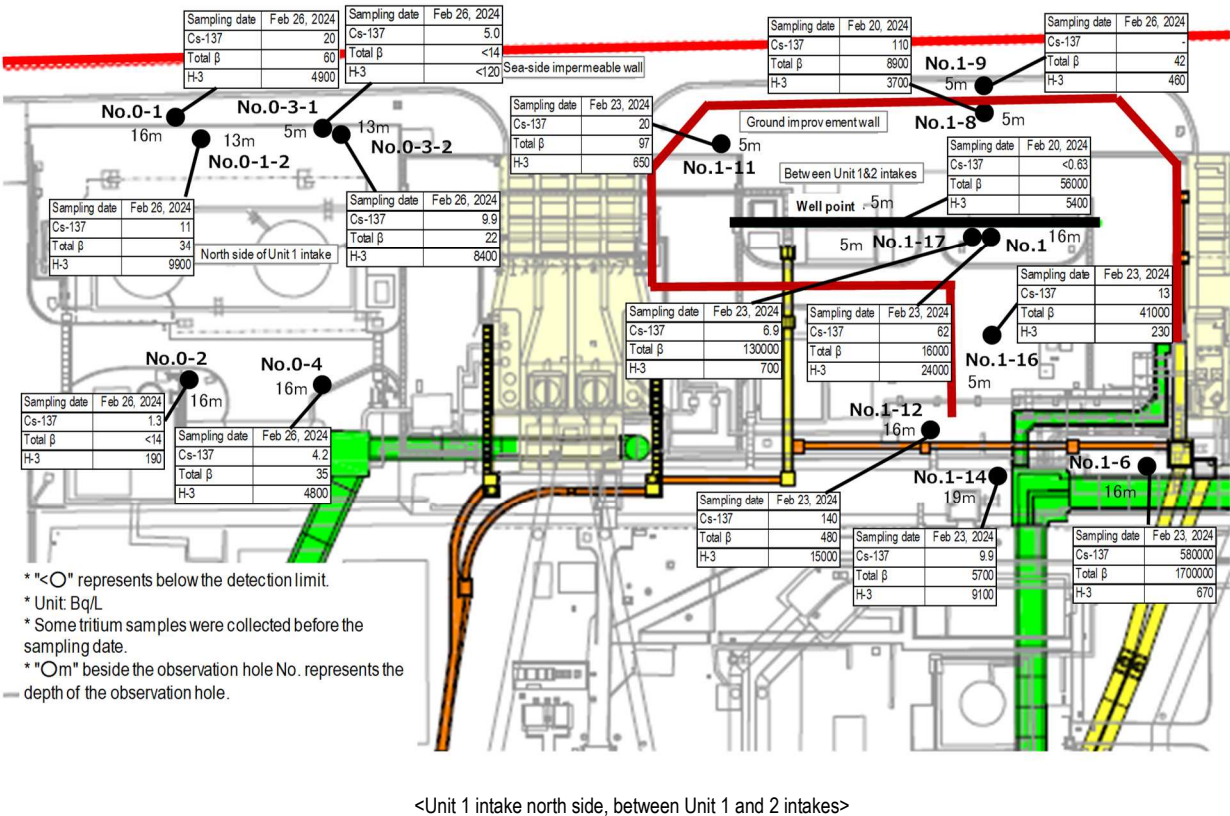


completed installation and connection of steel pipe sheet piles for the sea-side impermeable walls.

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. During the period of discharge of ALPS treated water, the concentration of tritium increased at the sampling point near the discharge outlet, but this was considered as within the assumed range based on the results of the oceanic dispersion simulation.

➤ Progress status of measures for fish in the port

- Work to re-cover the seabed inside the Units 1-4 intake open channel commenced from October 16, 2023. At present, to avoid stirring up the sedimentary layer, construction of the first layer (sand covering) was completed on January 25, 2024 and construction of the second layer (soil covering) has been underway since February 19, 2024. After commencing these constructions, ongoing monitoring is being conducted to detect any significant variation in the concentration of cesium in seawater. Work continues to complete the re-covering withing the 1st half of FY2024.
- Work to replace the east breakwater fish transfer prevention net has been underway since July 26, 2323. Installation of the net was completed until 25/27 span (as of February 17). Work continues, targeting an early completion while keeping the weather, marine meteorology and other aspects in mind and with a safety-first approach.
- The seawater and seabed soil inside the Units 1-4 intake open channel were also investigated. The analytical results examining the seawater and seabed soil showed no significant difference in the overall trend compared with the results in September, though a slight difference due to variation was identified.



