

Main decommissioning works and steps

All fuel had been removed from Unit 4 SFP by December 22, 2014. Work continues toward fuel removal and debris (Note 1) retrieval from Unit 1-3.

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

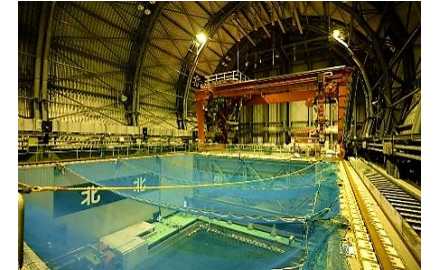
Unit 1: Fuel removal scheduled to start in FY2023
 Unit 2: Fuel removal scheduled to start in FY2023
 Unit 3: Fuel removal scheduled to start around mid-FY2018
 Unit 4: Fuel removal completed in 2014

(Note 2)
 The method employed to retrieve fuel debris for the first unit will be confirmed in FY2019.

Toward fuel removal from the spent fuel pool

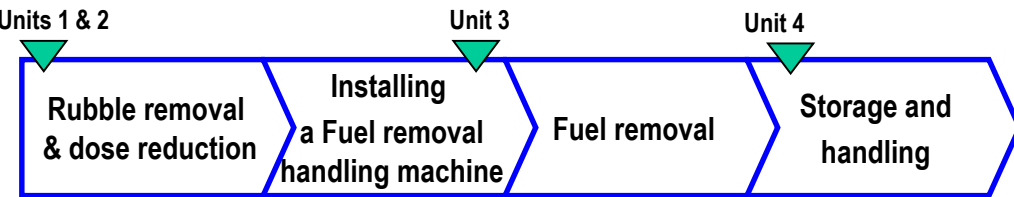
Toward fuel removal from Unit 3 SFP within November 2018, works are underway with safety first.

As measures to reduce the dose on the Reactor Building operating floor, the decontamination and installation of shields were completed in June and December 2016 respectively. Installation of a fuel removal cover started from January 2017 and installation of all dome roofs was completed in February 2018.

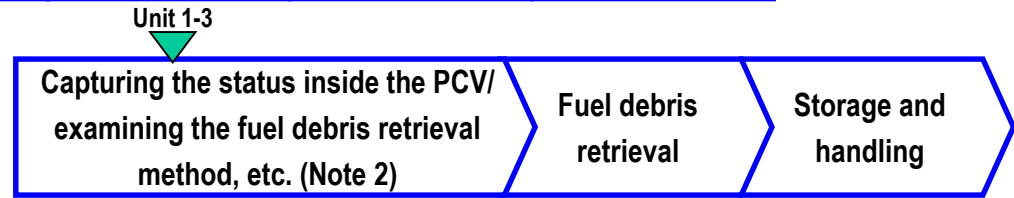


Status inside the cover for fuel removal (March 15, 2018)

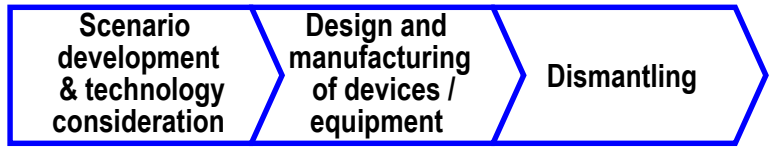
Fuel Removal from SFP



Fuel Debris Retrieval



Dismantling Facilities



Three principles behind contaminated water countermeasures:

Countermeasures for contaminated water are implemented in accordance with the following three principles:

1. Eliminate contamination sources

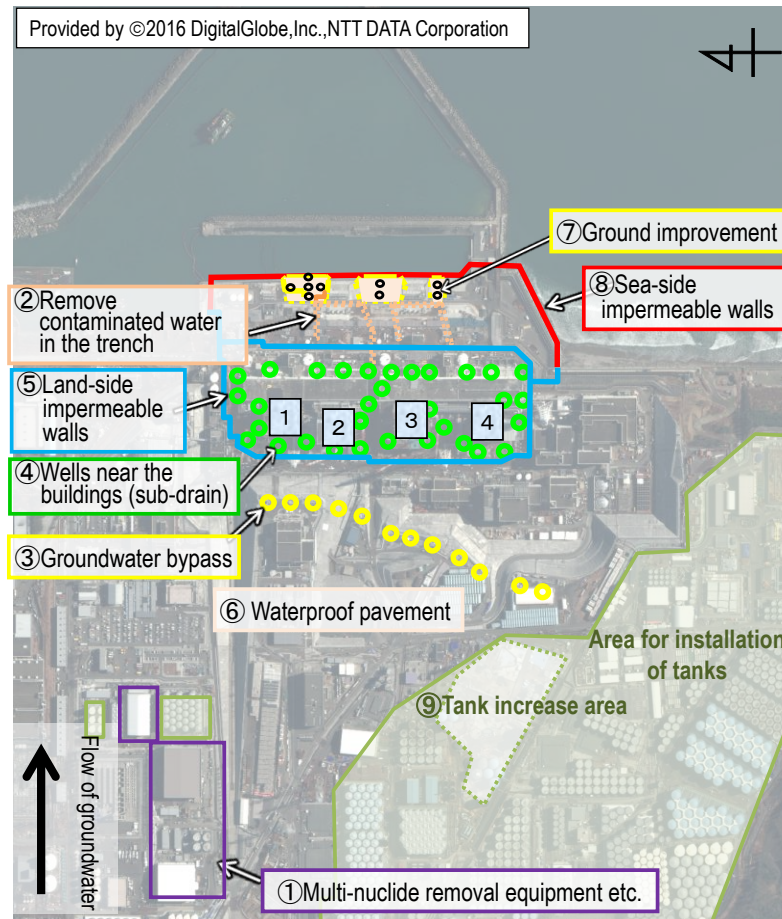
- ① Multi-nuclide removal equipment, etc.
- ② Remove contaminated water from the trench (Note 3)
 (Note 3) Underground tunnel containing pipes.

2. Isolate water from contamination

- ③ Pump up groundwater for bypassing
- ④ Pump up groundwater near buildings
- ⑤ Land-side impermeable walls
- ⑥ Waterproof pavement

3. Prevent leakage of contaminated water

- ⑦ Enhance soil by adding sodium silicate
- ⑧ Sea-side impermeable walls
- ⑨ Increase the number of (welded-joint) tanks



Multi-nuclide removal equipment (ALPS), etc.

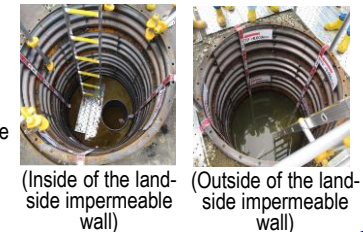
- This equipment removes radionuclides from the contaminated water in tanks and reduces risks.
- Treatment of contaminated water (RO concentrated salt water) was completed in May 2015 via multi-nuclide removal equipment, additional multi-nuclide removal equipment installed by TEPCO (operation commenced in September 2014) and a subsidy project of the Japanese Government (operation commenced in October 2014).
- Strontium-treated water from equipment other than ALPS is being re-treated in ALPS.



High-performance (multi-nuclide removal equipment)

Land-side impermeable walls

- Land-side impermeable walls surround the buildings and reduce groundwater inflow into the same.
- Freezing started on the sea side and part of the mountain side from March 2016 and on 95% of the mountain side from June 2016. Freezing of the remaining unfrozen sections advanced with a phased approach and freezing of all sections started in August 2017.
- In March 2018, the land-side impermeable walls were considered completed except for a portion of the depths: based on a monitoring result showing that the underground temperature had declined below 0°C in almost all areas, while on the mountain side, the difference between the inside and outside increased to approx. 4-5 m. Multi-layered contaminated water management measures, including subdrains and facing, have kept the groundwater level stable. Consequently, a water-level management system to isolate the buildings from groundwater was considered to have been established. The Committee on Countermeasures for Contaminated Water Treatment, held on March 7, clearly recognized the effect of the land-side impermeable walls in shielding groundwater and evaluated that the land-side impermeable walls had allowed a significant reduction in the amount of contaminated water generated.



(Inside of the land-side impermeable wall) (Outside of the land-side impermeable wall)

Sea-side impermeable walls

- Impermeable walls are being installed on the sea side of Units 1-4, to prevent contaminated groundwater from flowing into the sea.
- The installation of steel pipe sheet piles was completed in September 2015 and they were connected in October 2015. These works completed the closure of the sea-side impermeable walls.



(Sea-side impermeable wall)

Progress Status and Future Challenges of the Mid- and Long-Term Roadmap toward Decommissioning of TEPCO Holdings' Fukushima Daiichi Nuclear Power Station Units 1-4 (Outline)

Progress status

◆ The temperatures of the Reactor Pressure Vessel (RPV) and Primary Containment Vessel (PCV) of Units 1-3 have been maintained within the range of approx. 25-35°C^{*1} over the past month. There was no significant change in the density of radioactive materials newly released from Reactor Buildings in the air^{*2}. It was evaluated that the comprehensive cold shutdown condition had been maintained.

*1 The values varied somewhat, depending on the unit and location of the thermometer

*2 In June 2018, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.00022 mSv/year at the site boundary. The annual radiation dose from natural radiation is approx. 2.1 mSv/year (average in Japan).

Status toward fuel removal at Unit 1

To create an access route for work to protect the spent fuel pool, X-braces will be removed.

A mockup test simulating the actual machine was conducted in June to confirm the whole process of remote-controlled work from cutting and catching to drawing.

Prior to formulating a detailed plan for pool protection work after removing the X-braces, measurement of the dose around the pool started from July 23.

After improving the accuracy of the work procedures, operation training will be provided to fully prepare to start removing the X-braces in September 2018.



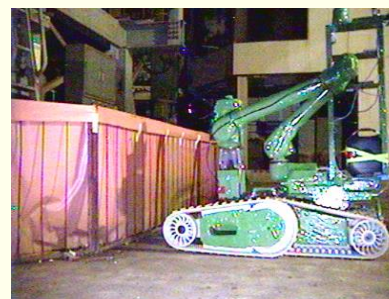
Mockup test

Status toward fuel removal at Unit 2

An investigation near the opening wall on the operating floor using a remote-controlled unmanned robot detected no large scattering obstacles to operate of the robot.

Contamination of the robot was below the level that would prevent maintenance by workers in the front room.

These results confirmed the availability of future work to move and organize the remaining objects, and investigations of dose, contamination statuses, etc. on the operating floor.

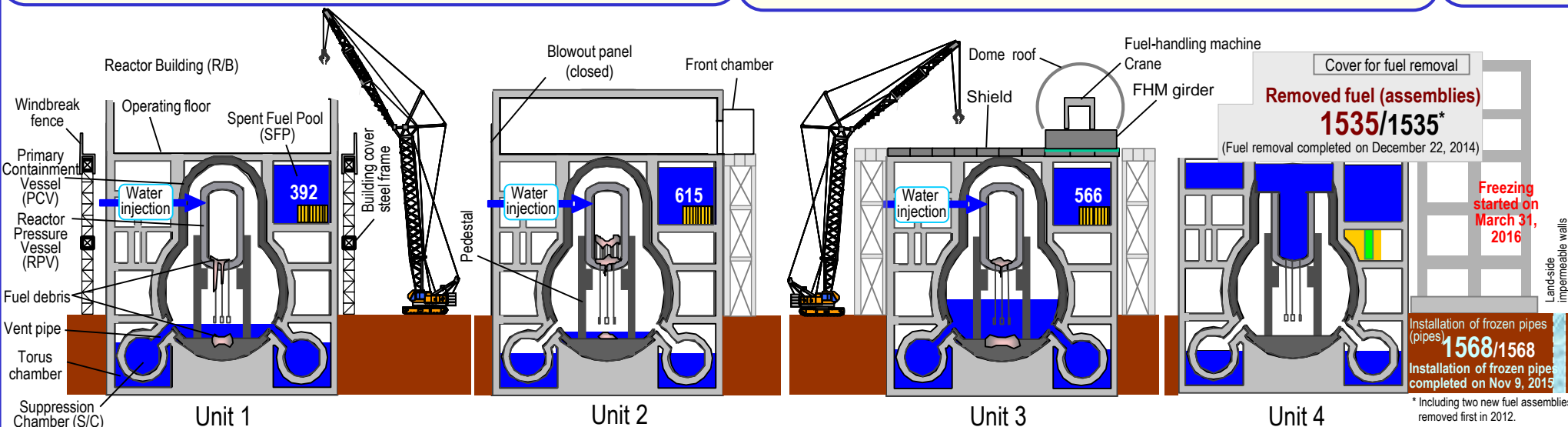
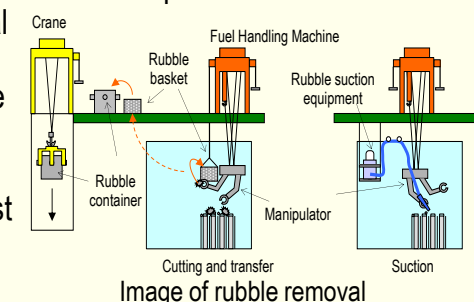


Investigation using a remote-controlled unmanned robot

Status toward fuel removal at Unit 3

Regarding the failure detected at the control panel during the test crane operation, the failed equipment was replaced and a test operation on July 14 confirmed that it could work normally.

Toward fuel removal, rubble in the pool will be removed and training using the actual machine will be provided to improve the skills of workers. Preparation will continue with safety first to start fuel removal within November 2018.



The 3rd International Forum on the Decommissioning of the Fukushima Daiichi NPS

The 3rd International Forum on the Decommissioning of the Fukushima Daiichi Nuclear Power Station will be held in Naraha Town on August 5 and Iwaki City on August 6. (Organizer: Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF))

On Day 1, mainly for the local community, members in charge of the decommissioning of the Fukushima NPS will sincerely answer questions from local residents and engage in dialogue with them. On Day 2, mainly for technical experts, international members and Japanese experts will join the discussion on remote technology.

Progress toward dismantling the Unit 1/2 exhaust stack

From the perspective of further reducing risks, the upper half of the Unit 1/2 exhaust stack will be dismantled to ensure a seismic margin.

