Main decommisioning works and steps

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

Fuel Removal from SFP
- Units 1 & 2
- Fuel Debris Retrieval
- Rubber removal & dose reduction
- Installing a Fuel removal handling machine
- Fuel removal
- Storage and handling
- Unit 3
- Unit 4
- Capturing the status inside the PCV, examining the fuel debris retrieval method, etc. (Note 1)
- Fuel debris retrieval
- Storage and handling
- Scenario development & technology consideration
- Design and manufacturing of devices / equipment
- Dismantling

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.

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 unfrrozen sections advanced with a phased approach and freezing of all sections started in August 2017.
- In March 2016, 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 substrains 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.

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.

Summary of Decommissioning and Contaminated Water Management
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment
September 27, 2018
Progress status of stagnant water treatment in buildings

To reduce the risk of stagnant water leaking from buildings, water levels in the Unit 1-4 buildings are being lowered sequentially. The connecting part between Unit 1 and 2 was separated on September 13.

Separation of the connecting part between Unit 3 and 4 was completed in December 2017. Based on these results, the milestone (a main target process) of "separating the connecting parts between Unit 1 and 2 and Unit 3 and 4 (by the end of 2018)" in the Mid- and Long-Term Roadmap was achieved. This separation allowed for stagnant water management by unit.

Water levels in buildings will continue to be lowered sequentially toward completion of stagnant water treatment in buildings within 2020*1.

Progress status of fuel debris

The connecting part between Unit 1 and 2 was separated on September 13.

Work to move and reorganize the remaining three sections (two on the east side and one on the south side).

Water levels in buildings will continue to be lowered sequentially toward completion of stagnant water treatment in buildings.

Status toward fuel removal at Unit 1

To create an access route for preparatory work to protect the spent fuel pool, etc., removal of X-braces started from September 19 and removal of one section on the west side was completed on September 25.

Radiation and dust were thoroughly managed during the removal and no significant variation was indicated at the dust monitors and monitoring posts.

Work will continue with safety first to remove the remaining three sections (two on the east side and one on the south side).

To formulate a work plan to dismantle the Reactor Building rooftop, the entire operating floor will be investigated.

Before this investigation, work to move and reorganize the remaining obstacles within the operating floor started from August 23. On September 10, the equipment (Warrior) left within the building since the previous investigation was moved.

An increased dust density was detected within the operating floor during the work, though it had no effect outside the building. After sprinkling water over the area as part of the remaining object removal work, the effect to suppress dust scattering will be checked.

Work to move and reorganize the remaining objects will continue with safety first.

To prevent any outflow of stagnant water from buildings due to backwash and reduce any increase of stagnant water in buildings due to anaseism, work to seal off the openings of buildings is underway (61 of 122 openings were closed off).

To minimize damage to important facilities and subsequently reduce the risk of delaying the overall decommissioning work, a plan to extend the existing tide embankment to the north side is being examined as part of work to prepare for the potentially urgent danger of the Choshima trench tsunami.

Work to seal off the openings will continue with safety first. Regarding the tide embankment, details will be examined focused on early completion while minimizing the effect on ongoing decommissioning work.

Status toward fuel removal at Unit 2

To formulate a work plan to dismantle the Reactor Building rooftop, the entire operating floor will be investigated.

Before this investigation, work to moved and reorganize the remaining obstacles within the operating floor started from August 23. On September 10, the equipment (Warrior) left within the building since the previous investigation was moved.

An increased dust density was detected within the operating floor during the work, though it had no effect outside the building. After sprinkling water over the area as part of the remaining object removal work, the effect to suppress dust scattering will be checked.

Work to move and reorganize the remaining objects will continue with safety first.

Progress status of earthquakes and tsunami countermeasures

To prevent any outflow of stagnant water from buildings due to backwash and reduce any increase of stagnant water in buildings due to anaseism, work to seal off the openings of buildings is underway (61 of 122 openings were closed off).

To minimize damage to important facilities and subsequently reduce the risk of delaying the overall decommissioning work, a plan to extend the existing tide embankment to the north side is being examined as part of work to prepare for the potentially urgent danger of the Choshima trench tsunami.

Work to seal off the openings will continue with safety first. Regarding the tide embankment, details will be examined focused on early completion while minimizing the effect on ongoing decommissioning work.

