Summary of Decommissioning and Contaminated Water Management

March 30, 2017

Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Main decommissioning works and steps

Fuel removal from Unit 4 SFP has been completed and preparatory work to remove fuel from Unit 1-3 SFP and fuel debris (Note 1) removal is ongoing.

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

Fuel Removal from SFP

Units 1 & 2 ▼ Rubble removal & dose reduction → Unit 3 ▼ Installing a Fuel-Handling Machine → Fuel removal → Unit 4 ▼ Storage and handling

Unit 1: Fuel removal to start in FY2020
Unit 2: Fuel removal to start in FY2020
Unit 3: Fuel removal to start in mid-FY2018
Unit 4: Fuel removal completed in 2014

Fuel Debris Removal

Unit 1-3 ▼ Capturing the status inside the PCV/ examination of the fuel debris removal method, etc. (Note 2) → Fuel debris removal → Storage and handling

(Note 2)
The fuel debris removal method for each unit will be decided two years after revising the Mid- and Long-term roadmap (June 2015). The method for the first unit will be confirmed in the first half of FY2018.

Dismantling Facilities

Scenario development & technology consideration → Design and manufacturing of devices / equipment → Dismantling

Toward fuel removal from pool

Toward fuel removal from Unit 3 SFP, works to install the cover are underway.

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

Installation of a cover for fuel removal at Unit 3
Installation of reinforced members for FHM girder (March 13, 2017)

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)

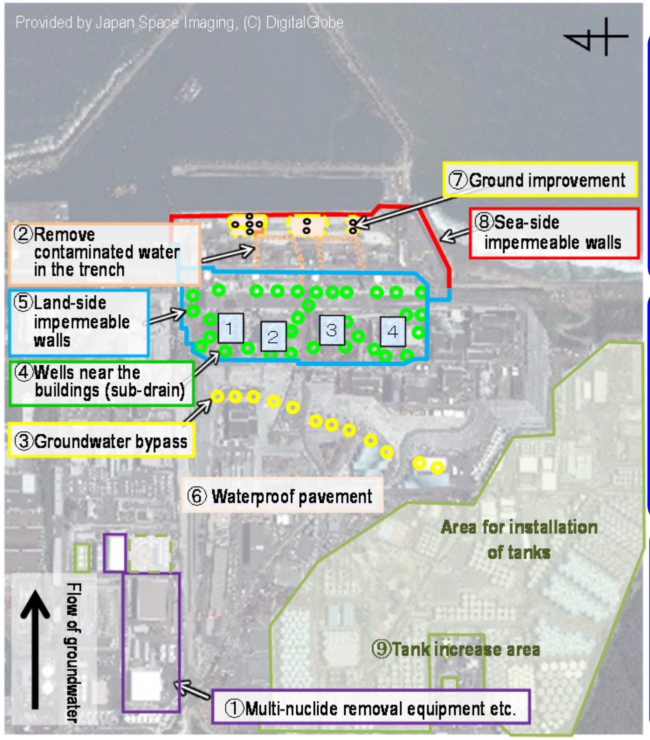
(Note 3) Underground tunnel containing pipes.

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. As for the land-side unfrozen sections, freezing started in two sections from December and four sections from March 3, except for one unfrozen section.
- On the sea side, the underground temperature declined below 0℃ throughout the scope requiring freezing except for the unfrozen parts under the seawater pipe trenches and the areas above groundwater level in October 2016.

(Opening/closure of frozen pipes)

Sea-side impermeable walls

- Impermeable walls are being installed on the sea side of Units 1-4, to prevent the 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 the Primary Containment Vessel (PCV) of Units 1-3 were maintained within the range of approx. 15-25°C*1 for 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 February 2017, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.00034 mSv/year at the site boundary. The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

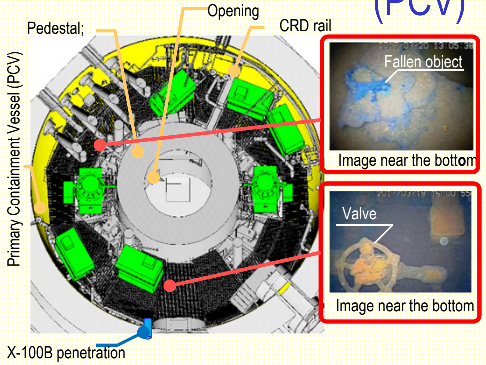
Results of investigation inside the Unit 1 Primary Containment Vessel (PCV)

Based on the results of an investigation conducted on the 1st floor grating in April 2015, the status of debris spreading to the basement floor outside the pedestal* was inspected using a self-propelled investigation device from March 18 to 22.

The investigation using a camera, etc. suspended from the 1st floor grating took images of the PCV bottom status near the pedestal opening for the first time and confirmed that the dose tended to increase near the bottom. No significant change was identified in the dose and the status of structures on the grating compared to the investigative results in April 2015.

The status inside the PCV will continue to be examined based on the image and dose data collected.

* The base supporting the Reactor Pressure Vessel (RPV)

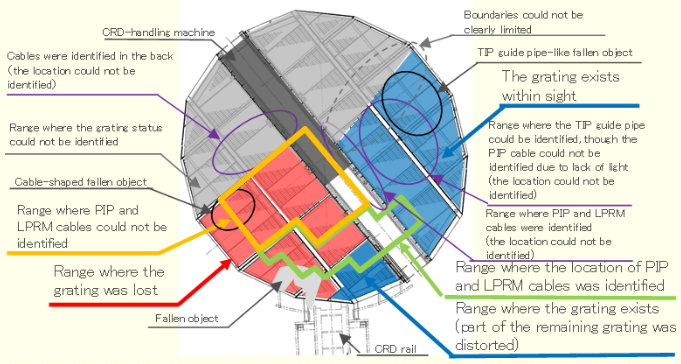


<Investigation inside the Unit 1 PCV>

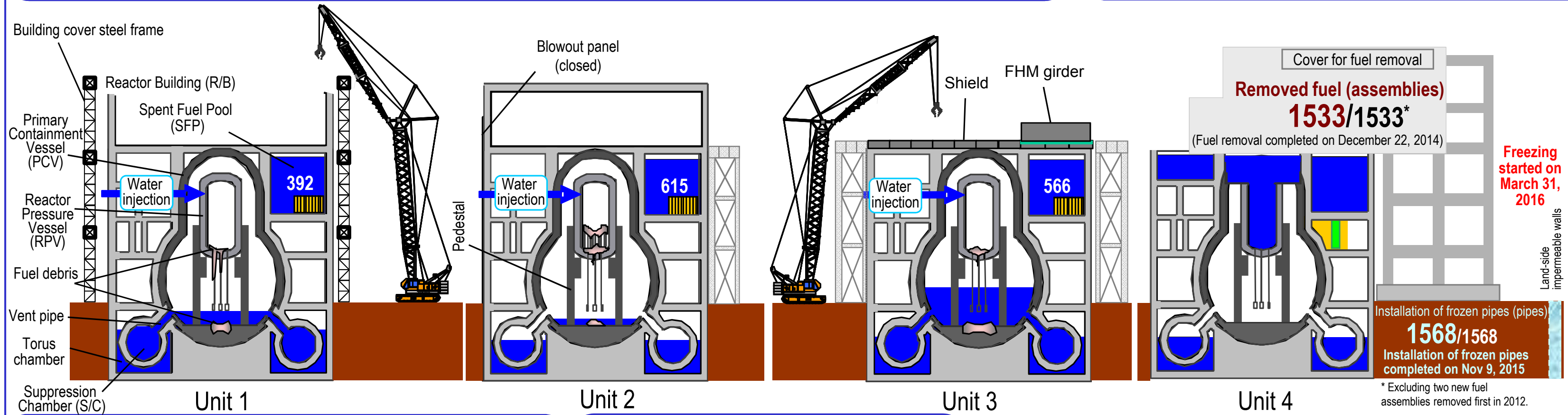
Results of investigation inside the Unit 2 PCV

Images taken inside the pedestal during the investigation inside the Unit 2 PCV, conducted from January 26 to February 16, were processed and the damage status such as lost grating was identified.

The status inside the pedestal will continue to be examined based on information acquired from the images.



<Results of investigation inside the Unit 2 pedestal>



Removal of accumulated water from the Unit 1 T/B

Toward the completion of accumulated water treatment at buildings by 2020, measures have been implemented to remove accumulated water from the Unit 1 Turbine Building (T/B) and completion of the removal from the lowest floor area was judged.

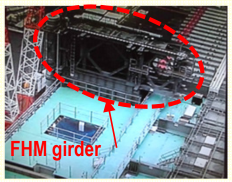
Efforts will continue by utilizing the work results and knowledge obtained at the Unit 1 T/B in accumulated water removal at Unit 2-4 T/Bs and other buildings

Installation progress of a cover for Unit 3 fuel removal

Toward fuel removal from Unit 3, a cover for fuel removal, etc. will be installed in the following order: stoppers, FHM girder*, working floor, traveling rail, dome roof, fuel-handling machine (FHM) and crane.

Parts for the cover, etc. are being sequentially transported by ship from the Onahama Port and work is steadily underway. From March 1, installation of the FHM girder started.

* Horizontal members composing the gate structure. A rail will be mounted on the girder where the fuel handling machine and crane will travel.



<Installation of the FHM girder>

Reduction in the volume of water injected into the Unit 2 reactor

To facilitate the purification of contaminated water in buildings, the volume of water injected into the Unit 2 reactor was reduced to 3.0 m^3/h on March 22 as was done for Units 1 and 3.

Cooling conditions of fuel debris and influence of accumulated water treatment in buildings will be checked based on data such as temperatures and radioactive densities in accumulated water in the buildings, which were changed by reducing the volume of water injected into Units 1-3.

Reduction of inflow into buildings

The inflow of groundwater and rainwater into buildings has been reduced from around 400 m^3/day (before measures were implemented) to the latest average of around 120 m^3/day in March 2017 by implementing various measures, such as groundwater bypass, subdrains and land-side impermeable walls, and almost has reached the target.