With efforts to reduce the exposure dose of workers in mind, the dismantling will adopt unmanned work at the upper part. To facilitate this work, a mockup test will be implemented from August.

Toward starting the work within the Fukushima Daiichi Nuclear Power Station from December (preparatory work such as carrying in materials and equipment), work will continue with safety first.

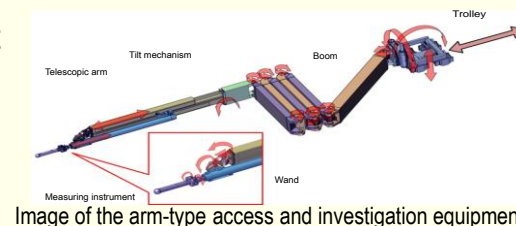
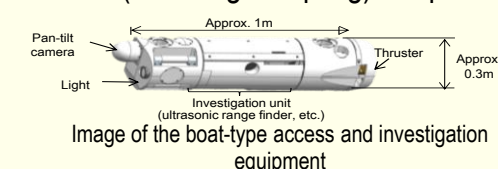


Mockup facility of the exhaust stack

Progress of examination on investigation, sampling and analysis inside the PCV

Prior to retrieving fuel debris, knowledge such as the characteristics of fuel debris and effect at the time of retrieval needs to be accumulated, hence additional investigations inside the PCV (including sampling) are planned.

Toward fuel removal, to acquire new knowledge at each Unit, further investigations are being considered. In FY2019, the inside of the Unit 1/2 PCV will be investigated to sample a small amount of deposit at the PCV bottom. In FY2020, sampling of a greater volume of fuel debris at Unit 2 is being considered. For Unit 3, the need for further investigation using the remotely operated underwater vehicle used in the previous investigation is being considered.



	Planned time for investigation	Investigative device
Unit 1	1st half of FY2019 (Sampling of small amount)	Boat-type access and investigation equipment with diving function
Unit 2	2nd half of FY2018 (Sampling of small amount)	Guide pipe
	2nd half of FY2019 (Sampling of small amount)	Arm-type access and investigation equipment
	Examination is underway to conduct within FY2020 (Sampling of more volume)	Examination is underway

* For Unit 3 the need for further investigation using the remotely operated underwater vehicle used in the previous investigation is being considered.

Plan of future inside investigations

Major initiatives – Locations on site



The 3rd International Forum on the Decommissioning of the Fukushima Daiichi NPS

Progress of examination on investigation, sampling and analysis inside the PCV

Status toward fuel removal at Unit 2

Status toward fuel removal at Unit 1

Status toward fuel removal at Unit 3

Progress toward dismantling the Unit 1/2 exhaust stack

Land-side impermeable walls

Unit 6

Unit 5

Unit 1

Unit 2

Unit 3

Unit 4

MP-1

MP-8

MP-2

MP-7

Site boundary

MP-3

MP-4

MP-6

MP-5

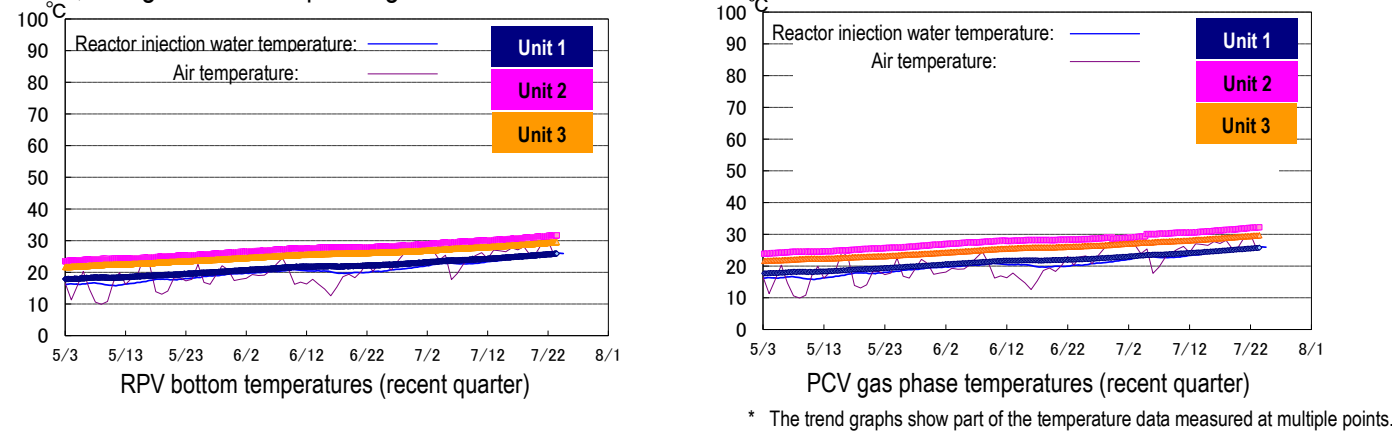
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* Data of Monitoring Posts (MP1-MP8.)
 Data (10-minute values) of Monitoring Posts (MPs) measuring the airborne radiation rate around site boundaries showed 0.456 – 1.641 μ Sv/h (June 27 – July 24, 2018).
 We improved the measurement conditions of monitoring posts 2 to 8 to measure the air-dose rate precisely. Construction works, such as tree-clearing, surface soil removal and shield wall setting, were implemented from February 10 to April 18, 2012.
 Therefore monitoring results at these points are lower than elsewhere in the power plant site.
 The radiation shielding panels around monitoring post No. 6, which is one of the instruments used to measure the radiation dose at the power station site boundary, were taken off from July 10-11, 2013, since further deforestation, etc. had caused the surrounding radiation dose to decline significantly.

I. Confirmation of the reactor conditions

1. Temperatures inside the reactors

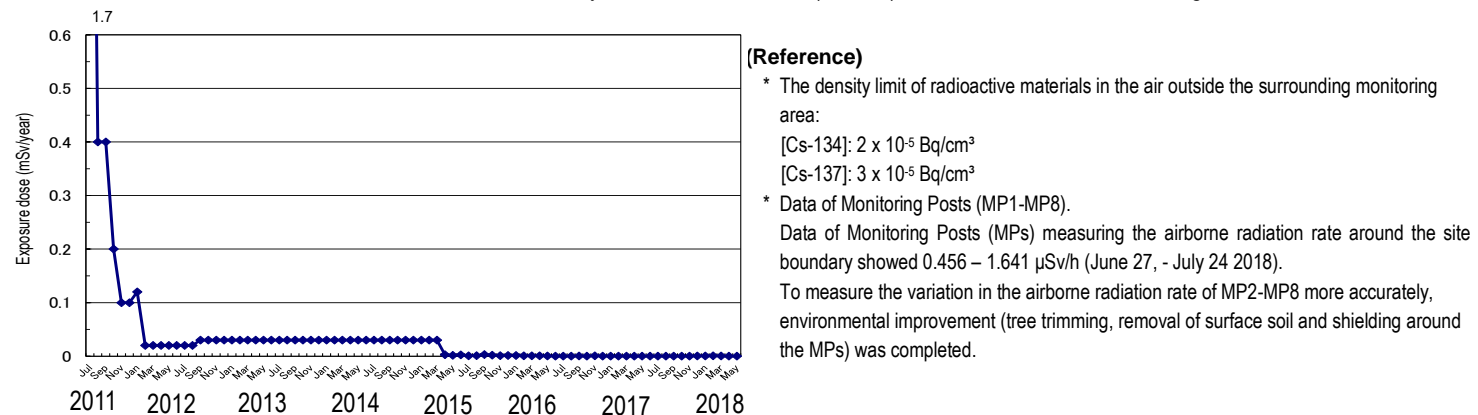
Through continuous reactor cooling by water injection, the temperatures of the Reactor Pressure Vessel (RPV) bottom and the Primary Containment Vessel (PCV) gas phase were maintained within the range of approx. 25 to 35°C for the past month, though it varied depending on the unit and location of the thermometer.



2. Release of radioactive materials from the Reactor Buildings

As of June 2018, the density of radioactive materials newly released from Reactor Building Units 1-4 in the air and measured at the site boundary was evaluated at approx. 1.3×10^{-12} Bq/cm³ for Cs-134 and 5.1×10^{-12} Bq/cm³ for Cs-137, while the radiation exposure dose due to the release of radioactive materials there was less than 0.00022 mSv/year.

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



Note: 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.

3. 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 abnormality 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

1. Contaminated water countermeasures

To tackle the increase in stagnant water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➤ Operation of the groundwater bypass

- From April 9, 2014, the operation of 12 groundwater bypass pumping wells commenced sequentially to pump up groundwater. The release started from May 21, 2014 in the presence of officials from the Intergovernmental Liaison

Office for the Decommissioning and Contaminated Water Issue of the Cabinet Office. Up until July 24, 2018, 393,328 m³ of groundwater had been released. The pumped-up groundwater was temporarily stored in tanks and released after TEPCO and a third-party organization had confirmed that its quality met operational targets.

- Pumps are inspected and cleaned as required based on their operational status.
- Water Treatment Facility special for Subdrain & Groundwater drains
 - To reduce the level of groundwater flowing into the buildings, work began to pump up groundwater from wells (subdrains) around the buildings on September 3, 2015. The pumped-up groundwater was then purified at dedicated facilities and released from September 14, 2015 onwards. Up until July 24, 2018, a total of 568,763 m³ had been drained after TEPCO and a third-party organization had confirmed that its quality met operational targets.
 - Due to the level of the groundwater drain pond rising after the sea-side impermeable walls had been closed, pumping started on November 5, 2015. Up until July 25, 2018, a total of approx. 184,000 m³ had been pumped up and a volume of approx. less than 10 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period June 21 – July 18, 2018).
 - As one of the multi-layered contaminated water management measures, in addition to waterproof pavement (facing) to prevent rainwater infiltrating the ground, etc., facilities to enhance the subdrain treatment system were installed and went into operation from April 2018. These facilities increased the treatment capacity to 1,500 m³ and improved reliability.
 - To maintain the level of groundwater pumped up from subdrains, work to install additional subdrain pits and recover those already in place is underway. They will go into operation sequentially from a pit for which work is completed (the number of pits which went into operation: 12 of 14 additional pits; 0 of 3 recovered pits).
 - To eliminate the need to suspend water pumping while cleaning the subdrain transfer pipe, the pipe will be duplicated, with installation of the pipe and ancillary facilities now underway.
 - Since the subdrains went into operation, the inflow into buildings tended to decline to less than 150 m³/day when the subdrain water level declined below T.P. 3.0 m but increased during rainfall.

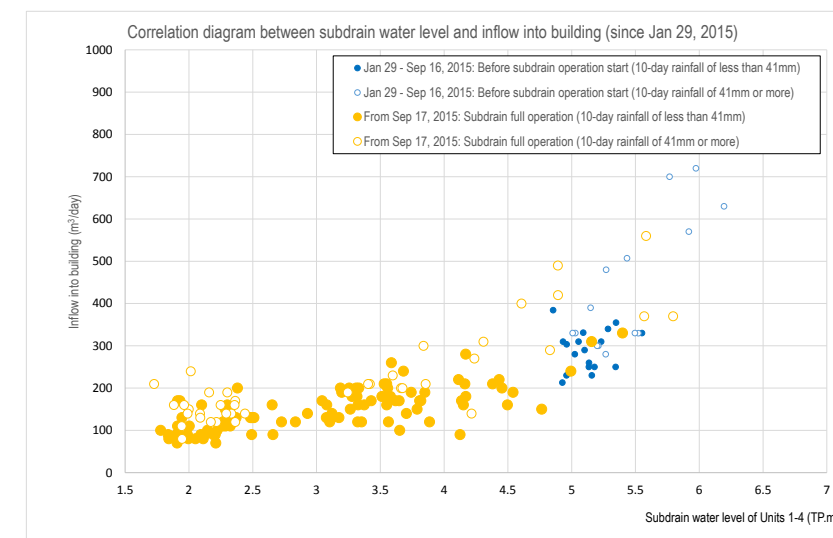


Figure 1: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Unit 1-4 subdrains

➤ LCO deviation due to failure of the subdrain water-level monitoring around PMB and HTI

- On July 25, 2018, an alarm indicating transmission abnormality of the subdrain water-level digital recorder was issued in the central monitoring system.
- The event was judged as deviation from the limiting condition for operation (LCO), based on an inspection result showing the subdrain water-level monitoring as having failed around the Process Main Building (PMB) and the High Temperature Incinerator Building (HTI).
- The transmission was recovered after switching the power to the digital recorder of the failed circuit on and off. Recovery from the LCO deviation was declared the same day.

- Work to add a water treatment server to the central monitoring system was implemented when the alarm was issued. The event was considered attributable to some abnormality in the transmission circuit due to this work. The causal relation and other details will be investigated.

➤ Construction status of the land-side impermeable walls

- A maintenance operation for the land-side impermeable walls to prevent frozen soil from thickening further has continued from May 2017 on the north and south sides and started from November 2017 on the east side, where frozen soil of sufficient thickness was identified. The scope of the maintenance operation was expanded in March 2018.
- In March 2018, the land-side impermeable walls were considered completed except for a portion of the depths, based on a monitoring result showing that the underground temperature had declined below 0°C in almost all areas, while on the mountain side, the difference between the inside and outside increased to approx. 4-5 m. Multi-layered contaminated water management measures, including subdrains and facing, have kept the groundwater level stable. Consequently, a water-level management system to isolate the buildings from groundwater was considered to have been established. The Committee on Countermeasures for Contaminated Water Treatment, held on March 7, clearly recognized the effect of the land-side impermeable walls in shielding groundwater and evaluated that the land-side impermeable walls had allowed a significant reduction in the amount of contaminated water generated.