Progress status toward fuel removal at Unit 3

An investigation into the cause of the defect on August 8 found an abnormality in several control cables. To identify potential defects in facilities, after temporarily resuming operation within September, a safety inspection (operation check and facility inspection) will be conducted and quality control will be checked by around the end of this year. Based on the inspection results, the necessary measures will be implemented and functions after resumption will be tested, and training for operation and troubleshooting will be provided.

At the same time, processes will also be reevaluated and reviewed while continuing work with safety first.

Decompression test of the Unit 2 PCV

To reduce hydrogen risks, the internal pressure of the Primary Containment Vessel (PCV) is kept higher than air by filling it with nitrogen.

Aiming to reduce the risk of emitting radioactive materials and improve operability during the investigation inside the PCV, a decompression test (STEP 1), in which the pressure was reduced by about 1kPa from the normal value*, was conducted. In the result, no significant variation was indicated in monitoring parameters such as hydrogen density (July 24 - August 31). Based on this result, the next decompression test (STEP 2), in which the pressure is reduced by about 2kPa from the normal value, will start from October 1 after confirming no safety problem with the decompression.

* Normal PCV pressure: air pressure + 4.25kPa

To formulate a work plan to dismantle the Reactor Building rooftop, the entire operating floor will be investigated.

Before this investigation, work to move and reorganize the remaining obstacles within the operating floor started from August 23. On September 10, the equipment (Warrior) left within the building since the previous investigation was moved.

An increased dust density was detected within the operating floor during the work, though it had no effect outside the building. After sprinkling water over the area as part of the remaining object removal work, the effect to suppress dust scattering will be checked.

Work to move and reorganize the remaining objects will continue with safety first.
Data of Monitoring Posts (MP1-MP8) measuring the airborne radiation rate around site boundaries showed 0.447 – 1.512 μSv/h (September 5-25, 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.

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.

- Status of contaminated water generated
  - Multi-layered measures including pumping up by subdrains and land-side impermeable walls, which have been implemented to control the continued generation of contaminated water, reduced groundwater inflow into buildings.
    - As a result of steady implementation of “isolation” measures (groundwater bypass subdrains, frozen wells, etc.), the inflow reduced from approx. 470 m³/day (the FY2014 average) when the measures were first launched to approx. 220 m³/day (the FY2017 average), though the figure varied depending on rainfall, etc.
    - Measures will continue to further reduce the volume of contaminated water generated.

- 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 September 25, 2018, 409,537 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 treatment plants and released from September 14, 2015 onwards. Up until September 25, 2018, a total of 602,904 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 September 24, 2018, a total of approx. 190,495 m³ had been pumped up and a volume under 10 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period August 30 – September 19, 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, increasing the treatment capacity to 1,500 m³ and improving 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. Installation of the pipe and ancillary facilities was completed.

- Since the subdrains went into operation, the inflow into buildings tended to decline to under 150 m³/day when the subdrain water level declined below T.P. 3.0 m but increased during rainfall.

For Unit 1, water shutoff of trench penetration of the common pipe trench was completed on September 21.

For Unit 2, water shutoff, inside filling, etc. of the intake power supply cable trench was completed on August 6.

For Unit 3, repairs to the damaged part on the Reactor Building roof drain were completed on July 12.

- Measures will continue to be implemented while verifying their effect and examining additional measures if necessary.

#### 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 September 20, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 388,000, 484,000 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 the 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 September 20, 509,000 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 September 20, approx. 482,000 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 September 24, 2018, a total of 115,674 m³).
Progress status of stagnant water treatment in buildings

- To reduce the risk of stagnant water leaking from buildings, water levels in the Unit 1-4 buildings are being lowered sequentially. The connecting part between Unit 1 and 2 was separated on September 13.
- Separation of the connecting part between Unit 3 and 4 was completed in December 2017. Based on these results, the milestone (a main target process) "separating the connecting parts between Unit 1 and 2 and Unit 3 and 4 (by the end of 2018)" in the Mid- and Long-term Roadmap was achieved. This separation allowed for stagnant water management by unit.
- Water levels in buildings will continue to be lowered sequentially toward completion of stagnant water treatment in buildings within 2020 (for buildings other than the Unit 1-3 Reactor Buildings, to which circulation water injection is provided).