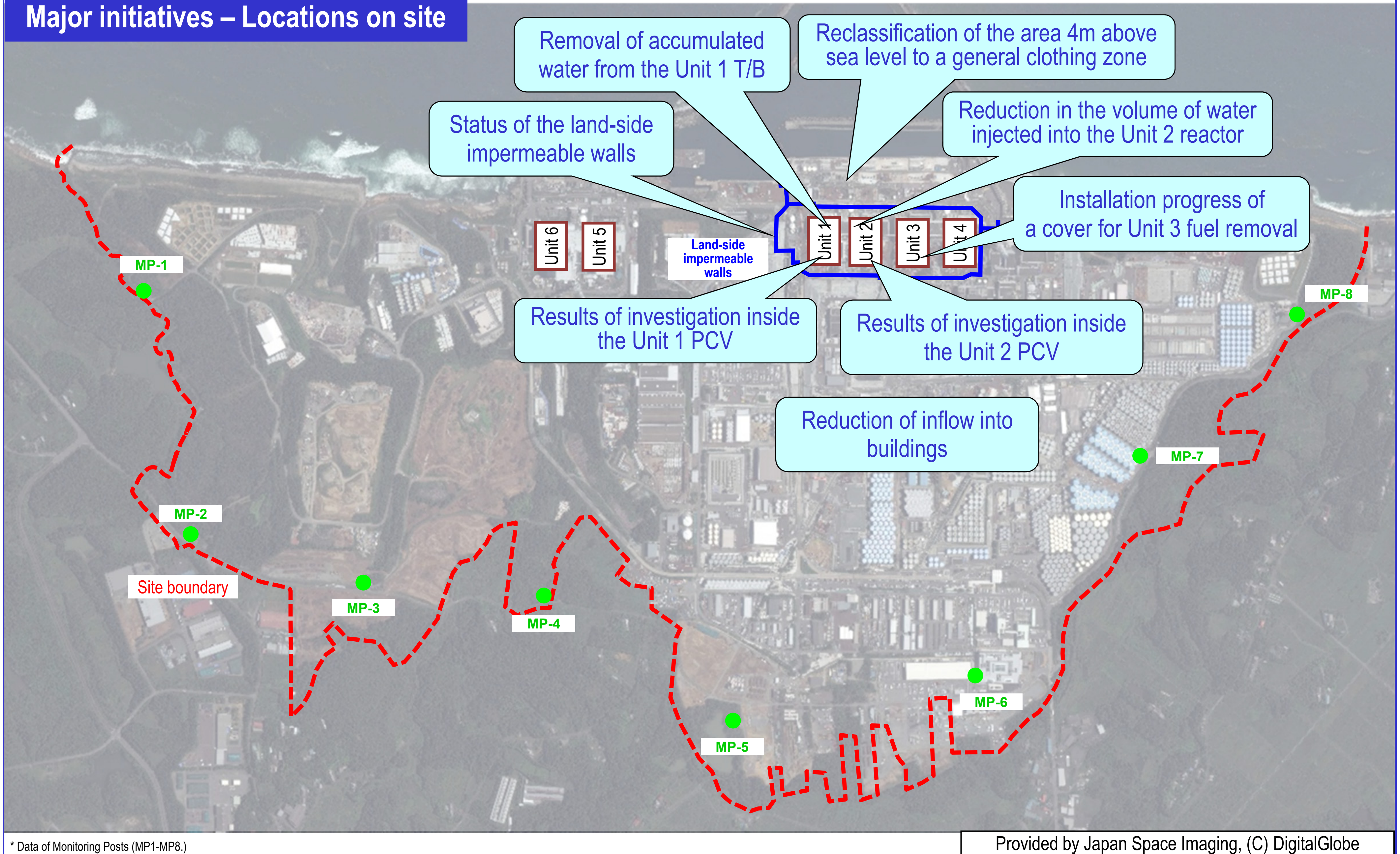
Status of the land-side impermeable walls

As for the land-side impermeable walls (on the mountain side), freezing and closure of unfrozen sections have been advanced with a phased approach. Freezing started at four sections from March 3, except for one unfrozen section. Groundwater volume pumped from the area 4 m above sea level was minimized to 85 m^3/day on March 6, and the average volume in March was approx. 118 m^3/day.

Reclassification of the area 4m above sea level to general clothing zone

Following rubble removal and facing in the "area 4m above sea level" (sea side of the Unit 1-4 buildings) and other areas to improve the on-site environment, the risk of physical contamination was reduced. To increase safety and workability by reducing the load during work, classification of the "area 4m above sea level" is redefined to "Green Zone" for general clothing from March 30.

Major initiatives – Locations on site



* Data of Monitoring Posts (MP1-MP8.)

Data (10-minute value) of Monitoring Posts (MPs) measuring airborne radiation rate around site boundaries show 0.485 – 2.080 μSv/h (February 22 – March 28, 2017).

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.

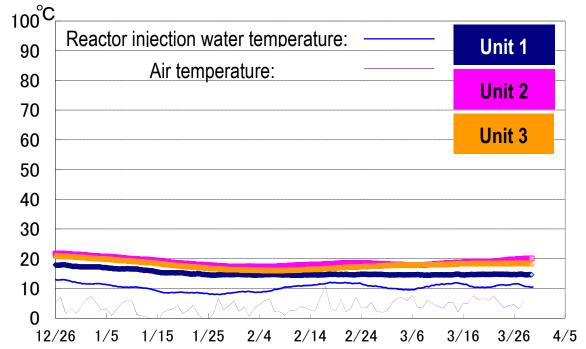
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

The radiation shielding panel around monitoring post No. 6, which is one of the instruments used to measure the radiation dose of the power station site boundary, were taken off from July 10-11, 2013, since the surrounding radiation dose has largely *declined* due to further *deforestation*, etc.

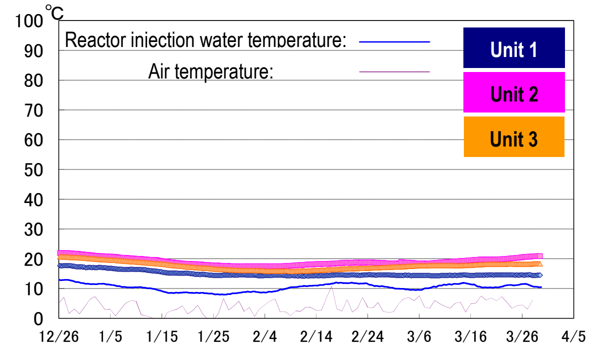
I. Confirmation of the reactor conditions

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. 15 to 25°C for the past month, though varying depending on the unit and location of the thermometer.



RPV bottom temperatures (recent quarter)



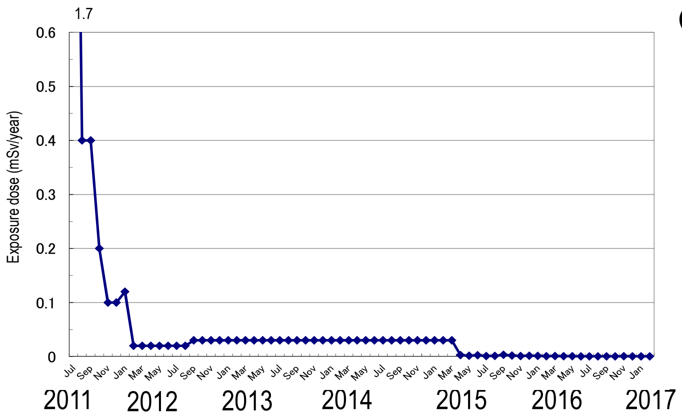
PCV gas phase temperatures (recent quarter)

* The trend graphs show part of the temperature data measured at multiple points.

2. Release of radioactive materials from the Reactor Buildings

As of February 2017, 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. 3.8×10^{-12} Bq/cm³ for Cs-134 and 1.7×10^{-11} Bq/cm³ for Cs-137 at the site boundary. The radiation exposure dose due to the release of radioactive materials was less than 0.00034 mSv/year at the boundary.

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



(Reference)

- * The density limit of radioactive materials in the air outside the surrounding monitoring area:
  [Cs-134]: 2 x 10^{-5} Bq/cm³
  [Cs-137]: 3 x 10^{-5} Bq/cm³
- * Dust density around the site boundaries of Fukushima Daiichi Nuclear Power Station (actual measured values):
  [Cs-134]: ND (Detection limit: approx. 1 x 10^{-7} Bq/cm³)
  [Cs-137]: ND (Detection limit: approx. 2 x 10^{-7} Bq/cm³)
- * Data of Monitoring Posts (MP1-MP8).
  Data of Monitoring Posts (MPs) measuring the airborne radiation rate around the site boundary showed 0.485 – 2.080 μSv/h (February 22 – March 28, 2017).
  To measure the variation in the airborne radiation rate of MP2-MP8 more accurately, environmental improvement (tree trimming, removal of surface soil and shielding around the MPs) was completed.

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 accumulated 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

➢ Reduction of inflow into buildings

- Inflow into buildings (inflow such as groundwater and rainwater into buildings), though the evaluation entails uncertainty, has declined from around 400 m³/day before measures were implemented to the latest average of around 120 m³/day (the average in March 2017) by steadily implementing various measures for reduction and has almost reached the target set in the previous revision of the Mid- and Long-Term Roadmap.
- Accumulated water in buildings will be treated steadily by controlling the generation of contaminated water through measures including additional phased reduction of water levels within and outside the buildings and the progressive closure of land-side impermeable walls.

➢ 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 March 28, 2017, 266,886 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 necessary based on their operational status.

➢ Water treatment facility special for Subdrain & Groundwater drains

- To reduce the 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. Up until March 28, 2017, a total of 297,660 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 since the sea-side impermeable walls were closed, pumping started on November 5, 2015. Up until March 28, 2017, a total of approx. 122,900 m³ had been pumped up. Approx. 10 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period February 16, 2016 - March 22, 2017).
- As a measure to enhance subdrains and groundwater drains, work to divide shared pipes, from subdrain pits to the relay tank, into independent pipes for each pit was completed on March 1 and operation started. In addition, to improve the treatment capability of subdrains and groundwater drains, work is underway to duplicate the system for the treatment equipment (the implementation plan for which was approved on February 10). An area is being constructed and the ground is being improved to accommodate additional water collection tanks and temporary water storage tanks.
- "Inflow such as groundwater and rainwater into buildings" correlates highly with the average water level of subdrains around the Unit 1-4 buildings.
- Since January 2017, in particular, the average subdrain water level has declined due to the progress of measures for subdrains, closure of unfrozen sections of the land-side impermeable walls (on the mountain side) and other construction in addition to the low-rainfall climate. "Inflow such as groundwater and rainwater into buildings" has also declined correspondingly.

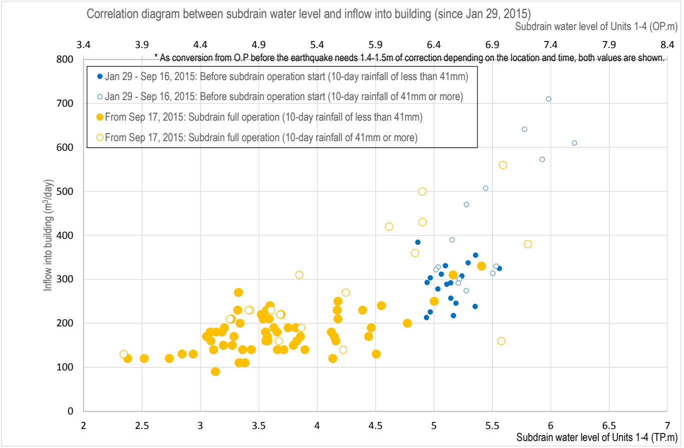


Figure 1: Correlation between inflow such as groundwater and rainwater into buildings and the water level of Unit 1-4 subdrains

➢ Construction status of the land-side impermeable walls

- As for the land-side impermeable walls (on the mountain side), freezing and closure of seven unfrozen sections have been advanced with a phased approach. Freezing started at two of the seven sections from December 3 and four of the remaining five sections from March 3, except for one unfrozen section.
- The groundwater volume pumped from the area 4 m above sea level was minimized to 85 m³/day on March 6, and the average volume in March was approx. 118 m³/day.