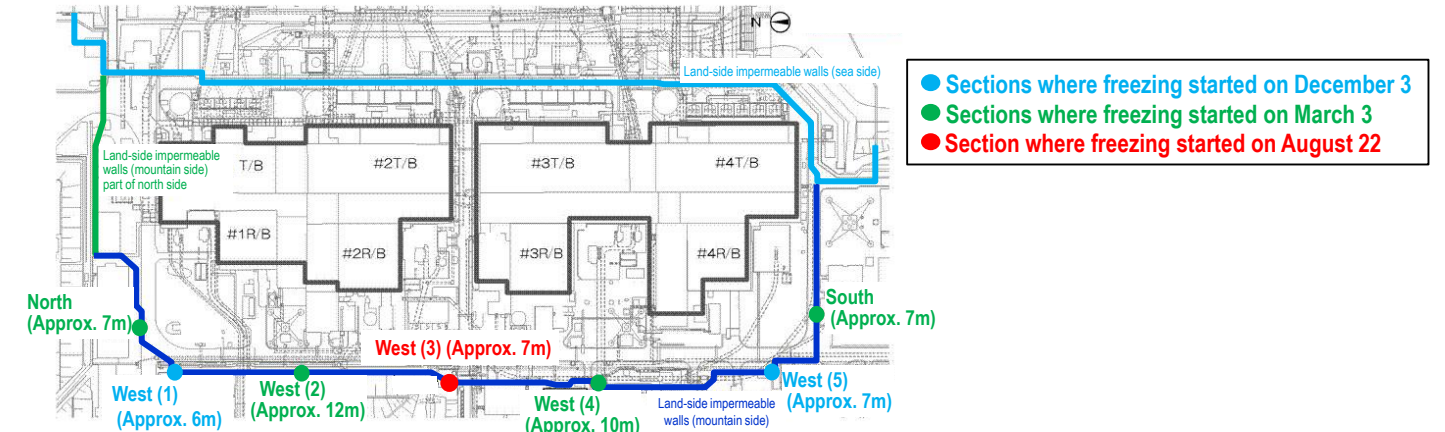


Figure 2: Closure of part of the land-side impermeable walls (on the mountain side)

➤ Progress status of measures to prevent rainwater inflow to buildings during heavy rain

- Measures are being implemented to prepare for an increase in contaminated water generated during heavy rain such as typhoons.
- Investigation and analysis to date confirmed that the actual value of the inflow to buildings differed from the estimated value during heavy rain such as typhoons.
- This difference is considered mainly attributable to inflows into buildings through the trench near the Unit 1 and 2 Turbine Buildings, from a damaged part of the Unit 2 Reactor Building roof drain and from a damaged part of the Unit 3 Turbine Building roof.

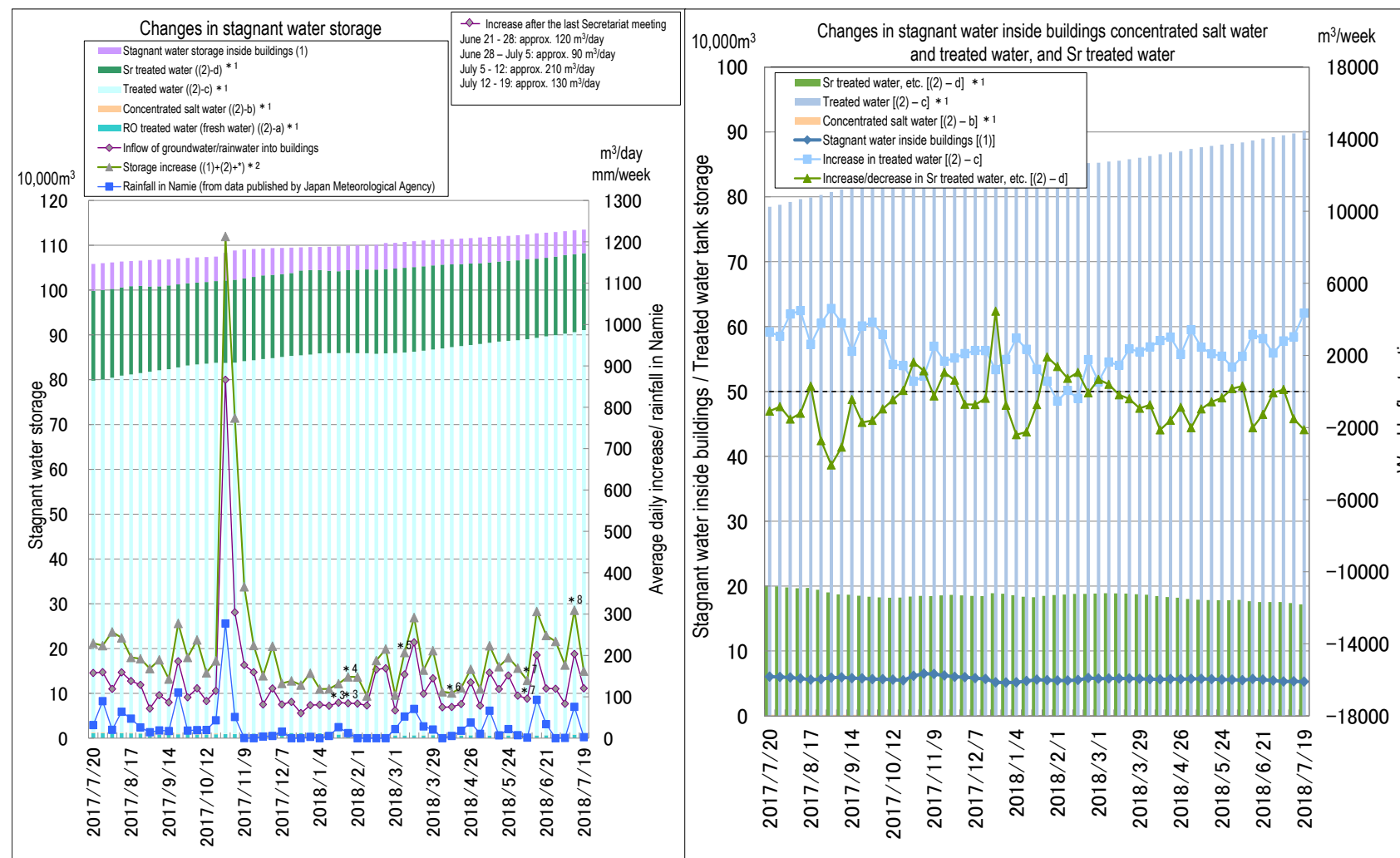


Figure 3: Status of stagnant water storage

As of July 19, 2018

- *1: Water amount for which the water-level gauge indicates 0% or more
- *2: To detect storage increases more accurately, the calculation method was reviewed as follows from February 9, 2017: (The revised method was applied from March 1, 2018) [(Inflow of groundwater/rainwater into buildings) + (other transfer) + (chemical injection into ALPS)]
- *3: Reevaluated by adding groundwater and rainwater inflow into the residual water areas (January 18 and 25, 2018).
- *4: Reviewed because SARRY reverse cleaning water was added to "Storage increase." (January 25, 2018)
- *5: The effect of calibration for the building water-level gauge was included in the following period: March 1-8, 2018 (Unit 3 Turbine Building).
- *6: The method used to calculate the chemical injection into ALPS was reviewed as follows: (Additional ALPS: The revised method was applied from April 12, 2018) [(Outlet integrated flow rate) - (inlet integrated flow rate) - (sodium carbonate injection rate)]
- *7: Reevaluated based on the revised calculation formula of stagnant water storage volume in Unit 2-4 Turbine Building seawater system pipe trenches. (Period of reevaluation: December 28, 2017 - June 7, 2018)
- *8: Reevaluated based on the revised method to manage the transfer volume from the Unit 1 seawater pipe trench. (Period of reevaluation: May 31 - June 28, 2018)

- As countermeasures to these inflows, work to stop water and fill the inside started from July 13 at the penetration parts inside the trench near the Unit 1 and 2 Turbine Building. Repair of the damaged portion of the Unit 2 Reactor Building roof drain was completed by July 12. For the damaged part of the Unit 3 Turbine Building roof, preparatory work for inflow countermeasures will be conducted from October.
 - After confirming the effect of the countermeasures, the necessary measures will be examined.
- Operation of multi-nuclide removal equipment
- Regarding the multi-nuclide removal equipment (existing and high-performance), hot tests using radioactive water were underway (for existing equipment, System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013; and for high-performance equipment, from October 18, 2014). The additional multi-nuclide removal equipment went into full-scale operation from October 16, 2017.
 - As of July 19, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 379,000, 454,000 and 103,000 m³ respectively (including approx. 9,500 m³ stored in the J1(D) tank, which contained water with a high density of radioactive materials at the System B outlet of existing multi-nuclide removal equipment).
 - To reduce the risks of strontium-treated water, treatment using existing, additional and high-performance multi-nuclide removal equipment has been underway (existing: from December 4, 2015; additional: from May 27, 2015; high-performance: from April 15, 2015). Up until July 19, 470,000 m³ had been treated.
- Toward reducing the risk of contaminated water stored in tanks
- Treatment measures comprising the removal of strontium by cesium-absorption apparatus (KURION) (from January 6, 2015) and the secondary cesium-absorption apparatus (SARRY) (from December 26, 2014) have been underway. Up until July 19, approx. 463,000 m³ had been treated.
- Measures in the Tank Area
- Rainwater, under the release standard and having accumulated within the fenced-in area of the contaminated water tank area, was sprinkled on site after eliminating radioactive materials using rainwater-treatment equipment since May 21, 2014 (as of July 23, 2018, a total of 110,044 m³).
- Collection of contaminated soil in the H4 north area
- For the H4 north area, in which leakage was detected in 2013, collection of contaminated soil started from March 2017 and was completed by July 10, 2018.
- Puddle under the multi-nuclide removal equipment (existing ALPS) System C supply pump
- On July 10, 2018, a puddle (approx. 20 cm × 30 cm × 1 mm) was detected under the supply pump of the existing ALPS (C).
 - The puddle remained within the fences in the multi-nuclide removal equipment building and no external leakage was detected. The puddle was then wiped off.
- Leakage from the air hose for air washing of the desalination equipment ultra-filter
- On July 18, 2018, leakage from the air hose for air washing of the desalination equipment ultra-filter was detected.
 - The leakage (10,000 mm × 5,000 mm × 1 mm) remained within the fences and leaked water was collected the following day.
 - The leakage was considered attributable to age-related degradation of the air hose. The damaged hose will be replaced.
- Leakage from the union part of the desalination equipment
- On July 19, 2018, leakage from the union part of the desalination equipment treated water outlet pipe was detected when the equipment was started up.
 - The leakage (200 mm × 100 mm × 1 mm) remained within the fences.
 - An inspection confirmed that the leakage was attributable to the loosened union part. The union part will be

tightened and other union parts will be inspected.

2. 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. The removal of spent fuel from the Unit 4 pool commenced on November 18, 2013 and was completed by December 22, 2014

➤ Main work to help spent fuel removal at Unit 1

- The installation of windbreak fences, which will reduce dust scattering during rubble removal, started on October 31, 2017 and was completed by December 19, 2017.
- As preparatory work to remove fuel from the Unit 1 spent fuel pool, rubble removal on the operating floor north side started from January 22.
- Rubble is being removed carefully by suction equipment. No significant variation was identified around the site boundaries where the density of radioactive materials was monitored and at onsite dust monitors during the above removal work.
- Removed rubble is stored in solid waste storage facilities or other storage areas depending on the dose level.
- To create an access route for work to protect the spent fuel pool, X-braces will be removed.
- A mockup test simulating the actual machine was conducted in June to confirm the whole process of remote-controlled work from cutting and catching to drawing.
- Prior to formulating a detailed plan for pool protection work after removing the X-braces, measurement of the dose around the pool started from July 23.
- After improving the accuracy of the work procedures, operation training will be provided to fully prepare to start removing the X-braces in September 2018.

➤ Main work to help spent fuel removal at Unit 2

- An investigation near the opening wall on the operating floor using a remote-controlled unmanned robot detected no large scattering obstacles to operate of the robot.
- Contamination of the robot was below the level that would prevent maintenance by workers in the front room.
- These results confirmed the availability of future work to move and organize the remaining objects, and investigations of dose, contamination statuses, etc. on the operating floor.

➤ Main work to help spent fuel removal at Unit 3

- Regarding the failure detected at the control panel during the test crane operation, the failed equipment was replaced and a test operation on July 14 confirmed that it could work normally.
- Toward fuel removal, rubble in the pool will be removed and training using the actual machine will be provided to improve the skills of workers. Preparation will continue with safety first to start fuel removal within November 2018.

➤ Progress toward dismantling the Unit 1/2 exhaust stack

- From the perspective of further reducing risks, the upper half of the Unit 1/2 exhaust stack will be dismantled to ensure a seismic margin.
- With efforts to reduce the exposure dose of workers in mind, the dismantling will adopt unmanned work at the upper part. To facilitate this work, a mockup test will be implemented from August.
- Toward starting the work within the Fukushima Daiichi Nuclear Power Station from December (preparatory work such as carrying in materials and equipment), work will continue with safety first.

3. Retrieval of fuel debris

➤ Progress of examination on investigation, sampling and analysis inside the PCV

- Prior to retrieving fuel debris, knowledge such as the characteristics of fuel debris and effect at the time of retrieval needs to be accumulated, hence additional investigations inside the PCV (including sampling) are planned.
- Toward fuel removal, to acquire new knowledge at each Unit, further investigations are being considered. In FY2019,

the inside of the Unit 1/2 PCV will be investigated to sample a small amount of deposit at the PCV bottom.

- In FY2020, sampling of a greater volume of fuel debris at Unit 2 is being considered. For Unit 3, the need for further investigation using the remotely operated underwater vehicle used in the previous investigation is being considered.

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

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

➤ Management status of the rubble and trimmed tree

- As of the end of June 2018, the total storage volume of concrete and metal rubble was approx. 243,000 m³ (-2,300 m³ compared to at the end of May, with an area-occupation rate of 61%). The total storage volume of trimmed trees was approx. 133,900 m³ (- m³, with an area-occupation rate of 76%). The total storage volume of used protective clothing was approx. 54,000 m³ (+600 m³, with an area-occupation rate of 76%). The decrease in rubble was mainly attributable to transfer from the rubble storage tent A and transportation to the temporary soil-covered type storage pool (the 4th pool). The increase in used protective clothing was mainly attributable to acceptance of used protective clothing.