Progress status of earthquakes and tsunami countermeasures

- To prevent any outflow of stagnant water from buildings due to backwash and reduce any increase in stagnant water in buildings due to anasim, work to seal off the openings of buildings is underway (61 of 122 openings were closed off).
- To minimize damage to important facilities and subsequently reduce the risk of delaying the overall decommissioning work, a plan to extend the existing tide embankment to the north side is being examined as part of work to prepare for the potentially urgent danger of the Chisima trench tsunami.

- Work to seal off the openings will continue with safety first. Regarding the tide embankment, details will be examined focused on early completion while minimizing the effect on ongoing decommissioning work.

Leakage from the back-pulse pot drain of the additional multi-nuclide removal equipment (B)

- On September 8, 2018, an alarm was issued from the leakage detector in the additional multi-nuclide removal equipment (B) (during circulation standby).
- An onsite investigation detected flooding of a plastic tank for collecting drainage from the system-water leakage check port and draining of condensed water in compressed air, which was placed at the reverse cleaning apparatus (back-pulse pot). The apparatus used an air-compressor to declog the cross-flow filter as part of the pretreatment process. The flood was considered attributable to inflow of condensed water in compressed air during reverse cleaning.
- The leakage (2,500 × 200 × 20 mm) remained within the fences and no external leakage was detected.
- On September 9, 2018, accumulated water was again detected in the same plastic tank. Based on a sampling result showing that the water originated from the multi-nuclide removal equipment system, the flooding water of the plastic tank the previous day also originated from the same system.
- A leakage check in the operating state, conducted to investigate the cause, detected no leakage. On September 14, after implementing flood-prevention measures, the apparatus resumed operation.

Leakage from the supply pump 1B mechanical seal of the existing multi-nuclide removal equipment (B)

- On September 21, 2018, water leakage (dripage) from supply pump 1B of the pretreatment equipment was detected at the existing multi-nuclide removal equipment (B).
- The leakage (250 × 200 × 3 mm) remained within the fences and no leakage outside the existing multi-nuclide removal equipment building was detected. Based on the water quality check result, the leakage was judged to be system water of the multi-nuclide removal equipment. After shifting the equipment to circulation standby mode, the stopping of leakage (dripage) was confirmed.
- The water was considered to constitute leakage from the mechanical seal based on an inspection result detecting leaked water oozing from the shaft seal part of the pump.
- After covering the shaft seal part, a test operation will be conducted to check the extent of leakage and measures will be examined.

Leakage from the cross-flow filter drain line of the existing multi-nuclide removal equipment (C)

- On September 25, 2018, a puddle was detected inside the cross-flow filter C skid at the existing multi-nuclide removal equipment (C) and operation was suspended.
- The leakage (2,000 × 1,000 × 1 mm) remained within the existing multi-nuclide removal equipment building and no external leakage was detected.
- An onsite investigation detected a small hole in the cross-flow filter 1C drain line, from which leakage of system water of the existing multi-nuclide removal equipment was confirmed.
- The leakage cause will be investigated.

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 spent fuel pool (SFP), 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.

Once removed, rubble is stored in solid waste storage facilities or other storage areas depending on the dose level.

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

Prior to formulating a plan to remove rubble around the spent fuel pool, an onsite investigation started from July 23 and was completed on August 2.

To create an access route for preparatory work to protect the spent fuel pool, etc., removal of X-braces started from September 19 and removal of one section on the west side was completed on September 25.

Radiation and dust were thoroughly managed during the removal and no significant variation was indicated at the dust monitors and monitoring posts.

Work will continue with safety first to remove the remaining three sections (two on the east side and one on the south side).

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 the robot.

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

To formulate a work plan to dismantle the Reactor Building rooftop, the entire operating floor will be investigated.

Before this investigation, work to move and reorganize the remaining objects within the operating floor started from August 23 and reorganization of fences, etc. is underway.

On September 10, the equipment (Warrior) left within the building since the previous investigation was moved.

An increased dust density was detected within the operating floor during the work, though it had no effect outside the building. After sprinkling water over the area as part of the remaining object removal work, the effect to suppress dust scattering will be checked.

Work to move and reorganize the remaining objects will continue with safety first.

Main work to help spent fuel removal at Unit 3

Regarding the fuel-handling machine (FHM) and the crane, consecutive defects have occurred since the test operation started on March 15.

