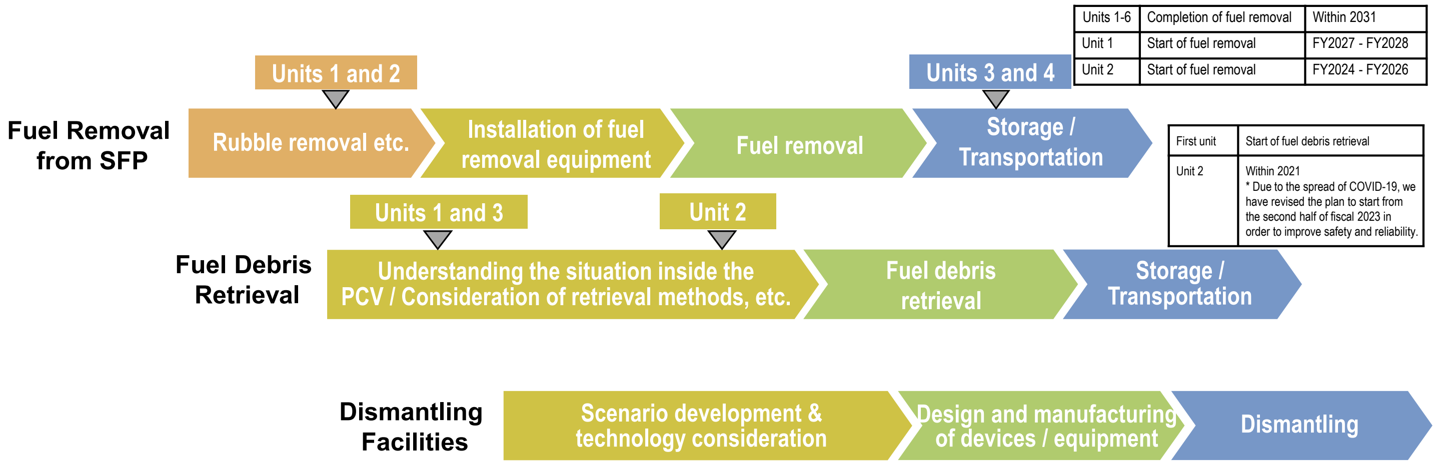
Outline of Decommissioning, Contaminated Water and Treated Water Management

September 29, 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.



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

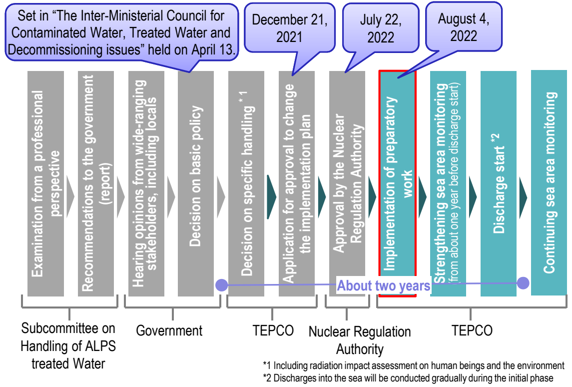
Units 1-6	Completion of fuel removal	Within 2031
Unit 1	Start of fuel removal	FY2027 - FY2028
Unit 2	Start of fuel removal	FY2024 - FY2026

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

Measures for treated water

Handling of ALPS treated water

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



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

Contaminated water management – triple-pronged efforts -

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

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

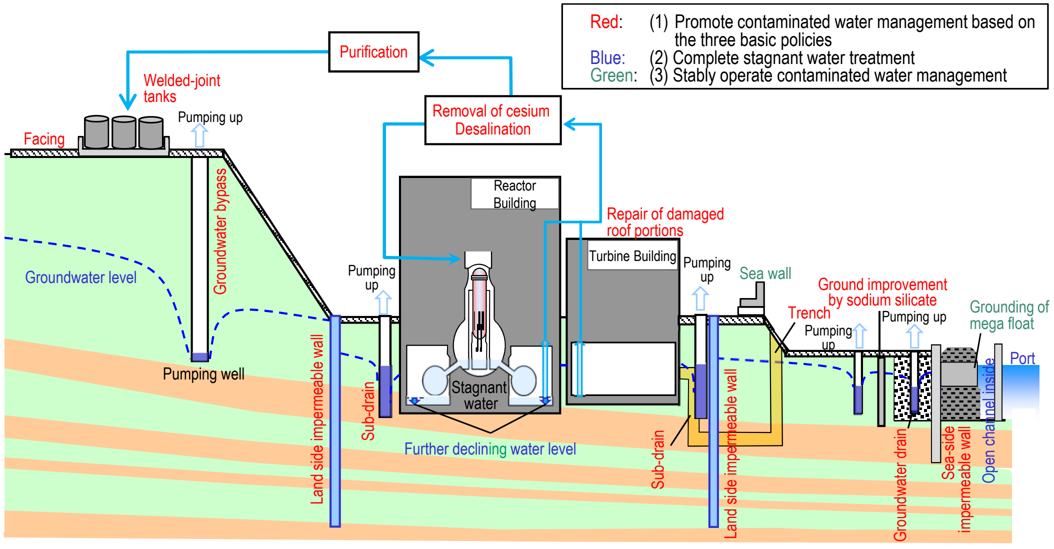
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized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

(2) Efforts to complete stagnant water treatment

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

(3) Efforts to stably operate contaminated water management

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



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

Progress status

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

Summary of the "Approach to Strengthening and Expansion of Measures in the Handling of ALPS treated Water"

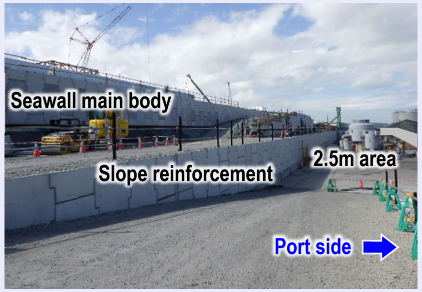
On August 30, given developments in various measures outlined in the "Action Plan for the Continuous Implementation of the Basic Policy on Handling of ALPS Treated Water" formulated by the government in December 2021, the "Approach to Strengthening and Expansion of Measures in the Handling of ALPS treated Water at the Fukushima Daiichi Nuclear Power Station" was summarized in the 4th meeting of the Inter-Ministerial Council concerning the Continuous Implementation of the Basic Policy on Handling of ALPS treated Water.

TEPCO will do our utmost to implement measures according to the government's "Basic Policy" on the handling ALPS treated water and continue to minimize the adverse impacts on reputation.

Tsunami countermeasures, including installing the Japan Trench Tsunami Seawall are steadily progressing

Regarding the Japan Trench Tsunami Seawall, with completion in FY2023 in mind, installation of the seawall main body is now 30% complete.

Regarding work to transfer the function of sub-drains and other water-collection facilities from the present area of 2.5 m to that of 33.5 m above sea level, ground improvement will start from October.



<Construction of the seawall main body>

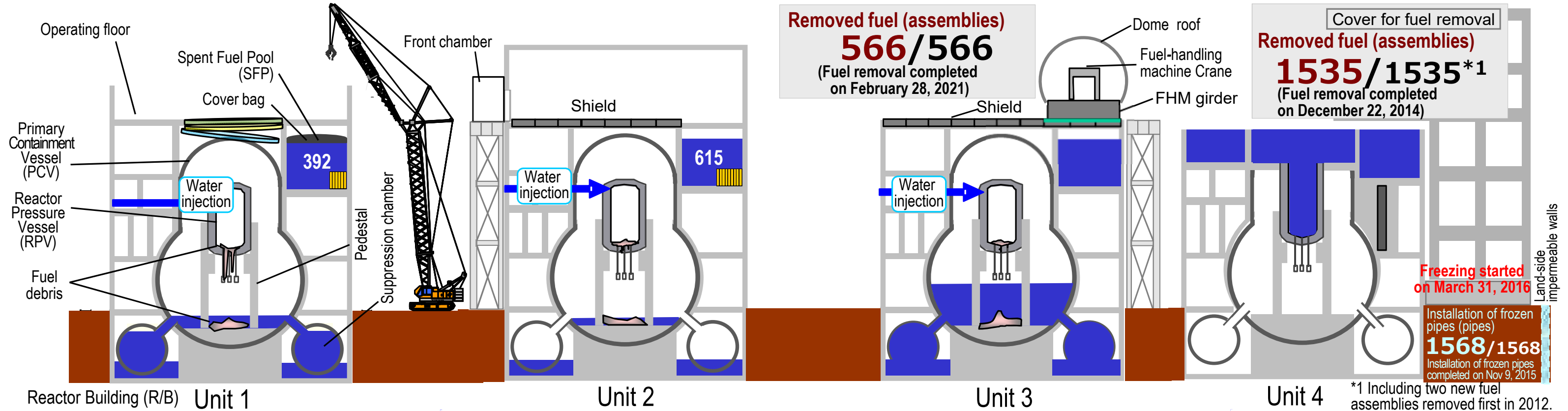
For work to collect zeolite sandbags and others, actual scale mockup is planned

For high-dose zeolite and activated carbon sandbags installed on the bottom floor of Process Main Building (PMB) and High Temperature Incinerator Building (HTI), underwater collection is being pondered, in which a water-shielding effect is expected.

A mockup test of a trial machine of a remotely operated vehicle (ROV) for "accumulating zeolite" has been conducted established in the TEPCO laboratory.

From October, a mockup test in the environment further simulating the actual site will be conducted in the Naraha Center for Remote Control Technology Development of the Japan Atomic Energy Agency (JAEA).

<ROV for accumulating zeolite being manufactured>



Removed fuel (assemblies)
566/566
(Fuel removal completed on February 28, 2021)

Removed fuel (assemblies)
1535/1535[*1]
(Fuel removal completed on December 22, 2014)

Installation of frozen pipes (pipes)
1568/1568
Installation of frozen pipes completed on Nov 9, 2015

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

Improvement of the High Integrity Container (HIC) exhaust filters

In response to the damage in the High Integrity Container (HIC) exhaust filters of ALPS in August 2021, installation of the improved HIC exhaust filters proceeded and was completed on September 22, 2022.

After a performance test, the filters will go into operation on September 30.

Work to remove spent fuel from the Unit 6 spent fuel pool

The operation to remove spent fuel from the Unit 6 spent fuel pool has been divided into 68 times and two removals were completed as of September.

To make space in the common pool to accommodate the spent fuel once removed and transported, spent fuel stored in the common pool is contained in dry casks and transported on-site from the common pool building to the Temporary Cask Custody Area for storage. Transportation of one cask was completed and the remaining 21 casks are scheduled for transportation by around the end of FY2023.

Unit 1 Progress toward the latter half of the PCV internal investigation

Based on the reflected information of interference acquired in the internal investigation of the Unit 1 Primary Containment Vessel (PCV) by the remotely operated underwater vehicle (ROV), the cable catch event of the investigative equipment and others training toward the latter half of the investigation is underway.

During the latter-half investigation, an area where ROV can levitate and the sensor and others can hang down will be selected to detect and evaluate deposit debris and conduct sampling and 3D mapping.

Moreover, visual inspection of the pedestal inside and walls to enhance the insight will be carried out.