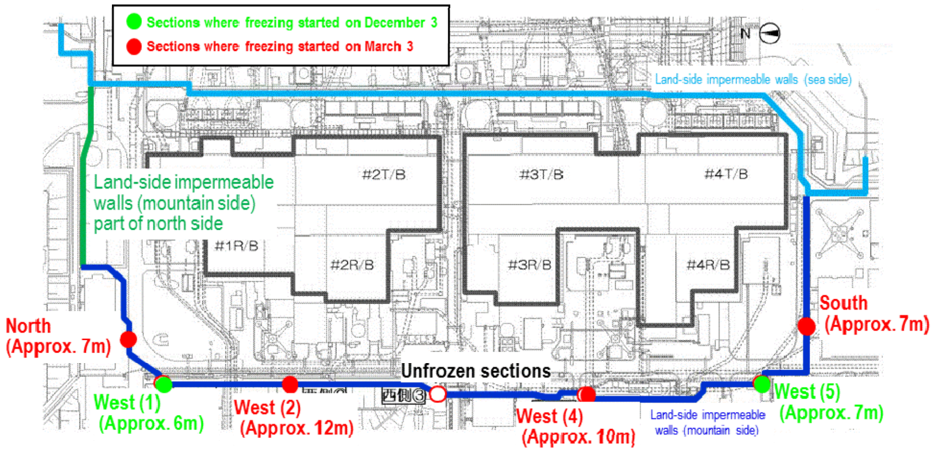


Figure 2: Closure of part of the land-side impermeable walls (on the mountain side)

➢ Operation of multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing, additional 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; for additional equipment, System A: from September 17, 2014, System B: from September 27, 2014, System C: from October 9, 2014 and for high-performance equipment, from October 18, 2014).
- As of March 23, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 339,000, 326,000 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 March 23, approx. 315,000 m³ had been treated.
- The existing multi-nuclide removal equipment System B has been suspended to investigate the cause and repair in response to delamination of the rubber lining detected inside the coprecipitation tank. No delamination of rubber lining was identified inside the coprecipitation tanks of Systems A and C or the supply tanks of Systems A-C. The volume required can be treated by the remaining five systems: two systems of existing equipment excluding System B and three systems of additional equipment.

➢ 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 March 23, approx. 355,000 m³ had been treated.

➢ Measures in Tank Areas

- Rainwater, under the release standard and having accumulated within the fences in the contaminated water tank area, was sprinkled on site after eliminating radioactive materials using rainwater-treatment equipment since May 21, 2014 (as of March 27, 2017, a total of 77,458 m³).

➢ Removal of accumulated water from Unit 1 T/B

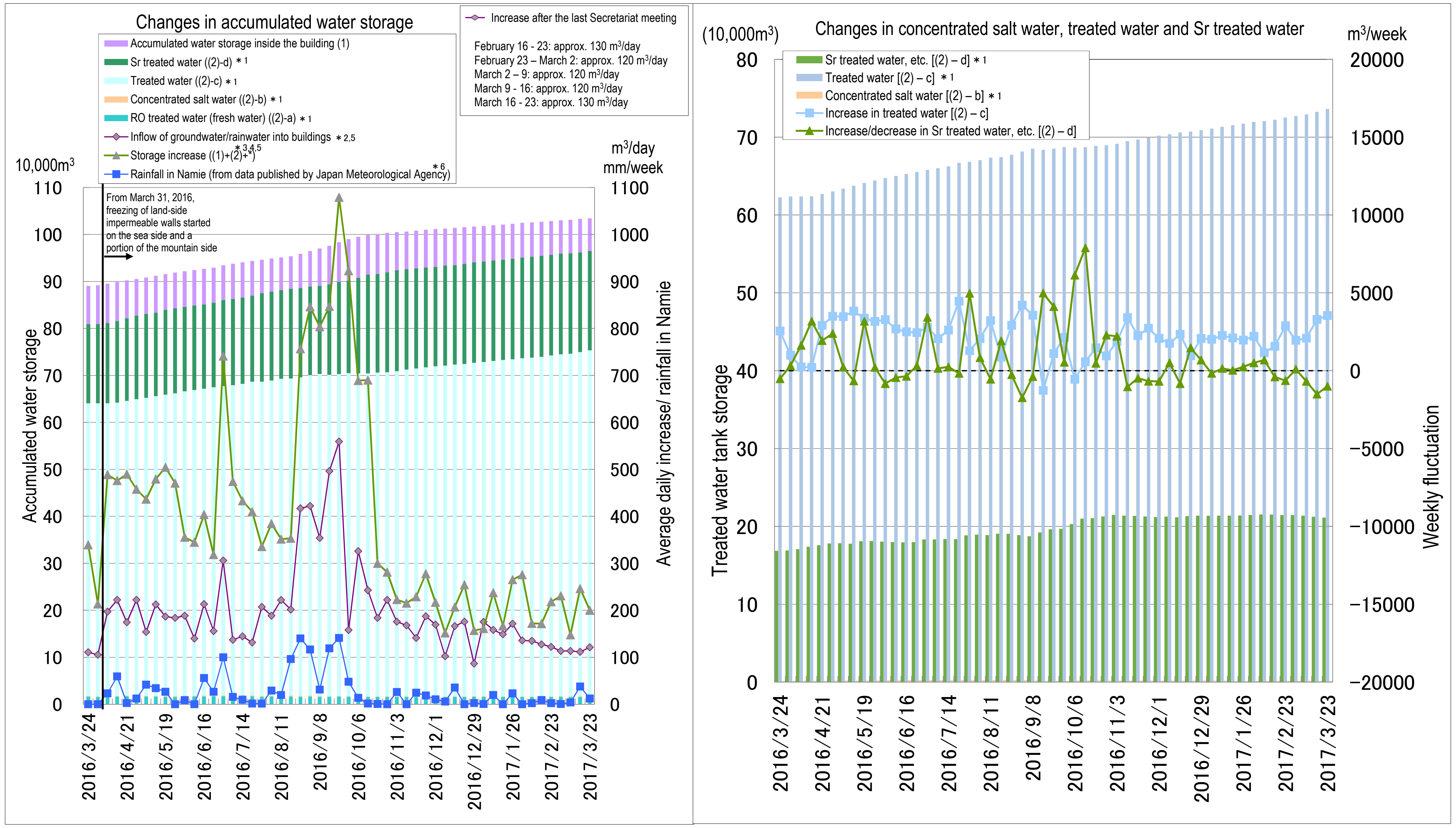
- Regarding the Unit 1 Turbine Building (T/B), measures including the installation of transfer equipment and dust reduction were implemented to remove accumulated water of the T/B down to the lowest floor surface by the end of FY2016 as part of efforts to reduce the risk of accumulated water leakage from buildings.
- Following the completion of work to install new transfer equipment and collect sludge, which may float in the air as dust, the water level was decreased by transfer equipment from March 22 and water removal to the lowest floor surface was confirmed on March 24.
- Based on the verification results, showing that accumulated water was stably drained by the additional pump and the water level was controlled within the floor drain sump since the decline in the water level, completion of accumulated water removal from the Unit 1 T/B lowest floor area was judged.
- Efforts will continue by utilizing the work results and knowledge obtained at the Unit 1 T/B in accumulated water removal at the Unit 2-4 T/Bs and other buildings.

➢ Leakage inside the fences of the secondary cesium absorption apparatus (SARRY)

- On March 2, accumulated water and discontinued leakage were identified inside the fences near the secondary cesium absorption apparatus (SARRY) System A post filter in the High Temperature Incinerator Building. Based on the on-site investigative results that confirmed the trace of leakage from the plastic cover over the pressure-tight hose joint at the post-filter vent line, the accumulated water was determined to be treated water from SARRY. On March 3, the pressure-tight hose was replaced and no leakage was identified.

➢ Closure of Unit 2 seawater pipe trench vertical shaft C

- Regarding the Unit 2 seawater pipe trench, contaminated water in the trench was removed by June 30 and filling was completed on July 10, 2015. As the vertical shaft C has remained and been monitored as an observation well without closing the top, the increased water level in the shaft was considered attributable to groundwater inflow. Monitoring of the shaft was terminated and the shaft was closed by March 9. Freezing operation of building connections was terminated on March 10.



As of March 23, 2017

*1: Water amount with which water-level gauge indicates 0% or more

*2: Since September 10, 2015, the data collection method has been changed
(Evaluation based on increased in storage: in buildings and tanks → Evaluation based on increase/decrease in storage in buildings)
"Inflow of groundwater/rainwater into buildings" = "Increase/decrease of water held in buildings" + "Transfer from buildings to tanks" - "Transfer into buildings (water injection into reactors and transfer from well points, etc.)"

3: Since April 23, 2015, the data collection method has been changed. (Increase in storage (1)+(2) → (1)+(2)+)

*4: On February 4, 2016 and January 19, 2017, corrected by reviewing the water amount of remaining concentrated salt water

*5: "Increase/decrease of water held in buildings" used to evaluate "Inflow of groundwater/rainwater into buildings" and "Storage increase" is calculated based on the data from the water-level gauge. During the following evaluation periods, when the gauge was calibrated, these two values were evaluated lower than anticipated.
(March 10-17, 2016: Main Process Building; March 17-24, 2016: High-Temperature Incinerator Building (HTI); September 22-29, 2016: Unit 3 Turbine Building)

*6: For rainfall, data of Namie (from data published by the Japan Meteorological Agency) is used. However, due to missing values, data of Tomioka (from data published by the Japan Meteorological Agency) is used alternatively (April 14-21, 2016)

Figure 3: Status of accumulated water storage

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 on December 22, 2014

➢ Main work to help remove spent fuel at Unit 1

- The status of rubble under the fallen roof was investigated to collect data, which will then be used when considering rubble removal methods for the Unit 1 Reactor Building operating floor (September 13, 2016 – March 10, 2017). The investigation collected useful information as part of preparation of a rubble removal plan such as the status of the roof slab, overhead crane and fuel-handling machine and misalignment of well plugs. Another investigation will follow to prepare a work plan for safe rubble removal.
- No significant variation associated with the work was identified at monitoring posts and dust monitors. The building cover is being dismantled, with anti-scattering measures steadily implemented and safety first.
- An annual inspection of cranes used in the work to dismantle the Unit 1 building cover was completed (November 23, 2016 – March 24, 2017).
- Pillars and beams of the building cover will be modified and windbreak sheets installed on the beams from March 31, 2017. The pillars and beams (covered by windbreak sheets) will be restored around mid-FY2017.

➢ Main work to help remove spent fuel at Unit 2

- To help remove the spent fuel from the pool of the Unit 2 Reactor Building, a gantry and a front chamber accessing the operating floor were installed on the west side of the reactor building (September 28, 2016 – March 21, 2017). Installation of equipment in the front chamber and preparatory work to make an opening in the external wall of the Reactor Building are underway (both projects will be completed by early May 2017).
- To construct a work area, dismantling of the cement blower building started from March 21 (scheduled for completion in early April 2017).

➢ Main work to help remove spent fuel at Unit 3

- Installation of stoppers*1 started on January 17 and was completed on March 7.
- To check the exposure dose on the operating floor after the installation, six-direction dose measurement was performed from February 27 to March 1.
- Installation of the FHM girder*2 started from March 1.

*1 Projections to horizontally support the fuel removal cover to the reactor building.
*2 Horizontal members composing the gate structure. A rail will be mounted on the girder where the fuel handling machine (FHM) and crane will travel.