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

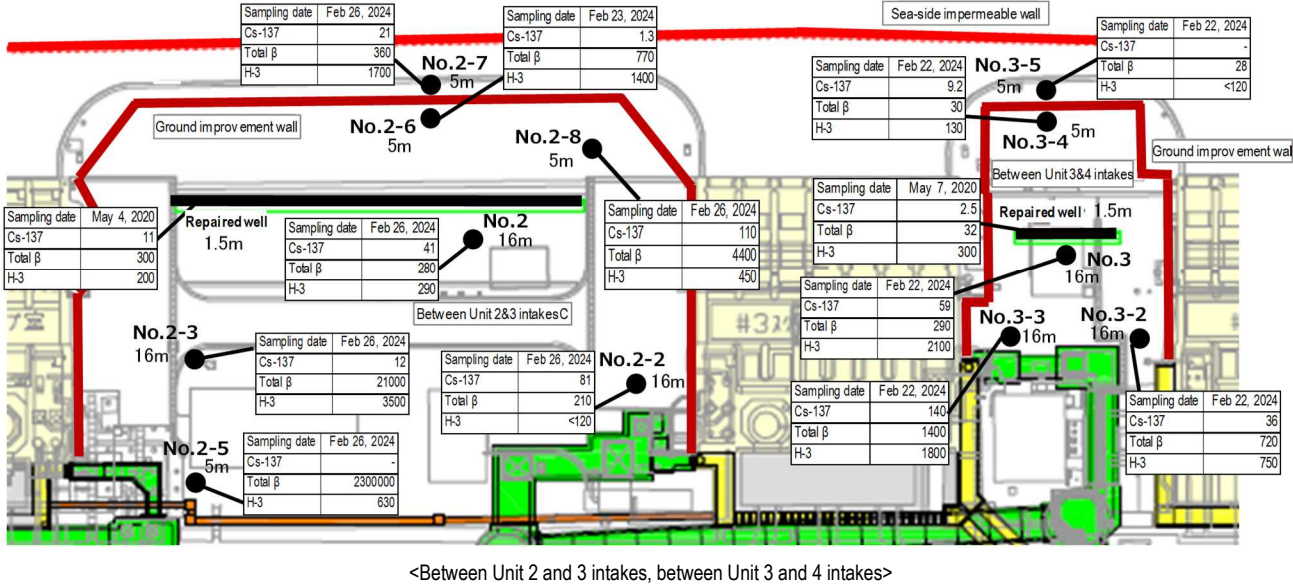


Figure 5: Seawater concentration around the port

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 October to December 2023 was approx. 9,500 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 7,900). 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 March 2024 (approx. 4,200 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, at approx. 3,500 to 4,600.

- The number of workers from within Fukushima Prefecture remained constant and that from outside decreased slightly. The local employment ratio (cooperating company workers and TEPCO HD employees) as of January 2024 remained constant at around 70%.
- The average exposure doses of workers were approx. 2.60, 2.51 and 2.16 mSv/person-year during FY2020, 2021 and 2022, 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 remained sufficiently within the limit and allowed them to continue engaging in radiation work.

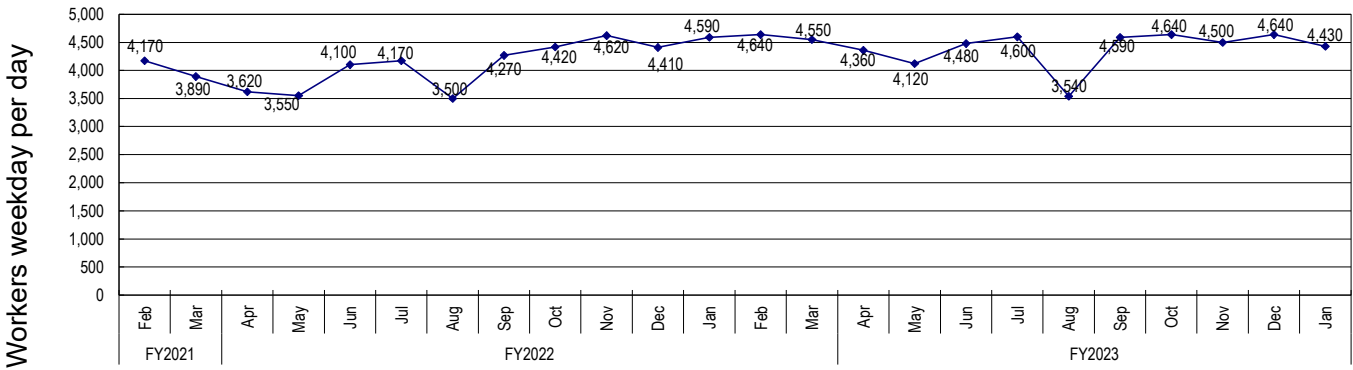


Figure 6: Changes in the average number of workers weekday per day for each month of the most recent 2 years (actual values)

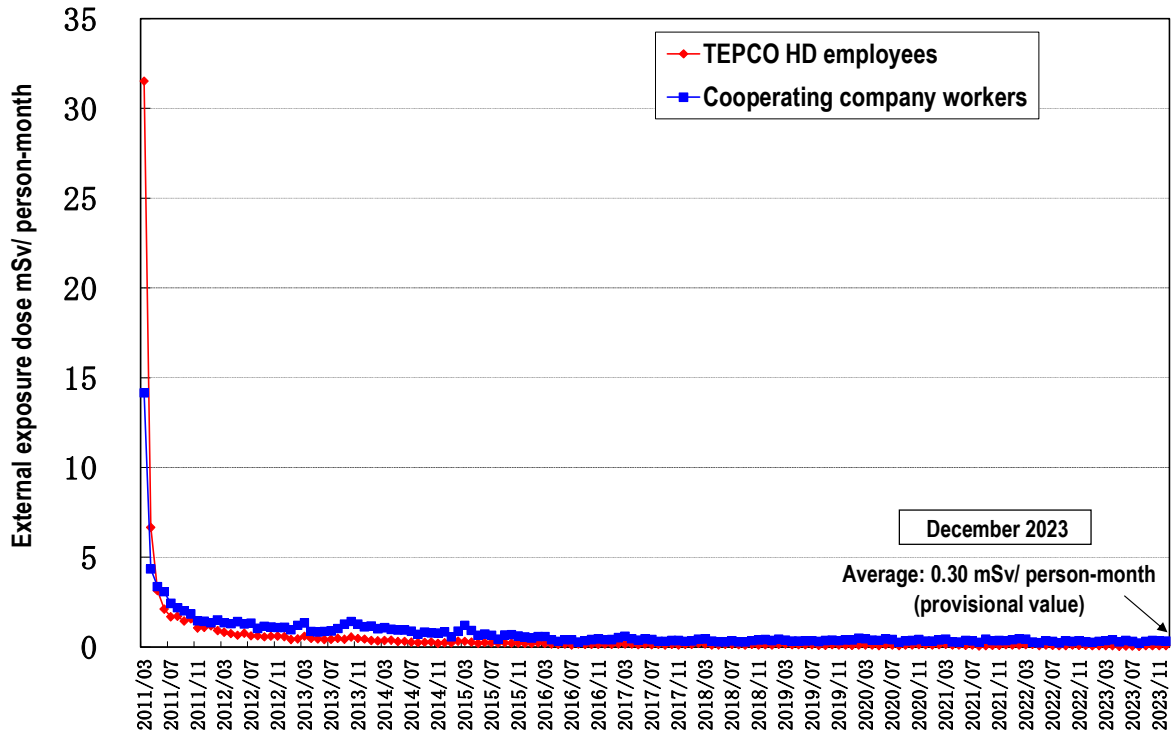


Figure 7: Changes in monthly average exposure dose of individual worker (monthly exposure dose since March 2011)

#### Others

##### ➤ Current status of Units 5 and 6 of the Fukushima Daiichi Power Station

- To eliminate leakage risk due to earthquake and other incidents, the operation of flanged tanks will be terminated and inclusive water will be treated.
- Flanged-tanks of Units 5 and 6 (F1 and F2 tank areas) are B, C, H, I and J group tanks. Among them, treatment of inclusive water in H, I and J group (21 tanks) was completed in October 2022. Operation of B group (4 tanks) was terminated and inclusive water was transferred to C group tanks. Operation of C group will be terminated. A bypass line will be constructed and inclusive water will be treated after February 26.