<Investigative equipment ROV-E (for deposit sampling)>

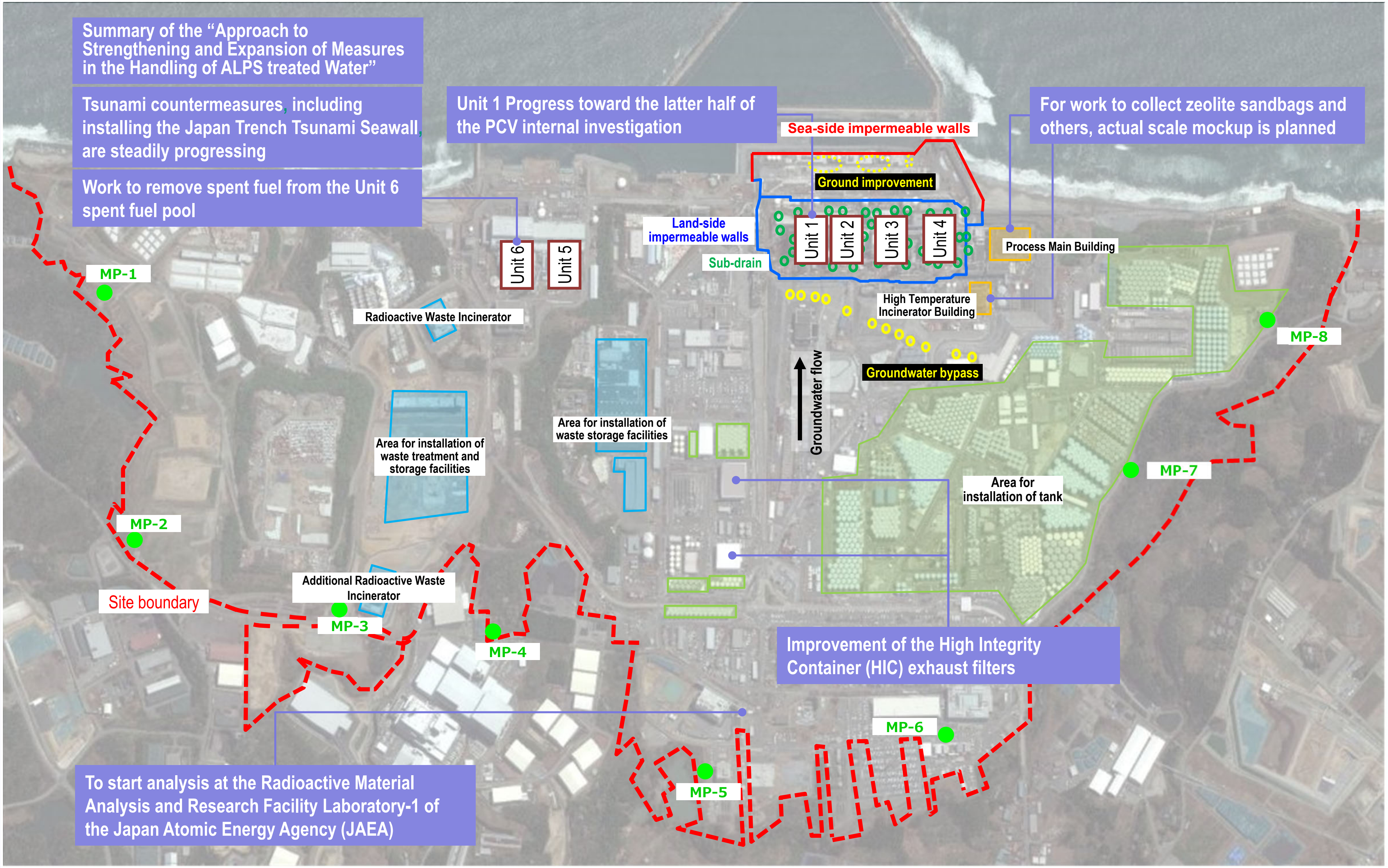
To start analysis at the Radioactive Material Analysis and Research Facility Laboratory-1 of the Japan Atomic Energy Agency (JAEA)

At the Radioactive Material Analysis and Research Facility Laboratory-1, after completing preparation to handle radioactive materials, analysis using radioactive materials will start from October 1.

Once operation is underway, beginning with confirming the procedures using the standard radiation source (RI), analysis intended to help determine the characteristics of solid waste will commence sequentially.

<Radioactive Material Analysis and Research Facility Laboratory-1>

Major initiatives – Locations on site



Summary of the “Approach to Strengthening and Expansion of Measures in the Handling of ALPS treated Water”

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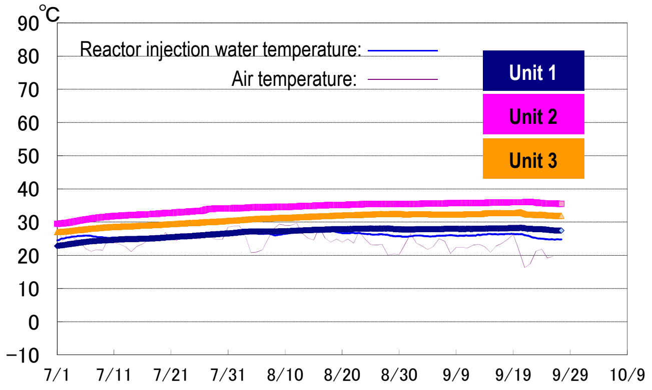
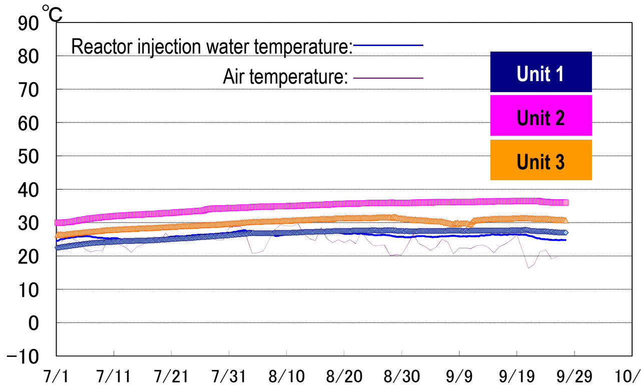
I. Confirmation of the reactor conditions

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 within the range of approx. 25 to 40°C for the past month, though it varied depending on the unit and location of the thermometer.



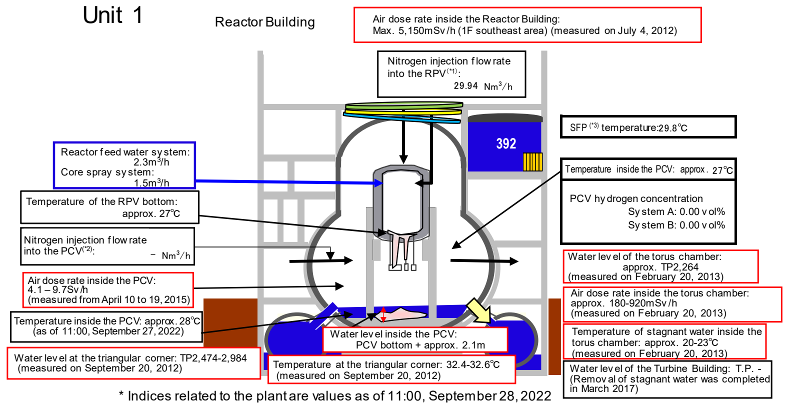
RPV bottom temperatures (recent quarter)



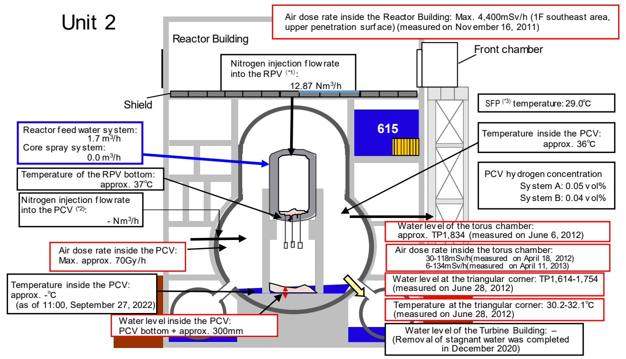
PCV gas phase temperatures (recent quarter)

*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, September 28, 2022



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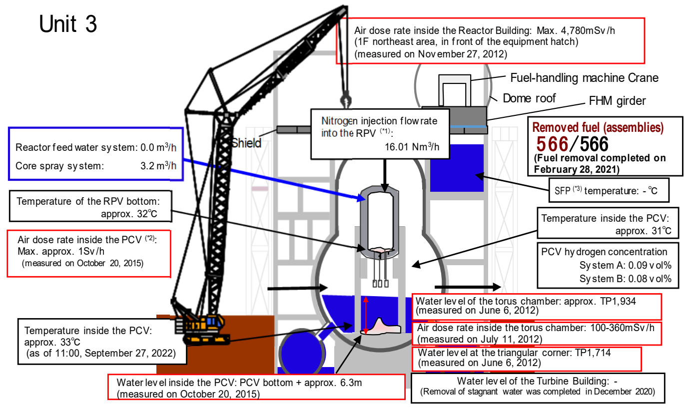


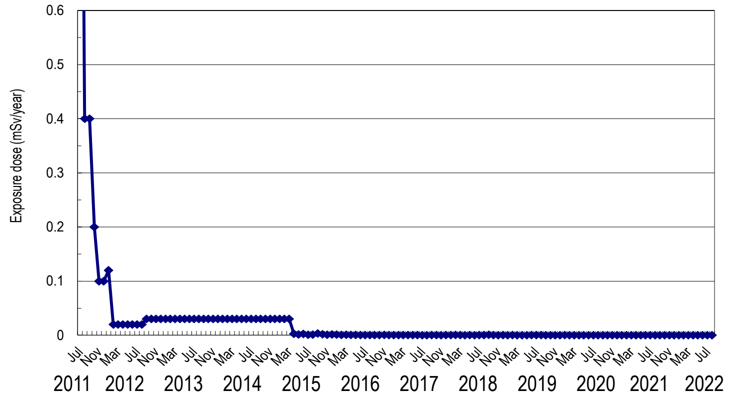
* Indices related to the plant are values as of 11:00, September 28, 2022

(*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 August 2022, the concentration of radioactive materials newly released from Reactor Building Units 1-4 into the air and measured at the site boundary was evaluated at approx. 2.3×10^{-12} Bq/cm³ and 2.0×10^{-12} Bq/cm³ for Cs-134 and -137 respectively, while the radiation exposure dose due to the release of radioactive materials there was less than 0.00005 mSv/year.

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



(Reference)

- * The concentration limit of radioactive materials in the air outside the surrounding monitoring area:
  [Cs-134]: 2 x 10^{-5} Bq/cm^{3Marc}
  [Cs-137]: 3 x 10^{-5} Bq/cm³
- * Data of Monitoring Posts (MP1-MP8).
  Data of Monitoring Posts (MPs) measuring the air dose rate around the site boundary showed 0.318 – 1.063 μSv/h (August 24 – September 27, 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.

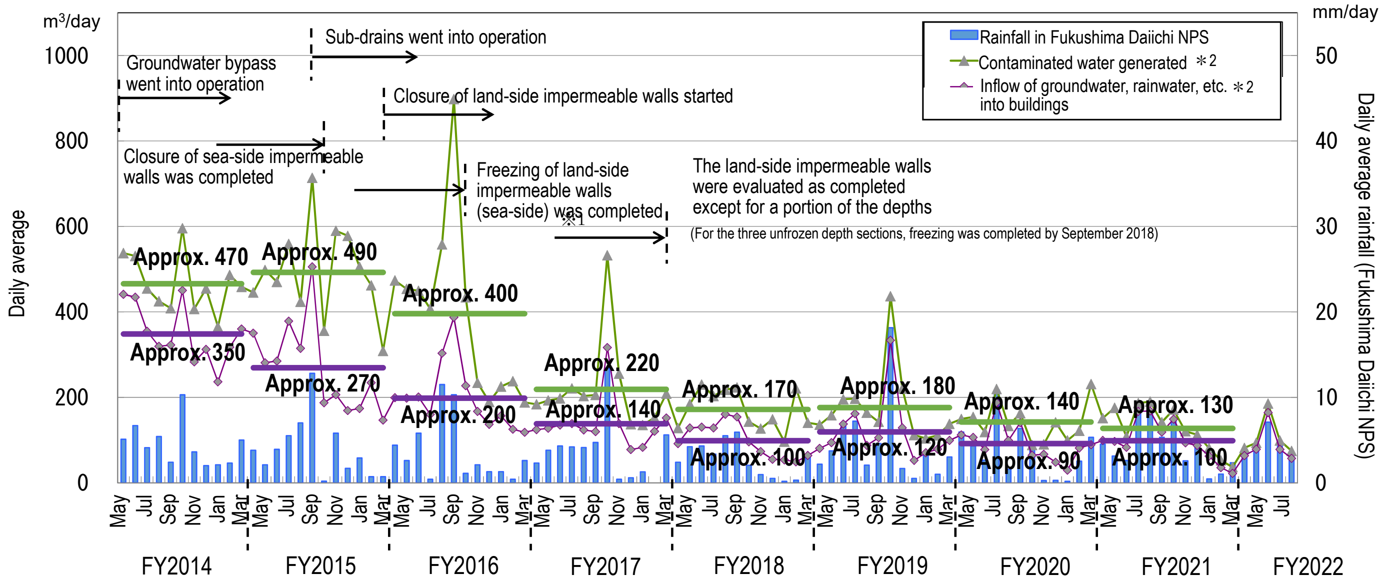
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

II. Progress status by each plan

Measures for contaminated water and treated water

➢ Status of contaminated water generated

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



*1 Values differ from those announced at the 20th Committee on Countermeasures for Contaminated Water Treatment (held on August 25, 2017) because the method of calculating the contaminated water volume generated was reviewed on March 1, 2018. Details of the review are described in the materials for the 50th and 51st meetings of the Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment.