For the FHM, an alarm was issued during the pre-operation inspection on August 8 and operation was suspended. It was confirmed as attributable to disconnection due to corrosion by rainwater ingress to the cable connection.

For the crane, an alarm was issued during the work to clear materials and equipment on August 15 and operation was suspended. The cause is being investigated.

These defects are considered commonly attributable to insufficient quality control of components incorporated in the FHM and the crane.

An investigation into the cause of the defect on August 8 found an abnormality in several control cables.

To identify potential defects in facilities, after temporarily resuming operation within September, a safety inspection (operation check and facility inspection) will be conducted and quality control will be checked by around the end of this year.

Based on the inspection results, the necessary measures will be implemented, functions after resumption will be tested and training for operation and troubleshooting will be provided.

At the same time, processes will also be reevaluated and reviewed while continuing work with safety first.

Omission of dust measurement on the common SFP operating floor

On September 5, 2018, it was confirmed that during the work to transfer spent fuel in the pool water on the operating floor of the common spent fuel pool (SFP), prescribed dust measurement for emission management was omitted.

The implementation plan specifies that dust must be measured when handling spent fuel to confirm any significant increase in the density of particle radioactive materials.

The area monitor installed on the operating floor detected no significant increase in the dose rate on that day.

The omission of dust measurement was considered attributable to inappropriate communication and confirmation about whether or not the work included any spent fuel transfer. A review of the work communication flow which would allow mutual confirmation among the dust measurement location, contractor and work implementation place is being examined.

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

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

Management status of the rubble and trimmed trees

- As of the end of August 2018, the total storage volume of concrete and metal rubble was approx. 247,300 m³ (+2,300 m³ compared to at the end of July, with an area-occupation rate of 62%). 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. 56,700 m³ (+1,300 m³, with an area-occupation rate of 80%). The increase in rubble was mainly attributable to construction related to tanks and transfer of rubble from the temporary storage area A. The increase in used protective clothing was mainly attributable to the acceptance of used protective clothing.

Management status of secondary waste from water treatment

- As of September 6, 2018, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%), while that of concentrated waste fluid was 9,410 m³ (area-occupation rate: 88%). The total number of stored spent vessels, High-Integrity Containers (HiCs) for multi- nuclide removal equipment, etc., was 4,090 (area-occupation rate: 64%).

4. 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

Progress status of the decompression test inside the Fukushima Daiichi Nuclear Power Station Unit 2 PCV

- To suppress any increase in hydrogen density, an inert atmosphere is maintained inside the Primary Containment Vessel (PCV) by filling it with nitrogen and its internal pressure is maintained higher than air.

- Aiming to reduce the risk of emitting radioactive materials from the PCV and improve operability during the inside investigation, the PCV decompression test (STEP 1) was conducted at Unit 2 (July 24 - August 31).

- In the test (STEP 1), the PCV pressure was reduced by about 1kPa from the normal value (air pressure + about 4.25kPa). In the result, no significant variation was indicated in monitoring parameters such as hydrogen density.

- Based on the test result (STEP 1), the next PCV decompression test (STEP 2), in which the PCV pressure is reduced by about 2kPa from the normal value, will start from October 1 after confirming no safety problem with the decompression.

5. 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 No. 1-12 had been declining from around 2,000 Bq/L since January 2018 to around 300 Bq/L and then increasing and currently stands at around 700 Bq/L.

The density of gross β radioactive materials at No. 1-16 had been declining from around 43,000 Bq/L since April 2018 and currently stands at around 19,000 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 3,500 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 4,700 Bq/L.

The density of gross β radioactive materials at No. 2-5 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 33,000 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 1,800 Bq/L. Since April 1, 2015, pumping of groundwater continued (at the well point between the Unit 2 and 3 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 unchanged and below the legal discharge limit following the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls.

### Tables and Figures

#### Table 1: Water Quality Data

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<thead>
<tr>
<th>Sampling Date</th>
<th>Unit</th>
<th>Gross β</th>
<th>Cs-137</th>
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<td>Sep 24, 2018</td>
<td>No. 1-16</td>
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<td>Mar 2018</td>
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#### Figure 5: Groundwater density on the Turbine Building east side

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

#### Figure 6: Seawater density around the port

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

### 6. 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 May to July 2018 was approx. 9,800 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 7,200). 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 October 2018 (approx. 4,230 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 7).
The number of workers from within Fukushima Prefecture increased. The local employment ratio (TEPCO and partner company workers) as of August 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 \(\approx 1.7\) mSv/month)

For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.