##### ➤ Countermeasures for infectious diseases

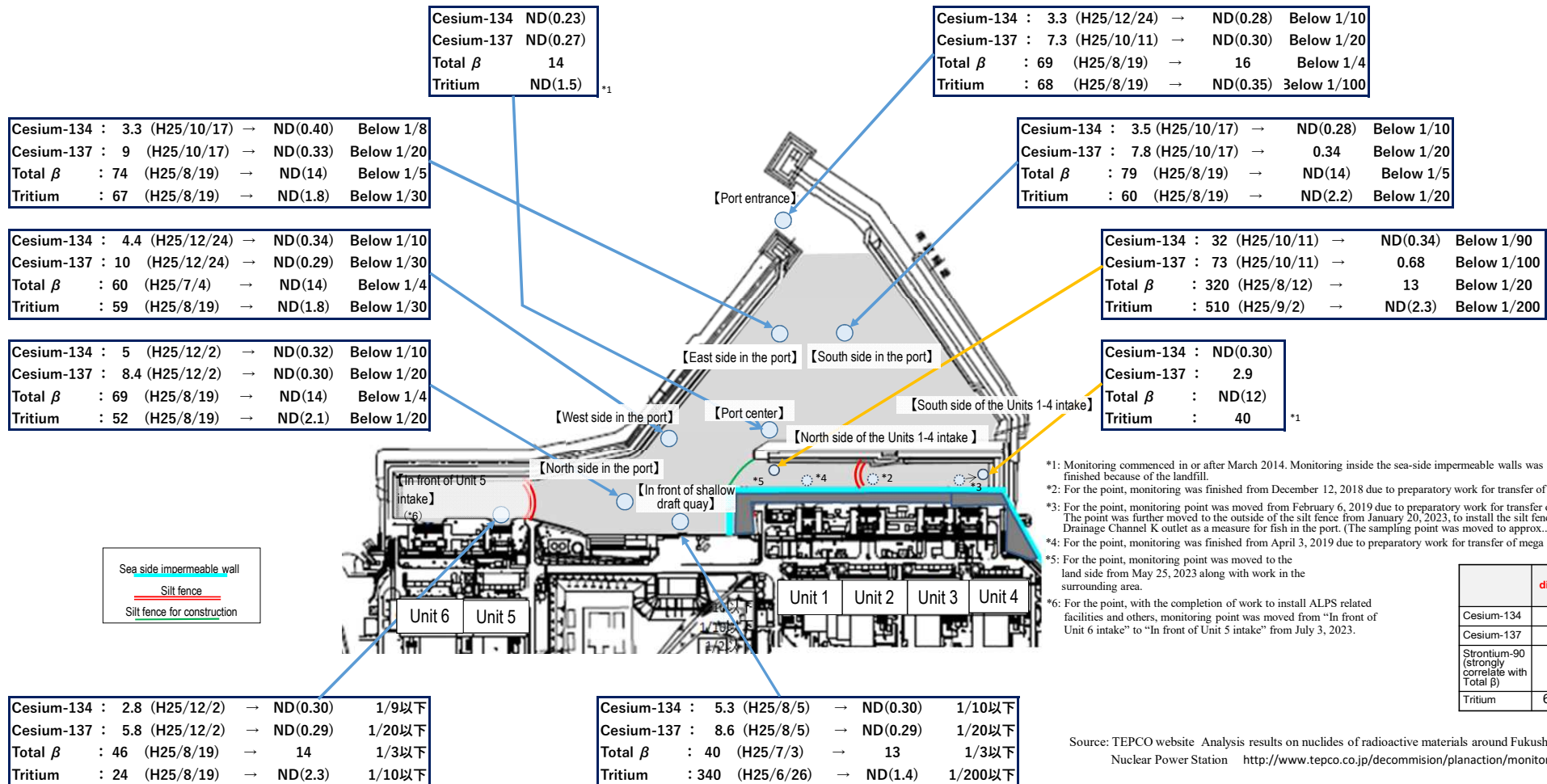
- Countermeasures for various infectious diseases (influenza, norovirus, COVID-19, etc.) depend on personal decisions and basic countermeasures (visiting medical institutions when feeling unwell, ventilation, avoidance of the “Three Cs,” frequent handwashing, etc.) being implemented appropriately by each worker and TEPCO proceeds with decommissioning while prioritizing safety.
- As in previous years, to prevent the spread of influenza infections and serious infections, a vaccination program of influenza has been implemented since October 2023 to January 2024 for TEPCO HD employees and cooperating company workers in the Fukushima Daiichi Nuclear Power Station who wish to be vaccinated.