3. Removal of fuel debris

Promoting the development of technology and collection of data required to prepare fuel debris removal, such as investigations and repair of PCV's leakage parts as well as decontamination and shielding to improve PCV accessibility.

➢ Status toward investigation inside the Unit 1 PCV

- The status of fuel debris inside the primary containment vessel (PCV) (the basement floor outside the pedestal) was inspected by a self-propelled investigation device injected into the Unit 1 PCV (March 18-22).

- The inspection took images of the PCV bottom status near the pedestal opening for the first time and confirmed that the dose tended to increase near the bottom. No significant change was identified in the dose on the grating and the status of structures compared to the investigative results in April 2015. The status of the PCV floor surface will continue to be examined based on the collected image and dose data.

➢ Status toward investigation inside the Unit 2 PCV

- Images taken by the pre-inspection device inside the pedestal (telescopic type) during the investigation inside the PCV, conducted from January 26 to February 16, were processed and the following new information was identified: the range of lost grating and damage status of PIP cables, etc. in the CRD housing. The status inside the pedestal will continue to be examined based on information acquired from the images.

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 rubble and trimmed trees

- As of the end of February 2017, the total storage volume of concrete and metal rubble was approx. 201,700 m^3 (+1,300 m^3 compared to at the end of January, with an area-occupation rate of 73%). The total storage volume of trimmed trees was approx. 79,300 m^3 (±0 m^3, with an area-occupation rate of 75%). The total storage volume of used protective clothing was approx. 10,700 m^3 (+200 m^3, with an area-occupation rate of 91%). The increase in rubble was mainly attributable to construction related to the installation of tanks. The increase in used protective clothing was mainly attributable to the acceptance of used clothing, etc. due to suspension of the Radioactive Waste Incinerator for periodical inspection.

➢ Management status of secondary waste from water treatment

- As of March 23, 2017, the total storage volume of waste sludge was 597 m^3 (area-occupation rate: 85%) and that of concentrated waste fluid was 9,333 m^3 (area-occupation rate: 87%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 3,566 (area-occupation rate: 57%).

5. Reactor cooling

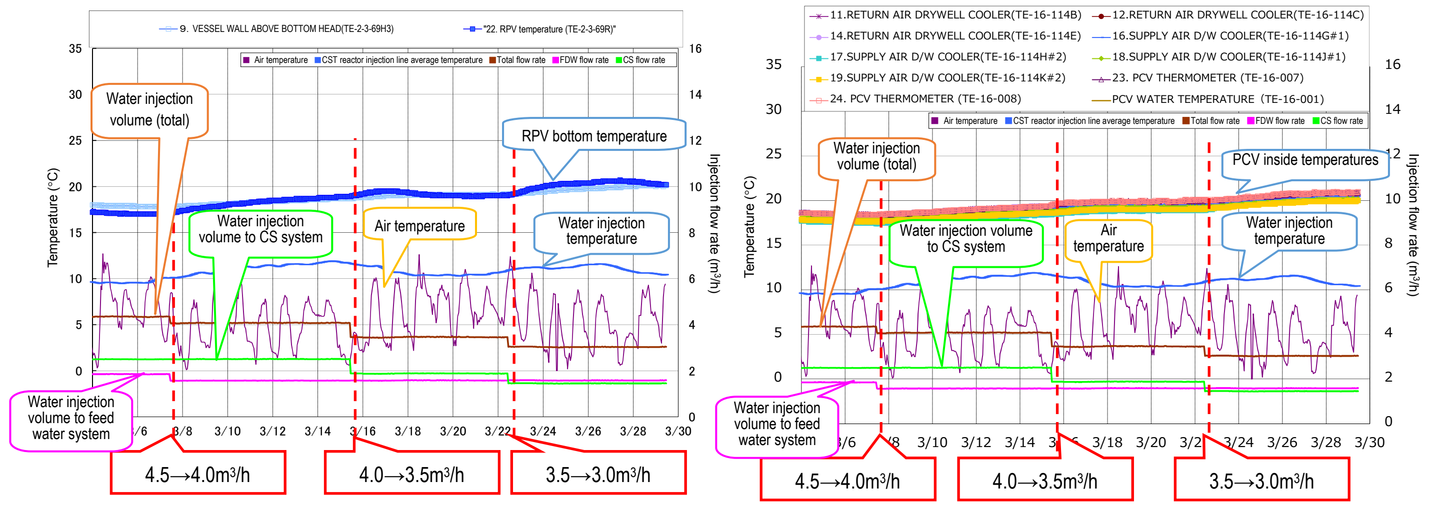
The cold shutdown condition will be maintained by cooling the reactor by water injection and measures to complement the status monitoring will continue

➢ Check of temperature in association with declining decay heat of spent fuel in the Unit 1 SFP

- Decay heat of spent fuel stored in the Unit 1 spent fuel pool (SFP) has been declining.
- Prior to reviewing the operation method of SFP circulating cooling facilities, the requirement that SFP temperature stably stands below the limit (60℃) even if cooling by the Unit 1 SFP circulating cooling facility is suspended, must be satisfied. To verify compliance, the temperature will be checked after SFP cooling by the Unit 1 facility is suspended for about three weeks in April to confirm that the SFP temperature stably stands at around 30℃.

➢ Reduction in volume of water injected into the Unit 1-3 reactors

- The volume of water injected into the Unit 2 reactor was reduced from 4.5 to 4.0 m^3/h from March 7, from 4.0 to 3.5 m^3/h from March 15 and 3.5 to 3.0 m^3/h from March 22. No abnormality attributable to the reduction was detected under the cold shutdown condition.



<RPV bottom temperatures> <PCV inside temperatures>

Figure 4: Change in temperatures in the Unit 2 reactor after reducing the water injection volume

➢ Causes and recurrence prevention measures for suspension of important safety equipment attributable to human errors (two cases) (implementation status)

- Recurrence prevention measures were implemented in response to the suspension of important safety equipment attributable to human errors, which occurred on December 4 and 5, 2016 (suspension of the Unit 2 and 3 SFP alternative cooling facility and the Unit 3 condensate storage tank reactor water injection pump). Short-term measures such as removal of the operation switch lever from the water injection pump control panel were completed by January 2017. The following of the mid- and long-term measures were also completed:
  - ✓ Physical protection measures including fixing by tools were implemented for easily-operable faucet valves (February 23, 2017).
  - ✓ Measures to ensure the early detection of pressure variation in the common SFP cooling secondary system (review of alert setting values, etc.) were examined and implemented (January 27, 2017).
  - ✓ Criteria for the necessity of notifications and announcements were defined in cases of abnormality occurring in the common SFP cooling secondary system and included in the “Notification and Announcement Standard” (February 28, 2017).
  - ✓ Internal manuals related to maintenance of important facilities will be revised (March 2017).
  - ✓ Stickers indicating emergency contact will be attached on helmets (March 2017)
- Measures regarding common facility and human errors to both events will also be implemented for similar important facilities (those including functions to “stop, cool and enclose,” and supply power to these important facilities, as well as those where any functional decline may have an environmental impact on the outside of the site, or affect the monitoring function).

6. Reduction in radiation dose and mitigation of contamination

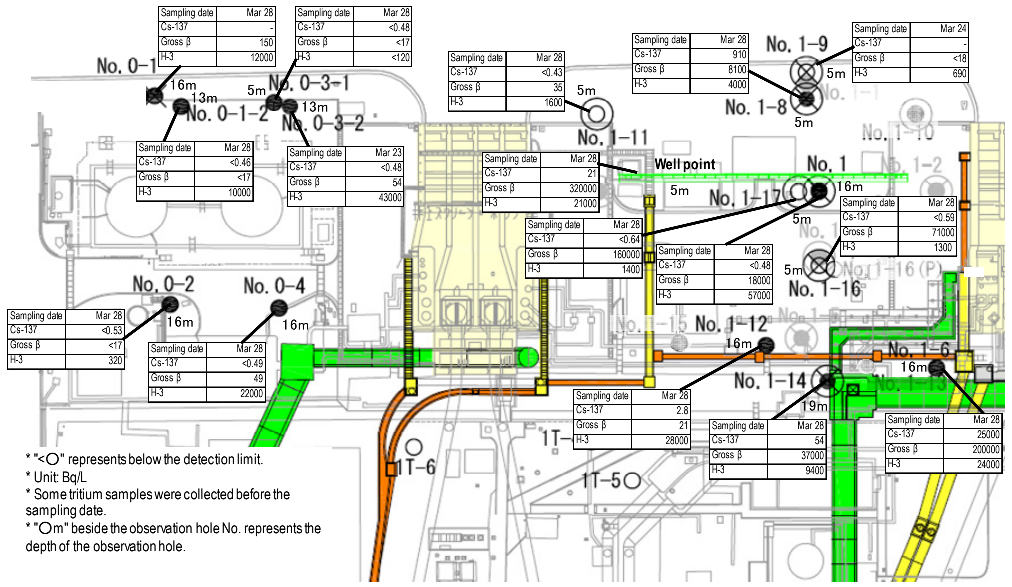
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

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

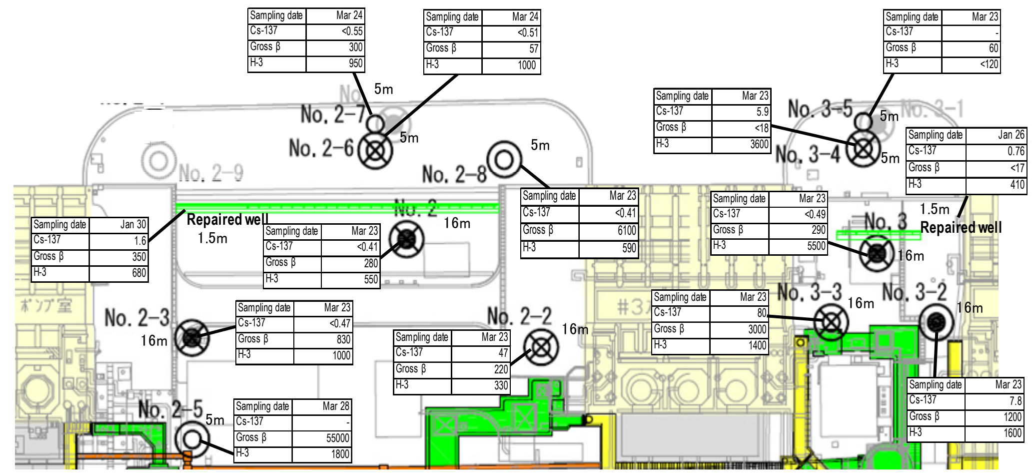
- Regarding radioactive materials in the groundwater near the bank on the north side of the Unit 1 intake, despite the gradually increasing tritium density at groundwater Observation Hole No. 0-1 since October 2016, it currently remains constant at around 13,000 Bq/L.
- Regarding the groundwater near the bank between the Unit 1 and 2 intakes, though the density of gross β radioactive materials at groundwater Observation Hole No. 1-6 had been declining since July 2016, it has remained constant since mid-October 2016 and currently stands at around 200,000 Bq/L. Though the tritium density at the same groundwater Observation Hole had been increasing from around 6,000 Bq/L to 60,000 Bq/L since November

2016, it currently stands at around 20,000 Bq/L. Though the tritium density at the groundwater Observation Hole No. 1-8 had been increasing from around 2,000 Bq/L since November 2016, it currently stands at around 4,000 Bq/L. Though the tritium density at the groundwater Observation Hole No. 1-9 had been increasing from around 200 Bq/L to 1,000 Bq/L since December 2016, it currently stands at around 700 Bq/L. Though the density of gross β radioactive materials at groundwater Observation Hole No. 1-16 had been increasing to around 100,000 Bq/L after declining to 6,000 Bq/L since August 2016, it has been declining since mid-October 2016 and currently stands at around 60,000 Bq/L. Though the tritium density at groundwater Observation Hole No. 1-17 had been declining from 40,000 Bq/L and increasing since March 2016, it has been declining since mid-November 2016 and is currently slightly higher than before the decrease at around 1,400 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).