### 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, seven workers suffered heat stroke due to work up until September 24 (in FY2017, five workers up until the end of September). Ongoing measures will be taken to prevent heat stroke.

### Status of spent fuel storage in Units 5 and 6

- Regarding Unit 5, fuel removal from the reactor was completed in June 2015. 1,374 spent fuel assemblies and 168 non-irradiated fuel assemblies were stored in the spent fuel pool (storage capacity: 1,590 assemblies).
- Regarding Unit 6, fuel removal from the reactor was completed in November 2013. 1,456 spent fuel assemblies and 198 non-irradiated fuel assemblies (180 of which were transferred from the Unit 4 spent fuel pool) are stored in the spent fuel pool (storage capacity: 1,654 assemblies) and 230 non-irradiated fuel assemblies are stored in the storage facility of non-irradiated fuel assemblies (storage capacity: 230 assemblies).

### Status of stagnant water in Units 5 and 6

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

### Transfer of non-irradiated fuel assemblies in Units 5 and 6 to the outside of the site

To advance preparation for decommissioning the Fukushima Daiichi Nuclear Power Station as planned, non-irradiated fuel assemblies stored in Units 5 and 6 will be transferred to a fuel fabrication plant (Nuclear Fuel Industries, Ltd.).

At Unit 6, preparatory work started on the operating floor from August 20, 2018.

### Results of 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 was 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 sincerely answered questions from local residents and engaged them in dialog. On Day 2, mainly for technical experts, international members and Japanese experts joined the discussion on remote technology.
Status of seawater monitoring within the port (comparison between the highest values in 2013 and the latest values)

“The highest value” → “the latest value (sampled during September 17-25)”; 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/1/smp/index-j.html

Cesium-134: 3.3 (2013/10/17) → ND(0.26) Below 1/10
Cesium-137: 9.0 (2013/10/17) → 1.3 Below 1/6
Gross β: 74 (2013/8/19) → ND(16) Below 1/4
Tritium: 67 (2013/8/19) → ND(1.8) Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.31) Below 1/10
Cesium-137: 10 (2013/12/24) → 0.71 Below 1/10
Gross β: 60 (2013/7/4) → ND(16) Below 1/3
Tritium: 59 (2013/8/19) → ND(1.8) Below 1/30

Cesium-134: 5.0 (2013/12/2) → ND(0.34) Below 1/10
Cesium-137: 8.4 (2013/12/2) → 0.45 Below 1/10
Gross β: 69 (2013/8/19) → ND(16) Below 1/4
Tritium: 52 (2013/8/19) → ND(1.8) Below 1/20

Cesium-134: 2.8 (2013/12/2) → ND(0.56) Below 1/5
Cesium-137: 5.8 (2013/12/2) → ND(0.45) Below 1/10
Gross β: 46 (2013/8/19) → ND(15) Below 1/3
Tritium: 24 (2013/8/19) → ND(2.0) Below 1/10

Cesium-134: 3.3 (2013/12/24) → ND(0.51) Below 1/6
Cesium-137: 7.3 (2013/10/11) → 0.79 Below 1/9
Gross β: 69 (2013/8/19) → ND(18) Below 1/3
Tritium: 68 (2013/8/19) → ND(1.4) Below 1/40

Cesium-134: 3.5 (2013/10/17) → ND(0.28) Below 1/10
Cesium-137: 7.8 (2013/10/17) → 0.73 Below 1/10
Gross β: 79 (2013/8/19) → ND(16) Below 1/4
Tritium: 60 (2013/8/19) → ND(1.8) Below 1/30

Cesium-134: 32 (2013/10/11) → ND(0.52) Below 1/60
Cesium-137: 73 (2013/10/11) → 7.6 Below 1/9
Gross β: 320 (2013/8/12) → ND(15) Below 1/20
Tritium: 510 (2013/9/2) → 8.7 Below 1/50

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.

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.
### 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.