## 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 February 5 - 26)”; unit (Bq/L); ND represents a value below the detection limit

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

Summary of TEPCO data as of February 27, 2024





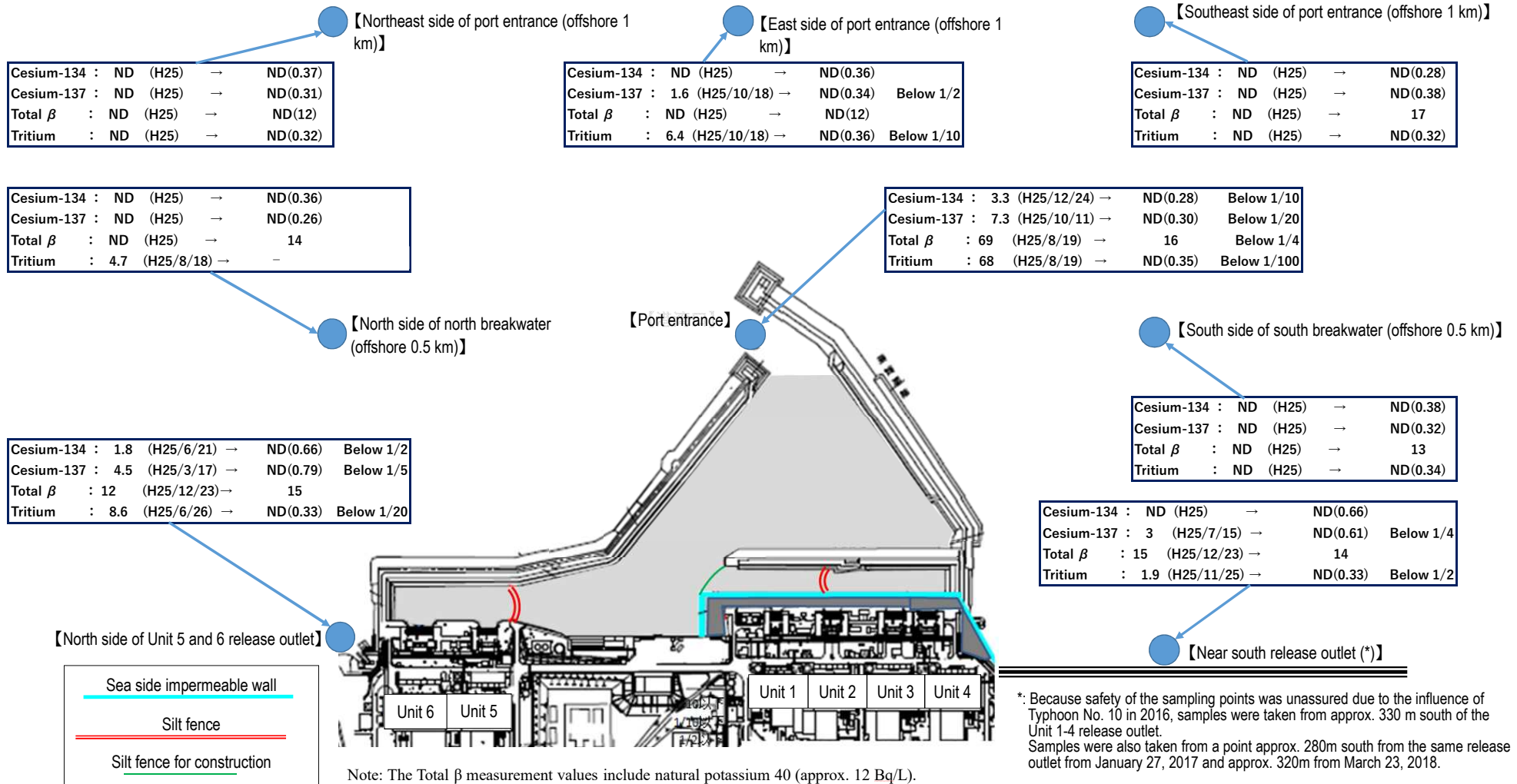
## Status of seawater monitoring around outside of the port (comparison between the highest values in 2013 and the latest values)

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 February 5 - 26)

Summary of TEPCO data as of February 27, 2024

	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



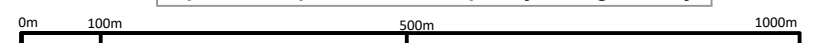
Note: The Total β measurement values include natural potassium 40 (approx. 12 Bq/L).  
They also include the contribution of yttrium 90, which radioactively balance strontium 90.

\*: 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/decommission/planaction/monitoring/index-j.html>



## February 29, 2024



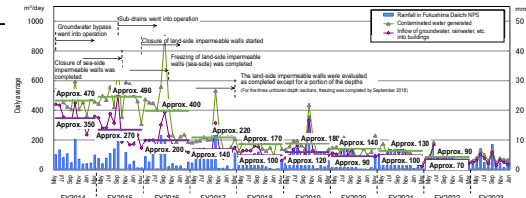


# 1 Contaminated water management

- Milestones of the Mid- and Long-term Roadmap (major processes)
  - [Completed] Suppressing the amount of contaminated water generated to 150 m<sup>3</sup>/day or less (within 2020)
  - [Suppressed] the amount of contaminated water generated to 100 m<sup>3</sup>/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)