- Regarding radioactive materials in the groundwater near the bank between the Unit 2 and 3 intakes, though the tritium density at groundwater Observation Hole No. 2-3 had remained constant at around 4,000 Bq/L and been declining since November 2016, it has remained constant at around 1,000 Bq/L. Though the density of gross β radioactive materials at groundwater Observation Hole No. 2-5 had increased to 500,000 Bq/L since November 2015 and been declining since January 2016, it has been increasing since mid-October 2016 and currently stands at around 60,000 Bq/L. Though the tritium density at the same groundwater Observation Hole had remained constant at around 500 Bq/L, it has been increasing since November 2016 and currently stands at around 1,800 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).
- Regarding radioactive materials in the groundwater near the bank between the Unit 3 and 4 intakes, though the densities of tritium and gross β radioactive materials at groundwater Observation Hole No. 3-2 had been increasing since September 2016, they have been gradually declining since the end of October from 3,000 Bq/L for tritium and 3,500Bq/L for gross β radioactive materials and both are currently slightly higher than before the increase at around 1,500Bq/L. At groundwater Observation Hole No. 3-3, despite the increase in tritium density since September 2016, it has been gradually declining from 2,500 Bq/L since early November and is currently slightly higher than before the increase at around 1,500 Bq/L. At groundwater Observation Hole No. 3-4, though the tritium density had been declining since September 2016, it has been gradually increasing from 2,500 Bq/L since the end of October and currently stands at the same level before the decline at around 4,000 Bq/L. At groundwater Observation Hole No. 3-5, the density of gross β radioactive materials had been declining to around 30 Bq/L since October 2016. Despite having increased to around 90 Bq/L since February 2017, it currently stands at around 60 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 area, densities have remained low except for the increase in cesium 137 and gross β radioactive materials during heavy rain. They have been 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 within the port, densities have remained low except for the increase in cesium 137 during heavy rain. They have been 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 have remained constant and within the same range as before.



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



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

Figure 5: Groundwater density on the Turbine Building east side

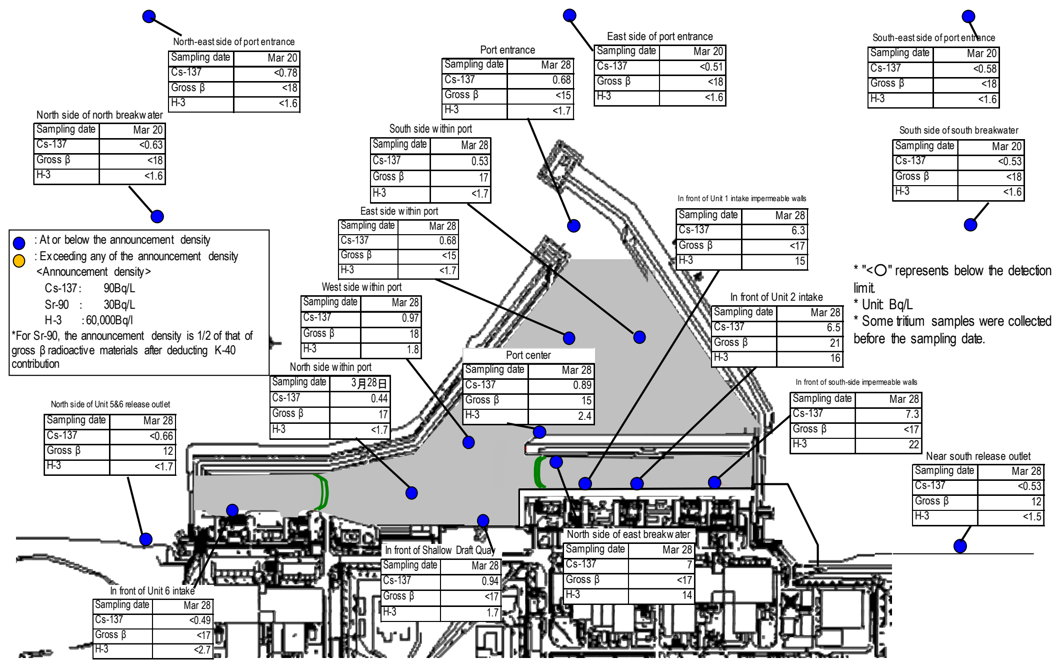


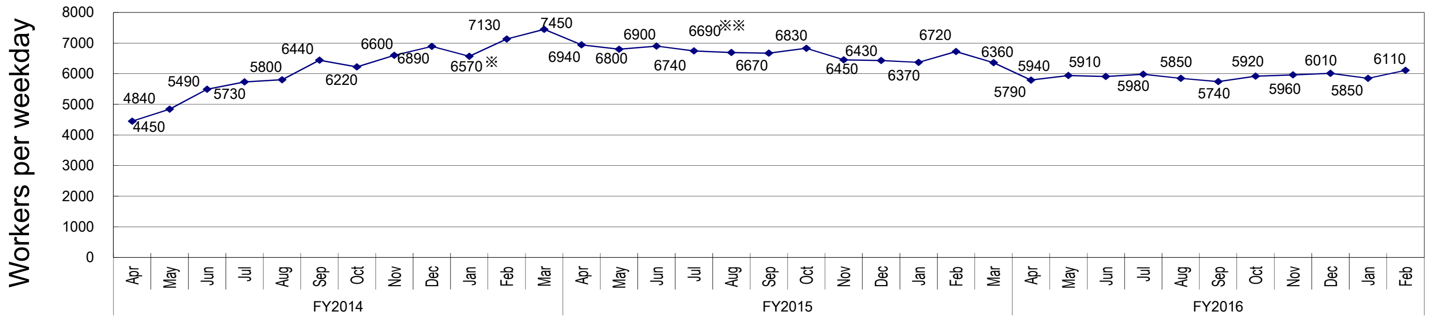
Figure 6: Seawater density around the port

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 November 2016 to January 2017 was approx. 12,500 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 9,700). 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 April 2017 (approx. 5,610 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. 4,500 to 7,500 since FY2014 (see Figure 7). Some works for which contractual procedures have yet to be completed were excluded from the estimate for April 2017.
- The number of workers from both within and outside Fukushima Prefecture has increased. The local employment ratio (TEPCO and partner company workers) as of February has remained at around 55%.
- The monthly average exposure dose of workers remained at approx. 1 mSv/month during FY2013, FY2014 and FY2015. (Reference: Annual average exposure dose 20 mSv/year ≒ 1.7 mSv/month)
- For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.



※ Calculated based on the number of workers as of January 20 (due to safety inspection from January 21)
※※ Calculated based on the number of workers from August 3-7, 24-28 and 31 (due to overhaul of heavy machines)

Figure 7: Changes in the average number of workers per weekday for each month since FY2014

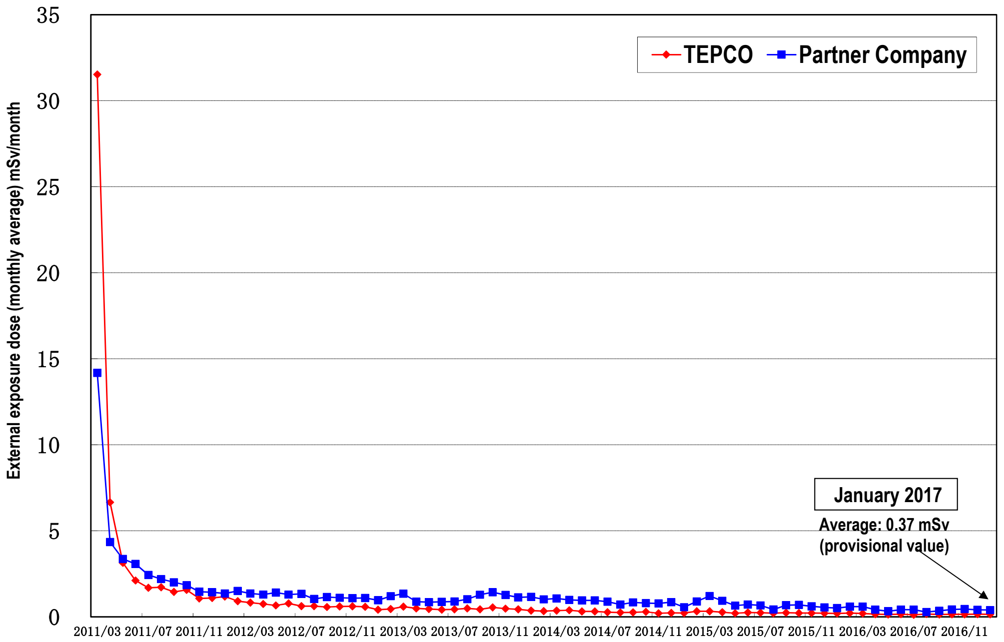


Figure 8: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

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

- Since November, measures for influenza and norovirus have been implemented, including free influenza vaccinations (subsidized by TEPCO Holdings) in the Fukushima Daiichi Nuclear Power Station (from October 26 to December 2) and medical clinics around the site (from November 1 to January 31, 2017) for partner company workers. As of January 31, a total of 8,206 workers had been vaccinated. In addition, a comprehensive range of other measures is also being implemented and notified to all workers, including daily actions to prevent infection and expansion (measuring body temperature, health checks and monitoring infection status) and response after detecting possible infections (control of swift entry/exit and mandatory wearing of masks in working spaces).

➢ Status of influenza and norovirus cases

- Until the seventh week of 2017 (February 13-19, 2017), there were 362 influenza infections and 15 norovirus infections. Totals for the same period for the previous season showed 128 cases of influenza and ten norovirus infections.

➢ Expansion of the Green Zone (general clothing area)

- From March 30, the operation zone classification was redefined for the area 4 m above sea level and Unit 1-4 slopes, in which the environment has been improved through measures including facing, from Yellow Zone to Green Zone to expand the areas where workers are allowed to wear general or dedicated clothing and disposable dust-protective masks.