#### Northeast side of port entrance (offshore 1km)
- Cesium-134: ND (2013) → ND (0.77)
- Cesium-137: ND (2013) → ND (0.73)
- Gross β: ND (2013) → ND (18)
- Tritium: ND (2013) → ND (0.91)

#### East side of port entrance (offshore 1km)
- Cesium-134: ND (2013) → ND (0.53)
- Cesium-137: 1.6 (2013/10/18) → ND (0.76) Below 1/2
- Gross β: ND (2013) → ND (18)
- Tritium: 6.4 (2013/10/18) → ND (0.91) Below 1/7

#### North side of north breakwater (offshore 0.5km)
- Cesium-134: ND (2013) → ND (0.52)
- Cesium-137: ND (2013) → ND (0.61)
- Gross β: ND (2013) → ND (18)
- Tritium: 4.7 (2013/8/18) → ND (0.91) Below 1/5

#### North side of Unit 5 and 6 release outlet
- Cesium-134: 1.8 (2013/6/21) → ND (0.67) Below 1/2
- Cesium-137: 4.5 (2013/3/17) → ND (0.62) Below 1/7
- Gross β: 69 (2013/8/19) → ND (18) Below 1/3
- Tritium: 68 (2013/8/19) → ND (1.4) Below 1/40

#### Southeast side of port entrance (offshore 1km)
- Cesium-134: ND (2013) → ND (0.81)
- Cesium-137: ND (2013) → ND (0.64)
- Gross β: ND (2013) → ND (18)
- Tritium: ND (2013) → ND (0.91)

#### South side of south breakwater (offshore 0.5km)
- Cesium-134: 3.3 (2013/12/24) → ND (0.51) Below 1/6
- Cesium-137: 7.3 (2013/10/11) → 0.79 Below 1/9
- Gross β: 6 (2013/8/19) → ND (18) Below 1/3
- Tritium: 68 (2013/8/19) → ND (1.4) Below 1/40

#### Near south release outlet
- Cesium-134: ND (2013) → ND (0.63)
- Cesium-137: 3.0 (2013/7/15) → ND (0.68) Below 1/4
- Gross β: 15 (2013/12/23) → 10
- Tritium: 1.9 (2013/11/25) → ND (0.90) Below 1/2

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.

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**Summary of TEPCO data as of September 26, 2018**

**Unit 3 Reactor Building**  
**November 2017**  
**Unit 2**  
Spent fuel is accepted from the common pool during the above removal work. No significant variation was identified around site boundaries where the density of radioactive materials was monitored and a rubble removal from the operating floor north side started from January 22, 2018. Rubble is being removed carefully by suction and installation of building cover were completed by December 19.

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.

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. 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.

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.

**Unit 4 Reactor Building (operating floor).** All roof panels and wall panels of the building cover were dismantled by November 10, 2016. Modification of the pillars and beams of the building cover and installation of building cover were completed by December 19.

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.

**To facilitate fuel removal from Unit 4 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 entire fuel handling facility inside the cover**
Progress toward decommissioning: Works to identify the plant status and 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 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.

**Unit 1 Reactor Building**

- **Air dose rate inside the Reactor Building:** Max. 5,150 mSv/h (1F southeast area) (measured on July 4, 2012)
- **Temperature inside the Reactor Building:** approx. 27°C
- **Water level inside the Reactor Building:** approx. TP + 2.474 m
- **Temperature of the Reactor Building floor:** approx. 27°C
- **PCV hydrogen concentration System A:** 0.00 vol%,
  **System B:** 0.00 vol%
- **Air dose rate inside the Reactor Building:** approx. 0.00 µSv/h

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

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.

**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.

- **PCV penetration to be used in this investigation**
  - 1st floor grating: Workers access opening
  - 100-BB penetration
  - Primary Containment Vessel (PCV)
  - Pedestal
  - Assumed access route

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

<table>
<thead>
<tr>
<th>Period</th>
<th>Evaluation results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb - May 2015</td>
<td>Confirmed that there was no large fuel in the reactor core.</td>
</tr>
</tbody>
</table>