Reference 1/6  
February 29, 2024  
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				
	Removal of contaminated water from seawater pipe trench	 Landing of the second Cesium Adsorption Apparatus (SARRY)		 Multi-nuclide removal equipment (ALPS)	▽ 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) ▽ Multi-nuclide Removal Equipment (high performance ALPS) (from 2014.10.18, hot tests conducted)	▽ Treatment start of strontium-reduced water (ALPS: from 2015.12.4, additional: from 2015.5.27, high-performance: from 2015.4.15) ▽ Start of full-scale operation (from 2017.10.16)				▽ Reduction of strontium by 3rd Cesium Adsorption Apparatus (SARRY II) (from 2019.7.12)					
Contaminated water management [Redirect]	Groundwater bypass		 Pumping well		▽ Installation start of groundwater bypass ▽ Operation start of groundwater bypass (drainage started from 2014.5.21)										
	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 m <sup>3</sup> /day)		▽ Enhancement of treatment capacity (2000m <sup>3</sup> /day)						
	Land-side impermeable wall		 Sub-drain purification system	 Land-side impermeable wall brine (refrigerant) circulation pipe	▽ Start of land-side impermeable walls ▽ Freezing start		▽ Freezing completion (except for some parts)		▽ Freezing completion (except for some parts)						
	Facing				▽ Completion of waterproof pavement (icing) (except for areas of 2.5 and 6.5m above sea level and around Unit 1-4)		▽ Completion of waterproof pavement (icing) (except for areas of 2.5 and 6.5m above sea level and around Unit 1-4)		▽ Completion of waterproof pavement (icing) (except for areas of 2.5 and 6.5m above sea level and around Unit 1-4)						
Contaminated water management [Retain]	Bank groundwater measures		High concentration of radioactive materials ▽ Area 2.5m above sea level - Start of ground improvement by water glass detected from observation well of bank ▽ Installation start of seaside impermeable walls	▽ Start of pumping of water from contaminated areas (well point) ▽ Installation start of seaside impermeable walls	▽ Installation of seaside impermeable walls complete ▽ Operation start of groundwater drain (pumping-up started on 2015.11.5)										
	Storage facility	▽ Storage in steel square tanks ▽ Storage in flanged cylindrical tanks ▽ Water leakage (10L) from flanged tank		▽ Water leakage (300L) from flanged tank ▽ Water leakage (100L) from flanged tank ▽ Completion of fence to prevent leakage expanding ▽ Work to raise fence height complete	▽ 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	▽ Completion of purification treatment of RO concentrated salt water ▽ Completion of replacement of steel square tanks		 Construction of welded-joint tanks	▽ Purification of strontium-reduced water in flanged tanks complete ▽ Transfer and storage of all treated water in welded-joint tanks				 Flanged and welded-joint tanks		
Treatment of stagnant water		▽ Installation of stagnant water transfer equipment/transfer start		▽ Completion of work to improve reliability of transfer line (replacement with PE pipes)	▽ Start to maintain water-level difference with sub-drain water level ▽ Transfer start from each building to Central RW Building			▽ Floor exposure of Unit 1 TB ▽ Separation of stagnant water between Units 3 and 4	▽ Separation of stagnant water between Units 1 and 2 ▽ Floor exposure of Unit 1 RWB		▽ Treatment of stagnant water in buildings complete ▽ Floor exposure of Unit 2 TB, RWB ▽ Floor exposure of Unit 3 TB, RWB ▽ Floor exposure of Unit 4 RB, TB, RWB		▽ Completed lowering to target water level of Unit 2 RB ▽ Completed lowering to target water level of Unit 1, 3 RB		
Countermeasures to tsunami	Closure of openings		▽ Examination start of measures to close building openings ▽ Work for common pool complete	▽ Work for Units 1 and 2 TB complete ▽ Work for HTI building complete								▽ Measures to close openings were completed ▽ Work for Units 1-4 RWB was completed			
	Seawall	▽ Installation of outer-rise tsunami seawall complete													
	Mega float			 Chishima Trench Tsunami Seawall complete	 Construction of Japan Trench Tsunami Seawall			▽ Construction start of Chishima Trench Tsunami Seawall ▽ Start of marine construction Temporary grounding of mega float	▽ Completion of installation ▽ Internal filling complete (reduction of tsunami risks)						

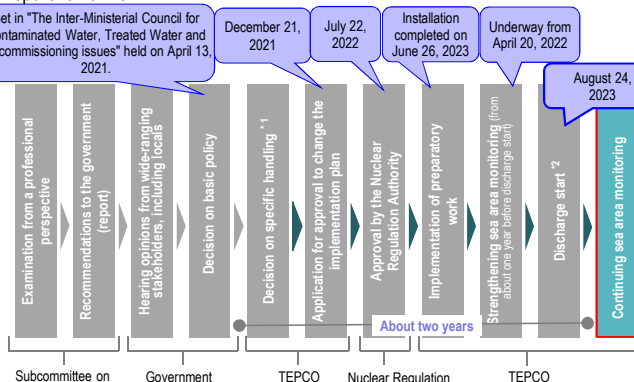


## 2 Handling of ALPS treated water

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.

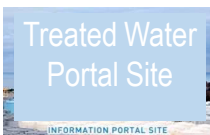
Regarding the discharge of ALPS treated water into the sea, TEPCO must comply with regulatory and other safety-related standards to ensure the safety of the public, surrounding environment and agricultural, forestry and fishery products. To minimize adverse impacts on reputation, monitoring will be further 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.

Set in "The Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning issues" held on April 13, 2021.



### Information provision and communication to foster understanding

- Occasions to deepen the understanding are organized by communications related to decommission via various media and visit to the power station.



- On the dedicated website "Treated Water Portal Site" (Japanese, English, Chinese and Korean) within the TEPCO website, monitoring results of radioactive materials are published timely.



- Visit and dialogue meeting of Fukushima Daiichi Nuclear Power Station have been held since 2019 for 13 cities, towns and villages.



- Through various opportunities such as visit and on-site explanations, communications continue where opinions of related parties are heard, their thought is taken seriously, and TEPCO conveys its efforts, thought and countermeasures for reputational damage.

### Examination concerning handling of ALPS treated water

Tritiated Water Taskforce (2013.12 – 2016.5, 15 meetings)



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)

Review meeting concerning the implementation plan on handling of ALPS treated water (from 2021.7 to 2022.4, 15 meetings)

Tank area viewed from the Large Rest House (2015.10.29)

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

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

2022.4.28, 5.13, 7.15

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

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)

2023.6.26 Completion of installation  
2023.7.7 Receipt of Certificate of Completion for Pre-service Inspections

2023.8.24 Commencement of discharge

### Status of discharge of ALPS treated water into the sea

On August 22, 2023, as the 1st phase of the 1st discharge of ALPS treated water, a small amount of ALPS treated water (approx. 1 m<sup>3</sup>) was diluted with seawater (approx. 1,200 m<sup>3</sup>), and to confirm that ALPS treated water was diluted as assumed, diluted ALPS treated water was stored in the discharge shaft (upstream pool) and sampled.

On August 24, regarding tritium concentration of diluted ALPS treated water, it was confirmed the analytical value was within the range of uncertainty of calculated concentration and below 1,500 Bq/L. Subsequently, discharge of ALPS treated water into the sea commenced from the same day (August 24) and the 1st discharge was completed on September 11.

Discharge of ALPS treated water from Tank Group C of the measurement / confirmation facility into the sea (2nd discharge) commenced from October 5, 2023, and completed on October 23.