*2: The monthly daily average is derived from the daily average from the previous Thursday to the last Wednesday, which is calculated based on the data measured at 7:00 on every Thursday.

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

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

- At the Water-Treatment Facility Special for Sub-drain & Groundwater drains, release started from September 14, 2015 and up until September 19, 2022, 1,978 release operations had been conducted.
  The water quality of all temporary storage tanks satisfied the operation target.

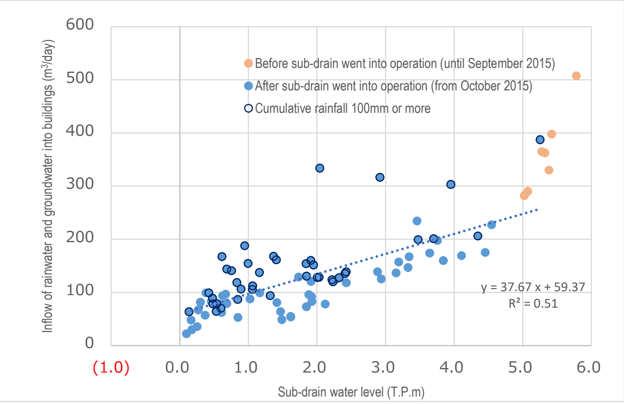


Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

➢ 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 August 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 August 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 due to the land-side impermeable walls and the decline in the set water level of the sub-drains. On the mountainside, the average difference between the inside and outside has remained at 4-5 m. The water level in the bank area has also remained low (T.P. 1.4 m) relative to the ground surface (T.P. 2.5 m).
- As the set water level of the sub-drains declined slightly (T.P. -0.55 ⇒ -0.65 m) and others in FY2021, the groundwater level on the sea side of the Unit 1-4 buildings remained low (except during heavy rainfall) compared with the T.P. 2.5 m area.
- Regarding the temporary increase in inflow to buildings during rainfall, countermeasures by facing around Units 1-4 will be implemented to prevent rainfall inflow. To further suppress inflow, water-stoppage measures will be examined for remaining building penetrations such as pipes and gaps between buildings.
- Given that the inflow peaks at Unit 3 (approx. 60m^3/day), an investigation into building external wall penetrations in the deep part (T.P.+2m and deeper) of Unit 3 is underway. Based on the investigative results using a camera, the need to further suspend water to the D/G room building external wall penetrations will be assessed and likewise the charging method for the Unit 3 intake power source cable duct.
- Regarding water stoppage of gap edges, the drilling and casting methods will be examined based on tests. Regarding application to the site, the potential risk of outflow of water stoppage material is assumed. To check this risk, conducting tests to implement water stoppage of gap edges in Units 5 and 6 will be examined. By measuring the groundwater flow rate and checking the casting surface while casting the water-stoppage material using actual machines, a mixture applicable to the site of Units 1-4 and construction management items will be examined.

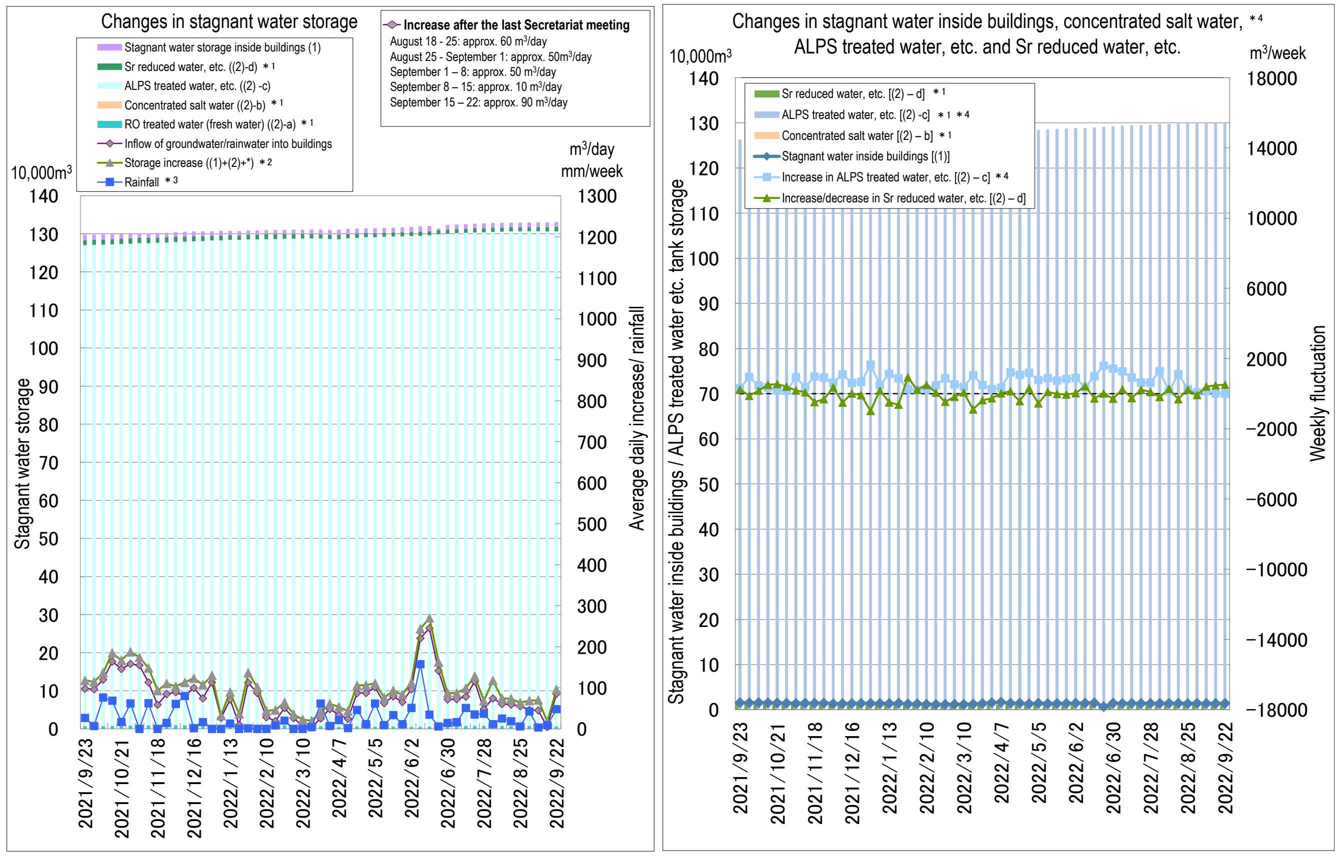
➢ Operation of the multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing), hot tests using radioactive water are ongoing (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 have been underway (from October 18, 2014).
- As of September 22, 2022, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 489,000, 741,000 and 103,000 m^3, respectively (including approx. 9,500 m³ stored in the J1(D) tank, which contained water with highly concentrated radioactive materials at the System B outlet of the existing multi-nuclide removal equipment).
- Treatment measures comprising the removal of strontium by cesium-adsorption apparatus (KURION), the secondary cesium-adsorption apparatus (SARRY) and the third cesium-adsorption apparatus (SARRY II) continued. Up until September 22, 2022, approx. 688,000 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 September 22, 2022, approx. 852,000 m^3 had been treated.

As of September 22, 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: The notation of treated water by the multi-nuclide removal equipment and others was reviewed in accordance with redefining of ALPS treated water by the Government (April 27, 2021)

Figure 3: Status of stagnant water storage

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

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

- Both concentrations of tritium and Cesium-137 in seawater within 20km of the coast had remained constant for the past year and low within the fluctuation range of seawater in Japan*.
- The concentration of tritium in seawater further than 20km from the coast remained low, including at new measurement points, within the fluctuation range of seawater in Japan*. The concentration of Cesium-137 remained constant over the past year within the fluctuation range of seawater in Japan*.

  * : The range of the minimum – maximum values detected during April 2018 – March 2020 in the database below

  In Japan (including off the coast of Fukushima Prefecture)

Tritium concentration:	0.043 - 20 Bq/L
Cesium-137 concentration:	0.0010 - 0.38 Bq/L

  Off the coast of Fukushima Prefecture

Tritium concentration:	0.043 - 0.89 Bq/L
Cesium-137 concentration:	0.0013 - 0.38 Bq/L

  Source: Environmental Radioactivity and Radiation in Japan, Environmental Radiation Database
  https://www.kankyo-hoshano.go.jp/data/database/
- For the status of fish and seaweed, no samples were collected in April. The concentration of tritium in fish sampled at the sampling point T-S8 had remained constant for the past year and low within the fluctuation range of seawater in Japan*. Regarding fish at other sampling points, measurement data is being verified.

  * : The range of the minimum – maximum values detected during April 2018 – March 2020 in the database below

  In Japan (including off the coast of Fukushima Prefecture)

Tritium concentration:	0.06 – 0.1 Bq/L
- To ensure transparency and objectivity in measurement, third-party analysis will participate in new measurement points of the marine monitoring and measure cesium in sea water (ten points no more than 2km from the port) from October. The measurement results will then be published on the website of each point.

➢ Progress status of treatment of contaminated water in buildings

- For the Units 1-3 Reactor Buildings (R/Bs) for which circulation water injection is conducted, contaminated water in R/Bs will be reduced to approx. half of that at the end of 2020 (approx. 3,000m^3), within FY2022 to 2024.
- Regarding efforts to reduce the level of contaminated water in buildings, to alleviate any risk of influencing later-stage facilities attributable to rapid concentration change and associated with highly concentrated contaminated water treatment including α-nuclide at the lower part of R/B, the water level is being reduced at a guideline pace of 10 cm per two weeks for each building.
- The water level was reduced to the target level in Unit 2 and is also currently being reduced in Unit 3. Subsequently, Unit 1 will be reduced.
- For the Process Main Building (PMB) and the High Temperature Incinerator Building (HTI), while maintaining the minimized water level and after completing the work to collect zeolite sandbags and others within the due target of 2024, floors will be exposed.
- For R/B contaminated water in which a relatively high α concentration (in the order of 100-100000 Bq/L) is detected, based on the results of tests and analysis acquired at present, facilities that can remove α-nuclide are being designed.

➢ Measures to reduce the 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 is underway.
- To minimize the sum of concentration ratios required by law, based on the condition inside the tanks after treating residual water and the storage record, reused tank areas are classified into three categories (1)-(3), with measures being implemented and examination underway in each category.
- Among tanks in the Category (2) (removing sludge inside the tank + repainting + replacing the connection pipe and the valve), following the tanks in G3-G area, those in G3-E area became full. The analytical results of the stored water conducted showed that in some tanks, the sum of concentration ratios required by law of seven nuclides (water undergoing treatment) exceeded 1.
- However, from the perspective of the purpose for this measure “minimizing the influence of residual radioactive materials inside tanks” (which were used to store strontium-reduced water), it was considered that certain positive results were achieved.
- Before being discharged into the sea, the water will be purified until the sum of 62 nuclides + Carbon-14 becomes less than 1.

➢ Concentration of Sr-90 in the additional ALPS (A) outlet water exceeding the legal discharge limit

- In the additional ALPS (A) operated from July 27 to August 5, the concentration of strontium 90 (Sr-90) in the outlet water sampled on July 28 exceeded the normal value. Water sampled at the same point on August 4 was lower than the legal discharge limit.
- All treated water was stored in tanks and none was released into the environment. When water treated from July 31 to August 5 was stored in the temporary storage tanks, sampling was conducted and the concentration of Sr-90 (4.2 Bq/L) was lower than the legal discharge limit. Based on this result, the above excess was assumed as a temporary increase in Sr-90 concentration.
- Water treated during July 27-30 was stored in the reused tank areas. Reused tanks stored Sr-reduced water and others in the past and later decontaminated. Based on the sampling results, the water will be purified by ALPS and others as many times as required until the sum of 62 nuclides + Carbon-14 becomes less than 1.