➤ Management status of secondary waste from water treatment

- As of July 5, 2018, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%), while that of concentrated waste fluid was 9,387 m³ (area-occupation rate: 88%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc., was 4,031 (area-occupation rate: 63%).

5. Reactor cooling

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

➤ Status of water injection solely by the FDW system in association with the installation of PE pipes in the Unit 3 CS system line

- For the Core Spray (CS) system line of the Unit 3 reactor water injection facilities, work to replace SUS flexible tubes with polyethylene (PE) pipes is underway to improve reliability.
- Prior to the replacement, the CS system was suspended for the period June 27 – July 4, 2018 and water was injected to the reactor solely by the Feed Water (FDW) system.
- During the period of water injection solely by the FDW system, the RPV bottom and PCV temperatures, which were specified as monitoring parameters, increased by approx. 1°C, but this was considered attributable to the increase in the water injection temperature due to the increased air temperature. No significant variation was indicated in the dust monitor of the PCV gas management facility, nor was any abnormality detected in the reactor cooling status.

➤ Standby operation of the Unit 4 spent fuel pool

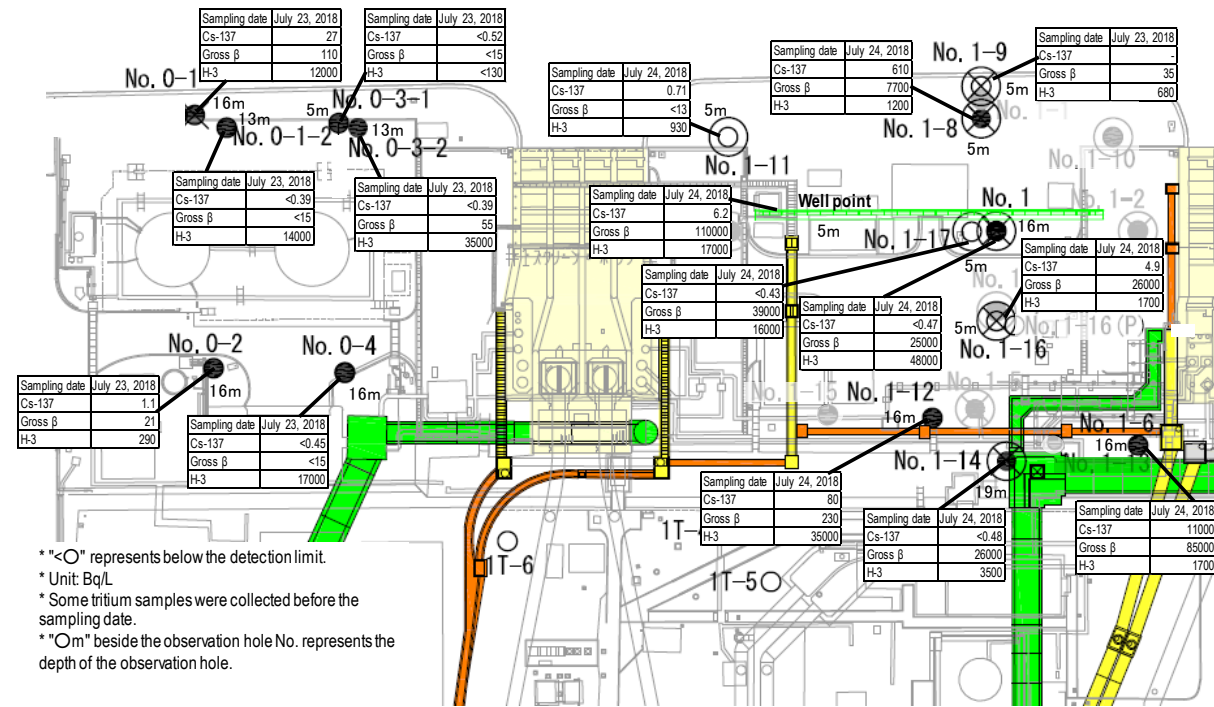
- For Unit 4, removal of fuel assemblies from the spent fuel pool (SFP) was completed in 2014.
- The SFP, in which radioactive components (control rods, etc.) are currently stored, is managed and maintained in a stable condition, while the water level is maintained at the overflow level by circulating pool water. To prevent leakage due to corrosion, etc., water quality is managed by periodically injecting chemicals.
- To reduce the risk of leakage from the circulation system, measures to ensure the health of the SFP were examined, which would include suspending standby operation, periodically inspecting water quality and injecting chemicals.
- The suspension started on July 20, 2018, and the water quality has been inspected. The results will be evaluated to confirm the effect of the suspension.

6. Reduction in radiation dose and mitigation of contamination

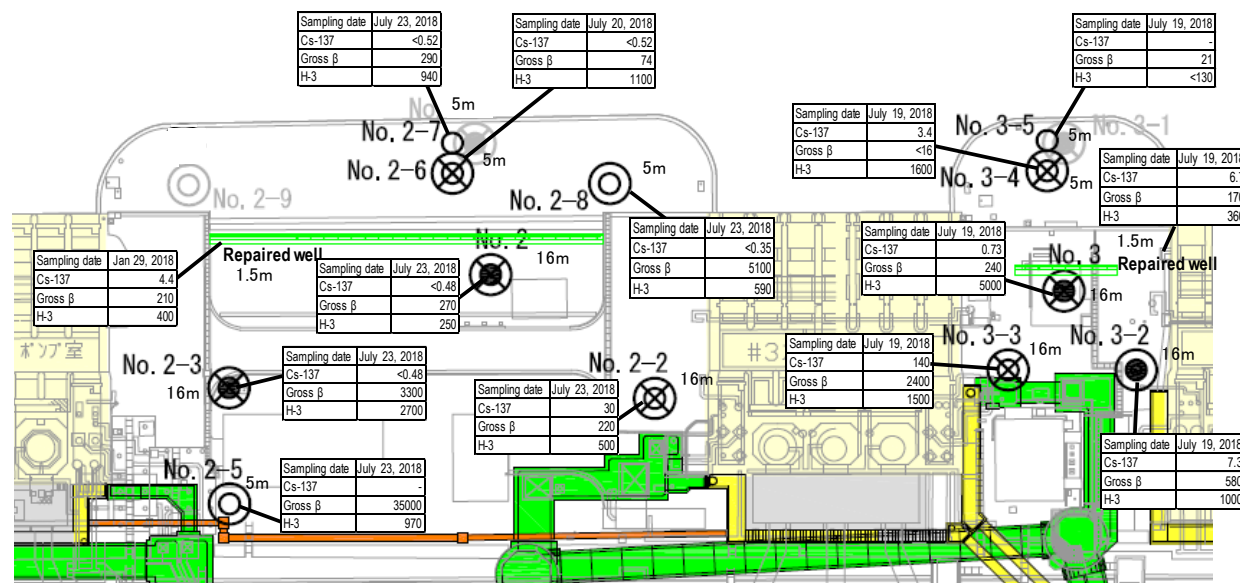
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

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

- The H-3 density at No. 1-6 had been increasing from around 2,000Bq/L since November 2017 to around 15,000 Bq/L. Since March 2018, it has been repeatedly declining, then increasing and currently stands at around 2,000 Bq/L. The density of gross β radioactive materials at the same point had been declining from around 170,000 Bq/L since March 2018 and currently stands at around 90,000 Bq/L.
- The H-3 density at No. 1-8 had been declining from around 3,000Bq/L since March 2018 and currently stands at around 1,200 Bq/L.
- The density of gross β radioactive materials at No. 1-12 had been declining from around 2,000 Bq/L since January 2018 and currently stands at around 300 Bq/L.
- The H-3 density at No. 1-17 had been declining from around 30,000 Bq/L since December 2017 and currently stands at around 16,000 Bq/L. Since August 15, 2013, pumping of groundwater continued (at the well point between the Unit 1 and 2 intakes: August 15, 2013 – October 13, 2015 and from October 24; at the repaired well: October 14 - 23, 2015).
- The H-3 density at No. 2-3 had been increasing from around 1,000 Bq/L since November 2017 and currently stands at around 3,000 Bq/L. The density of gross β radioactive materials at the same point had been increasing from around 600 Bq/L since December 2017 and currently stands at around 3,000 Bq/L.
- The H-3 density at No. 2-5 had been increasing from around 700 Bq/L since November 2017 to around 1,800 Bq/L, then declining and currently stands at around 1,000 Bq/L. The density of gross β radioactive materials at the same point had been increasing from around 30,000 Bq/L since March 2018 to around 70,000 Bq/L, then declining and currently stands at around 30,000 Bq/L. Since December 18, 2013, pumping of groundwater continued (at the well point between the Unit 2 and 3 intakes: December 18, 2013 - October 13, 2015; at the repaired well: from October 14, 2015).
- The H-3 density at No. 3-4 had been declining from around 2,000 Bq/L since January 2018 to around 900 Bq/L, then increasing and currently stands at around 1,500 Bq/L. Since April 1, 2015, pumping of groundwater continued (at the well point between the Unit 3 and 4 intakes: April 1 – September 16, 2015; at the repaired well: from September 17, 2015).
- Regarding the radioactive materials in seawater in the Unit 1-4 intake open channel area, densities have remained below the legal discharge limit except for the increase in cesium 137 and strontium 90 during heavy rain. They have also been declining following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls. The density of cesium 137 has been increasing since January 25, 2017, when a new silt fence was installed to accommodate the relocation.
- Regarding the radioactive materials in seawater in the area within the port, densities have remained below the legal discharge limit except for the increase in cesium 137 and strontium 90 during heavy rain but declining following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls.
- Regarding the radioactive materials in seawater in the area outside the port, densities of cesium 137 and strontium 90 have been declining, but remained below the legal discharge limit at an unchanged level following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls.



<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 density on the Turbine Building east side

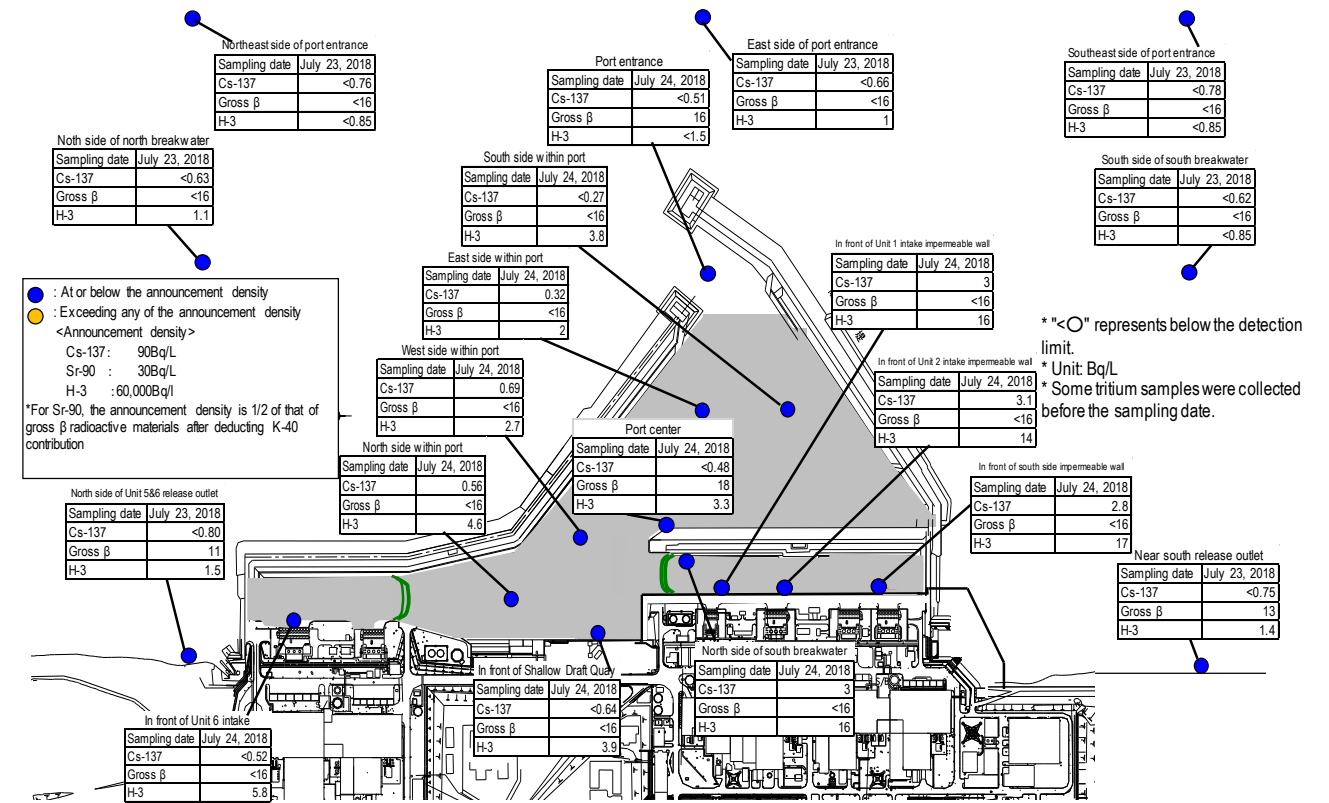


Figure 5: Seawater density around the port

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

Securing appropriate staff long-term while thoroughly implementing workers' exposure dose control. Improving the work environment and labor conditions continuously based on an understanding of workers' on-site needs

➤ Staff management

- The monthly average total of people registered for at least one day per month to work on site during the past quarter from March to May 2018 was approx. 10,300 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 7,600). Accordingly, sufficient people are registered to work on site.
- It was confirmed with the prime contractors that the estimated manpower necessary for the work in August 2018 (approx. 4,240 per day: TEPCO and partner company workers) would be secured at present. The average numbers of workers per day per month (actual values) were maintained, with approx. 4,100 to 6,200 since FY2016 (see Figure 6).
- The number of workers from within Fukushima Prefecture increased and outside, declined. The local employment ratio (TEPCO and partner company workers) as of June has remained constant at around 60%.
- The monthly average exposure dose of workers remained at approx. 0.59 mSv/month during FY2015, approx. 0.39 mSv/month during FY2016 and approx. 0.36 mSv/month during FY2017. (Reference: Annual average exposure dose 20 mSv/year \div 1.7 mSv/month)
- For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.