From November 2, 2023, discharge of ALPS treated water from Tank Group A of the measurement / confirmation facility into the sea (3rd discharge) commenced. Since the commencement of discharge, it has been confirmed that the discharge was conducted safely as planned based on the results of quick analysis conducted daily by TEPCO on tritium in seawater. The 3rd discharge was conducted safely as planned while confirming that the discharge satisfied the national government's requirement and was completed on November 20.

During the discharge period, no abnormality was detected by the sea area monitoring conducted by the national government, Fukushima Prefecture and TEPCO. (Discharge amount 7,753 m<sup>3</sup>)

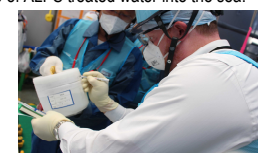
Regarding ALPS treated water to be discharged next, transfer to Tank Group B of the measurement / confirmation facility was completed on December 11. After agitation / circulation operation, and confirming that the discharge requirement is satisfied, the 4th discharge commenced from February 28, 2024.

Tank group discharged	Tank Group B	Tank Group C	Tank Group A
Tritium concentration	140,000 Bq/L	140,000 Bq/L	130,000 Bq/L
Discharge commencement	August 24, 2023	October 5, 2023	November 2, 2023
Discharge termination	September 11, 2023	October 23, 2023	November 20, 2023
Discharge amount	7,788 m <sup>3</sup>	7,810 m <sup>3</sup>	7,753 m <sup>3</sup>
Total tritium amount	1.1 trillion Bq	1.1 trillion Bq	1.0 trillion Bq



Operation by duty staff (Tank Group B, 2nd phase)

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



Sampling of ALPS treated water in the presence of the IAEA

### Rearing test of marine organisms

- To alleviate concerns and lead to relief of local residents, related parties and the everyone in society, marine organisms 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/breed/ingtest/index-j.html>

TEPCO X (Old Twitter): <https://twitter.com/TEPCOfishkeeper>



### Publication of the Comprehensive Report of the IAEA safety review

The Comprehensive Report on the safety review concerning handling of ALPS-treated water was published by the IAEA on July 4, 2023.

In the Executive Summary of the IAEA Comprehensive Report, the IAEA concluded the following: (1) the activities by Japan associated with the discharge of ALPS treated water into the sea are consistent with relevant international safety standards, (2) the discharge of the ALPS treated water will have a negligible radiological impact on people and the environment.

We will continue to share necessary information with the IAEA, while striving to foster further understanding of the international community about the discharge of ALPS treated water into the sea.

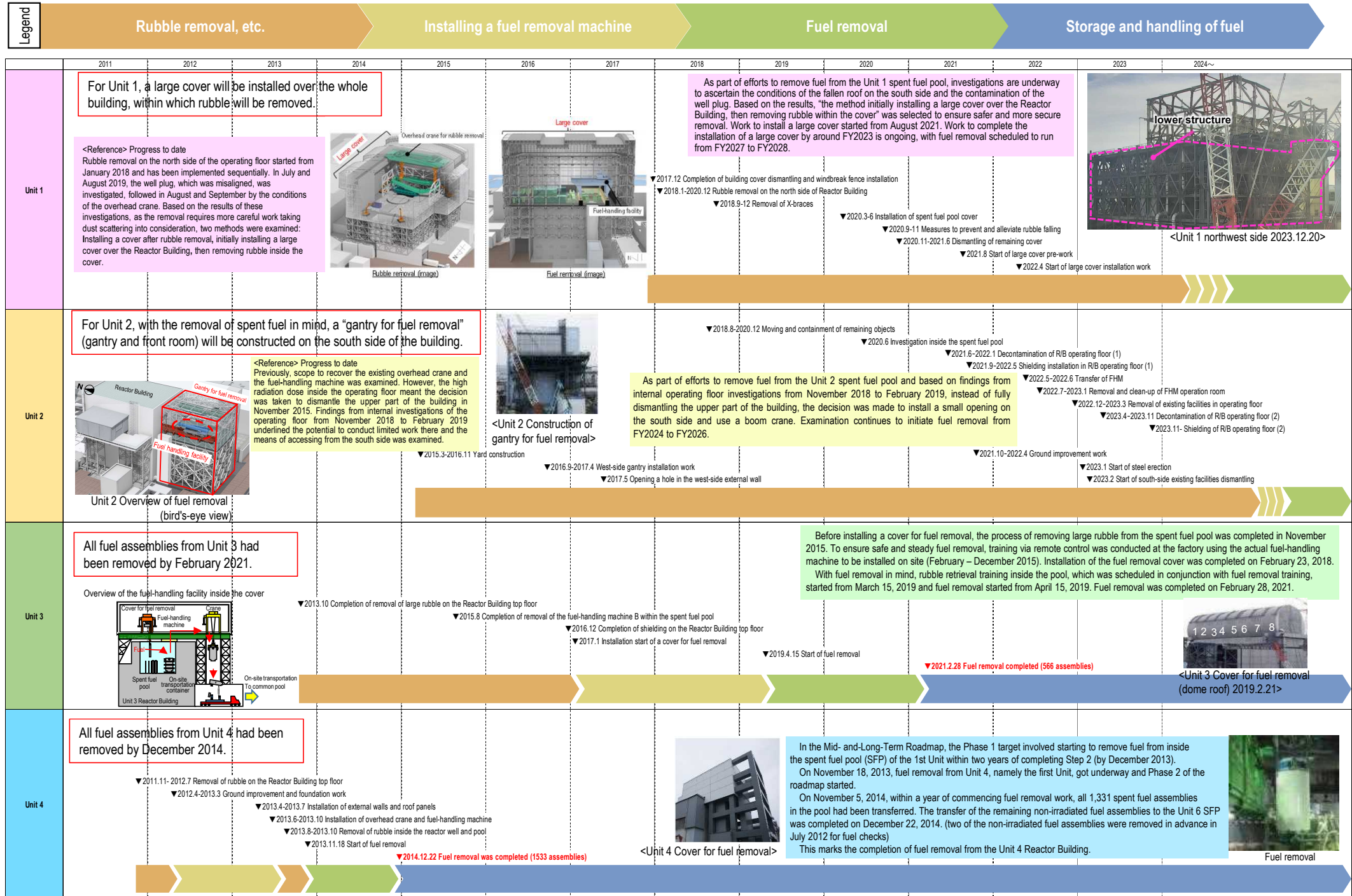


### 3 Removal of fuel from spent pool

Milestones of 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 3/6  
February 29, 2024  
Secretariat of the Team for  
Countermeasures for Decommissioning,  
Contaminated Water and Treated Water