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

- To measure and confirm or transfer facilities, work to install a pipe support, pipes and others for these facilities started from August 4 from around K4 area tanks.
- For the discharge facility, the bedrock layer is being drilled by the shield machine from August 4 to start construction of the discharge tunnel.
- From August 4, toward installing the partition weir, preparatory work, including constructing a runway for heavy-duty machines, is being implemented. In the sea-side area for Units 5 and 6, removal of sedimentation inside the open intake channels will be conducted simultaneously and after installing the partition weir, anti-permeation work will be removed.

Fuel removal from the spent fuel pools

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

➢ Main work to help spent fuel removal at Unit 1

- From 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. The ground assembly was completed for the temporary gantry and lower structure and approx. 50%, for the upper structure.
- A work yard was prepared around the Reactor Building and work to install a large cover started from August 2021.
- From April 13, 2022, drilling to install an anchor in the Reactor Building started. A temporary gantry was also installed from the part where anchors and base plates were installed.
- The Isolation Condenser secondary side pipe (IC pipe)*, which hinders the installation of anchors and baseplates, was removed in late September.

  * Isolation Condenser secondary-side pipe: The secondary-side pipe of the Isolation Condenser, which cools the inside of the Reactor Pressure Vessel when the external power source is lost and is currently unused.
- From the air dose investigation near the IC pipe, no significant contamination in the IC pipe was detected. However, anti-scattering agents were sprayed before work. The dust concentration is monitored by dust monitors on the four corners of the operating floor and existing dust monitors within the site during work.

➢ 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 before and after decontamination. Work to install shielding within a range including above the reactor well, where the dose was observed to peak, was completed at the end of May. Due to interference with installation of the new fuel-handling machine, work to remove the control room of the fuel-handling machine is underway from August and will be completed at the end of November. Work progressed as planned with no significant increase in dust detected.
- Outside the building, ground improvement work before installing the gantry for fuel removal was completed on April 2022. To install the gantry foundation, excavation of ground improvement construction roadbed (backfill soil) was completed in June. At present, to complete the installation of the concrete foundation by early November, work to assembly steel frames is underway.
- Regarding the gantry for Unit 2 fuel removal, from the perspective of reducing workers' exposure during installation, steel frames will be assembled into large blocks (ground assembly), carried-in to the Unit 2 south-side yard and erected. The 500 t crawler crane for ground assembly of steel frames was assembled during the period August 6-9 and the ground assembly (carry-in of gantry steel frames) started from August 31. Ground assembly proceeds outside the site and assembled blocks will be carried-in from late November to erect steel frames on site.

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 from X-2 penetration into the basement within the PCV to investigate inside and outside the pedestal.
- During June 7-11, the thickness of deposits was measured using the remotely operated submersible ROV-C robot.

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

- The trial retrieval equipment for the 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.
- Regarding the trial retrieval of Unit 2 debris, due to the influence of the COVID-19 infections and to increase work safety and reliability, the process was reviewed to starting around late FY2023.

➢ Resumption of inclusive water sampling toward reducing the dose of the Unit 1 Reactor Building Closed Cooling Water System

- For the Closed Cooling Water System (RCW), which is a high-dose source inside the Unit 1 Reactor Building (R/B), sampling of inclusive water toward reducing the dose was scheduled for the period January to March, 2022.
- The sampling was suspended because the work area was partially overwrapped with a PCV internal investigation implemented concurrently. However, since the preparation to resume is ready, work will be implemented from October and sampling is scheduled in December 2022.

➢ Investigation in the control room of the Unit 2 fuel-handling machine-

- As an "assumption about the status of the Units 1-3 core and Primary Containment Vessel at the Fukushima Daiichi Nuclear Power Station and examination of unsolved issues," efforts to clarify the accident progress continue.
- In the control room of the Unit 2 fuel-handling machine (FHM control room) located on the top floor (operating floor) of the Unit 2 Reactor Building, the window glass on the second floor was broken and the previous investigation confirmed contamination inside the room.
- As the FHM control room had remained almost untouched since the accident and is located near the shield plug, which is assumed to be the main release route of radioactive materials, the area was investigated to acquire information related to radioactive materials released at the time of the accident.
- From the dose measurement inside the room, results support the conventional assumption that gas, including radioactive materials, flowed in from the damaged part of the second floor window and contaminated the inside of the room.
- Smear samples are being analyzed in the internal analysis institute.

➢ Operation start of the intake facility inside the Unit 3 Primary Containment Vessel

- As measures to improve the quake resistance of the Primary Containment Vessel (PCV), the water level of the Suppression Chamber (S/C) will be decreased in stages.
- First, to control the PCV water level below the first floor of the Reactor Building, using the existing Residual Heat Removal System pipe connecting with the lower part of S/C, the PCV intake facility operating by the self-suction pump was installed.
- From early October, operation of the PCV intake facility will start to improve the quality of inclusive water in S/C toward reducing the PCV water level. With the target of reducing the Cs-137 concentration of S/C inclusive water to that equivalent to stagnant water in the building by replacing it with reactor injection water, influence on the water treatment facility and others will be suppressed.

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 August 2022, the total storage volume for concrete and metal rubble was approx. 330,400 m^3 (+500 m^3 compared to the end of July with an area-occupation rate of 88%). The total storage volume of trimmed trees was approx. 129,400 m^3 (+100 m^3, with an area-occupation rate of 74%). The total storage volume of used protective clothing was approx. 27,700 m^3 (-2,700 m^3, with an area-occupation rate of 53%). The increase in rubble was attributable to work around Units 1-4 buildings, construction related to the port, decontamination of flanged tanks and others. As of the end of August 2022, there were ten temporary deposits with storage capacity exceeding 1,000m^3, storage 50,700m^3.

➢ Management status of secondary waste from water treatment

- As of September 1, 2022, the total storage volume of waste sludge was 492 m^3 (area-occupation rate: 70%), while that of concentrated waste fluid was 9,380 m^3 (area-occupation rate: 91%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment and other vessels, was 5,417 (area-occupation rate: 85%).

➢ Formulation of an analysis plan for decommissioning at the Fukushima Daiichi Nuclear Power Station

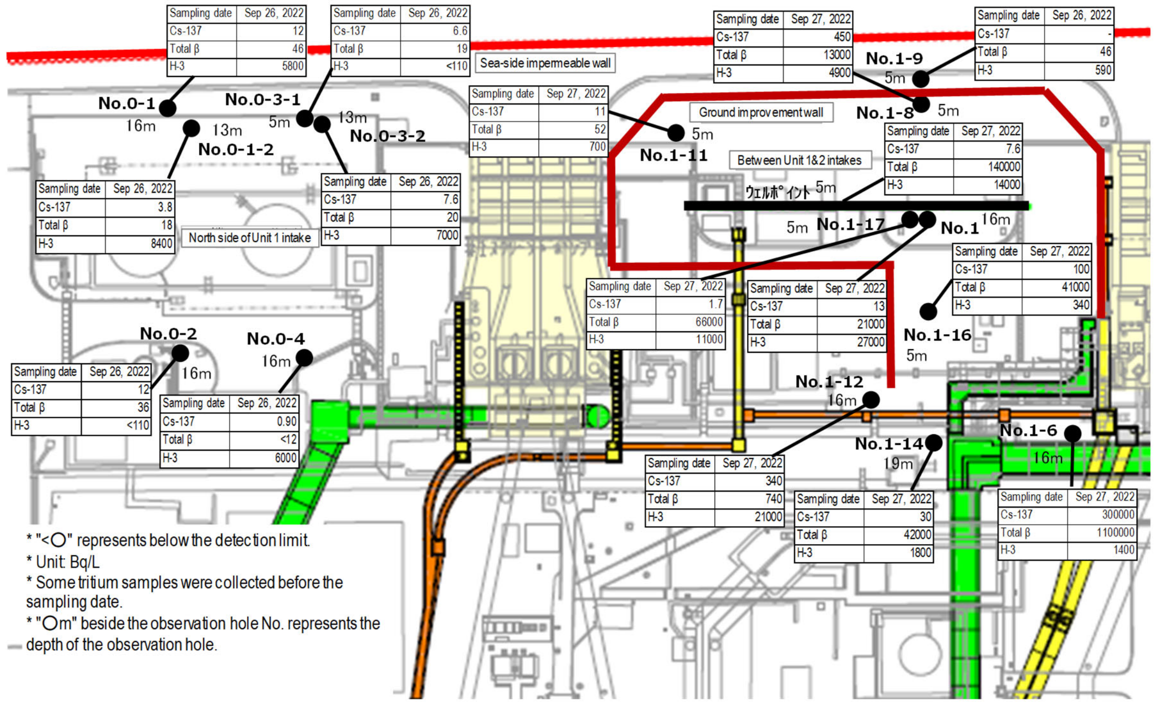
- An analysis plan focused on measures for wastes is being embodied.
- When formulating a plan, the analytical objectives and targets are clarified, analytical priorities are evaluated for each waste and based on characteristics of each, an analytical plan for each waste will be embodied.
- With the target within FY2022, the analytical plans for each waste will be integrated to formulate an overall plan.

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

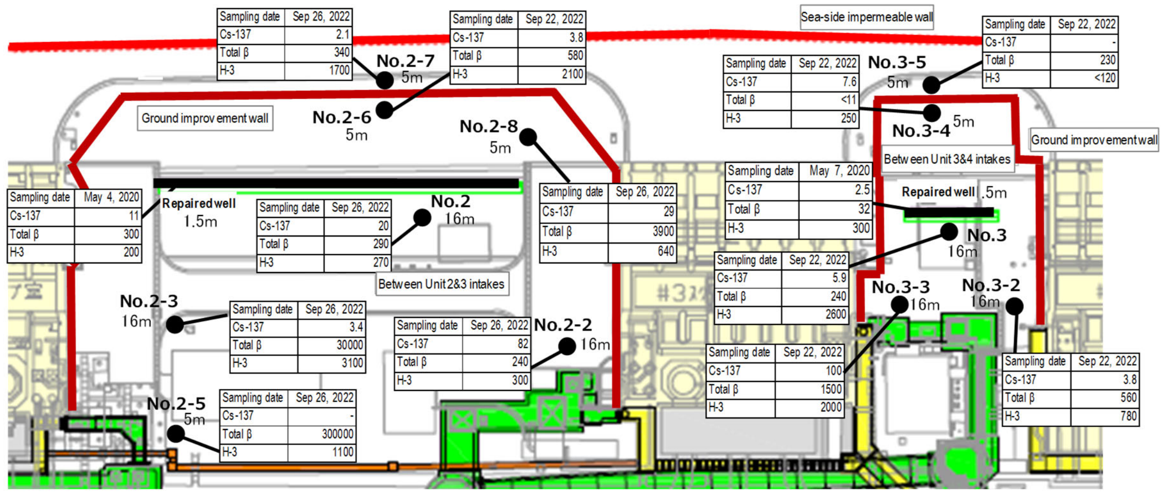
➢ Status of groundwater and seawater on the east side of Turbine Building Units 1-4

- 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 or declining at many observation holes, including Nos. 1-6, 1-9, 1-11, 1-12, 1-14, 1-16 and 1-17. The trend continues to be monitored carefully.
- In the area between the Unit 2 and 3 intakes, the H-3 concentration has been below the legal discharge limit of 60,000 Bq/L at all observation holes. It has been increasing and declining at Nos. 2-3, 2-5, 2-6 and 2-7 but has remained constant overall. The concentration of total β radioactive materials has remained constant overall but been increasing or declining at 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 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.



