# Outline of Decommissioning, Contaminated Water and Treated Water Management

December 22, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

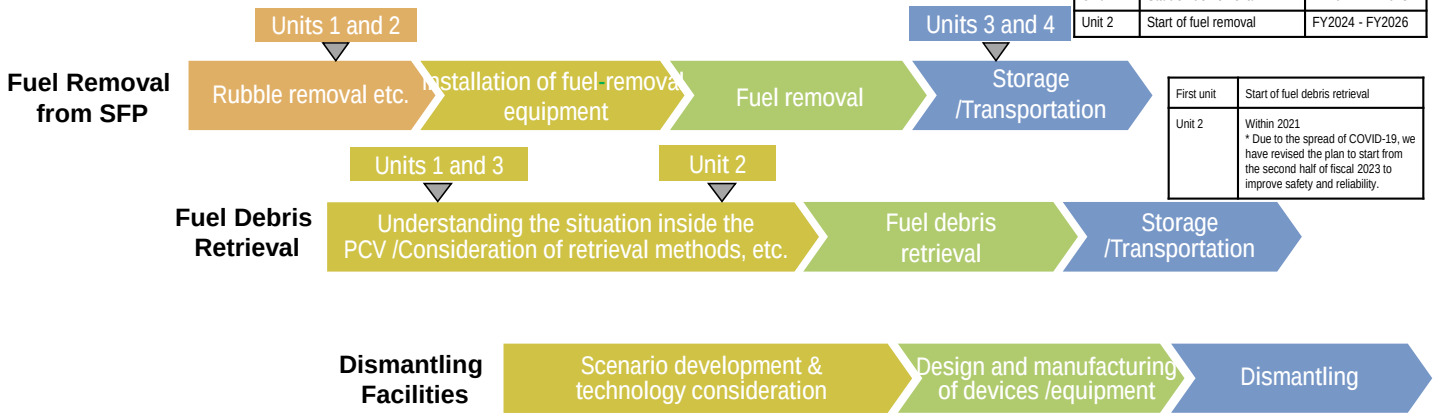
## Main decommissioning work and steps

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 |

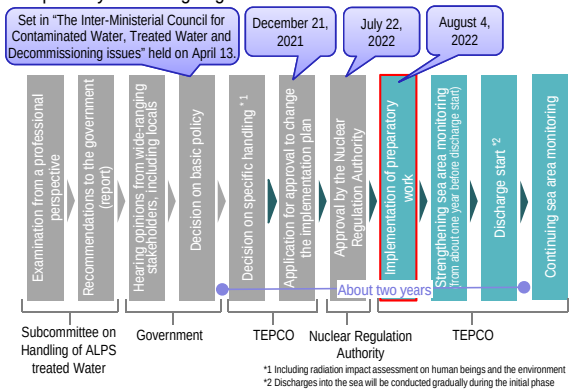



| | |
|---|---|
| First unit | Start of fuel debris retrieval |
| Unit 2 | Within 2021<br>* Due to the spread of COVID-19, we have revised the plan to start from the second half of fiscal 2023 to improve safety and reliability. |

## Measures for treated water

### Handling of ALPS treated water

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




*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

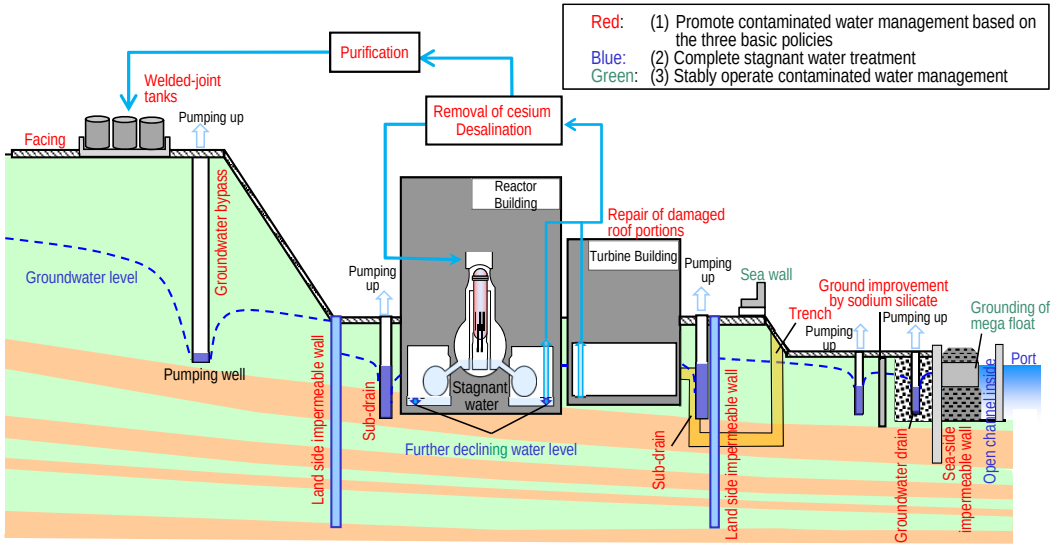
- Strontium-reduced water from other equipment is being re-treated in the Advanced Liquid Processing System (ALPS: multi-nuclide removal equipment) and stored in welded-joint tanks.
- Multi-layered contaminated water management measures, including land-side impermeable walls and sub-drains, have stabilized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

◆ 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.

## Substantiation of measures to further reduce contaminated water generated

On December 21st, the 26th Committee on Countermeasures for Contaminated Water Treatment (Chairperson: Dr. Yuzo Onishi) was held and discussed the substantiation of measures to further reduce contaminated water generated.

In FY2022, as well as the effects of existing multi-layered measures, facing and other measures further progressed. In conjunction with low rainfall, the average contaminated water generated during April – November remained constant at about 100 $m^3$/day.

TEPCO presented the outlook that by 2025, through measures including completing 50% of facing and installing the roof cover over the Unit 1 Reactor Building, the target of the Mid-and-Long-Term Roadmap, namely to suppress contaminated water generated to 100 $m^3$/day or lower, would be achieved and that by 2028, by measures including completing 80% of facing and locally stopping water in buildings, the volume of contaminated water generated would be reduced to about 50-70 $m^3$/day.

In response, as the Committee, opinions such as requesting, as well as providing accurate and transparent information at home and abroad and striving as far as possible to implement measures steadily without delay were concluded. As mid- and long-term issues, an examination of drastic water stoppage in buildings, while striving for consistency with the progress of the overall decommissioning process, such as fuel debris retrieval, was requested.

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

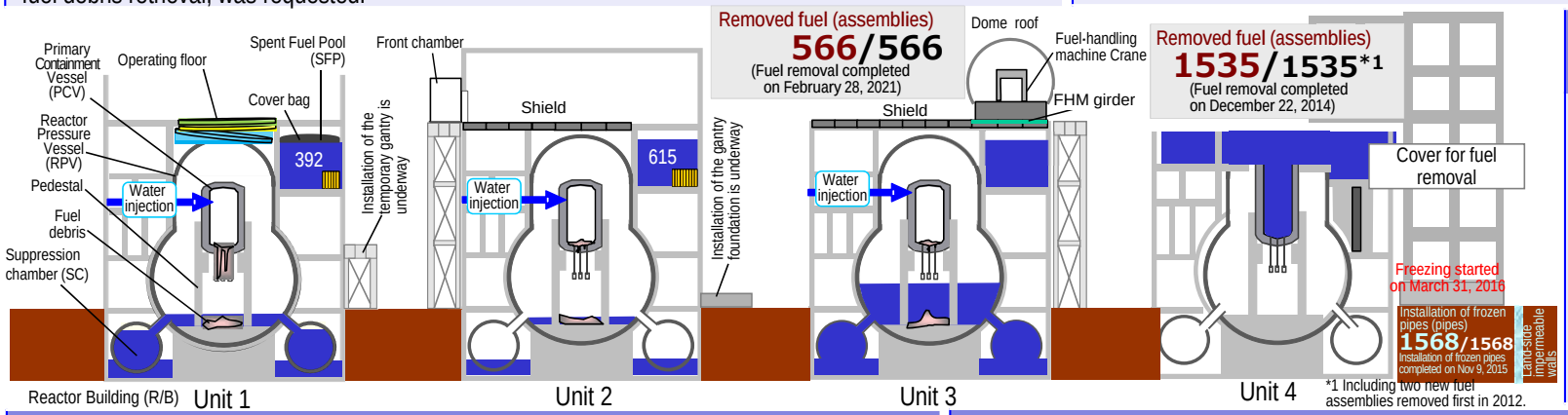
In the Unit 1 PCV internal investigation, regarding the deposit debris detection (gamma-ray nuclide analysis) by ROV-D, all eight points were measured during the period December 6-9.

At present, assessment such as gamma-ray nuclide analysis was completed for two of the eight points, from which data showing a high likelihood of debris was acquired. By assessing the remaining six points on an ongoing basis, debris distribution will also be assessed.

Moreover, from December 12, the preliminary work for deposit sampling investigation by ROV-E was conducted and the investigation will start from mid-January.

Since all images acquired in the first-half investigation conducted during the period February-June 2022, as preparation for publishment were completed, they are being provided at the Nuclear Information Corner at the Head Office of the Tokyo Electric Power Company Holdings, Inc. from December 12.

Nuclear Information Corner
https://www.tepco.co.jp/electricity/mechanism_and_facilities/power_generation/nuclear_power/info-j.html




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

## Unit 2 Investigation of the basement floor of the Reactor Building

It is considered that in Unit 2, the Reactor Core Isolation Cooling System (RCIC) operated for about three days, even after the tsunami arrival. To clarify why the RCIC stopped, an investigation inside the RCIC room, which is located on the basement, is being examined.

Given the present difficulty in accessing the RCIC room, as the preliminary investigation, the status of the basement floor is being investigated from December to check any equipment damage that could be hindering access.

## Status regarding the rearing test of marine organisms

To eliminate concerns and reassure those in society, a rearing test for flounder and abalones in seawater with ALPS treated water added and normal seawater for comparison is underway.

Regarding the test of flounder, in the case of seawater with ALPS treated water (tritium concentration: less than 1,500 Bq/L), as with the previous insight, it was confirmed that the tritium concentration in the body did not exceed that in the growing environment and that following the transfer to normal seawater, the tritium concentration in the body declined. In the next, the same verification will be conducted for abalones.

In addition, from November 30, a rearing test of flounder in seawater, adjusted to a tritium concentration of about 30 Bq/L, also started.

The status of the rearing test continues to be clearly conveyed through the website, live camera, rearing diary and others.

Marine organism rearing test live camera
https://www.youtube.com/channel/UCLEn8NHHX2WrMvn6ZYfAjJA

## Enhancement of the analysis scheme for decommissioning and others of the TEPCO Fukushima Daiichi Nuclear Power Station

On December 19, the Commission on Supervision and Evaluation of the Specified Nuclear Facilities was held and discussed enhancement of the analysis scheme for decommissioning and others of the Fukushima Daiichi Nuclear Power Station.