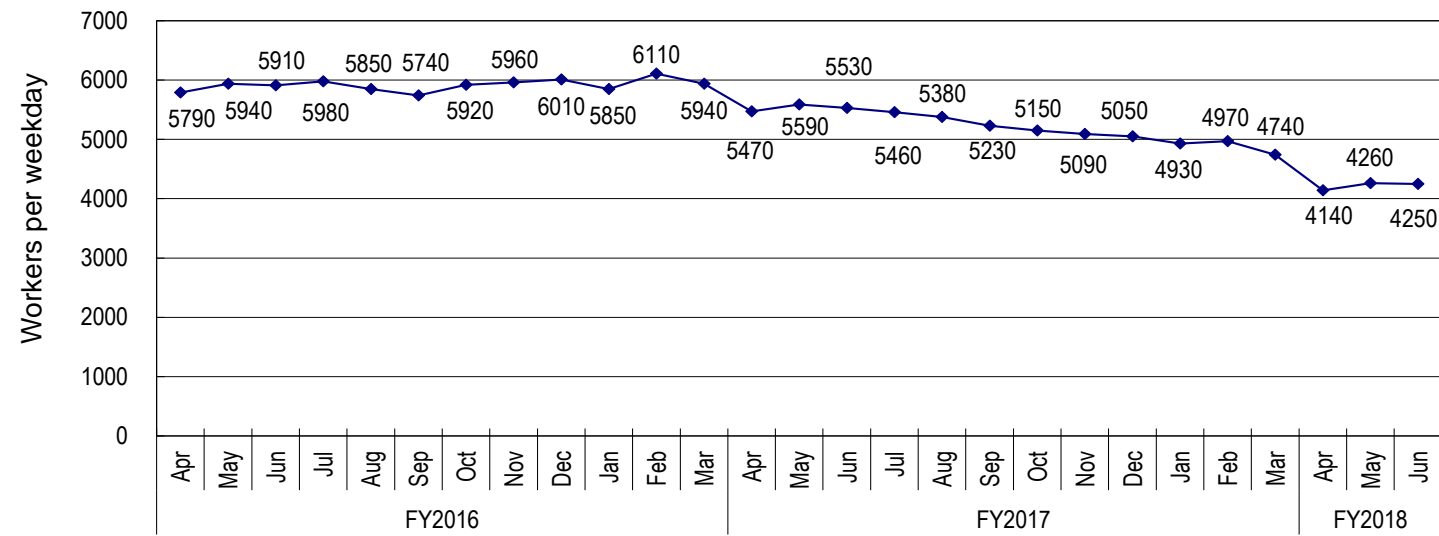


Figure 6: Changes in the average number of workers per weekday for each month since FY2016 (actual values)

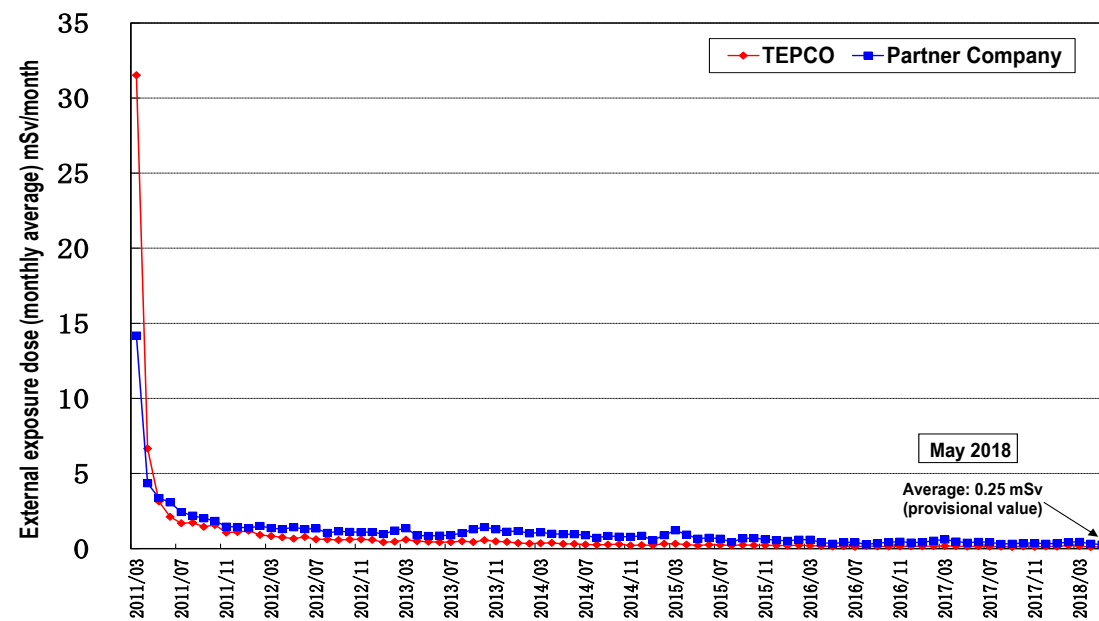


Figure 7: Changes in monthly individual worker exposure dose (monthly average exposure dose since March 2011)

8. Other

- The 3rd International Forum on the Decommissioning of the Fukushima Daiichi Nuclear Power Station
 - The 3rd International Forum on the Decommissioning of the Fukushima Daiichi Nuclear Power Station will be held in Naraha Town on August 5 and Iwaki City on August 6. (Organizer: Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF))
 - On Day 1, mainly for the local community, members in charge of the decommissioning of the Fukushima NPS will sincerely answer questions from local residents and engage in dialog with them. On Day 2, mainly for technical experts, international members and Japanese experts will join the discussion on remote technology.

➤ Status of heat stroke cases

- In FY2018, measures to further prevent heat stroke commenced from April to cope with the hottest season (in FY2017, from May).
- In FY2018, three workers suffered heat stroke due to work up until July 23 (in FY2017, three workers up until the end of July). Ongoing measures will be taken to prevent heat stroke.

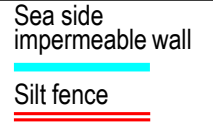
➤ Health management of workers in the Fukushima Daiichi NPS

- As health management measures in line with the guidelines of the Ministry of Health, Labour and Welfare (issued in August 2015), a scheme was established and operated, whereby primary contractors confirmed reexamination at medical institutions and the subsequent status of workers who are diagnosed as “detailed examination and treatment required” in the health checkup, with TEPCO confirming the operation status by the primary contractors.
- The recent report on the management status of the health checkup during the fourth quarter (January – March) in FY2017 confirmed that the primary contractors had provided appropriate guidance and properly managed the operation under the scheme. The report on the follow-up status during the third quarter and before confirmed that responses to workers, which had not been completed by the time of the previous report, were being provided on an ongoing basis and that checking of operations would continue.

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 July 16-24)”; unit (Bq/L); ND represents a value below the detection limit

Source: TEPCO website Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station <http://www.tepco.co.jp/nu/fukushima-np/f1/smp/index-j.html>



Cesium-134: 3.3 (2013/10/17) → ND(0.30) Below 1/10
Cesium-137: 9.0 (2013/10/17) → 0.32 Below 1/20
Gross β: **74** (2013/ 8/19) → ND(16) Below 1/4
Tritium: 67 (2013/ 8/19) → 2.0 Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.19) Below 1/20
Cesium-137: **10** (2013/12/24) → 0.69 Below 1/10
Gross β: **60** (2013/ 7/ 4) → ND(16) Below 1/3
Tritium: 59 (2013/ 8/19) → 2.7 Below 1/20

Cesium-134: 5.0 (2013/12/2) → ND(0.31) Below 1/10
Cesium-137: 8.4 (2013/12/2) → 0.56 Below 1/10
Gross β: **69** (2013/8/19) → ND(16) Below 1/4
Tritium: 52 (2013/8/19) → 4.6 Below 1/10

Cesium-134: 2.8 (2013/12/2) → ND(0.50) Below 1/5
Cesium-137: 5.8 (2013/12/2) → ND(0.52) Below 1/10
Gross β: **46** (2013/8/19) → ND(16) Below 1/2
Tritium: 24 (2013/8/19) → 5.8 Below 1/4

Cesium-134: ND(0.51)
Cesium-137: ND(0.48)
Gross β: 18
Tritium: 3.3 *

Cesium-134: 3.3 (2013/12/24) → ND(0.51) Below 1/6
Cesium-137: 7.3 (2013/10/11) → ND(0.51) Below 1/10
Gross β: **69** (2013/ 8/19) → 16 Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.5) Below 1/40

Cesium-134: 3.5 (2013/10/17) → ND(0.21) Below 1/10
Cesium-137: 7.8 (2013/10/17) → ND(0.27) Below 1/20
Gross β: **79** (2013/ 8/19) → ND(16) Below 1/4
Tritium: 60 (2013/ 8/19) → 3.8 Below 1/10

Cesium-134: **32** (2013/10/11) → ND(0.54) Below 1/50
Cesium-137: **73** (2013/10/11) → 3.0 Below 1/20
Gross β: **320** (2013/ 8/12) → ND(16) Below 1/20
Tritium: 510 (2013/ 9/ 2) → 16 Below 1/30

From February 11, 2017, the location of the sampling point was shifted approx. 50 m south of the previous point due to the location shift of the silt fence.

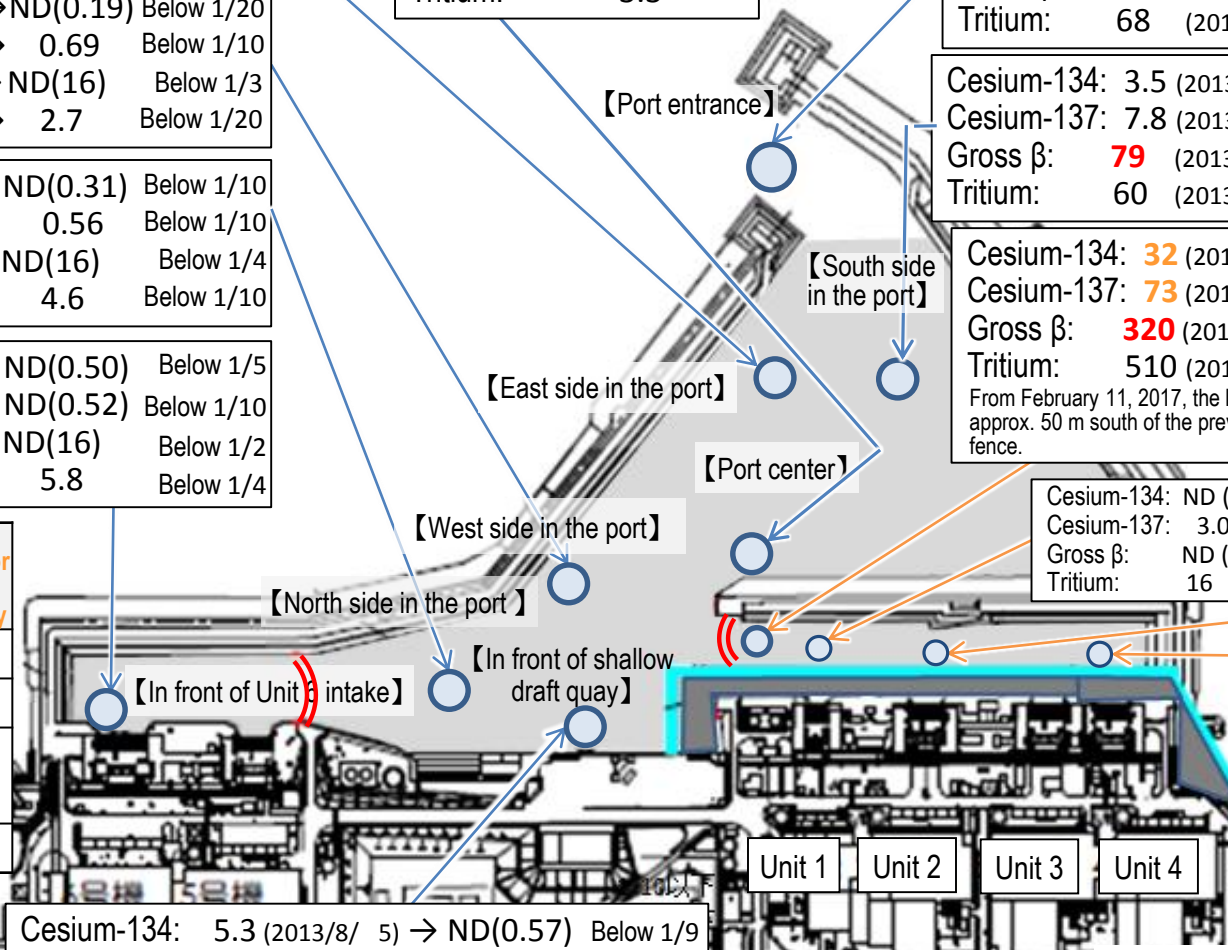
Cesium-134: ND (0.50)
Cesium-137: 3.0
Gross β: ND (16)
Tritium: 16 *

Cesium-134: ND (0.53)
Cesium-137: 3.1
Gross β: ND (16)
Tritium: 14 *

Cesium-134: ND (0.40)
Cesium-137: 2.8
Gross β: ND (16)
Tritium: 17 *

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

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



Cesium-134: 5.3 (2013/8/ 5) → ND(0.57) Below 1/9
Cesium-137: 8.6 (2013/8/ 5) → ND(0.64) Below 1/10
Gross β: **40** (2013/7/ 3) → ND(16) Below 1/2
Tritium: 340 (2013/6/26) → 3.9 Below 1/80

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

Summary of TEPCO data as of July 25, 2018

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

(The latest values sampled during July 16-24)

Unit (Bq/L); ND represents a value below the detection limit; values in () represent the detection limit; ND (2013) represents ND throughout 2013