8. Status of Units 5 and 6

➢ Status of spent fuel storage in Units 5 and 6

- Regarding Unit 5, fuel removal from the reactor was completed in June 2015. 1,374 spent fuel assemblies and 168 non-irradiated fuel assemblies are stored in the spent fuel pool (storage capacity: 1,590 assemblies).
- Regarding Unit 6, fuel removal from the reactor was completed in FY2013. 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 accumulated water in Units 5 and 6

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

➢ Water level increase at mega float No. 5 VOID (north side)

- On February 16, a periodical patrol of the mega float moored within the port detected an increase in ballast water level* at one (No. 5 VOID) on the north side of nine sections, by approx. 45 cm compared to the value of the previous measurement (on January 19, 2017) to sea level. The estimated seawater inflow was approx. 1,000m^3.
- Monitoring of seawater around the mega float was enhanced and no significant variation in the density of radioactive materials was identified.
- Investigative results using an underwater camera on the walls and floor surface of the No. 5 VOID confirmed damage to three parts on the northwest side, which were repaired by divers, including welding, during March 17-21. On March 28, the post inspection confirmed no new inflow after the repair.

* Water stored in ship bottom tanks, etc. to stabilize the hull

9. Other

➢ New system of Emergency Response Measures Headquarters in the Fukushima Daiichi Nuclear Power Station

- The Emergency Response Measures Headquarters in the Fukushima Daiichi Nuclear Power Station has been established at the Main Anti-Earthquake Building since the accident on March 11, 2011, where TEPCO employees belonging to each group of the emergency response organization (staff for nuclear disaster prevention) are working separately from the Administration Office Building.

- An emergency response measures office will be established in the Main Administrative Building while maintaining the emergency response system. By creating a new system that integrates the organization of the Main Administrative Building to further efficiently operate the work involving both emergency response and decommissioning.
- In case of an alert level (AL) event or failure, the staff for nuclear disaster prevention immediately moves to the Emergency Response Measures Headquarters at the Main Anti-Earthquake Building to take actions.

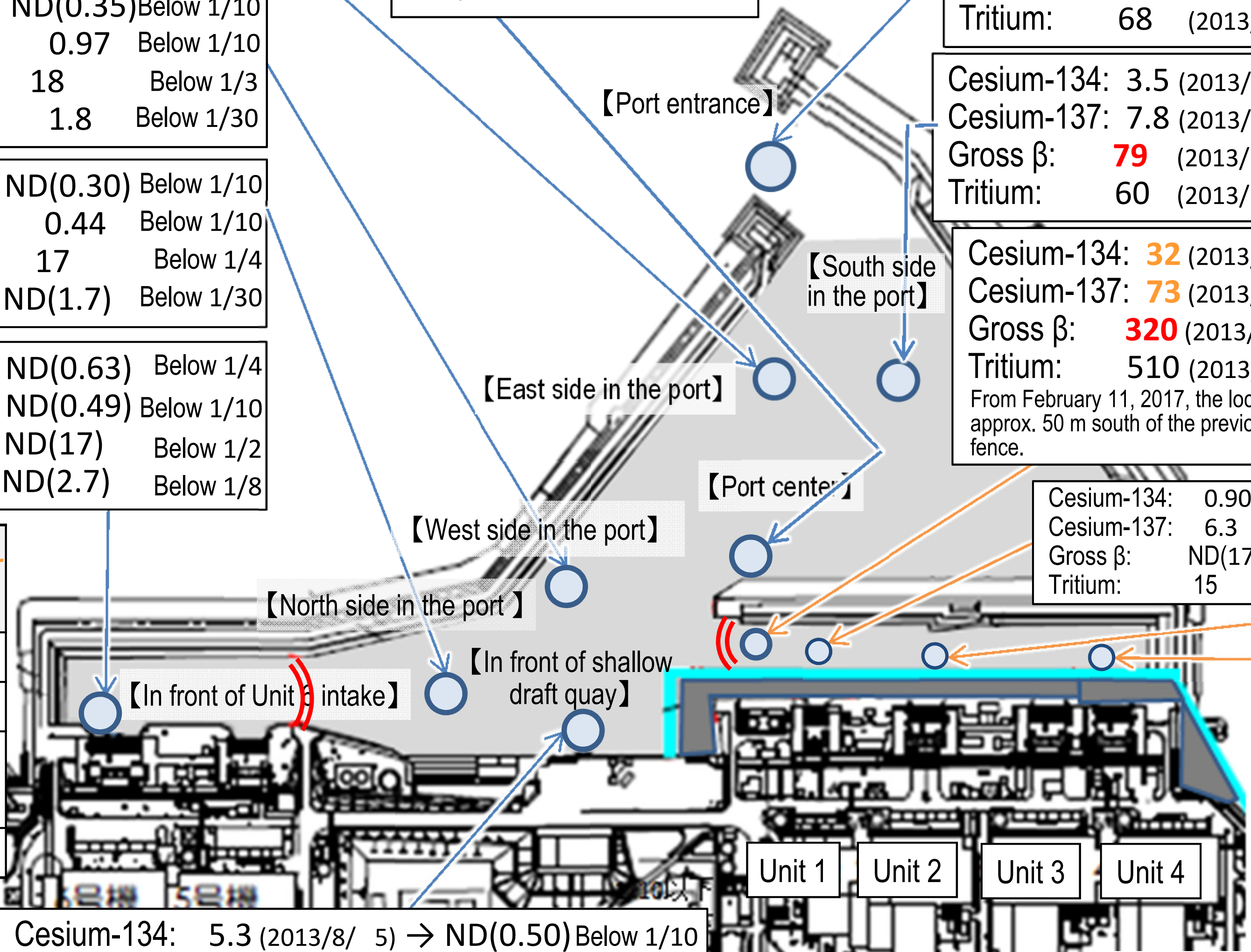
Status of seawater monitoring within the port (comparison between the highest values in 2013 and the latest values)

"The highest value" → "the latest value (sampled during March 20-28)"; 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

Sea side impermeable wall

Silt fence



Cesium-134: 3.3 (2013/10/17) → ND(0.31) Below 1/10
Cesium-137: 9.0 (2013/10/17) → 0.68 Below 1/10
Gross β: 74 (2013/ 8/19) → ND(15) Below 1/4
Tritium: 67 (2013/ 8/19) → ND(1.7) Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.35) Below 1/10
Cesium-137: 10 (2013/12/24) → 0.97 Below 1/10
Gross β: 60 (2013/ 7/ 4) → 18 Below 1/3
Tritium: 59 (2013/ 8/19) → 1.8 Below 1/30

Cesium-134: 5.0 (2013/12/2) → ND(0.30) Below 1/10
Cesium-137: 8.4 (2013/12/2) → 0.44 Below 1/10
Gross β: 69 (2013/8/19) → 17 Below 1/4
Tritium: 52 (2013/8/19) → ND(1.7) Below 1/30

Cesium-134: 2.8 (2013/12/2) → ND(0.63) Below 1/4
Cesium-137: 5.8 (2013/12/2) → ND(0.49) Below 1/10
Gross β: 46 (2013/8/19) → ND(17) Below 1/2
Tritium: 24 (2013/8/19) → ND(2.7) Below 1/8

Cesium-134: ND(0.56)
Cesium-137: 0.89
Gross β: 15
Tritium: 2.4 *

Cesium-134: 3.3 (2013/12/24) → ND(0.47) Below 1/7
Cesium-137: 7.3 (2013/10/11) → 0.68 Below 1/10
Gross β: 69 (2013/ 8/19) → ND(15) Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.7) Below 1/40

Cesium-134: 3.5 (2013/10/17) → ND(0.35) Below 1/10
Cesium-137: 7.8 (2013/10/17) → 0.53 Below 1/10
Gross β: 79 (2013/ 8/19) → 17 Below 1/4
Tritium: 60 (2013/ 8/19) → ND(1.7) Below 1/30

Cesium-134: 32 (2013/10/11) → 1.0 Below 1/30
Cesium-137: 73 (2013/10/11) → 7.0 Below 1/10
Gross β: 320 (2013/ 8/12) → ND(17) Below 1/10
Tritium: 510 (2013/ 9/ 2) → 14 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: 0.90
Cesium-137: 6.3
Gross β: ND(17)
Tritium: 15 *

Cesium-134: 1.4
Cesium-137: 6.5
Gross β: 21
Tritium: 16 *

Cesium-134: 0.92
Cesium-137: 7.3
Gross β: ND(17)
Tritium: 22 *

	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(0.50) Below 1/10
Cesium-137: 8.6 (2013/8/ 5) → 0.94 Below 1/9
Gross β: 40 (2013/7/ 3) → ND(17) Below 1/2
Tritium: 340 (2013/6/26) → 1.7 Below 1/200

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

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 March 29, 2017

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 March 20-28)

	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

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 (0.62)
Cesium-137: ND (2013) → ND (0.78)
Gross β: ND (2013) → ND (18)
Tritium: ND (2013) → ND (1.6)

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

Cesium-134: ND (2013) → ND (0.73)
Cesium-137: 1.6 (2013/10/18) → ND (0.51) Below 1/3
Gross β: ND (2013) → ND (18)
Tritium: 6.4 (2013/10/18) → ND (1.6) Below 1/4

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

Cesium-134: ND (2013) → ND (0.55)
Cesium-137: ND (2013) → ND (0.58)
Gross β: ND (2013) → ND (18)
Tritium: ND (2013) → ND (1.6)

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

Cesium-134: ND (2013) → ND (0.66)
Cesium-137: ND (2013) → ND (0.63)
Gross β: ND (2013) → ND (18)
Tritium: 4.7 (2013/ 8/18) → ND (1.6) Below 1/2

【Port entrance】

Cesium-134: 3.3 (2013/12/24) →ND (0.47) Below 1/7
Cesium-137: 7.3 (2013/10/11) → 0.68 Below 1/10
Gross β: 69 (2013/ 8/19) →ND (15) Below 1/4
Tritium: 68 (2013/ 8/19) →ND (1.7) Below 1/40