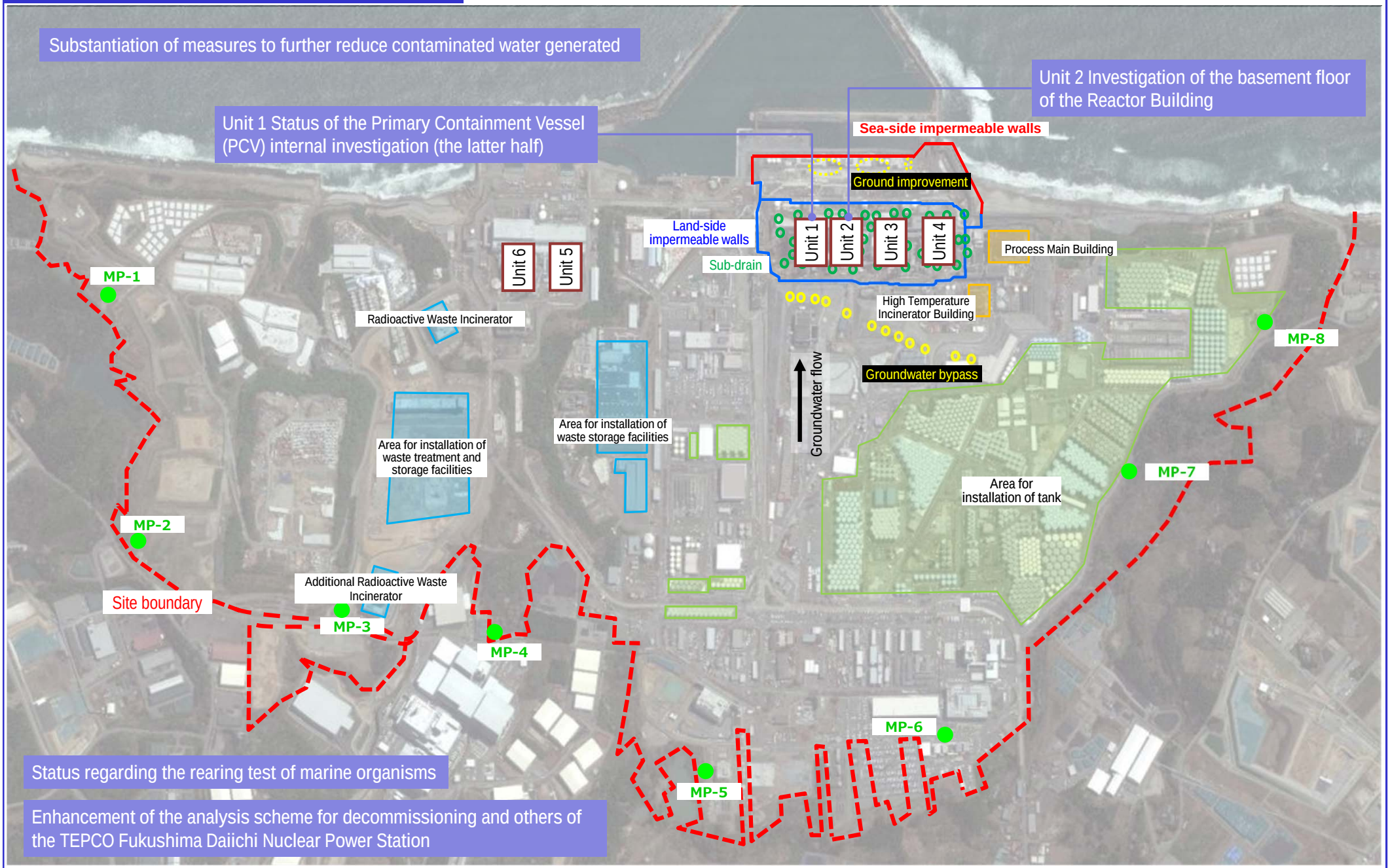
To “store and manage” a large amount of generated waste and subsequently “treat and dispose of that,” TEPCO proceeds with work to clarify the analysis needs along the decommissioning timeline; based on the analysis needs, formulate the analysis plan; identify substantial proficiencies for human resources with high technical capability and skills; and quantify the amount of human resources and the time it will be required.

Moreover, to steadily implement analysis for decommissioning, analysis and assessment methods are being developed by JAEA and others, analysis institutes are being secured and human resources are being developed and secured.

Regarding the development and securing of human resources in particular, the “analysis support team” integrating researchers and engineers with abundant experience and insight into analytical practices in Japan is organized and a curriculum is formulated with the aim of fostering analysis workers who will be engaged in solid waste analysis in the Fukushima Institute for Research, Education and Innovation (F-REI) to be established, to prepare for training.

These measures and examinations will steadily be realized and stakeholders will be united to proceed with decommissioning.

# Major initiatives – Locations on site

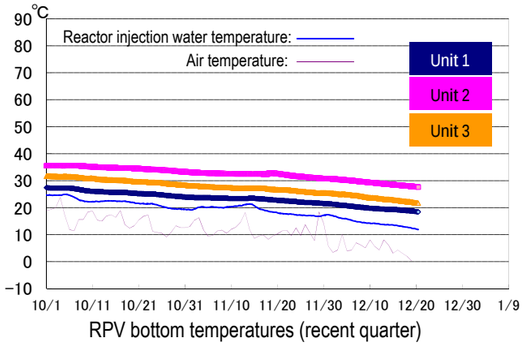



Provided by Japan Space Imaging Corp., photo taken on April 8, 2021
Product (C) [2020] DigitalGlobe, Inc., a Maxar company

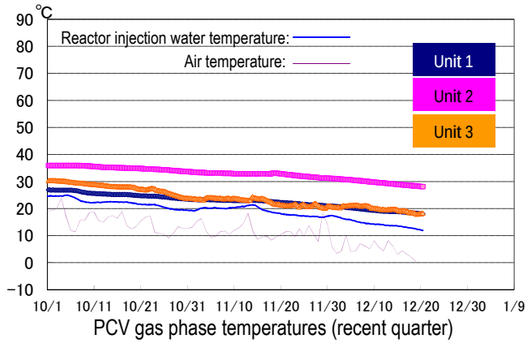
# I. Confirmation of the reactor conditions

## Temperatures inside the reactors

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

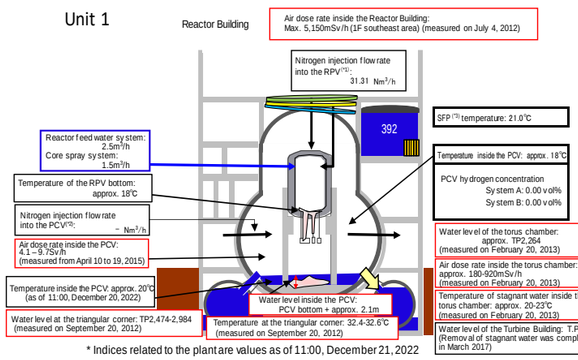



RPV bottom temperatures (recent quarter)

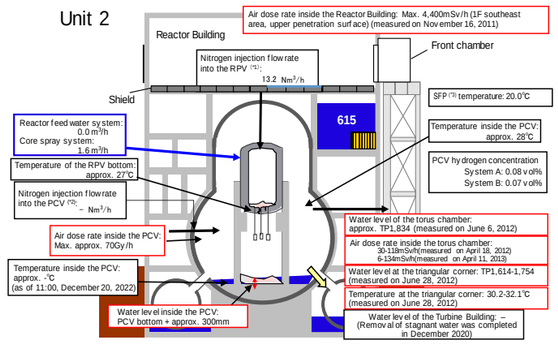



PCV gas phase temperatures (recent quarter)

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




* Indices related to the plant are values as of 11:00, December 21, 2022

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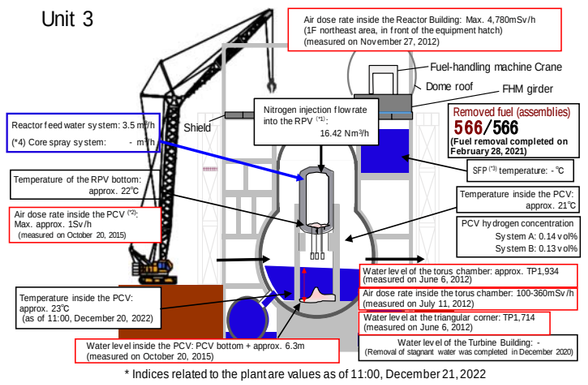


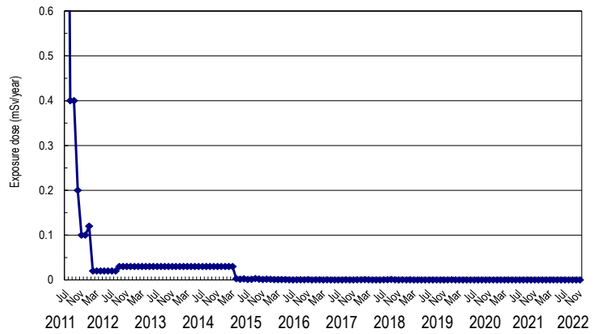

* Indices related to the plant are values as of 11:00, December 21, 2022

(*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 November 2022, the concentration of radioactive materials newly released from Reactor Building Units 1-4 into the air and measured at the site boundary was evaluated at approx. $1.6 \times 10^{-12}$ Bq/cm$^3$ and $1.7 \times 10^{-12}$ Bq/cm$^3$ for Cs-134 and -137 respectively, while the radiation exposure dose due to the release of radioactive materials there was less than 0.00003 mSv/year.

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




**(Reference)**

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

* Data of Monitoring Posts (MP1-MP8).
Data of Monitoring Posts (MPs) measuring the air dose rate around the site boundary showed 0.314 – 1.065 μSv/h (November 22 – December 20, 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.

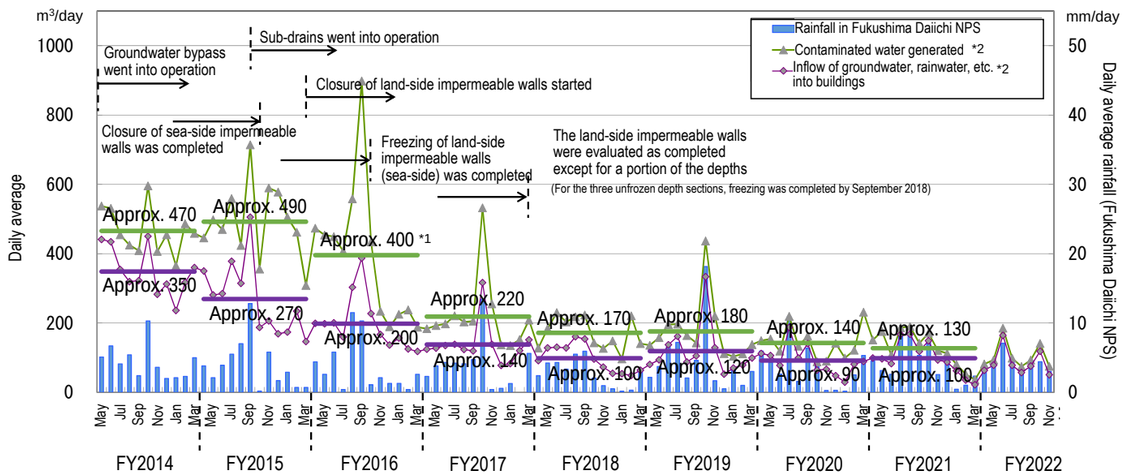
Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

# 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 m$^3$/day.
- Measures will continue to further reduce the amount of contaminated water generated.




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

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

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

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

- At the Water-Treatment Facility Special for Sub-drain & Groundwater drains, release started from September 14, 2015 and up until December 13, 2022, 2,063 release operations had been conducted.
  The water quality of all temporary storage tanks satisfied the operational target.