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

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

Cesium-134: ND (2013) → ND (0.68)
 Cesium-137: ND (2013) → ND (0.76)
 Gross β: ND (2013) → ND (16)
 Tritium: ND (2013) → ND (0.85)

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

Cesium-134: ND (2013) → ND (0.58)
 Cesium-137: 1.6 (2013/10/18) → ND (0.66) Below 1/2
 Gross β: ND (2013) → ND (16)
 Tritium: 6.4 (2013/10/18) → 1.0 Below 1/6

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

Cesium-134: ND (2013) → ND (0.65)
 Cesium-137: ND (2013) → ND (0.78)
 Gross β: ND (2013) → ND (16)
 Tritium: ND (2013) → ND (0.85)

Cesium-134: ND (2013) → ND (0.81)
 Cesium-137: ND (2013) → ND (0.63)
 Gross β: ND (2013) → ND (16)
 Tritium: 4.7 (2013/ 8/18) → 1.1 Below 1/4

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

【Port entrance】

Cesium-134: 3.3 (2013/12/24) → ND (0.51) Below 1/6
 Cesium-137: 7.3 (2013/10/11) → ND (0.51) Below 1/10
 Gross β: 69 (2013/ 8/19) → 16 Below 1/4
 Tritium: 68 (2013/ 8/19) → ND (1.5) Below 1/40

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

Cesium-134: ND (2013) → ND (0.88)
 Cesium-137: ND (2013) → ND (0.62)
 Gross β: ND (2013) → ND (16)
 Tritium: ND (2013) → ND (0.85)

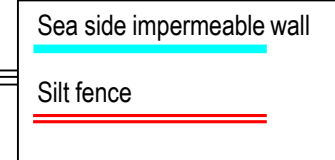
【North side of Unit 5 and 6 release outlet】

Cesium-134: 1.8 (2013/ 6/21) → ND (0.77) Below 1/2
 Cesium-137: 4.5 (2013/ 3/17) → ND (0.80) Below 1/5
 Gross β: 12 (2013/12/23) → 11
 Tritium: 8.6 (2013/ 6/26) → 1.5 Below 1/5

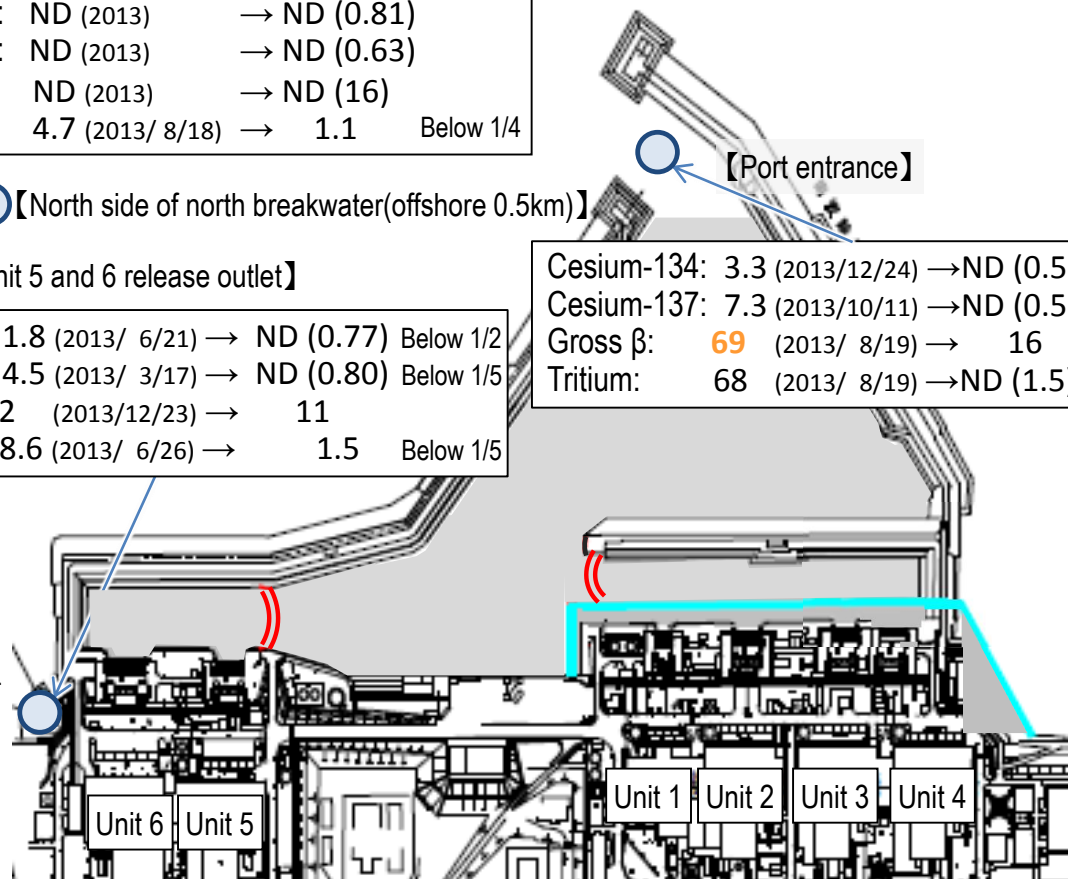
Cesium-134: ND (2013) → ND (0.78)
 Cesium-137: 3.0 (2013/ 7/15) → ND (0.75) Below 1/4
 Gross β: 15 (2013/12/23) → 13
 Tritium: 1.9 (2013/11/25) → 1.4

【Near south release outlet】

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

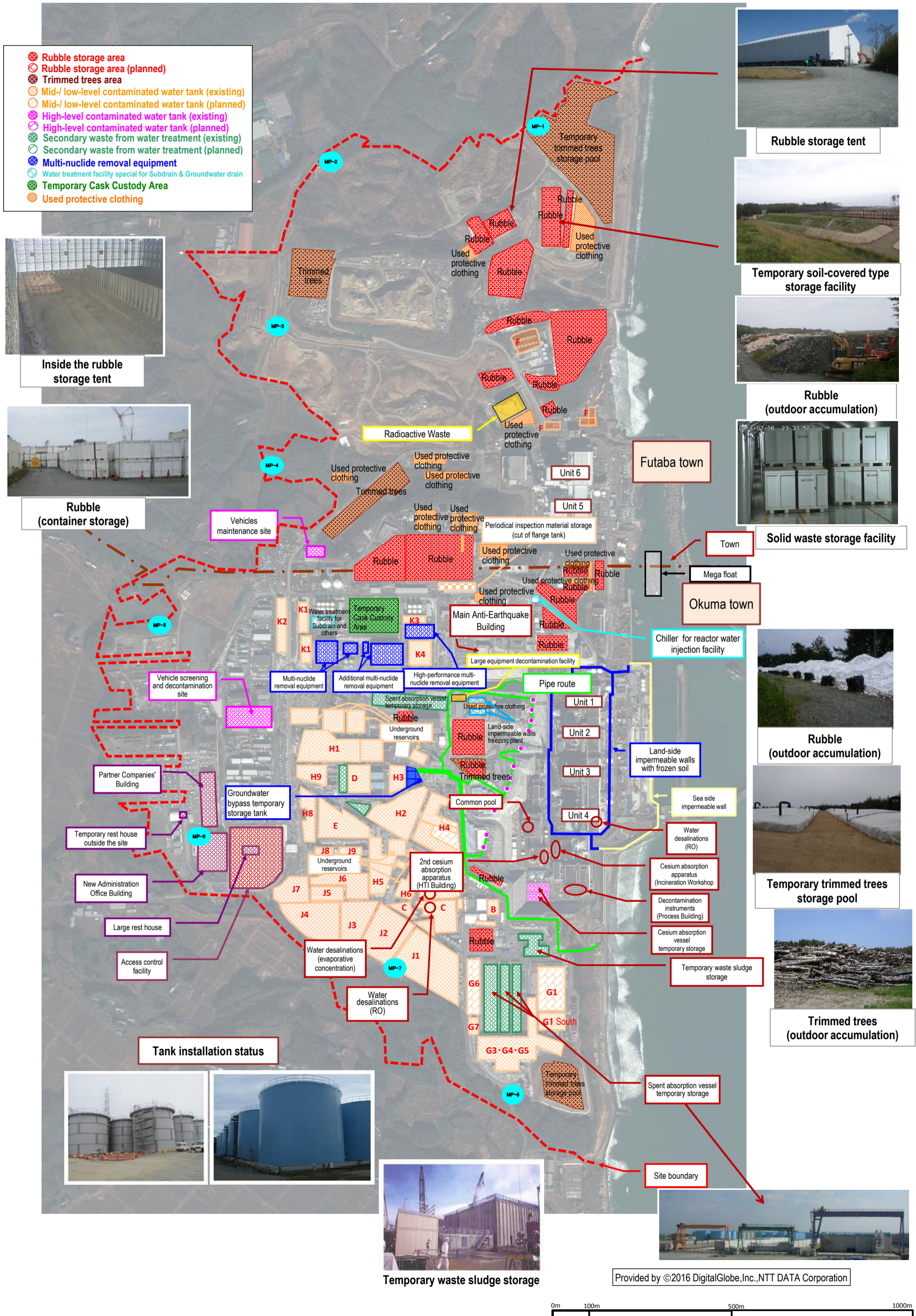


Note: The gross β measurement values include natural potassium 40 (approx. 12 Bq/L). They also include the contribution of yttrium 90, which radioactively balance strontium 90.



Summary of TEPCO data as of July 25, 2018

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site Layout



- Rubble storage area
- Rubble storage area (planned)
- Trimmed trees area
- Mid-/ low-level contaminated water tank (existing)
- Mid-/ low-level contaminated water tank (planned)
- High-level contaminated water tank (existing)
- High-level contaminated water tank (planned)
- Secondary waste from water treatment (existing)
- Secondary waste from water treatment (planned)
- Multi-nuclide removal equipment
- Water treatment facility special for Subdrain & Groundwater drain
- Temporary Cask Custody Area
- Used protective clothing



Inside the rubble storage tent



Rubble (container storage)



Rubble storage tent



Temporary soil-covered type storage facility



Rubble (outdoor accumulation)



Solid waste storage facility



Rubble (outdoor accumulation)



Temporary trimmed trees storage pool



Trimmed trees (outdoor accumulation)



Tank installation status



Temporary waste sludge storage



Spent absorption vessel temporary storage

Progress toward decommissioning: Fuel removal from the spent fuel pool (SFP)

Immediate target

Commence fuel removal from the Unit 1-3 Spent Fuel Pools

Unit 1

Regarding fuel removal from Unit 1 spent fuel pool, there is a plan to install a dedicated cover for fuel removal over the top floor of the Reactor Building (operating floor). All roof panels and wall panels of the building cover were dismantled by November 10, 2016. Removal of pillars and beams of the building was completed on May 11, 2017. Modification of the pillars and beams of the building cover and installation of building cover were completed by December 19. Rubble removal from the operating floor north side started from January 22, 2018. Rubble is being removed carefully by suction equipment. No significant variation was identified around site boundaries where the density of radioactive materials was monitored and at onsite dust monitors during the above removal work.



<Installation status (January 22)>



October 2015



November 2017

Scope of rubble removal (north side)

<Status of the operating floor>

Unit 2

To facilitate removal of fuel assemblies and retrieval of debris in the Unit 2 spent fuel pool, the scope of dismantling and modification of the existing Reactor Building rooftop was examined. From the perspective of ensuring safety during the work, controlling impacts on the outside of the power station, and removing fuel rapidly to reduce risks, we decided to dismantle the whole rooftop above the highest floor of the Reactor Building.

Examination of the following two plans continues: Plan 1 to share a container for removing fuel assemblies from the pool and retrieving fuel debris; and Plan 2 to install a dedicated cover for fuel removal from the pool.

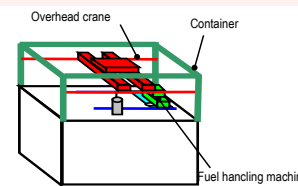


Image of Plan 1

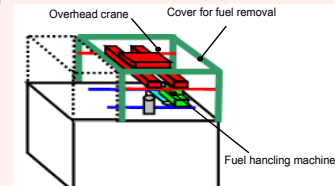


Image of Plan 2

Unit 3

Prior to the installation of a cover for fuel removal, removal of large rubble from the spent fuel pool was completed in November 2015. To ensure safe and steady fuel removal, training of remote control was conducted at the factory using the actual fuel-handling machine which will be installed on site (February – December 2015). Measures to reduce dose on the Reactor Building top floor (decontamination, shields) were completed in December 2016. Installation of a cover for fuel removal and a fuel-handling machine is underway from January 2017.

Installation of the fuel removal cover was completed on February 23, 2018. Work will continue with safety first toward fuel removal around mid-FY2018.



Installation of dome roof (February 21)

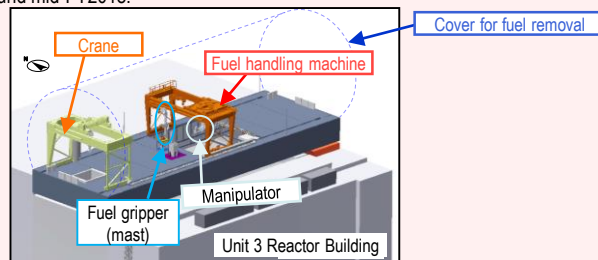


Image of entire fuel handling facility inside the cover

Unit 4

In the Mid- and Long-Term Roadmap, the target of Phase 1 involved commencing fuel removal from inside the spent fuel pool (SFP) of the 1st Unit within two years of completion of Step 2 (by December 2013). On November 18, 2013, fuel removal from Unit 4, or the 1st Unit, commenced and Phase 2 of the roadmap started.

On November 5, 2014, within a year of commencing work to fuel removal, 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. (2 of the non-irradiated fuel assemblies were removed in advance in July 2012 for fuel checks)

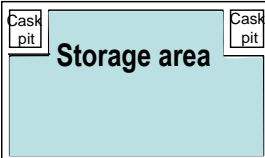
This marks the completion of fuel removal from the Unit 4 Reactor Building. Based on this experience, fuel assemblies will be removed from Unit 1-3 pools.