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

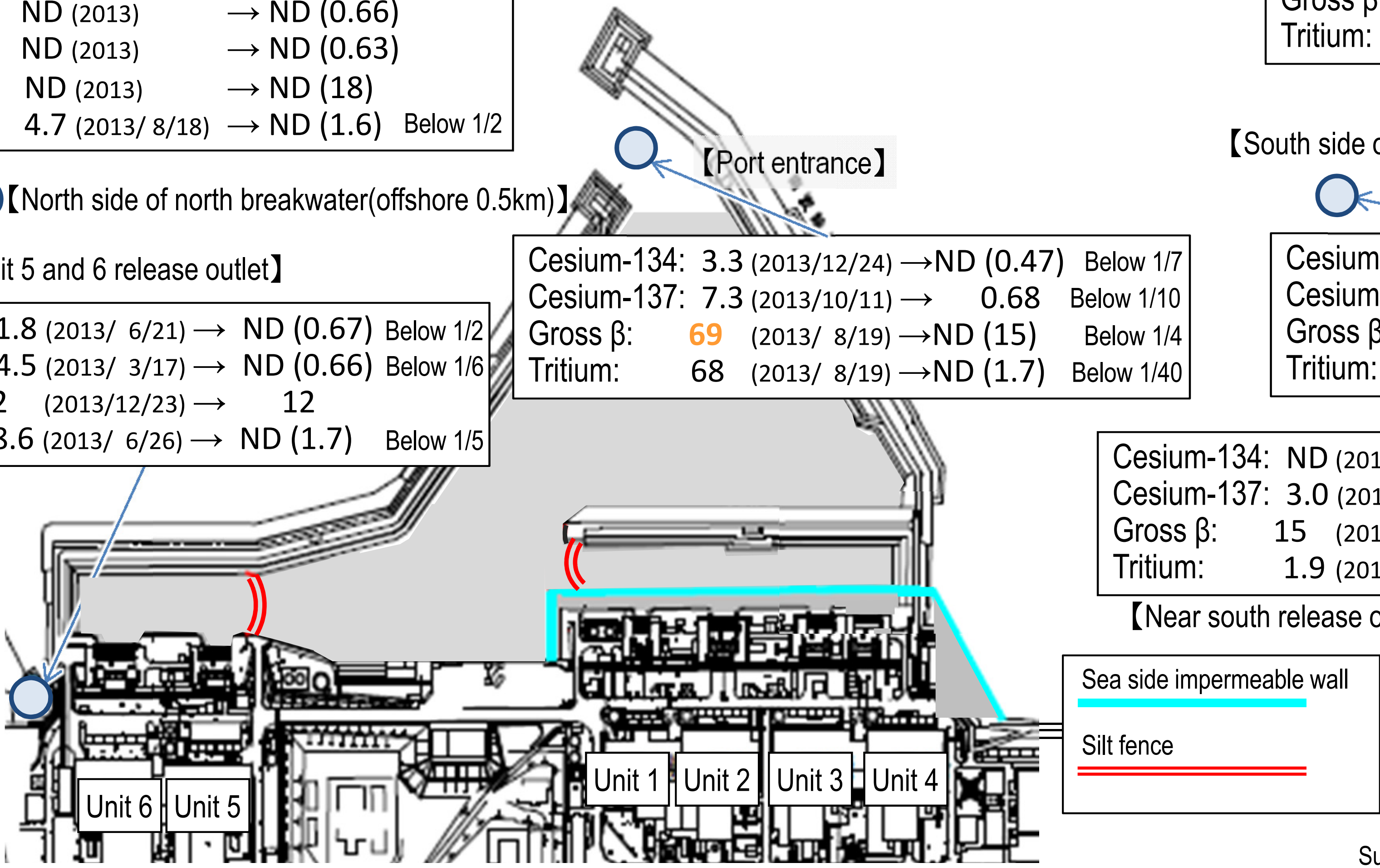
Cesium-134: ND (2013) → ND (0.68)
Cesium-137: ND (2013) → ND (0.53)
Gross β: ND (2013) → ND (18)
Tritium: ND (2013) → ND (1.6)

【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 (0.66) Below 1/6
Gross β: 12 (2013/12/23) → 12
Tritium: 8.6 (2013/ 6/26) → ND (1.7) Below 1/5

【Near south release outlet】

Cesium-134: ND (2013) → ND (0.66)
Cesium-137: 3.0 (2013/ 7/15) → ND (0.53) Below 1/5
Gross β: 15 (2013/12/23) → 12
Tritium: 1.9 (2013/11/25) → ND (1.5)



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.

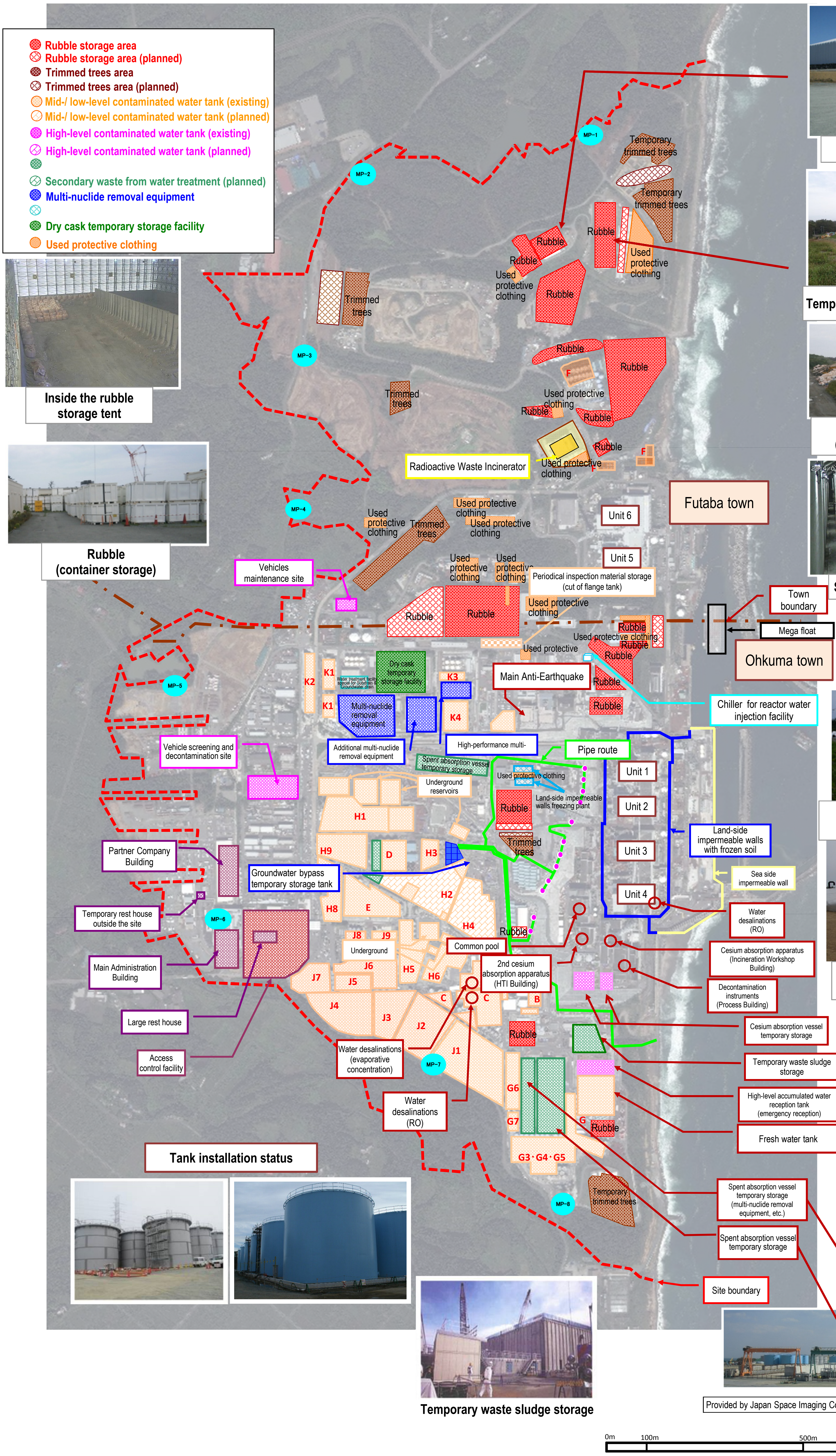
Note: Because safety of the sampling points was unassured due to the influence of Typhoon No. 10 in 2016, samples were taken from approx. 330 m south of the Unit 1-4 release outlet. From January 27, 2017, the location of the sampling point was also shifted approx. 280 m south of the Unit 1-4 release outlet.

Summary of TEPCO data as of March 29, 2017

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

Appendix 2
March 30, 2017

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site




Rubble storage tent


Temporary soil cover type storage


Rubble (outdoor accumulation)


Solid waste storage facility

Inside the rubble storage tent

Rubble (container storage)


Rubble (outdoor accumulation)


Temporary trimmed trees storage pool


Trimmed trees (outdoor accumulation)

Tank installation status

Temporary waste sludge storage

Provided by Japan Space Imaging Corporation, (C)DigitalGlobe

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.
The investigation into the rubble status on the operating floor, conducted from September 2016 to March 2017 to examine the method of rubble removal there, collected useful information for preparation of a rubble removal plan such as the status of the fuel handling machine. Pillars and beams of the building cover will be modified and windbreak sheets installed on the beams.
Thorough monitoring of radioactive materials will continue.


<Dismantling of wall panels>

Flow of building cover dismantling

Unit 2

To facilitate removal of fuel assemblies and 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 and debris from the pool; and Plan 2 to install a dedicated cover for fuel removal from the pool.

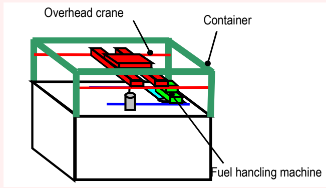


Image of Plan 1

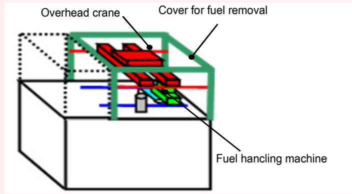
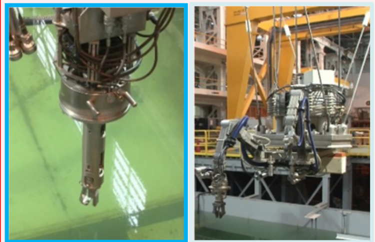


Image of Plan 2

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.


Fuel gripper (mast)
Manipulator
Fuel-handling facility (in the factory)

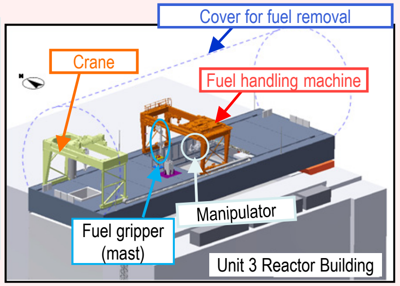


Image of entire fuel handling facility inside the cover

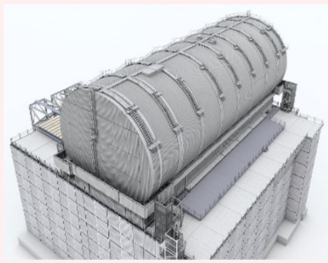


Image of the cover for fuel removal

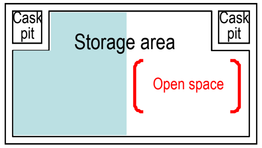
Unit 4

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 remove the fuel, 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.


Fuel removal status

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

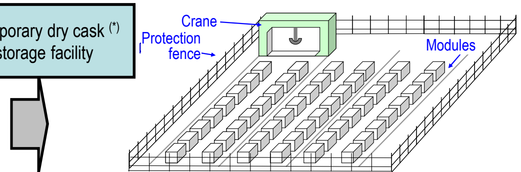
Common pool



An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

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 removed from the Unit 4 spent fuel pool began to be received (November 2013)

Temporary dry cask (*) storage facility



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

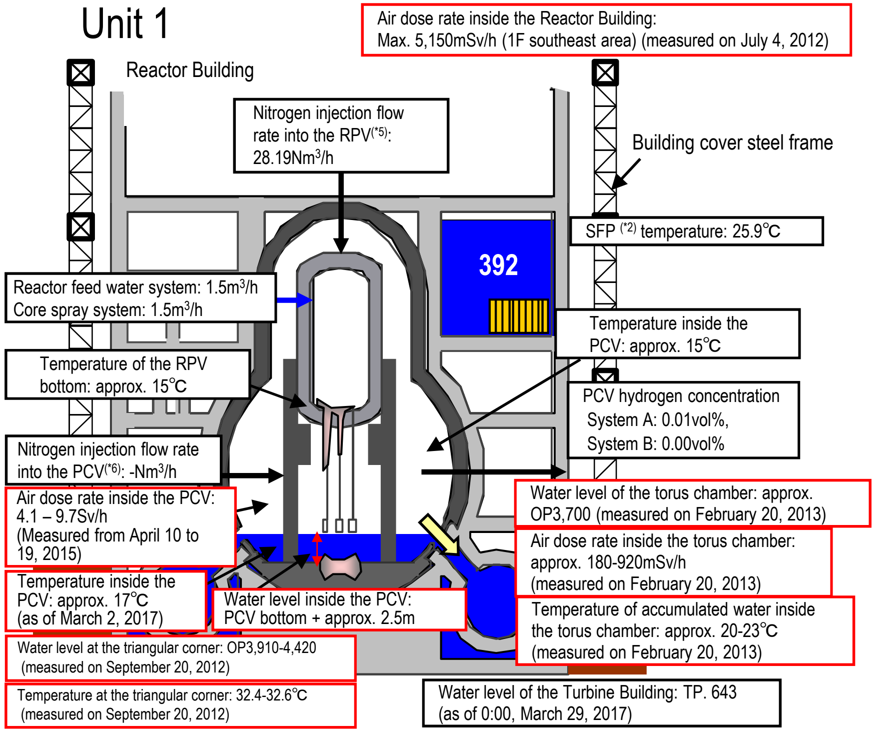
Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

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

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.