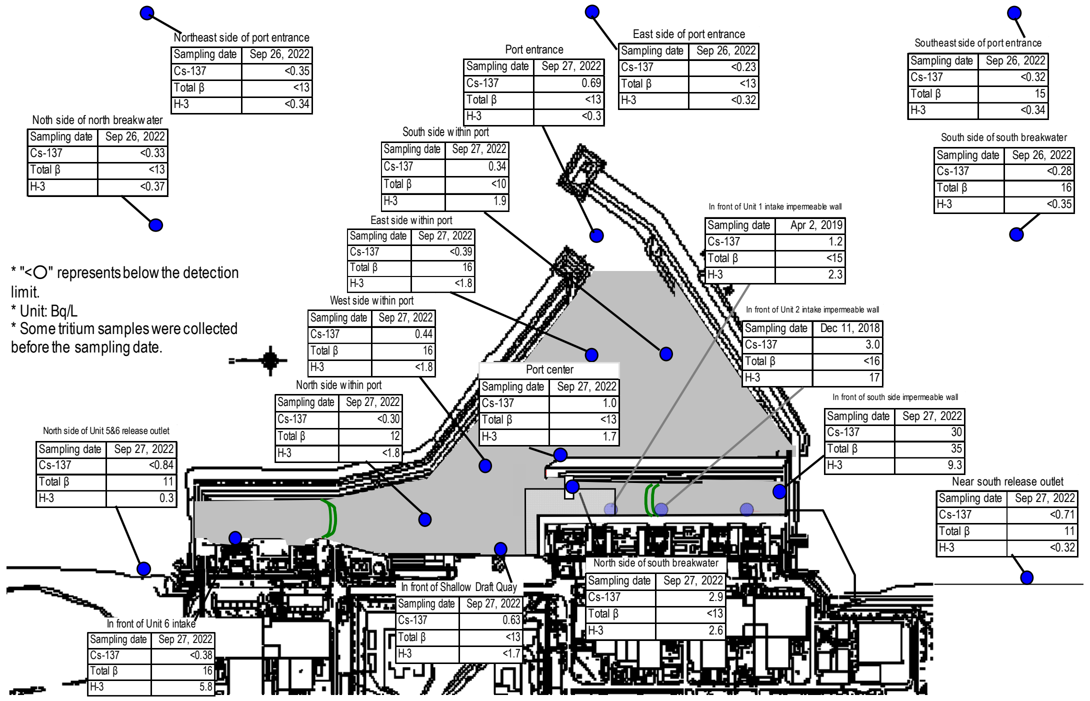
* "<○" represents below the detection limit.
* Unit: Bq/L
* Some tritium samples were collected before the sampling date.
* "○m" beside the observation hole No. represents the depth of the observation hole.

<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



* "<○" represents below the detection limit.
* Unit: Bq/L
* Some tritium samples were collected before the sampling date.

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 May to July 2022 was approx. 9,200 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 7,000). 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 October 2022 (approx. 4,000 workers per day: cooperating company workers and TEPCO HD employees) would be secured at present. The average numbers of workers per day for each month (actual values) for the most recent 2 years were maintained, with approx. 3,000 to 4,200.
- The number of workers from within Fukushima Prefecture increased slightly and those outside, remained constant. The local employment ratio (cooperating company workers and TEPCO HD employees) as of August 2022 remained constant at around 70%.
- The average exposure doses of workers were approx. 2.54 and 2.60 and 2.51 mSv/person-year during FY2019, 2020 and 2021, respectively. (The legal exposure dose limits are 100 mSv/person and 50 mSv/person-year over five years, the TEPCO HD management target is 20 mSv/person-year).
- For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.

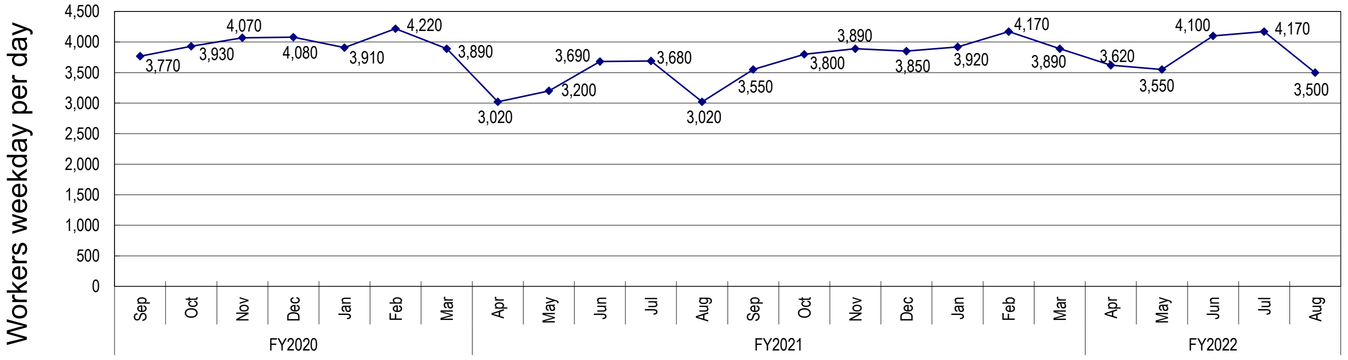


Figure 6: Changes in the average number of workers weekday per day for each month of the past 2 years (actual values)

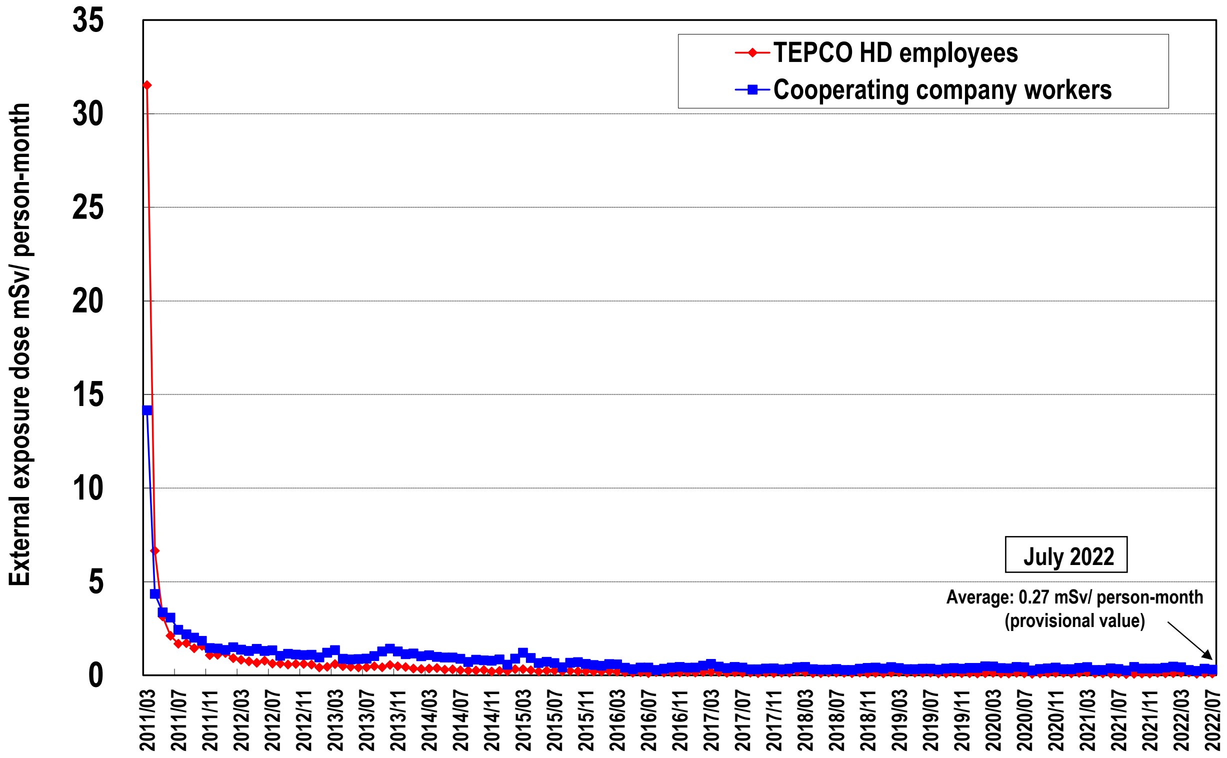


Figure 7: Changes in monthly average exposure dose of individual worker
(monthly exposure dose since March 2011)

➢ Countermeasures to suppress the spread of COVID-19 infections

- Since mid-July, "not to bring" the virus into the nuclear power station, the following additional countermeasures have been implemented:
  - Employees must check their own physical condition and that of their family members. Those at risk of infection, such as those having moved outside Fukushima Prefecture and their family members having moved from outside, are required to early detect infections by voluntarily undergoing an antigen test.
  - When commuting, an ongoing occupancy rate of 50% continues to be recommended. Attention is drawn to the need to avoid smoking on board, wear masks, ensure ventilation, refrain from conversation and others.
- In August, infections have been increasing than ever, mainly among cooperating company workers. Based on this status, the following countermeasures are implemented to suppress the infection spreading:
  - Cooperating companies which recorded many infections were visited to inspect the status of the infection-suppressing countermeasures, such as ventilation within the office and reinstructed on strict implementation of these countermeasures (particularly when commuting and taking a break).
  - Common areas within the site are simultaneously disinfected. Before coming to the company after the Obon holiday, employees had to strictly recheck their own physical condition and voluntarily undergo an antigen test.
- From the beginning of September, infections have been decreasing. However, the implementation of basic contents of the infection suppression countermeasures was reaffirmed for cooperating company workers.
- The ongoing basic countermeasures to prevent infection spreading, such as requiring employees to take their temperature before coming to the office, wear masks at all times, avoid the "Three Cs" by using the rest house in shifts, eat silently and carefully select business travel, will continue to be properly implemented to proceed with decommissioning work, prioritizing safety above all.
- As of September 28, 2022, 1,184 workers (including 161 TEPCO HD employees, 1,019 cooperating company workers, three business partner company employees and one temporary worker) of the Fukushima Daiichi Nuclear Power Station had contracted COVID-19, an increase in 355 workers (including 47 TEPCO HD employees, 308 cooperating company workers) from those in the previous published material (as of August 24).

- No significant influence on decommissioning work, such as a corresponding delay to work processes due to this infection, had been identified.

Status of heat stroke cases

- In FY2022, measures to further prevent heat stroke commenced from April to cope with the hottest season.
- FY2022, ten workers suffered heat stroke due to work up until September 26 (in FY2021, seven workers up until the end of September). Continued measures will be taken to prevent heat stroke.

Status of Units 5 and 6

Status of spent fuel storage in Units 5 and 6

- Regarding Unit 5, fuel removal from the reactor was completed in June 2015. A total of 1,374 spent and 168 non-irradiated fuel assemblies, respectively, were stored in the spent fuel pool (storage capacity: 1,590 assemblies).
- Regarding Unit 6, fuel removal from the reactor was completed in November 2013. Removal of the Unit 6 spent fuel started on August 30, 2022. The removal of spent fuel from the Unit 6 spent fuel pool was divided into 68 stages, with two removals scheduled in FY2022, about 22 removals over June-August 2023 and the remaining 44 removals after January 2024.
- As of September 2022, a total of 1,412 spent and 198 non-irradiated fuel assemblies (180 of which transferred from the Unit 4 spent fuel pool) are stored in the Unit 6 spent fuel pool (storage capacity: 1,654), while 230 non-irradiated fuel assemblies are stored in the storage facility of non-irradiated fuel assemblies (storage capacity: 230).