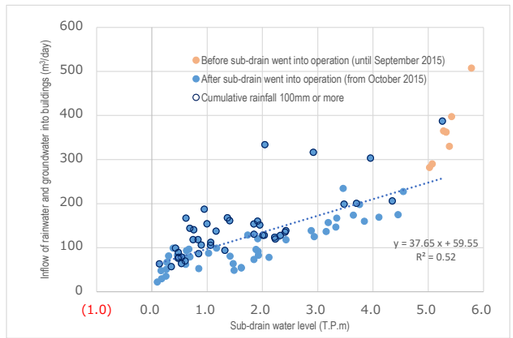



Figure 2: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Units 1-4 sub-drains

## ➢ Implementation status of facing

- Facing is a measure that involves asphalting the on-site surface to reduce the radiation dose, prevent rainwater infiltrating the ground and reduce the amount of underground water flowing into buildings. As of the end of November 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 November 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 each year due to the land-side impermeable walls and the decline in the set water level of the sub-drains. On the mountain side, the average difference between the inside and outside has remained at 4-5 m. The water level in the bank area has also remained low (T.P. 1.4 m) relative to the ground surface (T.P. 2.5 m).
- As the set water level of the sub-drains declined slightly (T.P. -0.55 ⇒ -0.65 m) and others in FY2021, the groundwater level on the sea side of the Unit 1-4 buildings remained low (except during heavy rainfall) compared to the T.P. 2.5 m area.

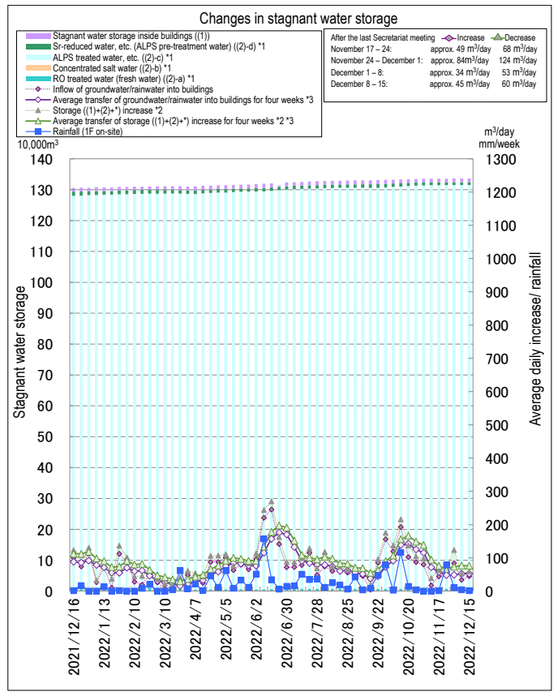
## ➢ Operation of the multi-nuclide removal equipment

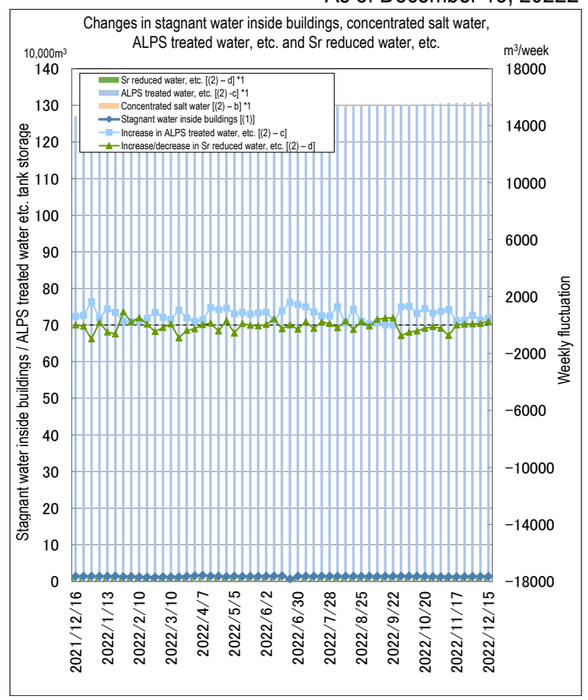
- Regarding the multi-nuclide removal equipment (existing), hot tests using radioactive water are ongoing (System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013). On March 23, 2022, a pre-service inspection certificate was granted by the Nuclear Regulation Authority and the entire pre-service inspection was completed. The multi-nuclide removal equipment (additional) went into full-scale operation from October 16, 2017. Regarding the multi-nuclide removal equipment (high-performance), hot tests using radioactive water have been underway (from October 18, 2014).
- As of December 15, 2022, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 494,000, 745,000 and 104,000 m$^3$, respectively (including approx. 9,500 m$^3$ stored in the J1(D) tank, which contained water with highly concentrated radioactive materials at the System B outlet of the existing multi-nuclide removal equipment).
- Treatment measures comprising the removal of strontium by cesium-adsorption apparatus (KURION), the secondary cesium-adsorption apparatus (SARRY) and the third cesium-adsorption apparatus (SARRY II) continued. Up until December 15, 2022, approx. 697,000 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 December 15, 2022, approx. 864,000 m$^3$ had been treated.

As of December 15, 20222




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

Figure 3: Status of stagnant water storage

## ➢ Temporary transfer of treated water to be re-purified to secure freshwater

- As the contaminated water management has progressed, contaminated water generated this fiscal year has been largely suppressed. (This may be potentially attributable to the less frequent occurrence of torrential rains like typhoons)
- On the other hand, with a decline in the volume of contaminated water generated, the freshwater purification volume also decreased. Storage in the freshwater storage tank in the area 33.5 m above sea level declined compared to previous years.
- At the same time, during the internal investigation of Unit 1 Primary Containment Vessel (PCV), which was underway since early December, work to increase the water injection rate into the reactor proceeded, which is one reason why the storage in the freshwater storage tank declined.
- If it becomes difficult to inject water into the reactor from the freshwater storage tank, filtered water can be used and facilities for this case have also been prepared, but the impact on the ALPS treated water tank capacity needs to be considered.
- To fully prepare for an increase in reactor injection water when the PCV water level declines after a large earthquake and ensure the Unit 1 PCV internal investigation is comprehensive, a portion of the treated water to be re-purified and stored in the ALPS treated water tank will be temporarily transferred to the waste liquid supply tank and subject to RO treatment to secure the storage volume in the freshwater purification tank. (The transfer will start from around February 2023.)
- This work will suppress any increase in contaminated water by using filtered water and reduce the amount of treated water to be re-purified eventually.

## ➢ Collection status of resin leaking from the Reactor Water Clean-up System spent resin tank room in the Unit 3 Filter Sludge Tank Room (FSTR) building

- On September 1, 2020, leakage of waste liquid and spent resin was detected from pipes connected with the Reactor Water Clean-up System spent resin storage tanks on the basement floor of the Unit 3 FSTR building.
- Work to collect spent resin having leaked and transfer it to the waste sludge storage tank (B) of the FSTR building started from June 2021 and was completed at the end of November 2022.
- As future management, to detect any minor leakage from the source tank at an early stage, the quality of the floor sump water will be periodically checked and time-based maintenance applied for the tank to prevent leakage.

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

- The concentration of tritium in seawater within 2km of the port has remained constant over the past year and also low at new measurement points within the fluctuation range of seawater in Japan*. The concentration of Cesium-137 increased temporarily, which was considered due to rainfall, as applied to the past fluctuation in seawater around the Fukushima Daiichi Nuclear Power Station. However, it remained constant relative to measurement benchmarks for the past year and at new measurement points and also 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*.
- The concentration of tritium in seawater further than 20km from the coast remained low, including at new measurement points, within the fluctuation range of seawater in Japan*. The concentration of Cesium-137 remained constant over the past year within the fluctuation range of seawater in Japan*.

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

In Japan (including off the coast of Fukushima Prefecture):
Tritium concentration: 0.043 - 20 Bq/L
Cesium-137 concentration: 0.0010 - 0.45 Bq/L
Off the coast of Fukushima Prefecture
Tritium concentration: 0.043 – 2.2 Bq/L
Cesium-137 concentration: 0.0010 - 0.45 Bq/L
Source: Environmental Radioactivity and Radiation in Japan, Environmental Radiation Database
https://www.kankyo-hoshano.go.jp/data/database/

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

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

  In Japan (including off the coast of Fukushima Prefecture)
  Tritium concentration: 0.064 – 0.12 Bq/L

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

- For the measurement and confirmation/transfer facilities, work to install a pipe support, piping and others for these facilities started from August 4 from around the K4 area tanks.
- For the discharge facility, a bedrock layer is being drilled by the shield machine from August 4 to start construction of the discharge tunnel. At present, no water leakage or other phenomena have been detected within the drilling range. Previously, construction of the downstream pool started from December 18.
- For the dilution facility, precast blocks for the discharge shaft (upper stream pool) have been manufactured since September 14 at a factory within Fukushima Prefecture and ground improvement for that shaft, which has also been conducted since October 7 as part of seismic countermeasures, was completed. Construction of the upper stream pool started from December 14.
- From August 4, as part of efforts to install 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, sedimentation inside the open intake channels is being removed simultaneously and after installing the partition weir, anti-permeation work will be removed.
- As part of the marine construction, during work to install the outlet caisson, seawater was sampled to confirm that the work did not involve any increase in cesium concentration in seawater. All the monitoring results until December 10 showed “Not Detected (ND)” and no significant fluctuation was detected in the cesium concentration in seawater. Seawater monitoring during marine construction offshore of the power station continues.

# 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 preliminary 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 is also being installed from the portion where anchors and base plates are 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.

## ➢ 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 highest level of dose was observed, was completed at the end of May 2022. Due to interference with the installation of the new fuel-handling machine, work to remove the control room of the fuel-handling machine (hereinafter FHM control room) has been underway since August. Once the removal of the FHM control room is complete, preliminary work to dismantle the existing facility on the south side will commence (rearrangement of site, inspection of remotely operated heavy machinery (annual inspection) and measures to prevent scattering of rubble and dust).
- Outside the building, construction of a gantry foundation has been underway since June 2022. After the construction is completed, the erection of a steel structure will commence. Outside the site, before erecting the steel structure on-site, ground assembly continues.

## ➢ Status of on-site transportation of spent fuel from the common pool to the Temporary Cask Custody Area

- To make space in the common pool to accommodate the Unit 6 spent fuel, work is underway to load spent fuel having been stored in the common pool with the 22 dry casks and transport them on site from the common pool building to the Temporary Cask Custody Area.
- Fuel loading of three dry casks was completed but the airtightness of the three exceeded the criteria. After removing fuel from the cask and cleaning the fuel top, two of the three casks satisfied the criteria and were transported to the

Temporary Cask Custody Area. For the third cask, the airtightness will be rechecked after the fuel removal and the fuel top re-cleaned.

- After observing the dry cask, the unsatisfied airtightness of the primary lid was considered attributable to iron oxide (clad) or calcium component (particle or ion) used when attaching the primary lid in the pool penetrating the flange face and turning into a foreign object.
- At present, the establishment of additional procedures to ensure airtightness is being examined. Based on these, the time when removal of Unit 6 spent fuel is completed is being reviewed.

Retrieval of fuel debris

### ➢ Unit 1 PCV internal investigation (the latter half)

- Regarding the deposit debris detection (gamma-ray nuclide analysis) by ROV-D, all eight points were measured during the period December 6-9.
- At present, operation of the equipment is being verified prior to injecting the succeeding machine ROV-E, aiming to start deposit sampling by ROV-E from mid-January 2023.