**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)

* Indices related to the plant are values as of 11:00, September 26, 2018

**Investigations inside PCV**

<table>
<thead>
<tr>
<th>Period</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2015</td>
<td>Acquiring images, Measuring air temperature and dose rate, Measuring water level and temperature, Installing permanent monitoring instrumentation</td>
</tr>
<tr>
<td>Apr 2015</td>
<td>Confirming the status of PCV 1st floor, Acquiring images, Measuring air temperature and dose rate, Replacing permanent monitoring instrumentation</td>
</tr>
<tr>
<td>Mar 2017</td>
<td>Confirming the status of PCV 1st basement floor, Acquiring images, Measuring dose rate, Sampling deposit, Replacing permanent monitoring instrumentation</td>
</tr>
<tr>
<td>May 2014</td>
<td>PCV vent pipe vacuum break line bellow (identified in May 2014)</td>
</tr>
<tr>
<td>Nov 2013</td>
<td>Sand cushion drain line (identified in November 2013)</td>
</tr>
</tbody>
</table>

**Leakage points from PCV**

- PCV vent pipe vacuum break line bellow (identified in May 2014)
- Sand cushion drain line (identified in November 2013)
Progress toward decommissioning: Works to identify the plant status and toward fuel debris retrieval

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
(1) 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.
(2) 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 penetration) 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 (1) 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 swimming 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.

Investigative results on torus chamber walls
• The torus chamber walls were investigated (on the north side of the east-side penetration) 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 (1) 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 swimming robot)
Progress toward decommissioning: Works to identify the plant status and toward fuel debris retrieval

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

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**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 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 connected 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

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**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.

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**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 pe-destal.
- 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 sliding off the rail with a portion buried in deposits, were visually understood.

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

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

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*Indices related to plant are values as of 1:130, September 26, 2018*

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**Table:**

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

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*Period*  
May – Sep 2017  
*Evaluation results*  
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.
Progress toward decommissioning: Work related to circulation cooling and stagnant water treatment line

**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:

- Addition 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 contamination 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 reactor. 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 stored 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.

Legend

- Reactor Building
- Turbine Building
- RO-installed water
- Bi-installed water
- SPT (B)
- Storage tank
- Storage tank (treated water)
- RO equipment (existing)
- Multi-nuclide removal equipment, etc.
- Buffer tank
- SARRY / KURION removal of Cs and Sr
- RO-installed water
- Condensed water
- Water pumping
- Groundwater level
- Groundwater bypass
- Salt treatment (RO membrane)
- Reactor water injection pump
- Condensate Storage tank
- Conveyance water cooling system
- Sub-drain water cooling system
- Water pumping
- Mobile strontium removal equipment, etc.
- Storage tank (strontium-treated water, etc.)
- Sub-drain pump
- Biofiltration
-感熱
- Groundwater level (Kurion/Sarry)
Progress toward decommissioning: Work to improve the environment within the site

**Immediate targets**

- Reduce the effect of additional release from the entire power station and radiation from radioactive waste (secondary water treatment waste, rubble, etc.) generated after the accident, to limit the effective radiation dose to below 1mSv/year at the site boundaries.
- Prevent contamination expansion in sea, decontamination within the site

**Optimization of radioactive protective equipment**

Based on the progress of measures to reduce environmental dosage on site, the site is categorized into two zones: highly contaminated area around Unit 1-4 buildings, etc. and other areas. To optimize protective equipment according to each category aiming at improving safety and productivity by reducing load during work.

From March 2016, limited operation started. From March and September 2017, the G Zone was expanded.

**Installation of dose-rate monitors**

To help workers in the Fukushima Daiichi Nuclear Power Station precisely understand the conditions of their workplaces, a total of 86 dose-rate monitors were installed by January 4, 2016. These monitors allow workers to confirm real-time on-site dose rates at their workplaces.

Workers are also able to check concentrated data through large-scale displays installed in the Main Anti-Earthquake Building and the access control facility.

**Installation of sea-side impermeable walls**

To prevent the outflow of contaminated water into the sea, sea-side impermeable walls have been installed.

Following the completed installation of steel pipe sheet piles on September 22, 2015, connection of these piles was conducted and connection of sea-side impermeable walls was completed on October 26, 2015. Through these works, closure of sea-side impermeable walls was finished and the contaminated water countermeasures have been greatly advanced.

**Status of the large rest house**

A large rest house for workers was established and its operation commenced on May 31, 2015.

Spaces in the large rest house are also installed for office work and collective worker safety checks as well as taking rest.

On March 1, 2016 a convenience store opened in the large rest house. On April 11, operation of the shower room started. Efforts will continue to improve convenience of workers.