Status of stagnant water treatment in Units 5 and 6

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

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 September 12-26)"; unit (Bq/L); ND represents a value below the detection limit

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

Summary of TEPCO data as of September 27, 2022

Cesium-134	:	ND(0.34)
Cesium-137	:	1.4
Total β	:	ND(14)
Toritium	:	2.0

※1

Cesium-134 :	3.3	(H25/12/24)	→	ND(0.31)	Below 1/10
Cesium-137 :	7.3	(H25/10/11)	→	0.70	Below 1/10
Total β :	69	(H25/8/19)	→	ND(14)	Below 1/4
Toritium :	68	(H25/8/19)	→	0.74	Below 1/90

Cesium-134 :	3.3	(H25/10/17)	→	ND(0.31)	Below 1/10
Cesium-137 :	9	(H25/10/17)	→	0.49	Below 1/10
Total β :	74	(H25/8/19)	→	ND(14)	Below 1/5
Toritium :	67	(H25/8/19)	→	ND(1.9)	Below 1/30

Cesium-134 :	3.5	(H25/10/17)	→	ND(0.32)	Below 1/10
Cesium-137 :	7.8	(H25/10/17)	→	ND(0.65)	Below 1/10
Total β :	79	(H25/8/19)	→	ND(14)	Below 1/5
Toritium :	60	(H25/8/19)	→	ND(1.9)	Below 1/30

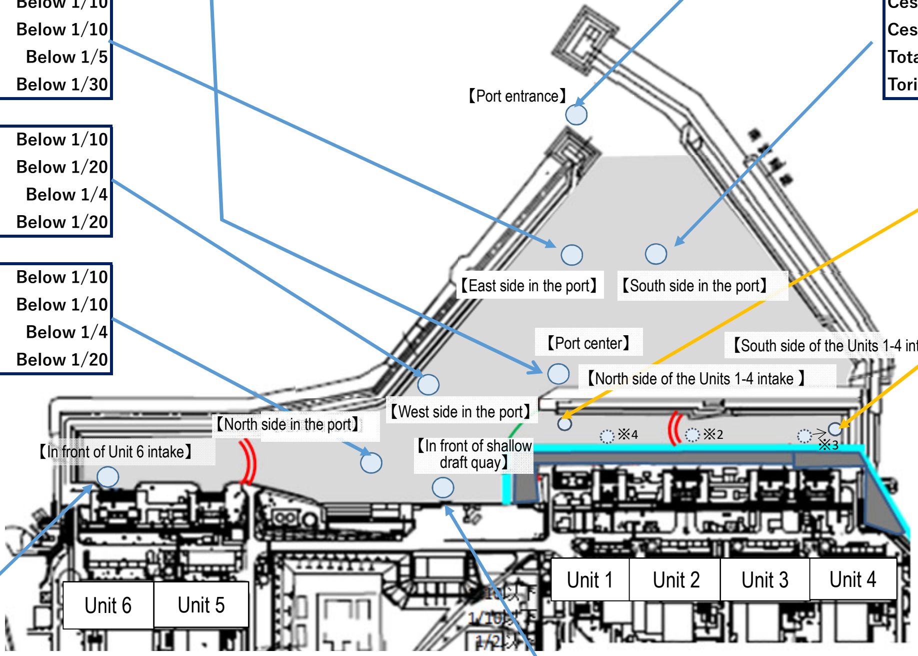
Cesium-134 :	4.4	(H25/12/24)	→	ND(0.35)	Below 1/10
Cesium-137 :	10	(H25/12/24)	→	ND(0.37)	Below 1/20
Total β :	60	(H25/7/4)	→	14	Below 1/4
Toritium :	59	(H25/8/19)	→	2.5	Below 1/20

Cesium-134 :	32	(H25/10/11)	→	ND(0.30)	Below 1/100
Cesium-137 :	73	(H25/10/11)	→	3.1	Below 1/20
Total β :	320	(H25/8/12)	→	ND(12)	Below 1/20
Toritium :	510	(H25/9/2)	→	5.3	Below 1/90

Cesium-134 :	5	(H25/12/2)	→	ND(0.31)	Below 1/10
Cesium-137 :	8.4	(H25/12/2)	→	0.48	Below 1/10
Total β :	69	(H25/8/19)	→	ND(14)	Below 1/4
Toritium :	52	(H25/8/19)	→	ND(1.9)	Below 1/20

Cesium-134	:	0.77
Cesium-137	:	35
Total β	:	42
Toritium	:	51

※1



Sea side impermeable wall
Silt fence
Silt fence for construction

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

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

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

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

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

Cesium-134 :	5.3	(H25/8/5)	→	ND(0.31)	Below 1/10
Cesium-137 :	8.6	(H25/8/5)	→	0.39	Below 1/20
Total β :	40	(H25/7/3)	→	ND(12)	Below 1/3
Toritium :	340	(H25/6/26)	→	ND(1.9)	Below 1/100

	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 September 12-26)

Summary of TEPCO data as of September 27, 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(0.25)	
Cesium-137 :	ND	(H25)	→	ND(0.35)	
Total β :	ND	(H25)	→	ND(13)	
Toritium :	ND	(H25)	→	-	

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

Cesium-134 :	ND	(H25)	→	ND(0.26)	
Cesium-137 :	1.6	(H25/10/18)	→	ND(0.23)	Below 1/2
Total β :	ND	(H25)	→	ND(13)	
Toritium :	6.4	(H25/10/18)	→	-	

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

Cesium-134 :	ND	(H25)	→	ND(0.25)	
Cesium-137 :	ND	(H25)	→	ND(0.32)	
Total β :	ND	(H25)	→	15	
Toritium :	ND	(H25)	→	-	

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

Cesium-134 :	ND	(H25)	→	ND(0.26)	
Cesium-137 :	ND	(H25)	→	ND(0.33)	
Total β :	ND	(H25)	→	ND(13)	
Toritium :	4.7	(H25/8/18)	→	-	

【Port entrance】

Cesium-134 :	3.3	(H25/12/24)	→	ND(0.31)	Below 1/10
Cesium-137 :	7.3	(H25/10/11)	→	0.70	Below 1/10
Total β :	69	(H25/8/19)	→	ND(14)	Below 1/4
Toritium :	68	(H25/8/19)	→	0.74	Below 1/90

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

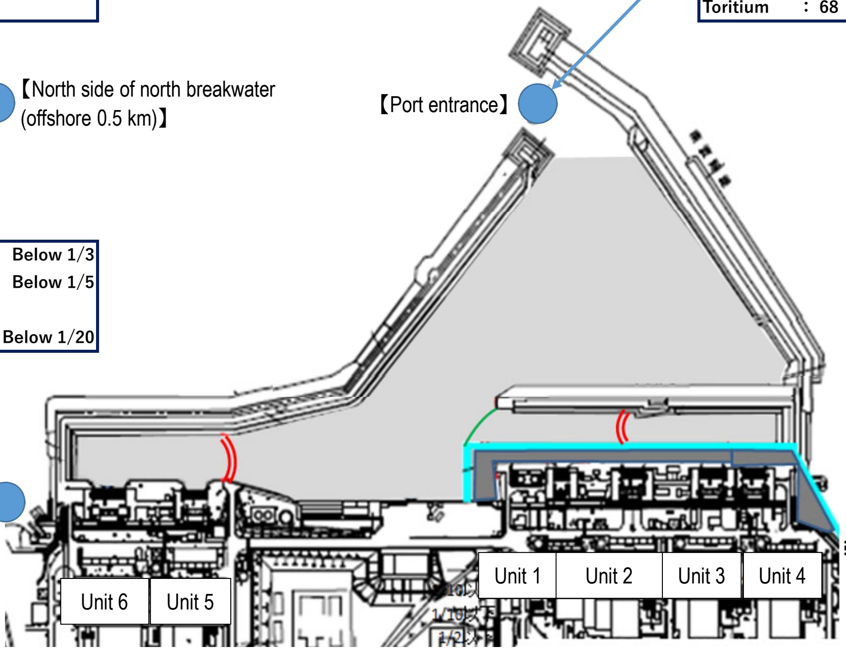
Cesium-134 :	ND	(H25)	→	ND(0.27)	
Cesium-137 :	ND	(H25)	→	ND(0.28)	
Total β :	ND	(H25)	→	16	
Toritium :	ND	(H25)	→	-	

【North side of Unit 5 and 6 release outlet】

Cesium-134 :	1.8	(H25/6/21)	→	ND(0.58)	Below 1/3
Cesium-137 :	4.5	(H25/3/17)	→	ND(0.85)	Below 1/5
Total β :	12	(H25/12/23)	→	10	
Toritium :	8.6	(H25/6/26)	→	ND(0.32)	Below 1/20

【Near south release outlet】

Cesium-134 :	ND	(H25)	→	ND(0.55)	
Cesium-137 :	3	(H25/7/15)	→	ND(0.78)	Below 1/3
Total β :	15	(H25/12/23)	→	9.6	
Toritium :	1.9	(H25/11/25)	→	ND(0.32)	Below 1/2



Sea side impermeable wall

Silt fence

Silt fence for construction

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

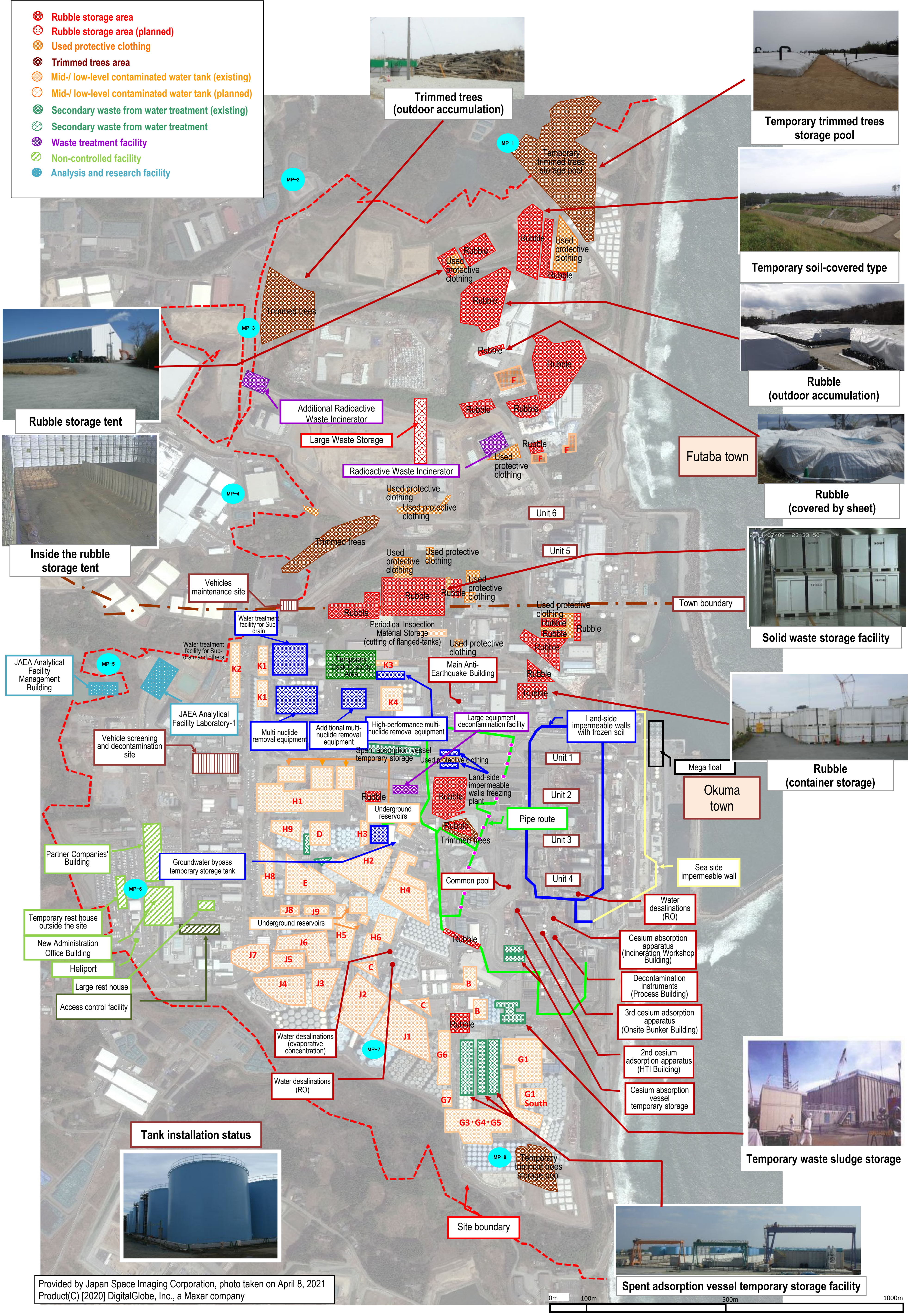
Note: Because safety of the sampling points was unassured due to the influence of Typhoon No. 10 in 2016, samples were taken from approx. 330 m south of the Unit 1-4 release outlet.
Samples were also taken from a point approx. 280m south from the same release outlet from January 27, 2017 and approx.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

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

Appendix 2

September 29, 2022

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout



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

1-1 Contaminated water management

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

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

Reference
September 29,, 2022
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

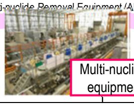
Contaminated water management【Remove】

Contaminated water treatment facility

- ▽Reception start of contaminated water to Central Waste Treatment Build
- ▽Decontamination equipment (AREVA)
- ▽Evaporative concentration equipment
- ▽Cesium Adsorption Apparatus (KURION)
- ▽2nd Cesium Adsorption Apparatus (SARRY)
- ▽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)
- ▽Reduction of strontium by 2nd Cesium Adsorption Apparatus (SARRY) (from 2014.12.26)
- ▽Reduction of strontium by Cesium Adsorption Apparatus (KURION) (from 2015.1.6)
- ▽Treatment of RO-condensed salt water complete
- ▽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)
- ▽Purification of strontium-reduced water in flanged tanks complete
- ▽Reduction of strontium by 3rd Cesium Adsorption Apparatus (SARRY II) (from 2019.7.12)
- ▽Purification of strontium-reduced water complete