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

- Using the Naraha mockup facility, a mockup test simulating the actual site is underway.
- At present, after modifying the control program to position the arm more accurately, permeability test etc. using the X-6 penetration mockup continues.
- For improvements extracted in the performance verification test at Naraha, measures and improvement will continue to be implemented.
- Regarding work to install an isolation room as a boundary while opening the X-6 penetration, bubble generation from the shielding door when the installation status was verified (verification of pressurization), was investigated. The investigative results suggested that it was considered attributable to the pressing mechanism of the shielding door.
- Work continues safely and carefully.

### ➢ Recent results concerning dose measurement and assessment as part of efforts to examine the process of fuel debris retrieval

- The Japan Atomic Energy Agency (JAEA) has conducted research and development to assess the dose rate, conduct remote, on-site, swift and simple analysis and visualize radiation sources required when examining fuel debris retrieval methods and working to retrieve fuel debris.
- Dose rate assessment technology which visualized the dose rate distribution inside the Primary Containment Vessel was utilized to formulate a work plan for the investigation inside the Unit 2 reactor well. Moreover, JAEA also developed mobile and radiation-resistant equipment for fuel debris remote, on-site, swift and simple analysis and an integrated Radiation Imaging System (iRIS) which provided mobile quick 3D visualization of the dose rate distribution and highly concentrated contaminated areas and confirmed the on-site applicability.
- To decontaminate the Fukushima Daiichi Nuclear Power Station in a safe and solid manner on an ongoing basis, the JAEA will proceed with the on-site application of research results and engage in research and development to flexibly meet new needs, such as issues emerging according to the progress of each unit, contribute to risk reduction such as a decline in exposure by the advanced visualization of radiation sources and others and help improve swiftness and rationality by advancing analysis technologies.

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

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

### ➢ Management status of rubble and trimmed trees

- As of the end of November 2022, the total storage volume for concrete and metal rubble was approx. 328,600m$^3$ (-800 m$^3$ compared to the end of October with an area-occupation rate of 88%). The total storage volume of trimmed trees was approx. 127,000m$^3$ (-900 m$^3$ with an area-occupation rate of 72%). The total storage volume of used protective clothing was approx. 18,900m$^3$ (-3,100m$^3$, with an area-occupation rate of 36%). The decrease in rubble was attributable to a transfer for area arrangement. As of the end of November 2022, there were six temporary deposits with storage capacity exceeding 1,000m$^3$, storage 56,400m$^3$.

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

- As of December 1, 2022, the total storage volume of waste sludge was 441 m$^3$ (area-occupation rate: 63%), while that of concentrated waste fluid was 9,395 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 5,472 (area-occupation rate: 87%).

### ➢ Status of the additional Radioactive Waste Incinerator in the Fukushima Daiichi Nuclear Power Station

- On December 7, when the waste supplier of the additional Radioactive Waste Incinerator was started up, abnormal vibration and floating of the electric motor was detected by the ITV screen of the control room and the waste supplier was suspended.
- The on-site investigation detected breakage or cracking in the welding part in two of the four mountain bolts which connected the electric motor base with the pedestal.
- Given the acknowledged need to investigate and repair, incineration was suspended the same day.
- Based on the investigative results, exposing the broken surface of the bolts, the cause was deemed to be metal fatigue. The electric motor repeated start up and shut down at regular intervals. The repeated burden on the bolt connection accelerated metal fatigue, weakened the bolt and consequently resulted in ductile breakage on December 7.
- On December 20, the units of the waste supplier were repaired and inspected and similar equipment was also checked. Ignition and heating of the burner started from around 9:00 pm on December 21 and incineration of trimmed trees resumed on the morning of December 22.
- While monitoring the dust concentration in the surrounding environment, work continues, prioritizing safety above all.

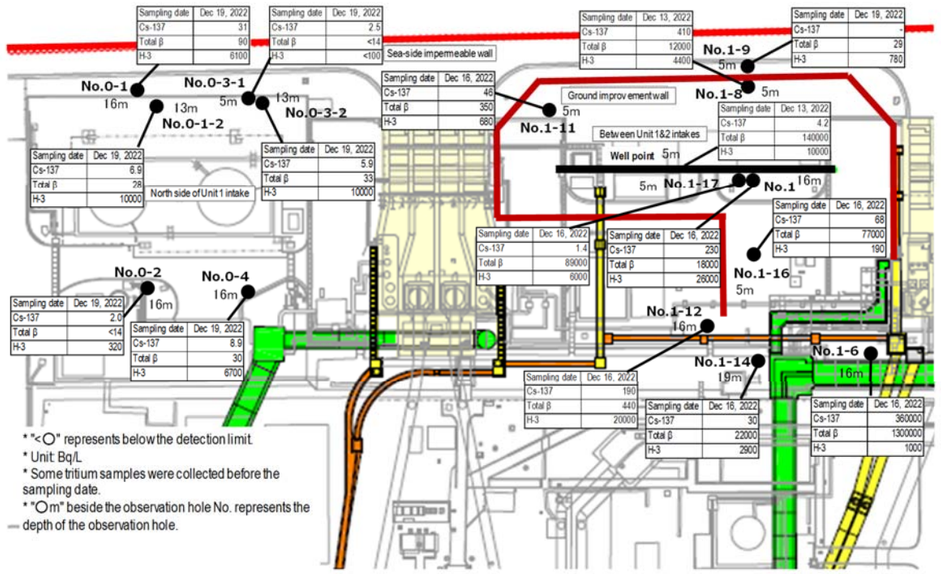
Reduction in radiation dose and mitigation of contamination

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

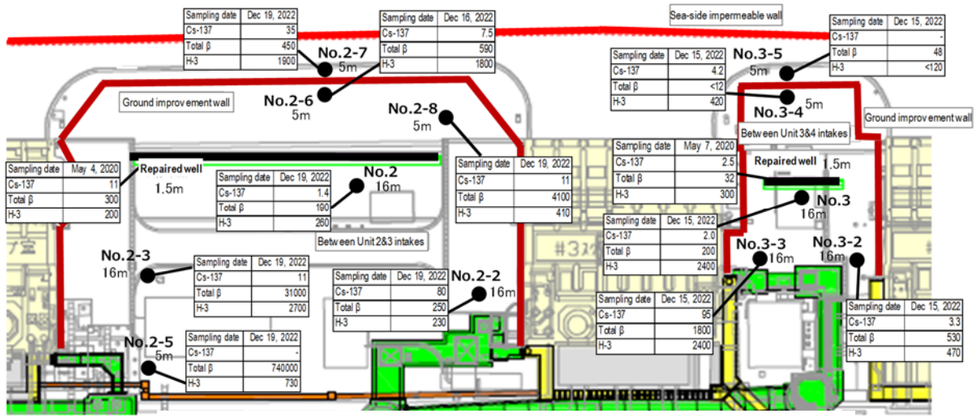
### ➢ Status of the groundwater and seawater on the east side of Turbine Building Units 1-4

- In the Unit 1 intake north side area, the H-3 concentration was below the legal discharge limit of 60,000 Bq/L at all observation holes and remained constant or has been declining overall. The concentration of total β radioactive materials has remained constant overall but increased temporarily from April 2020 and is even increasing or declining at many observation holes at present, including Nos. 0-1-2, 0-3-1, 0-3-2 and 0-4. The trend continues to be monitored carefully.
- In the area between the Unit 1 and 2 intakes, the H-3 concentration has remained below the legal discharge limit of 60,000 Bq/L at all observation holes. It has been increasing or declining at Nos. 1-14 and 1-17 but has otherwise remained constant or been declining overall. The concentration of total β radioactive materials has remained constant overall but been increasing or declining at many observation holes, including Nos. 1-6, 1-9, 1-11, 1-12, 1-14, 1-16 and 1-17. The trend continues to be monitored carefully.
- In the area between the Unit 2 and 3 intakes, the H-3 concentration has been below the legal discharge limit of 60,000 Bq/L at all observation holes. It has been increasing and declining at Nos. 2-3, 2-5, 2-6 and 2-7 but has remained constant overall. The concentration of total β radioactive materials has remained constant overall but been increasing or declining at No. 2-5. The trend continues to be monitored carefully.
- In the area between the Unit 3 and 4 intakes, the H-3 concentration has been below the legal discharge limit of 60,000 Bq/L at all observation holes and remained constant or been declining overall. The concentration of total β radioactive materials has remained constant overall but has been increasing or declining at many observation holes, including Nos. 3-4 and 3-5. The trend continues to be monitored carefully.

- In the groundwater on the east side of the Turbine Buildings, as with the total β radioactive materials, the concentration of cesium has also remained constant as the overall area but been increasing or declining and exceeded the previous highest record at some observation holes. Investigations into the fluctuation are underway for Nos. 0-3-2, 1, 1-6, 2-5, 2-6 and 3-3.
- The concentration of radioactive materials in drainage channels has remained constant overall, despite increasing during rainfall. In Drainage Channel D, drainage of the low-dose area on the west side of the site started to pass from August 30, 2022 and the concentration has remained low. From November 29, 2022, continuous monitors will be installed and drainage around the Units 1 and 2 switch yard will start to pass.
- In the open channel area of seawater intake for Units 1 to 4, the concentration of radioactive materials in seawater has remained below the legal discharge limit and been declining long term, despite temporary increases in Cs-137 and Sr-90 noted during rainfall. They have also been declining following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls. The concentration of Cs-137 has remained slightly higher in front of the south-side impermeable walls and slightly lower on the north side of the east breakwater since March 20, 2019, when the silt fence was transferred to the center of the open channel due to mega float-related construction.
- In the port area, the concentration of radioactive materials in seawater has remained below the legal discharge limit and been declining long term, despite temporary increases in Cs-137 and Sr-90 observed during rainfall. They have remained below the level of those in the Units 1-4 intake open channel area and been declining following the completed installation and connection of steel pipe sheet piles for the sea-side impermeable walls.
- In the area outside the port, regarding the concentration of radioactive materials in seawater, those of Cs-137 and Sr-90 declined and remained low after steel pipe sheet piles for the sea-side impermeable walls were installed and connected. Regarding the concentration of Cs-137, a temporary increase was sometimes observed on the north side of the Unit 5 and 6 outlets and near the south outlet due to the influence of weather, marine meteorology and other factors. Regarding the concentration of Sr-90, variation 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.




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




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

Figure 4: Groundwater concentration on the Turbine Building east side

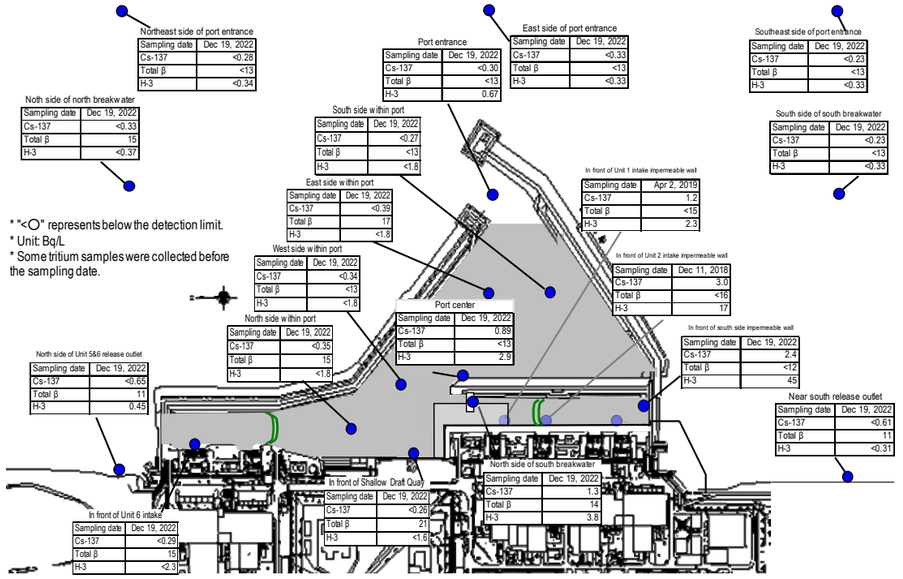



Figure 5: Seawater concentration around the port

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

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

### ➢ Staff management

- The monthly average total of personnel registered for at least one day per month to work on site during the past quarter from August to October 2022 was approx. 9,500 (cooperating company workers and TEPCO HD employees), which exceeded the monthly average workforce (approx. 7,300). Accordingly, sufficient personnel were registered to work on site.
- It was confirmed with the prime contractors that the estimated manpower necessary for the work in January 2023 (approx. 4,600 workers per day: cooperating company workers and TEPCO HD employees) would be secured at present. The average numbers of workers per day for each month (actual values) for the most recent 2 years were maintained, with approx. 3,000 to 4,600.
- The number of workers both from within and outside Fukushima Prefecture increased slightly. The local employment ratio (cooperating company workers and TEPCO HD employees) as of November 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.