* A part of the photo is corrected because it includes sensitive information related to physical protection.



Fuel removal status

Common pool

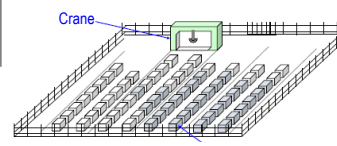


An open space will be maintained in the common pool (Transfer to the temporary cask custody area)

Progress to date

- The common pool has been restored to a condition allowing it to re-accommodate fuel to be handled (November 2012)
- Loading of spent fuel stored in the common pool to dry casks commenced (June 2013)
- Fuel removal from the Unit 4 spent fuel pool began to be received (November 2013 - November 2014)

Temporary cask⁽²⁾ custody area



Spent fuel is accepted from the common pool

Operation commenced on April 12, 2013; from the cask-storage building, transfer of 9 existing dry casks completed (May 21, 2013); fuel stored in the common pool sequentially transferred.

<Glossary>

(*1) Operating floor: During regular inspection, the roof over the reactor is opened while on the operating floor, fuel inside the core is replaced and the core internals are inspected.

(*2) Cask: Transportation container for samples and equipment, including radioactive materials.

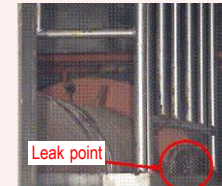
Immediate target Identify the plant status and commence R&D and decontamination toward fuel debris retrieval

Investigation into TIP Room of the Unit 1 Reactor Building

- To improve the environment for future investigations inside the PCV, etc., an investigation was conducted from September 24 to October 2, 2015 at the TIP Room⁽¹⁾. (Due to high dose around the entrance in to the TIP Room, the investigation of dose rate and contamination distribution was conducted through a hole drilled from the walkway of the Turbine Building, where the dose was low)
- The investigative results identified high dose at X-31 to 33 penetrations⁽²⁾ (instrumentation penetration) and low dose at other parts.
- As it was confirmed that work inside the TIP room would be available, the next step will include identification of obstacles which will interfere the work inside the TIP Room and formulation of a plan for dose reduction.

Investigation in the leak point detected in the upper part of the Unit 1 Suppression Chamber (S/C⁽³⁾)

Investigation in the leak point detected in the upper part of Unit 1 S/C from May 27, 2014 from one expansion joint cover among the lines installed there. As no leakage was identified from other parts, specific methods will be examined to halt the flow of water and repair the PCV.



Leak point

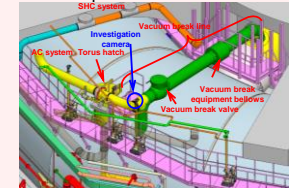
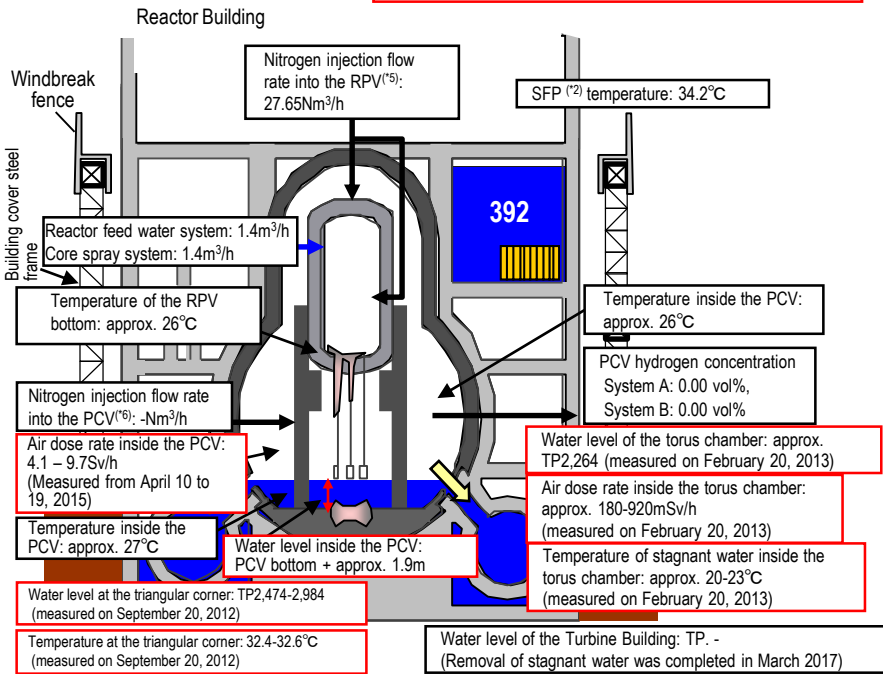


Image of the S/C upper part investigation

Unit 1

Air dose rate inside the Reactor Building:
Max. 5,150mSv/h (1F southeast area) (measured on July 4, 2012)

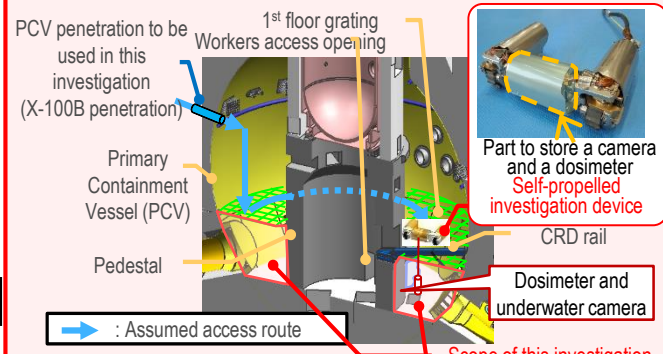


Status of investigation inside the PCV

Prior to fuel debris retrieval, an investigation inside the PCV will be conducted to inspect the status there including the location of fuel debris.

[Investigative outline]

- In April 2015, a device, which entered the inside of the PCV through a narrow access opening (bore: ϕ 100 mm), collected information such as images and airborne dose inside the PCV 1st floor.
- In March 2017, the investigation using a self-propelled investigation device, conducted to inspect the spreading of debris to the basement floor outside the pedestal, took images of the PCV bottom status for the first time. The status inside the PCV will continue to be examined based on the collected image and dose data.



<Image of investigation inside the PCV>

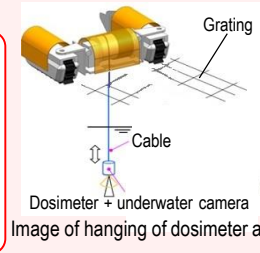


Image of hanging of dosimeter and camera



Image near the bottom

* Indices related to the plant are values as of 11:00, July 25, 2018

Investigations inside PCV	1st (Oct 2012)	2nd (Apr 2015)	3rd (Mar 2017)
	- Acquiring images - Measuring air temperature and dose rate - Measuring water level and temperature - Sampling stagnant water - Installing permanent monitoring instrumentation	- Confirming the status of PCV 1st floor - Acquiring images - Measuring air temperature and dose rate - Replacing permanent monitoring instrumentation	- Confirming the status of PCV 1st basement floor - Acquiring images - Measuring air temperature and dose rate - Sampling deposit - Replacing permanent monitoring instrumentation

Leakage points from PCV	PCV vent pipe vacuum break line bellows (identified in May 2014)	Sand cushion drain line (identified in November 2013)

Capturing the location of fuel debris inside the reactor by measurement using muons

Period	Evaluation results
Feb - May 2015	Confirmed that there was no large fuel in the reactor core.

<Glossary>
 (1) TIP (Traversing In-core Probe)
 (2) Penetration: Through-hole of the PCV
 (3) S/C (Suppression Chamber): Suppression pool, used as the water source for the emergent core cooling system.
 (4) SFP (Spent Fuel Pool)
 (5) RPV (Reactor Pressure Vessel)
 (6) PCV (Primary Containment Vessel)

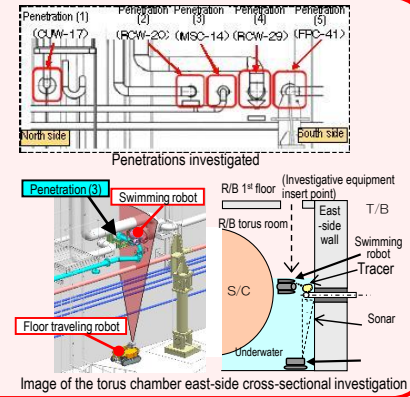
Immediate target Identify the plant status and commence R&D and decontamination toward fuel debris retrieval

Installation of an RPV thermometer and permanent PCV supervisory instrumentation

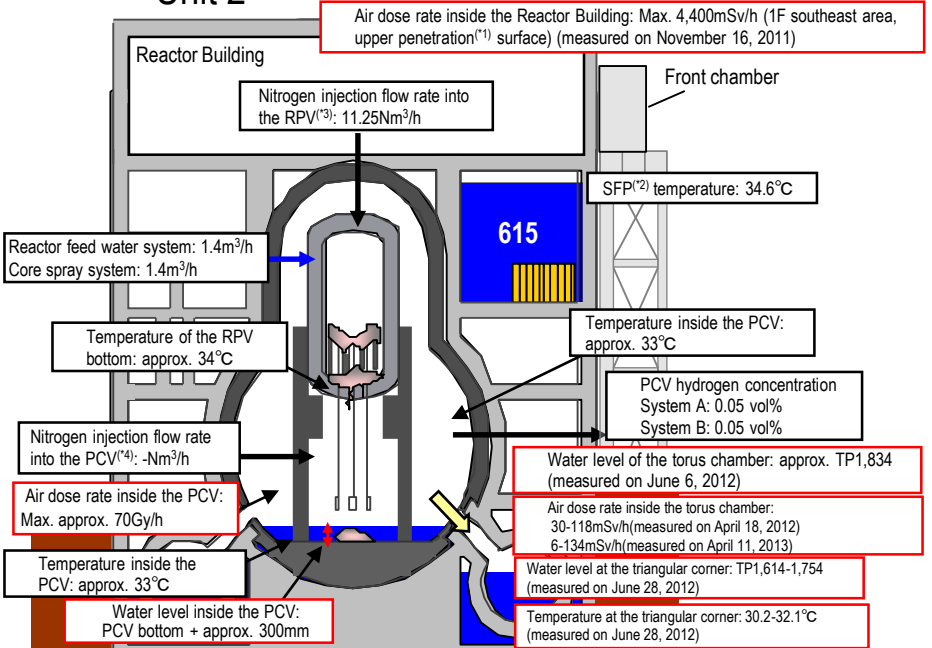
- Replacement of the RPV thermometer
 - As the thermometer installed at the Unit 2 RPV bottom after the earthquake had broken in February 2014, it was excluded from the monitoring thermometers.
 - In April 2014, removal of the broken thermometer failed and was suspended. Rust-stripping chemicals were injected and the broken thermometer was removed in January 2015. A new thermometer was reinstalled in March. The thermometer has been used as a part of permanent supervisory instrumentation since April.
- Reinstallation of the PCV thermometer and water-level gauge
 - Some of the permanent supervisory instrumentation for PCV could not be installed in the planned locations due to interference with existing grating (August 2013). The instrumentation was removed in May 2014 and new instruments were reinstalled in June 2014. The trend of added instrumentation will be monitored for approx. one month to evaluate its validity.
 - The measurement during the installation confirmed that the water level inside the PCV was approx. 300mm from the bottom.

Investigative results on torus chamber walls

- The torus chamber walls were investigated (on the north side of the east-side walls) using equipment specially developed for that purpose (a swimming robot and a floor traveling robot).
- At the east-side wall pipe penetrations (five points), "the status" and "existence of flow" were checked.
- A demonstration using the above two types of underwater wall investigative equipment showed how the equipment could check the status of penetration.
- Regarding Penetrations 1 - 5, the results of checking the sprayed tracer (*) by camera showed no flow around the penetrations. (investigation by the swimming robot)
- Regarding Penetration 3, a sonar check showed no flow around the penetrations. (investigation by the floor traveling robot)



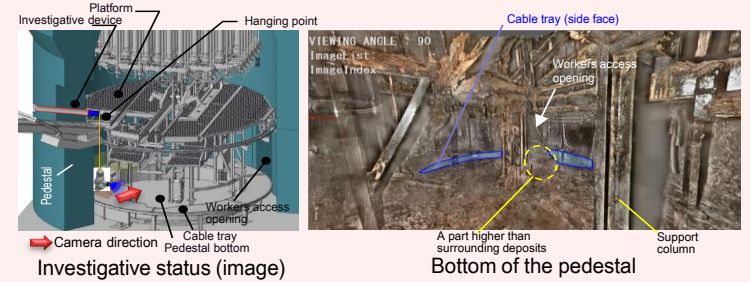
Unit 2



Status of investigation inside the PCV

Prior to fuel debris retrieval, an investigation inside the PCV will be conducted to inspect the status there including the location of fuel debris.

- [Investigative outline]
- Investigative devices such as a robot will be injected from Unit 2 X-6 penetration⁽¹⁾ and access the inside of the pedestal using the CRD rail.
- [Progress status]
- On January 26 and 30, 2017, a camera was inserted from the PCV penetration to inspect the status of the CRD replacement rail on which the robot will travel. On February 9, deposit on the access route of the self-propelled investigative device was removed and on February 16, the inside of the PCV was investigated using the device.
 - The results of this series of investigations confirmed fallen and deformed gratings and a quantity of deposit inside the pedestal.
 - On January 19, 2018, the status below the platform inside the pedestal was investigated using an investigative device with a hanging mechanism. From the analytical results of images obtained in the investigation, deposits probably including fuel debris were found at the bottom of the pedestal. In addition, multiple parts higher than the surrounding deposits were also detected. We presumed that there were multiple routes of fuel debris falling.



Capturing the location of fuel debris inside the reactor by measurement using muons

Period	Evaluation results
Mar - Jul 2016	Confirmed the existence of high-density materials, which was considered as fuel debris, at the bottom of RPV, and in the lower part and the outer periphery of the reactor core. It was assumed that a large part of fuel debris existed at the bottom of RPV.