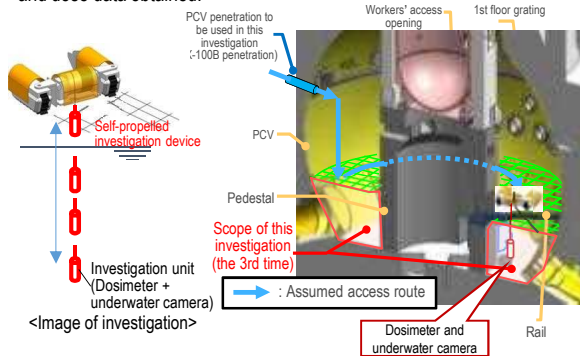
## Milestones of the Mid- and Long-Term Roadmap (major target processes)

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)

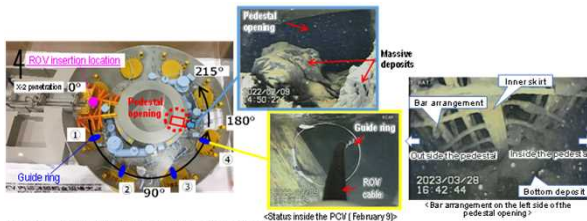
Before removing fuel debris, investigations inside the Primary Containment Vessel (PCV) are conducted to inspect the conditions there, including locations of fuel debris.

## Unit 1 Investigation overview

- In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:  $\phi 100$  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.



In February 2022, the guide ring\* was installed to facilitate the investigation. From March 28, 2023, the investigation inside the pedestal by ROV-A2 started and confirmed that a portion of the bar arrangement was exposed. Regarding the soundness of the pedestal, based on the past earthquake resistant evaluation by the International Research Institute for Nuclear Decommissioning (IRID), it was evaluated that even though a portion of the pedestal was lost, there would be no serious risk. However, as the present information is very limited, the investigation will continue to acquire as much information as possible for continued evaluation.



## Unit 1 PCV internal investigation

Investigations inside the PCV	1st (2012.10)	<ul style="list-style-type: none"><li>- Acquiring images</li><li>- Measuring the air temperature and dose rate</li><li>- Measuring the water level and temperature</li><li>- Sampling stagnant water</li><li>- Installing permanent monitoring instrumentation</li></ul>
	2nd (2015.4)	<ul style="list-style-type: none"><li>- Confirming the status of the PCV 1st floor</li><li>- Acquiring images</li><li>- Measuring the air temperature and dose rate</li><li>- Replacing permanent monitoring instrumentation</li></ul>
	3rd (2017.3)	<ul style="list-style-type: none"><li>- Confirming the status of the PCV 1st basement floor</li><li>- Acquiring images</li><li>- Measuring the dose rate</li><li>- Sampling deposit</li><li>- Replacing permanent monitoring instrumentation</li></ul>
	4th (From 2022.2)	<ul style="list-style-type: none"><li>- Acquiring information inside PCV (inside/outside of the pedestal)</li><li>- Acquiring images</li><li>- Measuring deposit thickness and sampling deposit</li><li>- Detecting deposit debris, 3D mapping</li></ul>
Leakage points from PCV	<ul style="list-style-type: none"><li>- PCV vent pipe vacuum break line bellows (identified in 2014.5)</li><li>- Sand cushion drain line (identified in 2013.11)</li></ul>	
<u>Evaluation of the location of fuel debris inside the reactor by measurement using muons</u> Confirmed that there was no large fuel in the reactor core. (2015.2-5)		

## 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.



- 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.



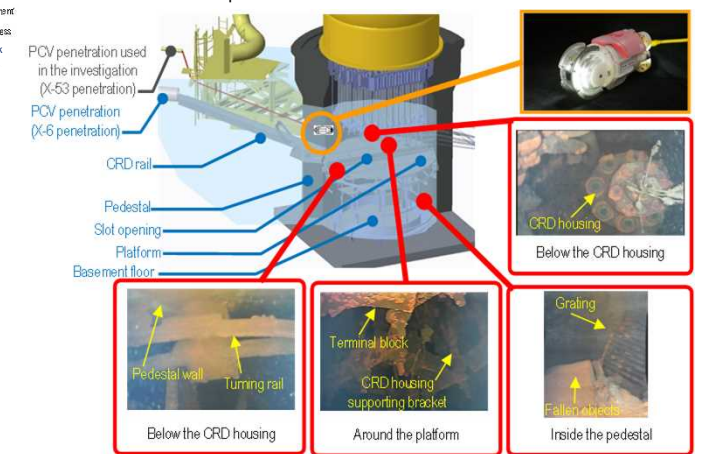
## Unit 2 PCV internal investigation

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	
<u>Evaluation of the location of fuel debris inside the reactor by measurement using muons</u> 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 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.