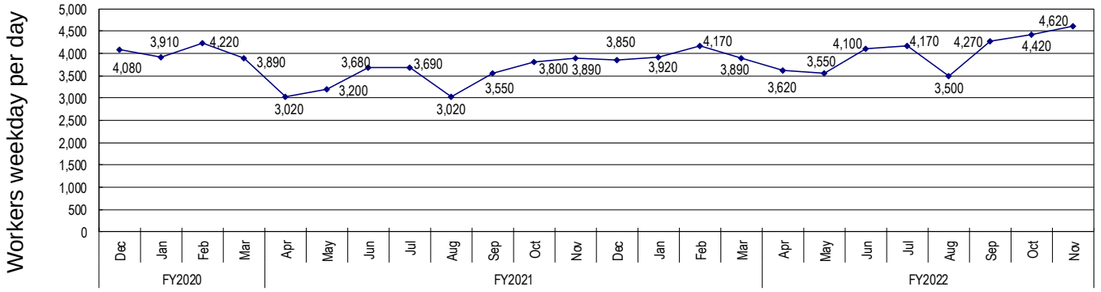



Figure 6: Changes in the average number of workers weekday per day for each month of the past 2 years (actual values)

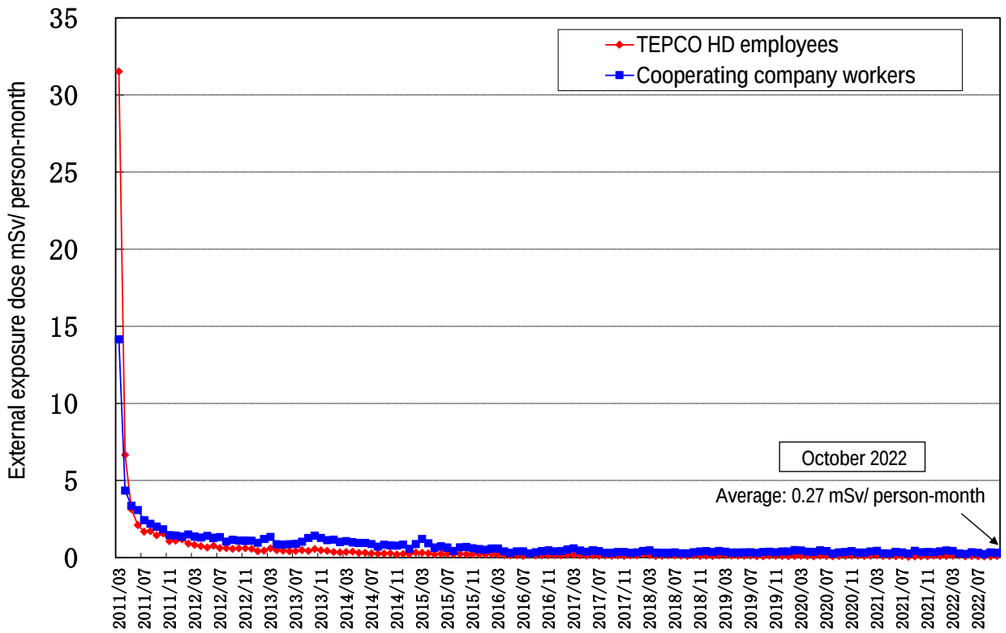



Figure 7: Changes in monthly average exposure dose of individual worker
(monthly exposure dose since March 2011)

## ➢ Results of the 13th questionnaire survey for workers to improve the work environment

- On August to September 2022, the 13th questionnaire survey was conducted as part of efforts to improve the work environment, to which approx. 4,690 workers (approx. 95.9%) responded.
- The results showed that many respondents assigned high marks in all questions about the present labor environment, evaluated their work in the Fukushima Daiichi Nuclear Power Station as rewarding and that the concerns of workers about radiation had been alleviated.
- TEPCO will continue to listen carefully to workers' opinions and requests, strive to improve the labor environment and create "a safe and comfortable-to-work workplace."

## ➢ Countermeasures to suppress the spread of COVID-19 infections

- Since late November, as across Japan and Fukushima Prefecture, infections have also been increasing in the Fukushima Daiichi Nuclear Power Station. In response, TEPCO HD employees on November 22 and cooperating company workers on November 24 were re-requested to thoroughly observe countermeasures to prevent COVID-19 infection spreading.
- 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, continued to be properly implemented to proceed with decommissioning work, prioritizing safety above all.
- As of December 21, 2022,
  (1) 1,583 workers (including 246 TEPCO HD employees, 1, 332 cooperating company workers, 3 business partner company employees and 2 temporary workers) of the Fukushima Daiichi Nuclear Power Station had contracted COVID-19, an increase in 172 workers (including 46 TEPCO HD employees and 126 cooperating company workers) from the figures in the previous published material (as of November 23).
  (2) Regarding the workplace vaccination program of COVID-19 (for the omicron variant), which has been implemented since November 28, 2022, 1,704 workers (including 429 TEPCO HD employees and 1,275 cooperating company workers) had been vaccinated.
- No significant influence on decommissioning work, such as a corresponding delay to work processes due to this infection, had been identified.

## ➢ Measures to prevent infection and expansion of influenza and norovirus

- Since November, measures for influenza and norovirus have been implemented, including free influenza vaccinations (subsidized by TEPCO HD) at medical clinics around the site (from October 11, 2022 to January 28, 2023) for cooperating company workers. As of December 17, 2022, a total of 4,121 workers had been vaccinated. In addition, a comprehensive range of other measures is also being implemented, including daily actions to prevent infection and expansion (measuring body temperature, health checks and monitoring infection status) and response after detecting possible infections (swift exit of possible patients and control of entry, mandatory wearing of masks in working spaces, etc.).

## ➢ Status of influenza and norovirus cases

- Until the 50th week of 2022 (December 12-18, 2022), no influenza and 1 norovirus infection were recorded. The totals for the same period for the previous season also showed no influenza and 1 norovirus infections.

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

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

"The highest value" → "the latest value (sampled during November 28 - December 12)"; unit (Bq/L); ND represents a value below the detection limit

**Summary of TEPCO data as of December 13, 2022**

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

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | ND(0.37) | | | |
| Cesium-137 | : | ND(0.33) | | | |
| Total β | : | ND(14) | | | |
| Toritium | : | 1.6 | ※1 | | |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 3.3 (H25/12/24) | → | ND(0.27) | Below 1/10 |
| Cesium-137 | : | 7.3 (H25/10/11) | → | ND(0.30) | Below 1/20 |
| Total β | : | 69 (H25/8/19) | → | ND(14) | Below 1/4 |
| Toritium | : | 68 (H25/8/19) | → | ND(0.33) | Below 1/200 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 3.3 (H25/10/17) | → | ND(0.25) | Below 1/10 |
| Cesium-137 | : | 9 (H25/10/17) | → | ND(0.39) | Below 1/20 |
| Total β | : | 74 (H25/8/19) | → | ND(14) | Below 1/5 |
| Toritium | : | 67 (H25/8/19) | → | ND(1.9) | Below 1/30 |

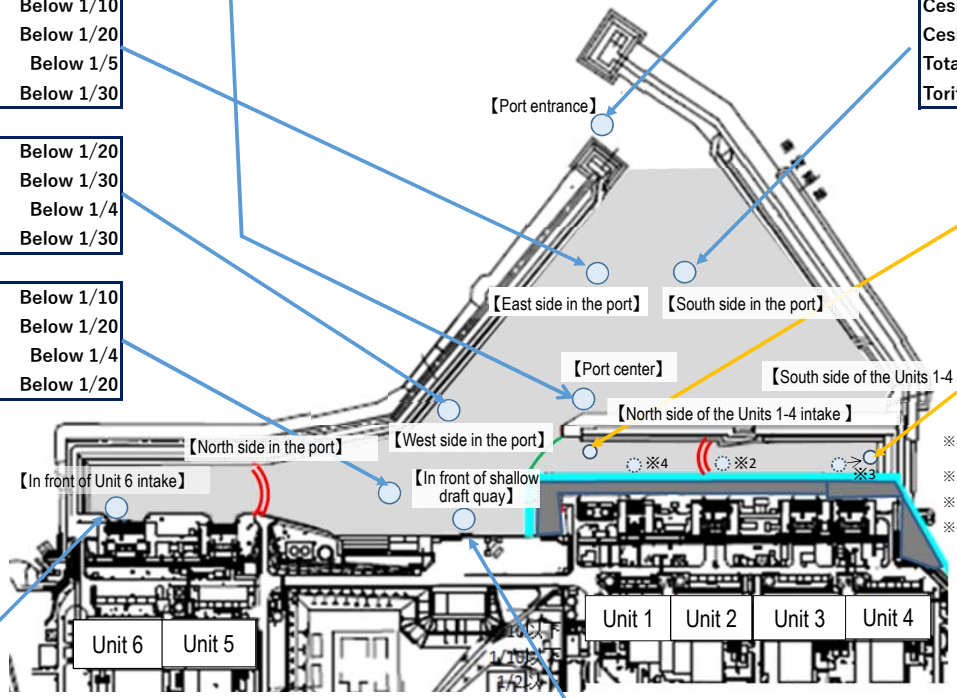
| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 3.5 (H25/10/17) | → | ND(0.31) | Below 1/10 |
| Cesium-137 | : | 7.8 (H25/10/17) | → | ND(0.36) | Below 1/20 |
| Total β | : | 79 (H25/8/19) | → | ND(14) | Below 1/5 |
| Toritium | : | 60 (H25/8/19) | → | ND(1.9) | Below 1/30 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 4.4 (H25/12/24) | → | ND(0.19) | Below 1/20 |
| Cesium-137 | : | 10 (H25/12/24) | → | ND(0.31) | Below 1/30 |
| Total β | : | 60 (H25/7/4) | → | ND(14) | Below 1/4 |
| Toritium | : | 59 (H25/8/19) | → | ND(1.9) | Below 1/30 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 32 (H25/10/11) | → | ND(0.26) | Below 1/100 |
| Cesium-137 | : | 73 (H25/10/11) | → | 1.2 | Below 1/60 |
| Total β | : | 320 (H25/8/12) | → | ND(13) | Below 1/20 |
| Toritium | : | 510 (H25/9/2) | → | ND(2.4) | Below 1/200 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 5 (H25/12/2) | → | ND(0.27) | Below 1/10 |
| Cesium-137 | : | 8.4 (H25/12/2) | → | 0.32 | Below 1/20 |
| Total β | : | 69 (H25/8/19) | → | ND(14) | Below 1/4 |
| Toritium | : | 52 (H25/8/19) | → | ND(1.9) | Below 1/20 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | ND(0.36) | | | |
| Cesium-137 | : | 1.8 | | | |
| Total β | : | ND(13) | | | |
| Toritium | : | 39 | ※1 | | |