Cesium Adsorption Apparatus (KURION)

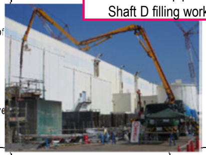

Landing of 2nd Cesium Adsorption Apparatus (SURRY)

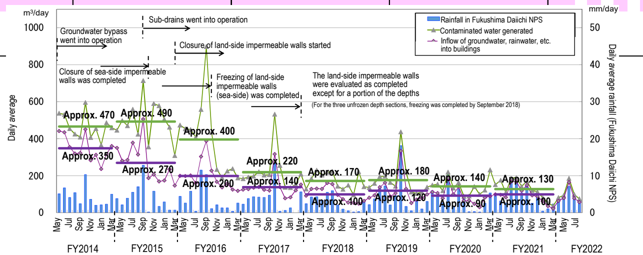

Multi-nuclide removal equipment (ALPS)

Removal of contaminated water from seawater pipe trench

【Removal of contaminated water in seawater pipe trench】

- ▽Trench Purification by mobile equipment
- Unit 2
  - ▽Completion of tunnel filling
  - ▽Transfer of stagnant water complete
  - ▽Completion of shaft filling
- Unit 3
  - ▽Completion of tunnel filling
  - ▽Transfer of stagnant water complete
  - ▽Completion of shaft filling (except for upper part of
- Unit 4
  - ▽Completion of tunnel filling
  - ▽Filling of openings II and III complete
  - ▽Transfer stagnant water complete
  - ▽Completion of filling parts running ove


Unit 2 seawater pipe trench Shaft D filling work



Contaminated water management【Redirect】

Groundwater bypass

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

Sub-drain

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

Land-side impermeable wall

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

Facing

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

Contaminated water management【Retain】

Bank groundwater measures

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

Storage facility

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

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

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


Pumping well


Sub-drain purification system


Land-side impermeable wall brine (refrigerant) circulation pipe


Construction of welded-joint tanks


Placement of seaside impermeable walls complete

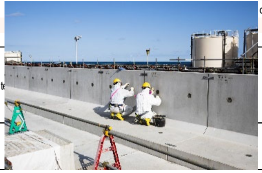

Flanged and welded-joint tanks

1-2 Contaminated water management

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

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

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Treatment of stagnant water		▽Installation of stagnant water transfer equipment/transfer start		▽Completion of work to improve reliability of transfer line (replacement with PE pipes)		▽Start to maintain water-level difference with sub-drain water level ▽Transfer start from each building to Central Rw Building		▽Floor exposure of Unit 1 T/B ▽Separation of stagnant water between Units 3 and 4	▽Separation of stagnant water between Units 1 and 2	▽Floor exposure of Unit 1 Rw/B	▽Floor exposure of Unit 2 T/B, Rw/B ▽Floor exposure of Unit 3 T/B, Rw/B ▽Floor exposure of Unit 4 R/B, T/B, Rw/B **▽Treatment of stagnant water in buildings complete**		
Countermeasures to tsunami risks	Closure of openings		▽Examination start of measures to close building openings		complete ▽Work for Units 1 and 2 T/B complete ▽Work for HTI building complete				▽Work for Process Main Building complete	▽Work for Unit 3 T/B complete	▽Work for Unit 1-3 R/B complete		**▽Closure of openings complete** ▽Work of Unit 1-4 Rw/B complete
	Seawall	▽Installation of outer-rise tsunami seawall complete								▽Construction start of Tsushima Trench Tsunami Seawall	▽Completion of installation	Japan Trench tsunami seawall ▽on-site start	
	Mega float								▽Start of marine construction	Temporary grounding of mega float▽	▽Internal filling complete (reduction of tsunami risks)		



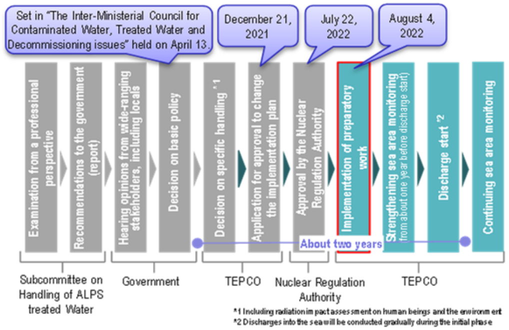
Chishima Trench Tsunami Seawall complete

Construction of Japan Trench Tsunami Seawall

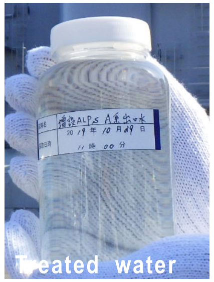
2 Handling of ALPS treated water

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

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



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



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

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

2020.2 Report of Subcommittee on Handling of ALPS treated water

Opportunity for receiving opinions from parties concerned concerning handling of ALPS treated water (2020.4 – 2020.10, 7 meetings)

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

2021.12.21 The "Application Documents for Approval to Amend the Implementation Plan for Fukushima Daiichi Nuclear Power Station Specified Nuclear Facility" regarding ALPS treated water were submitted to the Nuclear Regulation Authority

2021.12.28 "The Action Plan concerning the Continuous Implementation of the Basic Policy on Handling of ALPS Treated Water" was formulated

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

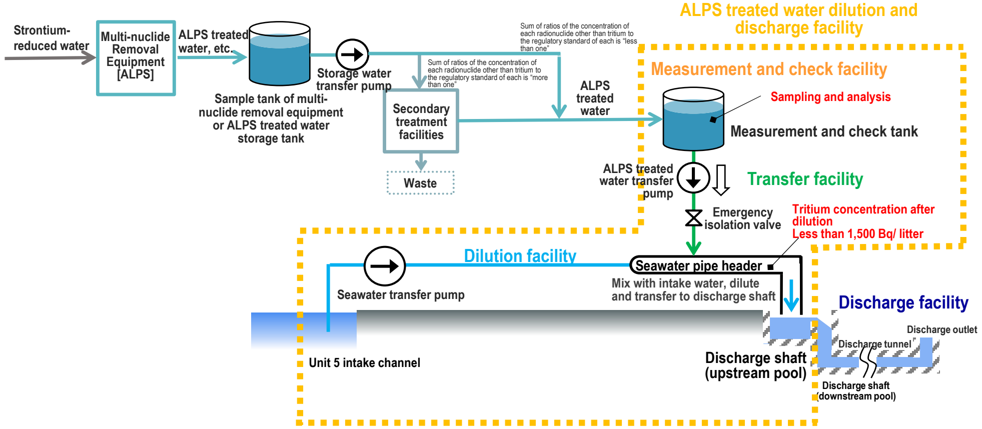
2022.4.28, 5.13, 7.15
Application to partially revise the Application Documents for Approval to Amend the Implementation Plan was submitted

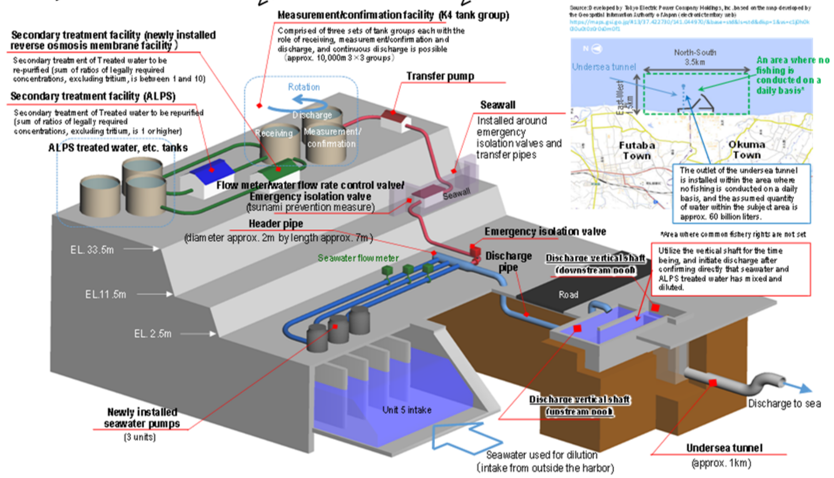
2022.7.22
Application for the Application Documents for Approval to Amend the Implementation Plan was approved

2022.8.4 Work has commenced

2014 2015 2016 2017 2018 2019 2020 2021 2022

【Overview of ALPS treated water dilution and discharge facility】





Comprised of three sets of tank groups each with the role of receiving, measurement/confirmation and discharge, and continuous discharge is possible (approx. 10,000m3×3 groups)

Secondary treatment of Treated water to be re-purified (sum of ratios of legally required concentrations, excluding tritium, is between 1 and 10)

Secondary treatment of Treated water to be repurified (sum of ratios of legally required concentrations, excluding tritium, is 1 or higher)

Installed around emergency isolation valves and transfer pipes

Source: Developed by Tokyo Electric Power Company Holdings, Inc. based on the map developed by the Geospatial Information Authority of Japan (electronic territory web)
https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1

The outlet of the undersea tunnel is installed within the area where no fishing is conducted on a daily basis, and the assumed quantity of water within the subject area is approx. 60 billion liters.

*Area where common fishery rights are not set

Utilize the vertical shaft for the time being, and initiate discharge after confirming directly that seawater and ALPS treated water has mixed and diluted.

3 Removal of fuel from spent pool

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

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

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

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Unit 4

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

▼ 2012.4-2013.3 Ground improvement and foundation work

▼ 2013.4-2013.7 Installation of external walls and roof panels

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

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

▼ 2013.11.18 Start of fuel removal

▼ 2014.12.22 Fuel removal was completed (1533 assemblies)

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


<Unit 4 Cover for fuel removal>

In the Mid- and-Long-Term Roadmap, the Phase 1 target involved starting to remove fuel from inside the spent fuel pool (SFP) of the 1st Unit within two years of completing Step 2 (by December 2013).

On November 18, 2013, fuel removal from Unit 4, namely the first Unit, got underway and Phase 2 of the roadmap started.

On November 5, 2014, within a year of commencing fuel removal work, all 1,331 spent fuel assemblies in the pool had been transferred. The transfer of the remaining non-irradiated fuel assemblies to the Unit 6 SFP was completed on December 22, 2014. (two of the non-irradiated fuel assemblies were removed in advance in July 2012 for fuel checks)

This marks the completion of fuel removal from the Unit 4 Reactor Building.


Fuel removal

Unit 3

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

Before installing a cover for fuel removal, the process of removing large rubble from the spent fuel pool was completed in November 2015. To ensure safe and steady fuel removal, training via remote control was conducted at the factory using the actual fuel-handling machine to be installed on site (February – December 2015). Installation of the fuel removal cover was completed on February 23, 2018.

With fuel removal in mind, rubble retrieval training inside the pool, which was scheduled in conjunction with fuel removal training, started from March 15, 2019 and fuel removal started from April 15, 2019. Fuel removal was completed on February 28, 2021.