<Glossary> (*1) Penetration: Through-hole of the PCV (*2) SFP (Spent Fuel Pool) (*3) RPV (Reactor Pressure Vessel) (*4) PCV (Primary Containment Vessel) (*5) Tracer: Material used to trace the fluid flow. Clay particles

* Indices related to plant are values as of 11:00, July 25, 2018

Investigations inside PCV	1st (Jan 2012)	2nd (Mar 2012)	3rd (Feb 2013 - Jun 2014)	4th (Jan - Feb 2017)
	- Acquiring images - Measuring air temperature	- Confirming water surface - Measuring water temperature - Measuring dose rate	- Acquiring images - Sampling stagnant water - Measuring water level - Installing permanent monitoring instrumentation	- Acquiring images - Measuring dose rate - Measuring air temperature
Leakage points from PCV	- No leakage from torus chamber rooftop - No leakage from all inside/outside surfaces of S/C			

Immediate target Identify the plant status and commence R&D and decontamination toward fuel debris retrieval

Water flow was detected from the Main Steam Isolation Valve* room

On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no possibility of outflow from the building.

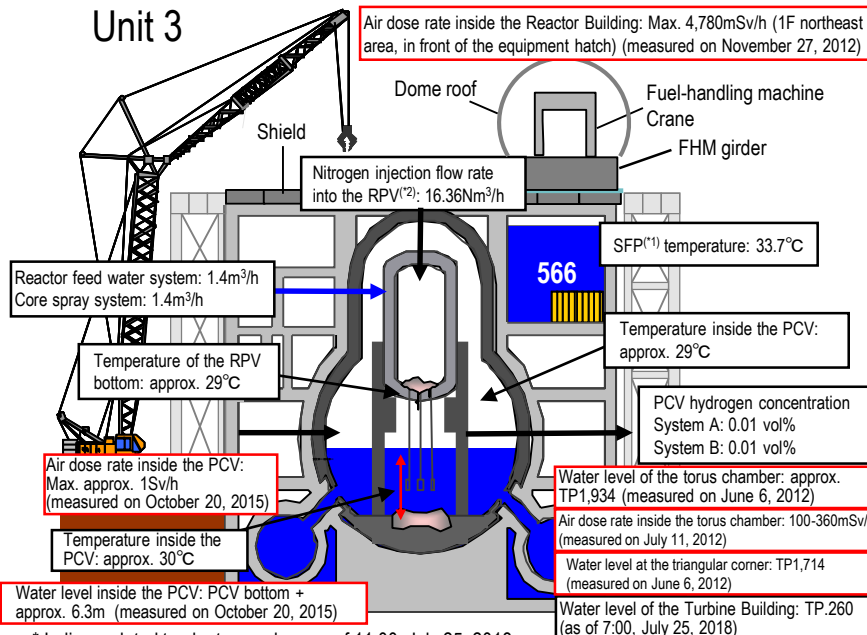
From April 23, 2014, image data has been acquired by camera and the radiation dose measured via pipes for measurement instrumentation, which connect the air-conditioning room on the Reactor Building 2nd floor with the Main Steam Isolation Valve Room on the 1st floor. On May 15, 2014, water flow from the expansion joint of one Main Steam Line was detected.

This is the first leak from PCV detected in the Unit 3. Based on the images collected in this investigation, the leak volume will be estimated and the need for additional investigations will be examined. The investigative results will also be utilized to examine water stoppage and PCV repair methods.

* Main Steam Isolation Valve: A valve to shut off the steam generated from the Reactor in an emergency

Unit 3

Air dose rate inside the Reactor Building: Max. 4,780mSv/h (1F northeast area, in front of the equipment hatch) (measured on November 27, 2012)



* Indices related to plant are values as of 11:00, July 25, 2018

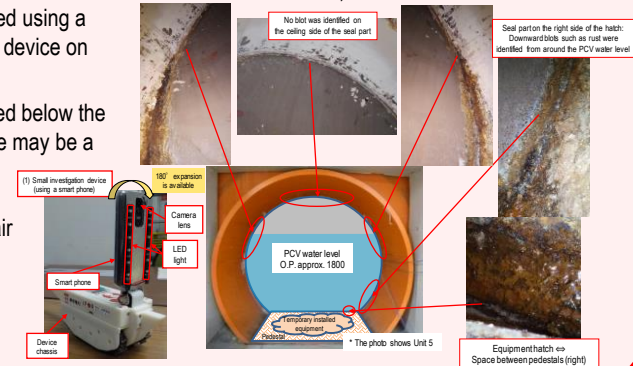
Investigations inside PCV	1st (Oct – Dec 2015)	- Acquiring images - Measuring air temperature and dose rate - Measuring water level and temperature - Sampling stagnant water - Installing permanent monitoring instrumentation (December 2015)
	2nd (Jul 2017)	- Acquiring images - Installing permanent monitoring instrumentation (August 2017)
Leakage points from PCV	- Main steam pipe bellows (identified in May 2014)	

Investigative results into the Unit 3 PCV equipment hatch using a small investigation device

- As part of the investigation into the PCV to facilitate fuel debris retrieval, the status around the Unit 3 PCV equipment hatch was investigated using a small self-traveling investigation device on November 26, 2015.

- Given blots such as rust identified below the water level inside the PCV, there may be a leakage from the seal to the extent of bleeding.

Methods to investigate and repair the parts, including other PCV penetrations with a similar structure, will be considered.

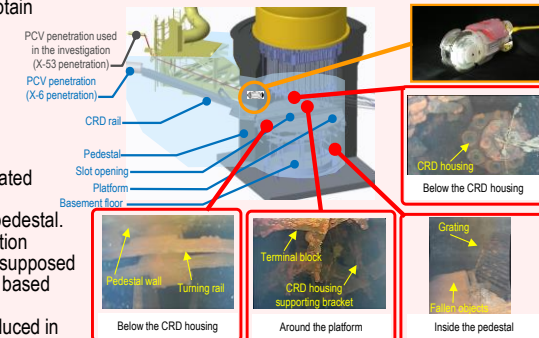


Investigation inside the PCV

Prior to fuel debris retrieval, the inside of the Primary Containment Vessel (PCV) was investigated to identify the status there including the location of the fuel debris.

[Investigative outline]

- The status of X-53 penetration(*4), which may be under the water and which is scheduled for use to investigate the inside of the PCV, was investigated using remote-controlled ultrasonic test equipment. The results showed that the penetration was not under the water (October 22-24, 2014).
- For the purpose of confirming the status inside the PCV, an investigation device was inserted into the PCV from X-53 penetration on October 20 and 22, 2015 to obtain images, data of dose and temperature and sample stagnant water. No damage was identified on the structure and walls inside the PCV and the water level was almost identical with the estimated value. 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 image data obtained in the investigation identified damage to multiple structures and the supposed core internals. Consideration about fuel removal based on the obtained information will continue.
- 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.



Status inside the pedestal

Capturing the location of fuel debris inside the reactor by measurement using muons

Period	Evaluation results
May – Sep 2017	The evaluation confirmed that no large lump existed in the core area where fuel had been placed and that part of the fuel debris potentially existed at the bottom of the RPV.

<Glossary>

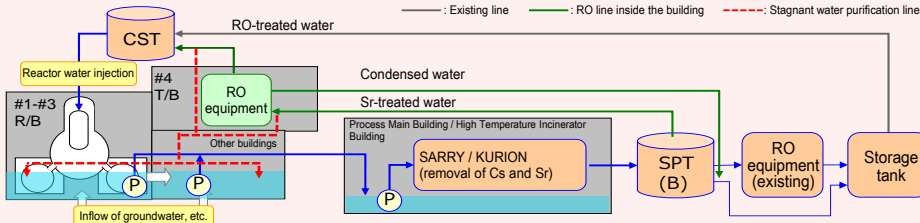
(*1) SFP (Spent Fuel Pool) (*2) RPV (Reactor Pressure Vessel) (*3) PCV (Primary Containment Vessel) (*4) Penetration: Through-hole of the PCV

Immediate target Stably continue reactor cooling and stagnant water treatment, and improve reliability

Work to improve the reliability of the circulation water injection cooling system and pipes to transfer stagnant water.

- Operation of the reactor water injection system using Unit 3 Condensate Storage Tank (CST) as a water source commenced (from July 5, 2013). Compared to the previous systems, the reliability of the reactor water injection system was enhanced, e.g. by increasing the amount of water-source storage and enhancing durability.
- To reduce the risk of contaminated-water leakage, the circulation loop was shortened by installing a reverse osmosis (RO) device in the Unit 4 Turbine Building within the circulation loop, comprising the transfer of contaminated water, water treatment and injection into the reactors. Operation of the installed RO device started from October 7 and 24-hour operation started from October 20. Installation of the new RO device inside the building shortened the circulation loop from approx. 3 to 0.8 km.
- To accelerate efforts to reduce the radiation density in stagnant water inside the buildings, circulating purification of stagnant water inside the buildings started on the Unit 3 and 4 side on February 22 and on the Unit 1 and 2 side on April 11.
- For circulating purification, a new pipe divided from the water treatment equipment outlet line was installed to transfer water purified at the water treatment equipment to the Unit 1 Reactor Building and the Unit 2-4 Turbine Buildings.
- The risks of stagnant water inside the buildings will continue to be reduced in addition to reduction of its storage.

* The entire length of contaminated water transfer pipes is approx. 2.1km, including the transfer line of surplus water to the upper heights (approx. 1.3km).



Progress status of dismantling of flange tanks

- To facilitate replacement of flange tanks, dismantling of flange tanks started in H1 east/H2 areas in May 2015. Dismantling of all flange tanks was completed in H1 east area (12 tanks) in October 2015, in H2 area (28 tanks) in March 2016, in H4 area (56 tanks) in May 2017, in H3 B area (31 tanks) in September 2017, in H5 and H5 north areas (31 tanks) in June 2018 and in G6 area (38 tanks) in July 2018. Dismantling of flange tanks in H6 area is underway.



Start of dismantling in H1 east area

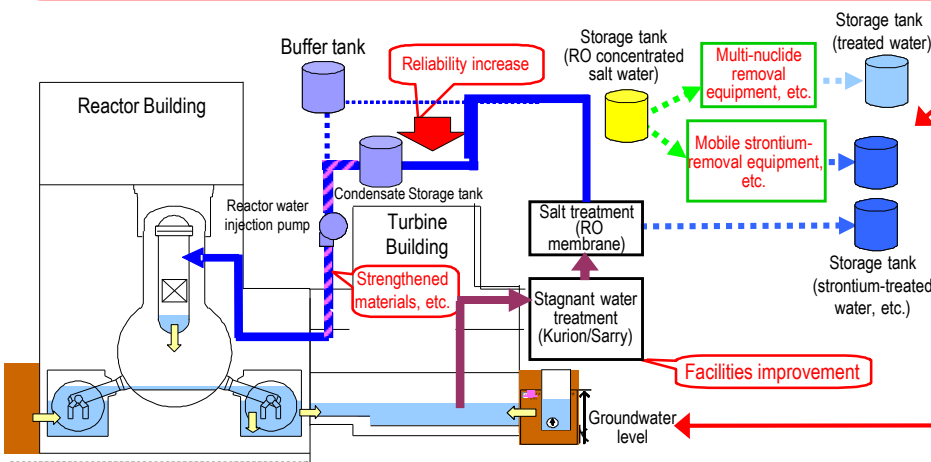


After dismantling in H1 east area

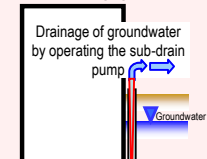
Completion of purification of contaminated water (RO concentrated salt water)

Contaminated water (RO concentrated salt water) is being treated using seven types of equipment including the multi-nuclide removal equipment (ALPS). Treatment of the RO concentrated salt water was completed on May 27, 2015, with the exception of the remaining water at the tank bottom. The remaining water will be treated sequentially toward dismantling the tanks.

The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.



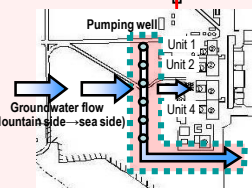
Preventing groundwater from flowing into the Reactor Buildings



Reducing groundwater inflow by pumping sub-drain water
 To reduce groundwater flowing into the buildings, pumping-up of groundwater from wells (subdrains) around the buildings started on September 3, 2015. Pumped-up groundwater was purified at dedicated facilities and released after TEPCO and a third-party organization confirmed that its quality met operational targets.

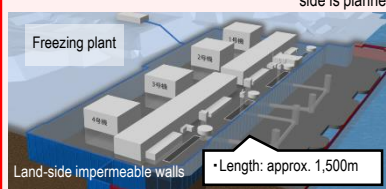
Via a groundwater bypass, reduce the groundwater level around the Building and groundwater inflow into the Building

Measures to pump up groundwater flowing from the mountain side upstream of the Building to reduce the groundwater inflow (groundwater bypass) have been implemented. The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets. Through periodical monitoring, pumping of wells and tanks is operated appropriately. At the observation holes installed at a height equivalent to the buildings, the trend showing a decline in groundwater levels is checked. The analytical results on groundwater inflow into the buildings based on existing data showed a declining trend.



Installing land-side impermeable walls with frozen soil around Units 1-4 to prevent the inflow of groundwater into the building

To prevent the inflow of groundwater into the buildings, installation of impermeable walls on the land side is planned. Freezing started on the sea side and at a part of the mountain side from March 2016 and at 95% of the mountain side from June 2016. Freezing of the remaining unfrozen sections advanced with a phased approach and freezing of all sections started in August 2017.



In March 2018, the land-side impermeable walls were considered completed except for a portion of the depths based on a monitoring result showing that the underground temperature had declined below 0°C in almost all areas and on the mountain side, the difference between the inside and outside increased to approx. 4-5 m. The multi-layered contaminated water management measures, including subdrains and facing, have kept the groundwater level stable. Consequently, a water-level management system to isolate the buildings from groundwater was considered to have been established. The Committee on Countermeasures for Contaminated Water Treatment held on March 7 clearly recognized the effect of the land-side impermeable walls in shielding groundwater and evaluated that the land-side impermeable walls allowed for a significant reduction in the amount of contaminated water generated.