Sea side impermeable wall
Silt fence
Silt fence for construction

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 2.8 (H25/12/2) | → | ND(0.30) | Below 1/9 |
| Cesium-137 | : | 5.8 (H25/12/2) | → | ND(0.29) | Below 1/20 |
| Total β | : | 46 (H25/8/19) | → | ND(13) | Below 1/3 |
| Toritium | : | 24 (H25/8/19) | → | ND(2.4) | Below 1/10 |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | : | 5.3 (H25/8/5) | → | ND(0.32) | Below 1/10 |
| Cesium-137 | : | 8.6 (H25/8/5) | → | 0.35 | Below 1/20 |
| Total β | : | 40 (H25/7/3) | → | ND(13) | Below 1/3 |
| Toritium | : | 340 (H25/6/26) | → | ND(1.6) | Below 1/200 |

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

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

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

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

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

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

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

Unit (Bq/L); ND represents a value below the detection limit; values in ( ) represent the detection limit; ND (2013) represents ND throughout 2013; The latest values sampled during November 28 - December 12)

Summary of TEPCO data as of December 13, 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(0.23) |
| Cesium-137 | ND | (H25) | → | ND(0.33) |
| Total β | ND | (H25) | → | ND(15) |
| 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(0.27) | Below 1/2 |
| Total β | ND | (H25) | → | ND(11) | |
| Toritium | 6.4 | (H25/10/18) | → | _ | |

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

| | | | | |
|---|---|---|---|---|
| Cesium-134 | ND | (H25) | → | ND(0.22) |
| Cesium-137 | ND | (H25) | → | ND(0.23) |
| Total β | ND | (H25) | → | ND(11) |
| Toritium | ND | (H25) | → | _ |

| | | | | |
|---|---|---|---|---|
| Cesium-134 | ND | (H25) | → | ND(0.30) |
| Cesium-137 | ND | (H25) | → | ND(0.29) |
| Total β | ND | (H25) | → | ND(19) |
| Toritium | 4.7 | (H25/8/18) | → | _ |

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

| | | | | |
|---|---|---|---|---|
| Cesium-134 | 3.3 | (H25/12/24) | → | ND(0.27) | Below 1/10 |
| Cesium-137 | 7.3 | (H25/10/11) | → | ND(0.30) | Below 1/20 |
| Total β | 69 | (H25/8/19) | → | ND(14) | Below 1/4 |
| Toritium | 68 | (H25/8/19) | → | ND(0.33) | Below 1/200 |

【Port entrance】

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

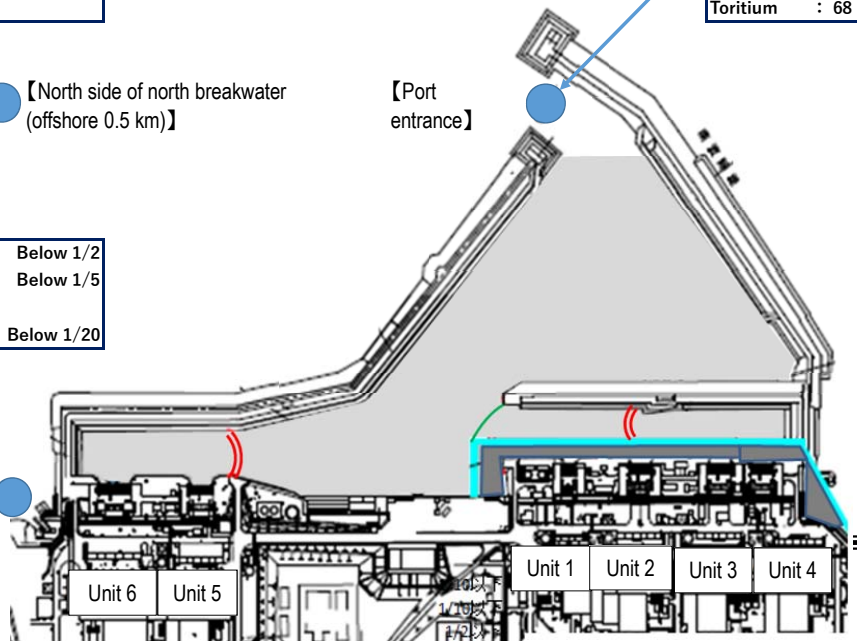
| | | | | |
|---|---|---|---|---|
| Cesium-134 | ND | (H25) | → | ND(0.33) |
| Cesium-137 | ND | (H25) | → | ND(0.23) |
| Total β | ND | (H25) | → | ND(11) |
| Toritium | ND | (H25) | → | _ |

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | 1.8 | (H25/6/21) | → | ND(0.75) | Below 1/2 |
| Cesium-137 | 4.5 | (H25/3/17) | → | ND(0.82) | Below 1/5 |
| Total β | 12 | (H25/12/23) | → | 11 | |
| Toritium | 8.6 | (H25/6/26) | → | ND(0.33) | Below 1/20 |

【North side of Unit 5 and 6 release outlet】

| | | | | | |
|---|---|---|---|---|---|
| Cesium-134 | ND | (H25) | → | ND(0.87) | |
| Cesium-137 | 3 | (H25/7/15) | → | ND(0.59) | Below 1/5 |
| Total β | 15 | (H25/12/23) | → | 8.7 | |
| Toritium | 1.9 | (H25/11/25) | → | ND(0.33) | Below 1/2 |

【Near south release outlet】




Sea side impermeable wall

Silt fence

Silt fence for construction

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

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

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

Appendix 2

December 22, 2022

# TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout

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

Trimmed trees (outdoor accumulation)

Temporary trimmed trees storage pool

Temporary soil-covered type

Rubble (outdoor accumulation)

Rubble storage tent

Inside the rubble storage tent

Rubble (covered by sheet)

Solid waste storage facility

Rubble (container storage)

Tank installation status

Temporary waste sludge storage

Spent adsorption vessel temporary storage facility

Futaba town

Okuma town

Town boundary

Site boundary

MP-1 Temporary trimmed trees storage pool

MP-2

MP-3 Trimmed trees

Rubble

Used protective clothing

Additional Radioactive Waste Incinerator

Large Waste Storage

Radioactive Waste Incinerator

MP-4

Used protective clothing

Trimmed trees

Unit 6

Unit 5

Vehicles maintenance site

Water treatment facility for Sub-drain

Water treatment facility for Sub-drain and others

Periodical Inspection Material Storage (cutting of flanged-tanks)

JAEA Analytical Facility Management Building

MP-5

JAEA Analytical Facility Laboratory-1

Vehicle screening and decontamination site

K1

K2

K3

K4

Temporary Cask Custody Area

Main Anti-Earthquake Building

Multi-nuclide removal equipment

Additional multi-nuclide removal equipment

High-performance multi-nuclide removal equipment

Large equipment decontamination facility

Land-side impermeable walls with frozen soil

Spent absorption vessel temporary storage

Land-side impermeable walls freezing plant

Mega float

Unit 1

Unit 2

Unit 3

Unit 4

Pipe route

Sea side impermeable wall

Water desalinations (RO)

Cesium absorption apparatus (Incineration Workshop Building)

Decontamination instruments (Process Building)

3rd cesium adsorption apparatus (Onsite Bunker Building)

2nd cesium adsorption apparatus

Cesium absorption vessel temporary storage

H1 H2 H3 H4 H5 H6 H8 H9

D E

J1 J2 J3 J4 J5 J6 J7 J8 J9

C B

G1 G1 South G3・G4・G5 G6 G7

Underground reservoirs

Common pool

Trimmed trees

MP-6

Partner Companies' Building

Groundwater bypass temporary storage tank

Temporary rest house outside the site

New Administration Office Building

Heliport

Large rest house

Access control facility

MP-7

Water desalinations (evaporative concentration)

Water desalinations (RO)

MP-8 Temporary trimmed trees storage pool

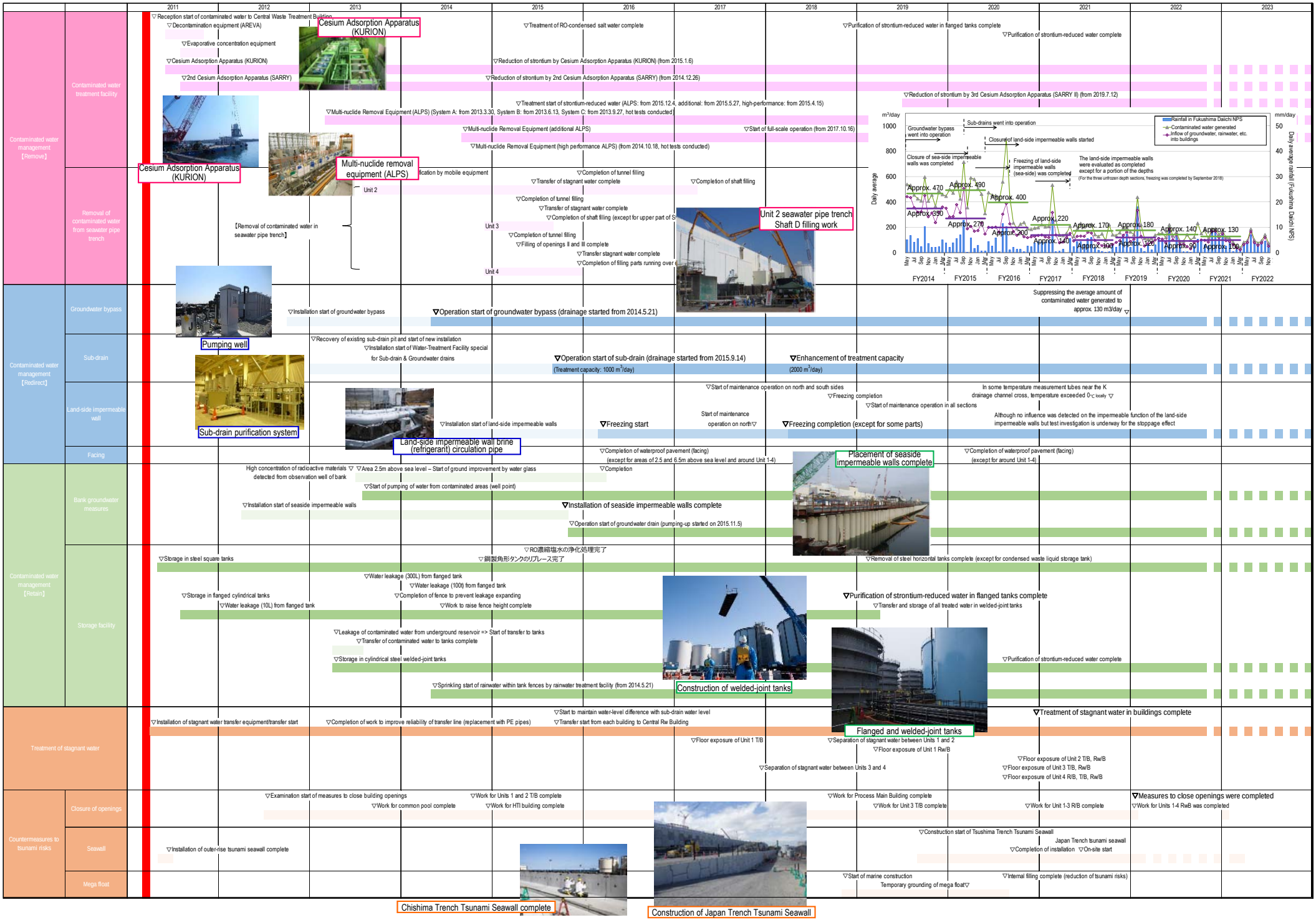
Provided by Japan Space Imaging Corporation, photo taken on April 8, 2021
Product(C) [2020] DigitalGlobe, Inc., a Maxar company