## &lt;Conditions inside the pedestal&gt;



## Unit 3 PCV internal investigation

Investigations inside the PCV	1st (2015.10-12)	<ul style="list-style-type: none"><li>- Acquiring images</li><li>- Measuring the air temperature and dose rate</li><li>- Measuring the water level and temperature</li><li>- Sampling stagnant water</li><li>- Installing permanent monitoring instrumentation (2015.12)</li></ul>
	2nd (2017.7)	<ul style="list-style-type: none"><li>- Acquiring images</li><li>- Installing permanent monitoring instrumentation (2017.8)</li></ul>
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)		



## 5 Management of solid radioactive waste

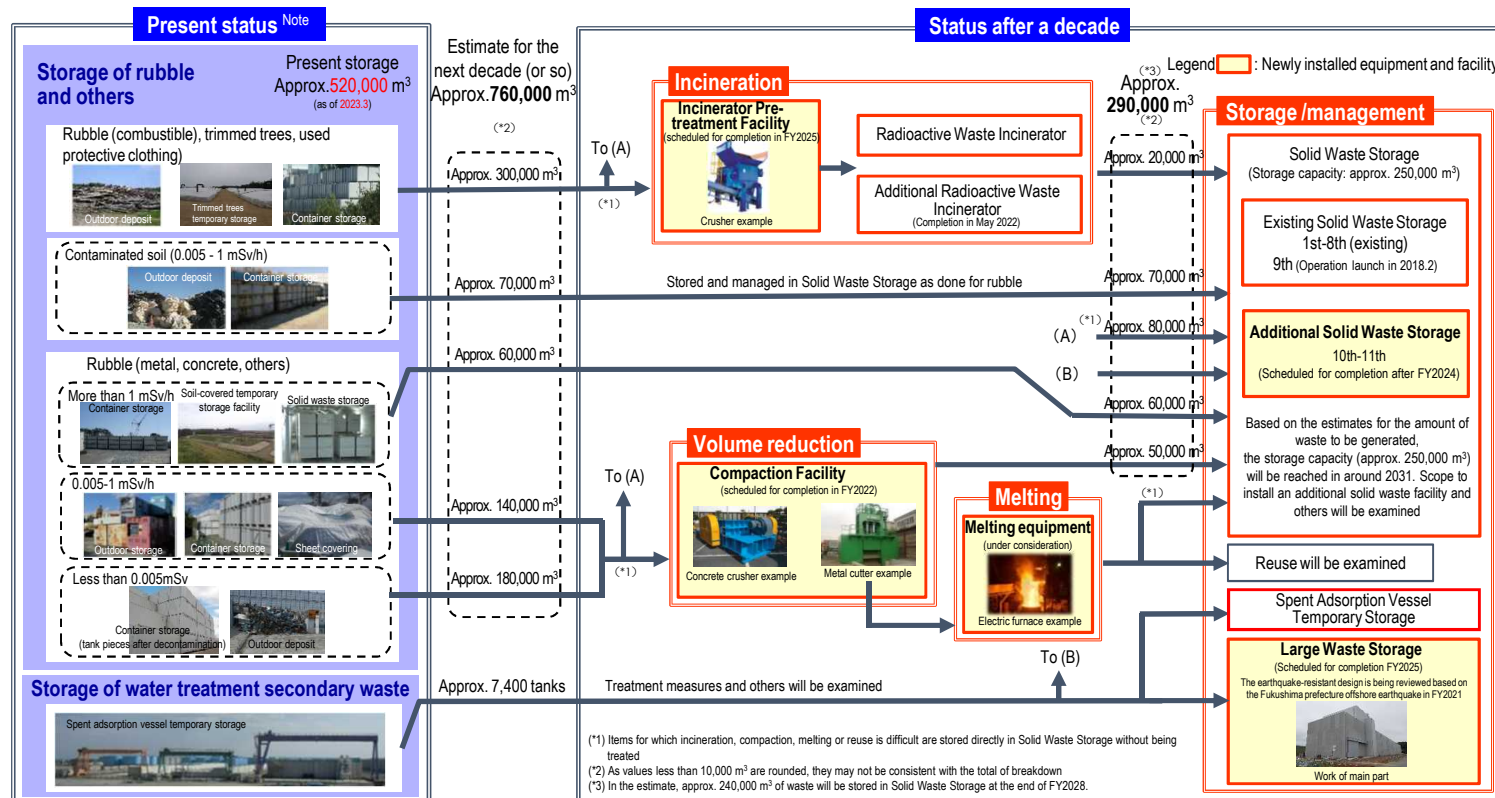
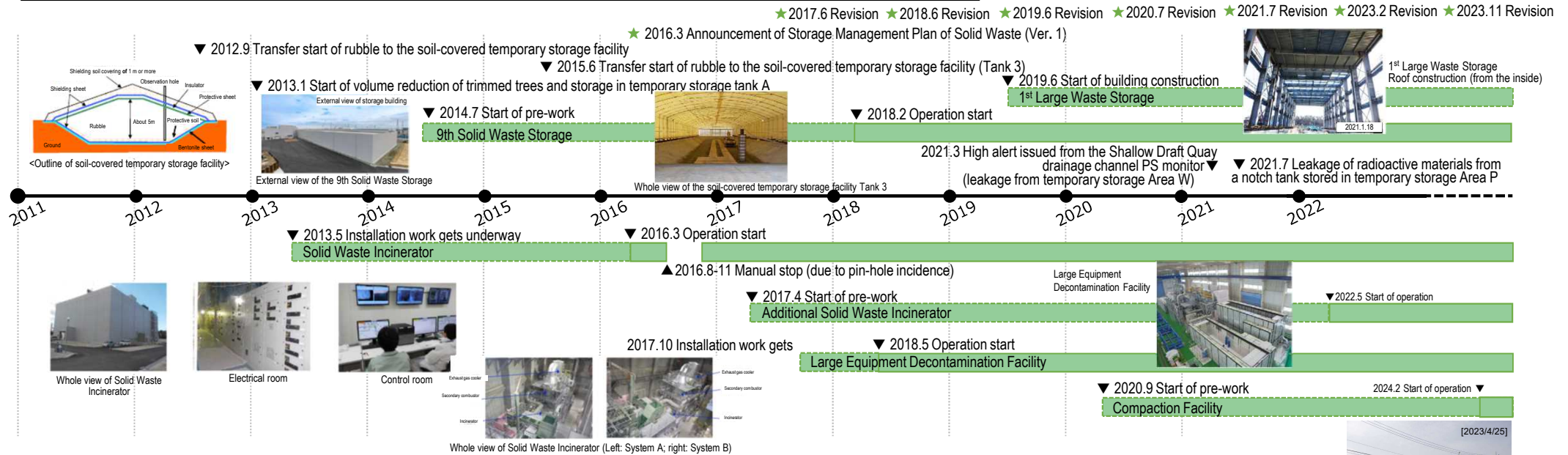
Reference 5/6

February 29, 2024

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

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)



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.

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.