▼ 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

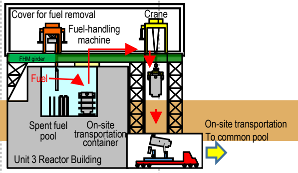
▼ 2016.12 Completion of shielding on the Reactor Building top floor

▼ 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 2

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

▼ 2015.3-2016.11 Yard construction

▼ 2016.9-2017.4 West-side gantry installation work

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

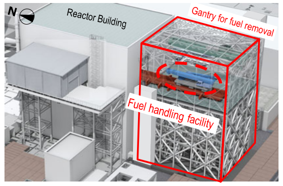
▼ 2018.8-2020.12 Moving and containment of remaining objects

▼ 2020.6 Investigation inside the spent fuel pool

▼ 2021.10-2022.4 Ground improvement work


<Unit 2 Construction of gantry for fuel removal>

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



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

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

Unit 1

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

▼ 2017.12 Completion of building cover dismantling and windbreak fence installation

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

▼ 2018.9-12 Removal of X-braces

▼ 2020.3-6 Installation of spent fuel pool cover

▼ 2020.9-11 Measures to prevent and alleviate rubble falling

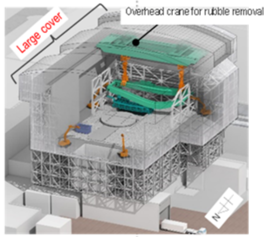
▼ 2020.11-2021.6 Dismantling of remaining cover

▼ 2021.8 Start of large cover pre-work

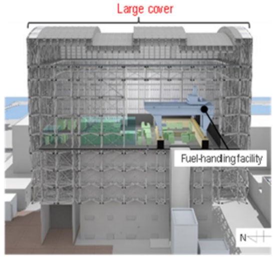
As part of efforts to remove fuel from the Unit 1 spent fuel pool, investigations are underway to ascertain the conditions of the fallen roof on the south side and the contamination of the well plug. Based on the results, “the method initially installing a large cover over the Reactor Building, then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

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


<Unit 1 Dismantling of remaining cover>



Rubble removal (image)



Fuel removal (image)

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

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

4 Work toward fuel debris retrieval

Reference
September 29,, 2022
Secretariat of the Team for Countermeasures for
Decommissioning, Contaminated Water and Treated Water

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

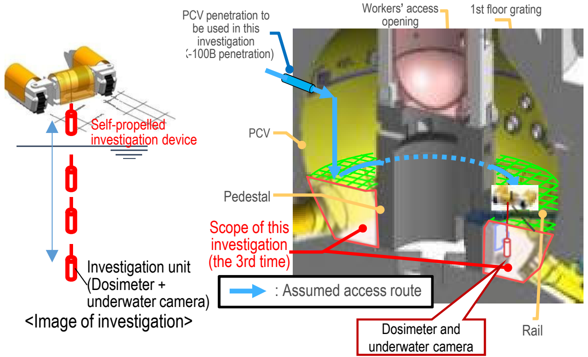
Start of fuel debris retrieval from the first unit (Unit 2). Expanding the scale in stages (within 2021 * The schedule will be extended for about 1 year due to the spread of COVID-19 infections)

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

Unit 1 Investigation overview

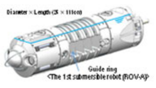
・In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:φ100 mm) collected information such as images and airborne dose inside the PCV 1st floor.

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

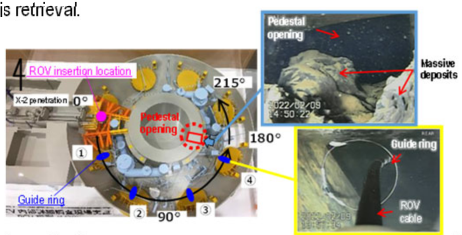


<Image of investigation>

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



<The 1st submersible robot (ROV-A)>



<Status inside the PCV (February 9)>

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)		

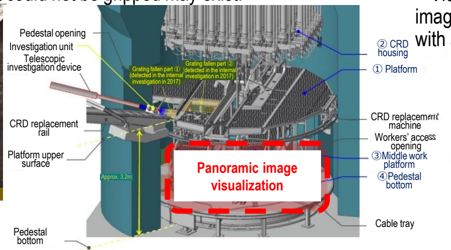
Unit 2 Investigation overview

・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.

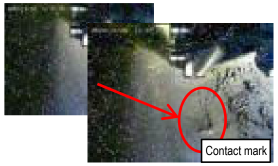
・In January 2018, the conditions below the platform inside the pedestal were investigated. Based on the analytical results of images obtained in the investigation, deposits, probably including fuel debris, were found at the bottom of the pedestal. Moreover, multiple parts exceeding the surrounding deposits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

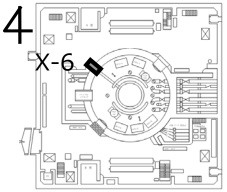


・In October 2020, as part of work to prepare for the PCV internal investigation and trial retrieval, a contact investigation to study deposits inside the penetration (X-6 penetration) was conducted, which involved inserting a guide pipe incorporating an investigative unit into the penetration. This confirmed 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 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 Investigation overview

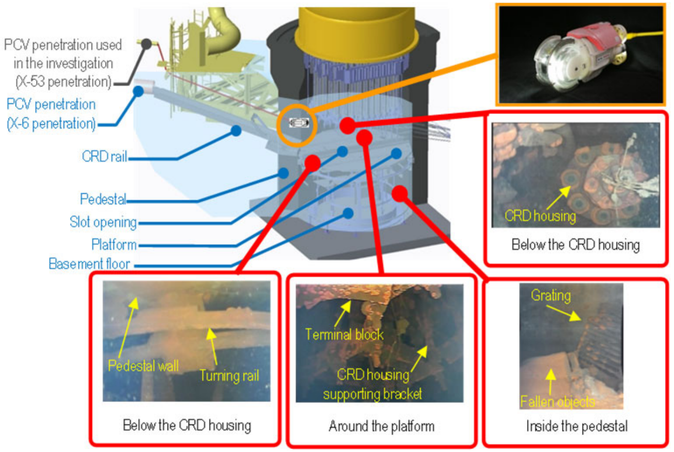
・In October 2014, the conditions of X-53 penetration, which may be under water and which is scheduled for use to investigate the inside of the PCV, was investigated via remote-controlled ultrasonic test equipment. The results showed that the penetration was not under water.

・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 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

Reference
September 29, 2022
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)

★ 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

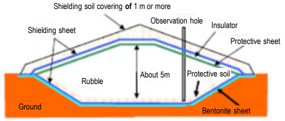
▼ 2015.6 Transfer start of rubble to the soil-covered temporary storage facility (Tank 3)

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

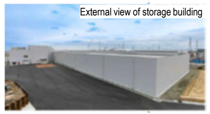
▼ 2019.6 Start of building construction

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

▼ 2018.2 Operation start

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

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

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

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

▼ 2013.5 Installation work gets underway

Solid Waste Incinerator

▼ 2016.3 Operation start

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

▼ 2017.4 Start of pre-work

Additional Solid Waste Incinerator

▼2022.5 Start of operation

2017.10 Installation work gets

▼ 2018.5 Operation start

Large Equipment Decontamination Facility

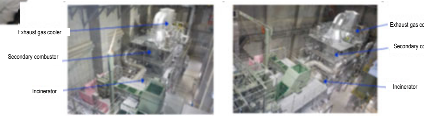
▼ 2020.9 Start of pre-work

Compaction Facility

Whole view of Solid Waste Incinerator

Electrical room

Control room



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

Site of Volume Reduction Faciility

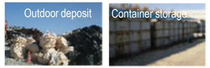
Present status Note

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)

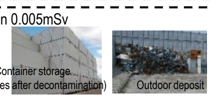


Rubble (metal, concrete, others)

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

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

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

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

Status after a decade

Legend 🟨: Newly installed equipment and facility

To (A)
(*1)

Incineration

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

Crusher example

Radioactive Waste Incinerator

Additional Radioactive Waste Incinerator

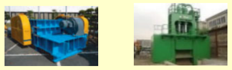
Stored and managed in Solid Waste Storage as done for rubble

Additional Radioactive Waste Incinerator

To (A)
(*1)

Volume reduction

Compaction Facility
(scheduled for completion in FY2022)



Concrete crusher example
Metal cutter example

Melting

Melting equipment

Electric furnace example

To (B)

Treatment measures and others will be examined

(*3)
Approx.
270,000 m³
(*2)

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

Storage /management

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

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

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

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

Reuse will be examined

Spent Adsorption Vessel Temporary Storage

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

Work of main part

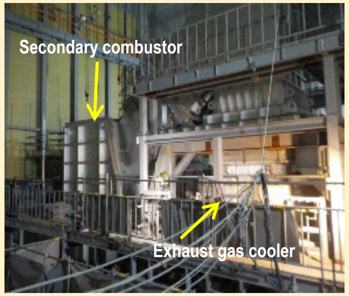
(*1) Items for which incineration, compaction, melting or reuse is difficult are stored directly in Solid Waste Storage without being treated
(*2) As values less than 10,000 m³ are rounded, they may not be consistent with the total of breakdown
(*3) In the estimate, approx. 240,000 m³ of waste will be stored in Solid Waste Storage at the end of FY2028.

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

●Efforts to eliminate temporary outdoor storage of rubble and others

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

Whole view of the Additional Solid Waste Incinerator Building



Main equipment

6 Improvement of work environment

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

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

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.

External view of Access Control Facility

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

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

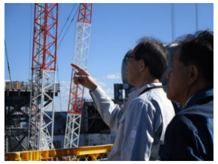
In March 2015, the Fukushima revitalization meal service center opened.

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

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

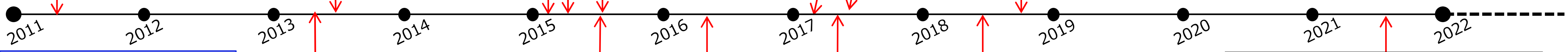
In May 2017, a heliport for emergency transport was installed inside the Fukushima Daiichi NPS and went into operation.
Compared to the previous operation (at Koriyama Coast, Futaba Town or Fukushima Daini NPS, relaying to a doctor helicopter), a faster response is available for seriously ill patients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

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



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

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



Changes in operation of controlled area

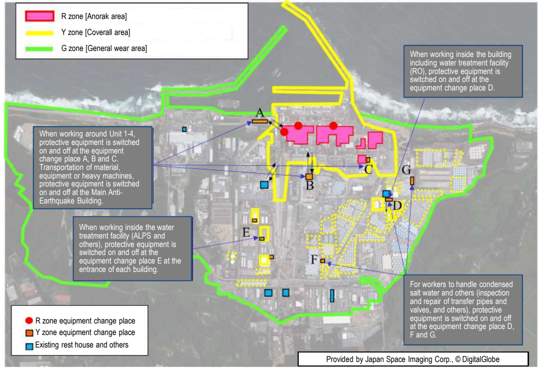
From May 2013, full-face mask unnecessary area was expanded sequentially.

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.



When working around Unit 1-4, protective equipment is switched on and off at the equipment change place A, B and C. Transportation of material, equipment or heavy machines, protective equipment is switched on and off at the Main Anti-Earthquake Building.

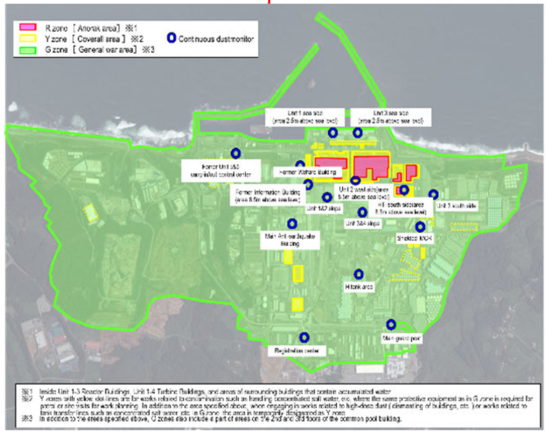
When working inside the building including water treatment facility (RO), protective equipment is switched on and off at the equipment change place D.

When working inside the water treatment facility (ALPS and others), protective equipment is switched on and off at the equipment change place E at the entrance of each building.

For workers to handle condensed salt water and others (inspection and repair of transfer pipes and valves, and others), protective equipment is switched on and off at the equipment change place D, F and G.

Provided by Japan Space Imaging Corp., © DigitalGlobe

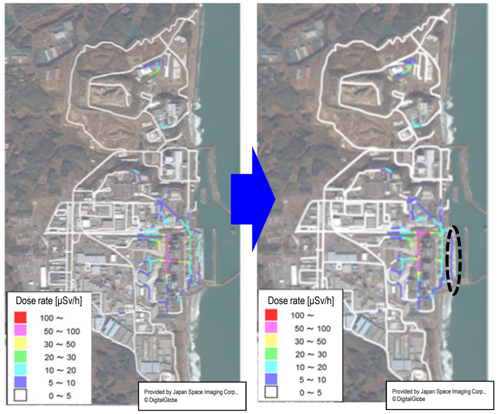
In March 2016, based on the progress of measures to reduce the environmental dosage on site, the site was categorized into two zones: Highly contaminated area around Unit 1-4 buildings, etc. and other areas where limited operation started to optimize protective equipment according to each category.



※1 Inside Unit 1-3 Reactor Buildings, Unit 1-4 Turbine Buildings, and areas of surrounding buildings that contain accumulated water
※2 Y zones with yellow dot-lines are for works related to contamination such as handling concentrated salt water, etc. where the same protective equipment as in G zone is required for patrol or site visits for work planning. In addition to the area specified above, when engaging in works related to high-dose dust (dismantling of buildings, etc.) or works related to tank transfer lines such as concentrated salt water, etc. in G zone, the area is temporarily designated as Y zone.
※3 In addition to the areas specified above, G zones also include a part of areas on the 2nd and 3rd floors of the common pool building.

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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