0m 100m 500m 1000m

# 1 Contaminated water management

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

Milestones of the Mid- and-Long-Term Roadmap (major target processes)
- [Completed] Suppressing the amount of contaminated water generated to 150 m³/day or less (within 2020)
- Suppressing the amount of contaminated water generated to 100 m³/day or less (within 2025)
- [Completed] Treatment of contaminated water in buildings was completed* (within 2020) *Except for Units 1-3 Reactor Buildings, Process Main Building and High Temperature Incinerator Building.
- Contaminated water in Reactor Buildings was reduced to about a half of the level at the end of 2020 (FY2022-FY2024)



# 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.


Overall view of mockup tanks


Flounder in rearing preparation tank

## Enhancement of communication activities

- Measures for decommissioning, contaminated water and treated water of the Fukushima Daiichi Nuclear Power Station need efforts to reduce risks over a long term. Regarding handling of ALPS treated water as a part of decommissioning, to local residents, those who in the fishery industry and related parties, we will thoroughly explain about the policies and responses concerning the facility design, operation and management to ensure safety, monitoring of radioactive materials and others, and proceed with efforts to sincerely face their concerns and interests and respond to each of them.
- Moreover, to further deepen the understanding of everyone in Japan and overseas, efforts to coherently disseminate measurement results of ALPS treated water and information concerning facility operation, radiation impact assessment and others will continue and be enhanced.

● Information dissemination via media in Japan and overseas and others
- To help deliver information based on scientific evidence, press release, press conference, disclosure of power plant site, briefing and others are held.
- For overseas major media, diplomatic corps and others, briefing and press tour are held. Information dissemination to neighboring countries is also being enhanced. Information dissemination to overseas media and information provision to embassies is focused.
  Ex.) May 10, 2022 Diplomatic corps and others, overseas media and others


Press conference

Completely revised in January 2022

"Understand by video. ALPS Treated Water" series
Now available on youtube
(Japanese and English)

● Safety review of International Atomic Energy IAgency (IAEA)
- In February 2022, IAEA officials and international professionals (US/ UK/ France/ Russia/ China/ others) visited Japan to conduct technical inspection based on the international safety standard and on April 29, the report of safety assessment was published.
- The report states that in regards to the safety of the facility, the IAEA has found that, "TEPCO successfully incorporated prevention measures in the design of the facility as well as in the associated operating procedures." In regards to the Radiological Environmental Impact Assessment, "it acknowledged that the doses to the assumed representative person are expected to be very low and significantly below the dose constraint set by the Japanese regulatory body."


IAEA onsite investigation

● Communication with related parties taking various opportunities
- Efforts to explain about policies and safety measures for handling of ALPS treated water, countermeasures to rumors and others to people in the Metropolitan area, local residents and related parties and hear their opinions proceed. (In FY2021, approx. 3,000 times)
- Visits and Discussion Meetings of the Fukushima Daiichi Nuclear Power Station have been held since FY2019 for 13 municipalities in Hamadori. In FY2021 and FY2022, the Visits and Discussion Meetings were expanded to within Fukushima Prefecture. (In FY2022, a total of 17 times are scheduled)
- Moreover, online visits (connecting visitors and guide online) utilizing the "Fukushima Daiichi Virtual Tour" video, which is now being published on the TEPCO web site, and others are also offered in response to the need of people in Japan and overseas.
  (From August 2020 to July 2022 Online visitors: 59 organizations, 2,250 persons including overseas organizations)


Discussion meeting (face-to-face dialogue)

● Rearing test of marine organisms
- To alleviate concerns and lead to relief of local residents, related parties and the everyone in society, marine orgasms are being reared in tanks of seawater containing ALPS treated water and the status is compared with the original seawater controls. The progress will be shown coherently and clearly.
- Regarding behaviors of tritium and others, a lot of research has been conducted in Japan and overseas. Based on the experimental results, firstly experimental data for a half year will be collected and subsequently, the same as past experimental results, the theory "tritium in vivo is not concentrated and the concentration of tritium in vivo will not exceed the level in the growing environment" will also be reaffirmed.
- Froom March 2022, practice to rear flounder started using coastal seawater around the nuclear power station to learn how to rear marine organisms, verify the equipment design and others.
- From September 30, the stage was shifted to the next "rearing test" and on October 3, ALPS treated water was added.

- From March 17, daily rearing status is published on the TEPCO HD homepage and twitter.
  - Homepage address: http://www.tepco.co.jp/decommission/information/newsrelease/breedingtest/index-j.html
  - Twitter address: https://twitter.com/TEPCOfishkeeper

## Examination concerning handling of ALPS treated water

Tritiated Water Taskforce (2013.12 – 2016.5, 15 meetings)


Tank area viewed from the Large Rest House (2015.10.29)

2016.6 Report of Tritiated Water Taskforce

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

2018.8 Explanatory and hearing meeting, receiving opinions

2020.2 Report of Subcommittee on Handling of ALPS treated water

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

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

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

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

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

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

2022.8.4 Work has commenced

2021.4.13 The basic policy on the handling of ALPS treated water was set

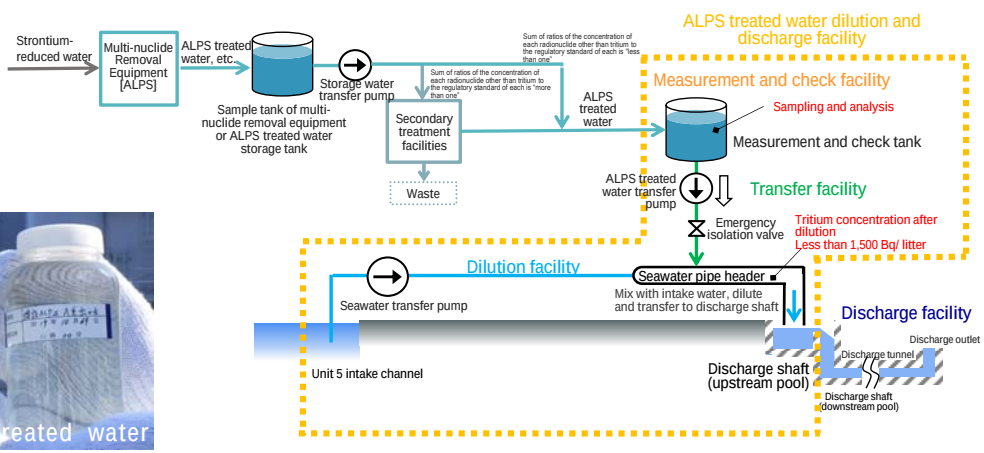
2021.4.16 The response of TEPCO was announced

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

2022.11.14 Application for the Application Documents for Approval to Amend the Implementation Plan was submitted

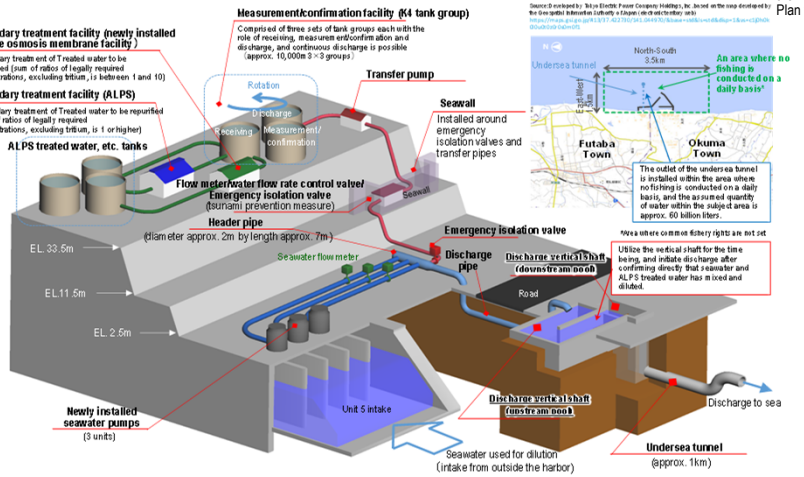
2014 2015 2016 2017 2018 2019 2020 2021 2022

【Overview of ALPS treated water dilution and discharge facility】









# 3 Removal of fuel from spent pool

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

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


December 22, 2022
Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

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

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

▼ 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

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

▼ 2014.12.22 Fuel removal was completed (1533 assemblies)

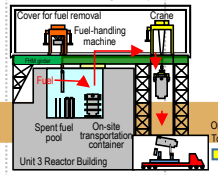
Unit 4

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

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

▼ 2013.10 Completion of removal of large rubble on the Reactor Building top floor
▼ 2015.8 Completion of removal of the fuel-handling machine B within the spent fuel pool
▼ 2016.12 Completion of shielding on the Reactor Building top floor
▼ 2017.1 Installation start of a cover for fuel removal
▼ 2019.4.15 Start of fuel removal

Overview of the fuel-handling facility inside the cover




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

▼ 2021.2.28 Fuel removal completed (566 assemblies)

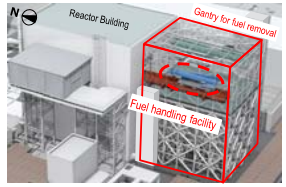
Unit 3

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 2

▼ 2020.3-6 Installation of spent fuel pool cover
▼ 2020.9-11 Measures to prevent and alleviate rubble falling
▼ 2020.11-2021.6 Dismantling of remaining cover
▼ 2017.12 Completion of building cover dismantling and windbreak fence installation
▼ 2018.1-2020.12 Rubble removal on the north side of Reactor Building
▼ 2018.9-12 Removal of X-braces
▼ 2021.8 Start of large cover pre-work

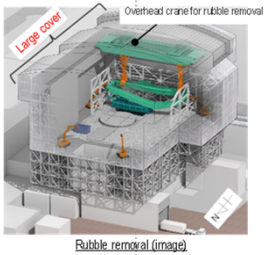
For Unit 1, a large cover will be installed over the whole building, within which rubble will be removed.

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

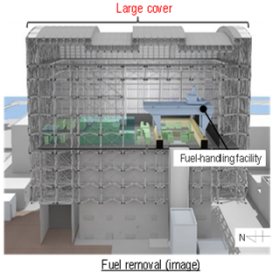
<Reference> Progress to date
Rubble removal on the north side of the operating floor started from January 2018 and has been implemented sequentially. In July and August 2019, the well plug, which was misaligned, was investigated, followed in August and September by the conditions of the overhead crane.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

Unit 1


<Unit 1 Dismantling of remaining cover>



Rubble removal (image)



Fuel removal (image)

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

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

# 4 Work toward fuel debris retrieval


December 22, 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)

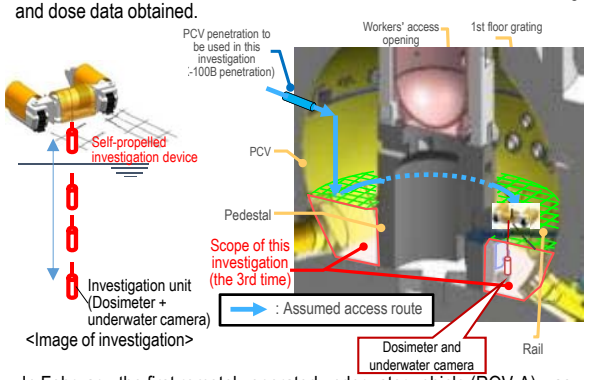
Start of fuel debris retrieval from the first unit (Unit 2). Expanding the scale in stages (within 2021 * The schedule will be extended for about 1 year due to the spread of COVID-19 infections)

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

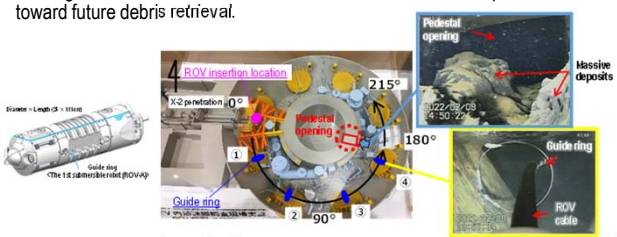
・In April 2015, a device having entered the inside of the PCV via a narrow opening (bore:φ100 mm) collected information such as images and airborne dose inside the PCV 1st floor.

・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.



<Status inside the PCV (February 9)>

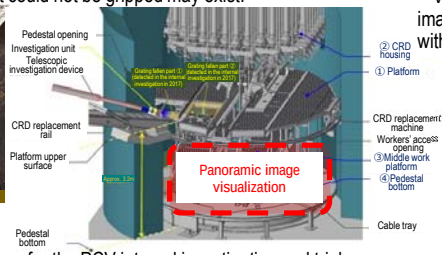
## Unit 2 Investigation overview

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

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

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

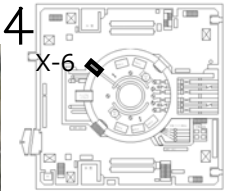

Bottom of the pedestal (after being processed in panoramic image visualization)




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

<Conditions of deposits before and after contact>


<Work in front of the penetration>



<Unit 2 Reactor Building 1st floor Location of the penetration>

## Unit 3 Investigation overview

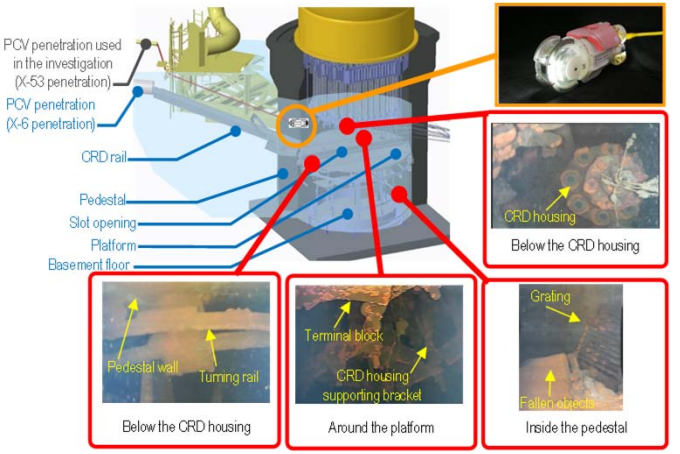
・In October 2014, the conditions of X-53 penetration, which may be under water and which is scheduled for use to investigate the inside of the PCV, was investigated via remote-controlled ultrasonic test equipment. The results showed that the penetration was not under water.

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

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

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

<Conditions inside the pedestal>




### Unit 1 PCV internal investigation

| | | |
|---|---|---|
| Investigations inside the PCV | 1st (2012.10) | - Acquiring images<br>- Measuring the air temperature and dose rate<br>- Measuring the water level and temperature<br>- Sampling stagnant water<br>- Installing permanent monitoring instrumentation |
| | 2nd (2015.4) | Confirming the status of the PCV 1st floor<br>- Acquiring images<br>- Measuring the air temperature and dose rate<br>- Replacing permanent monitoring instrumentation |
| | 3rd (2017.3) | Confirming the status of the PCV 1st basement floor<br>- Acquiring images<br>- Measuring the dose rate<br>- Sampling deposit<br>- Replacing permanent monitoring instrumentation |
| Leakage points from PCV | - PCV vent pipe vacuum break line bellows (identified in 2014.5)<br>- Sand cushion drain line (identified in 2013.11) | |

Evaluation of the location of fuel debris inside the reactor by measurement using muons
Confirmed that there was no large fuel in the reactor core. (2015.2-5)

### Unit 2 PCV internal investigation

| | | |
|---|---|---|
| Investigations inside the PCV | 1st (2012.1) | - Acquiring images - Measuring the air temperature |
| | 2nd (2012.3) | - Confirming water surface - Measuring the water temperature<br>- Measuring the dose rate |
| | 3rd (2013.2 – 2014.6) | - Acquiring images - Sampling stagnant water<br>- 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<br>- Determining characteristics of a portion of deposit |
| Leakage points from PCV | - No leakage from the torus chamber rooftop - No leakage from any internal/external surfaces of S/C | |

Evaluation of the location of fuel debris inside the reactor by measurement using muons
The existence of high-density materials, which were considered to constitute fuel debris, was confirmed at the bottom of RPV and in the lower part and outer periphery of the reactor core. It was assumed that a significant portion of fuel debris existed at the bottom of RPV. (2016.3-7)

### Unit 3 PCV internal investigation

| | | |
|---|---|---|
| Investigations inside the PCV | 1st (2015.10-12) | - Acquiring images<br>- Measuring the air temperature and dose rate<br>- Measuring the water level and temperature<br>- Sampling stagnant water<br>- Installing permanent monitoring instrumentation (2015.12) |
| | 2nd (2017.7) | - Acquiring images<br>- 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



December 22, 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)

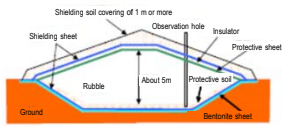
▼ 2012.9 Transfer start of rubble to the soil-covered temporary storage facility

▼ 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


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

▼ 2018.2 Operation start

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

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

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

▼ 2013.5 Installation work gets underway
Solid Waste Incinerator

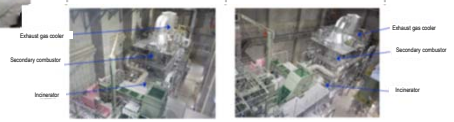
▼ 2016.3 Operation start

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


Whole view of Solid Waste Incinerator


Electrical room


Control room



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

2017.10 Installation work gets

▼ 2017.4 Start of pre-work
Additional Solid Waste Incinerator

▼2022.5 Start of operation

▼ 2018.5 Operation start
Large Equipment Decontamination Facility

▼ 2020.9 Start of pre-work
Compaction Facility

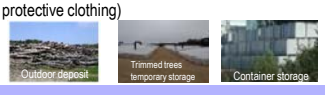
Site of Volume Reduction Faciility

## 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


0.005-1 mSv/h


Less than 0.005mSv


### Storage of water treatment secondary waste


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

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

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

Approx. 60,000 m³ → Additional Radioactive Waste Incinerator (A)

Approx. 60,000 m³ → (B)

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

Approx. 220,000 m³ → Volume reduction

Approx. 6,500 tanks → Treatment measures and others will be examined

## Status after a decade

Legend: Newly installed equipment and facility

### Incineration

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


Crusher example

Radioactive Waste Incinerator

Additional Radioactive Waste Incinerator

### Volume reduction

Compaction Facility (scheduled for completion in FY2022)


Concrete crusher example


Metal cutter example

### Melting

Melting equipment


Electric furnace example

To (B)

Approx. 270,000 m³ (*3) (*2)

### Storage /management

Approx. 20,000 m³

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

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

Approx. 60,000 m³

Approx. 60,000 m³ (*1)

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

Approx. 60,000 m³

Approx. 70,000 m³

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

(*1)

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.

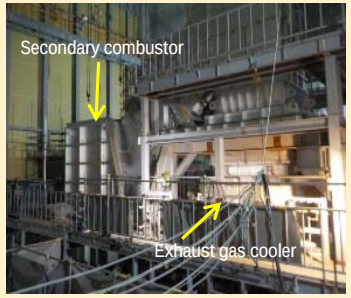
Note: Used protective clothing before incineration and BG-level concrete waste for which treatment and reuse is decided at present are not included.

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

## ●Efforts to eliminate temporary outdoor storage of rubble and others

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


Whole view of the Additional Solid Waste Incinerator Building



Main equipment

# 6 Improvement of work environment

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

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

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

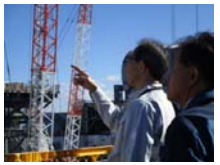
In February 2017, operation started at the Partner Companies' Building next to the New Administration Office Building.

External view of Access Control Facility

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

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

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



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

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

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

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

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

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

## Changes in operation of controlled area

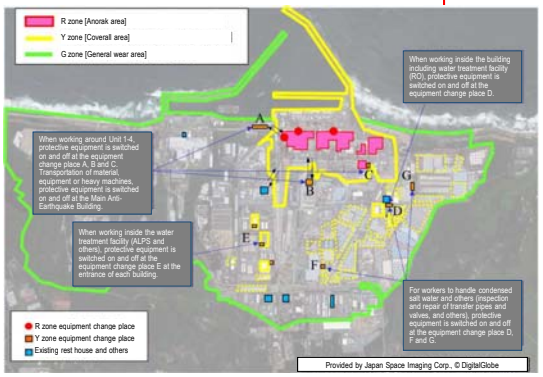
From May 2013, full-face mask unnecessary area was expanded sequentially.

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

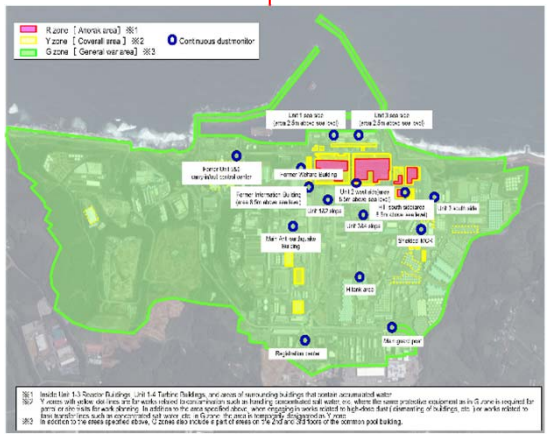
In March 2017, the G-zone area was expanded (to cover 95% of the whole site).

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


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




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

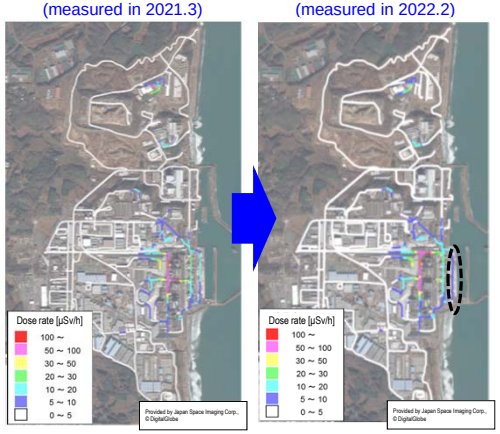



In May 2018, within about 96% of the site, workers are allowed to wear light equipment such as general workwear and disposable dust-protective masks.

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

FY2020 4th Quarter (measured in 2021.3)

FY2021 4th Quarter (measured in 2022.2)

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