Unit 1



* Indices related to the plant are values as of 11:00, March 29, 2017

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

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

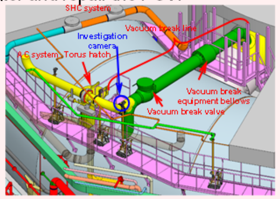


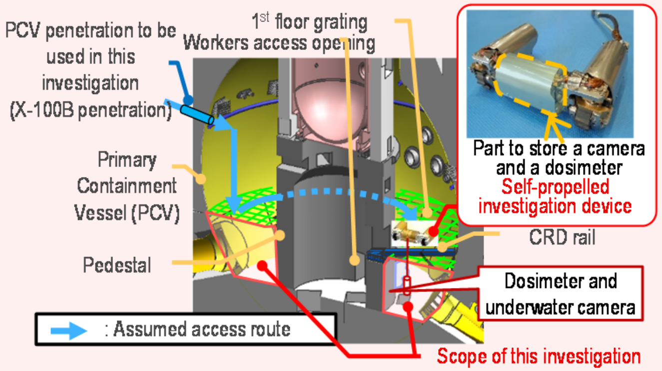
Image of the S/C upper part investigation

Status of investigation inside the PCV

Prior to fuel debris removal, 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>

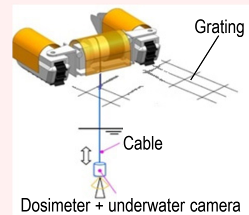


Image of hanging of dosimeter and camera

Image near the bottom

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)

Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

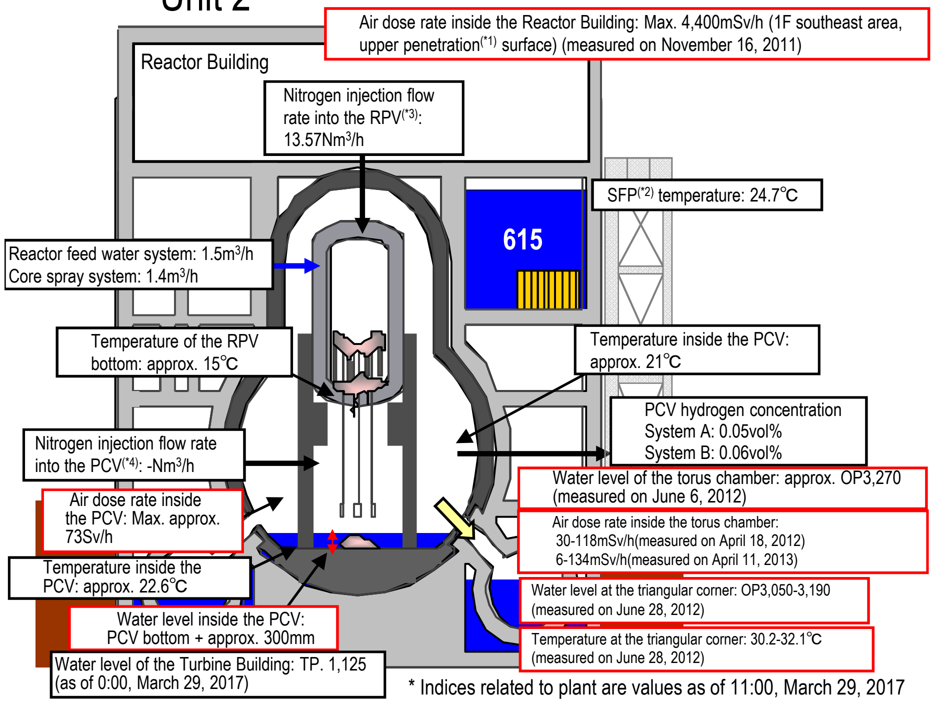
Immediate target	Identify the plant status and commence R&D and decontamination toward fuel debris removal

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.
- On April 2014, removal of the broken thermometer failed and was suspended. Rust-stripping chemicals were injected and the broken thermometer was removed on January 2015. A new thermometer was reinstalled on 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 on May 2014 and new instruments were reinstalled on 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.

Unit 2

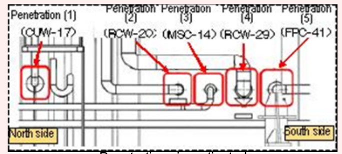


* Indices related to plant are values as of 11:00, March 29, 2017

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

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 [*5] 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)



Penetrations investigated

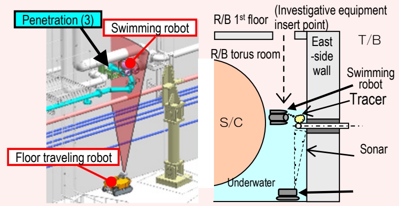


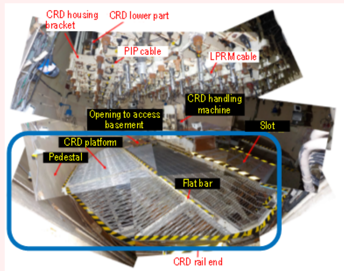
Image of the torus chamber east-side cross-sectional investigation

Status of investigation inside the PCV

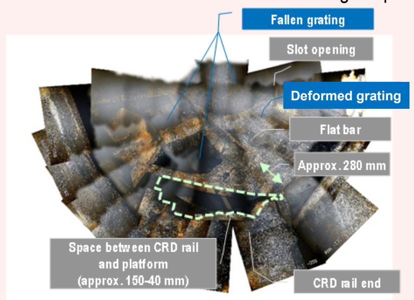
Prior to fuel debris removal, an investigation inside the PCV will be conducted to inspect the status there including the location of fuel debris.

[Investigative outline]
- A robot, injected from Unit 2 X-6 penetration(*1), will access the inside of the pedestal using the CRD rail.

[Progress status]
- As manufacturing of shields necessary for dose reduction around X-6 penetration was completed, a hole was made in December 2016 at the PCV penetration from which a robot will be injected.
- 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. The evaluation results of the collected information will be utilized in considering the policy for fuel debris removal.



(Reference) Inside the Unit 5 pedestal



Scope of investigation inside the PCV

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

Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

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

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

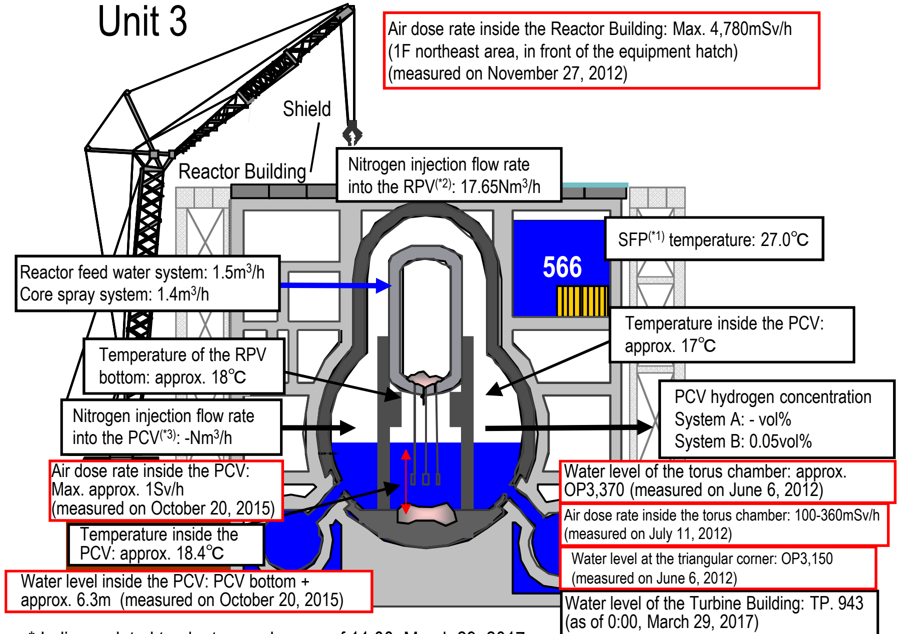
On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no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

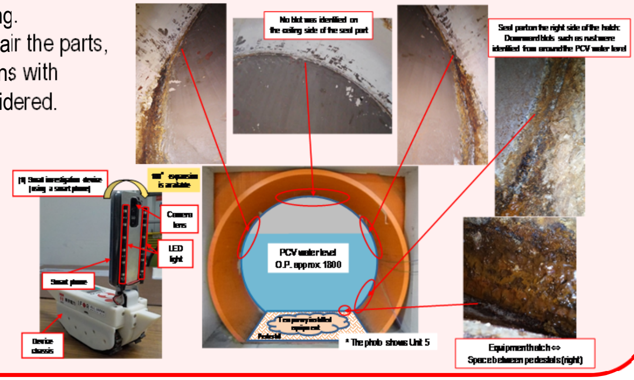


* Indices related to plant are values as of 11:00, March 29, 2017

Investigations inside PCV	1st (Oct – Dec 2015)	- Acquiring images - Measuring air temperature and dose rate - Measuring water level and temperature - Sampling accumulated water - Installing permanent monitoring instrumentation (scheduled for December 2015)
Leakage points from PC	- 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 removal, 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.



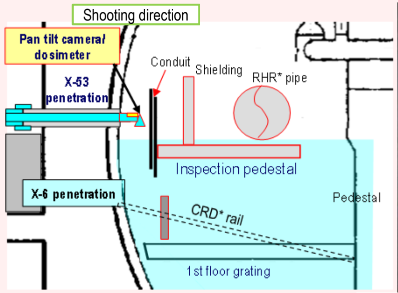
Investigation inside the PCV

Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV) including the location of the fuel debris, investigation inside the PCV was conducted.

[Steps for investigation and equipment development]

Investigation from X-53 penetration(*4)

- From October 22-24, the status of X-53 penetration, 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. Results showed that the penetration is not under the water.
- 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 accumulated 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 the next step, the obtained information will be analyzed to be utilized in the consideration about the policy for future fuel debris removal.



Inspection pedestal and water surface

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

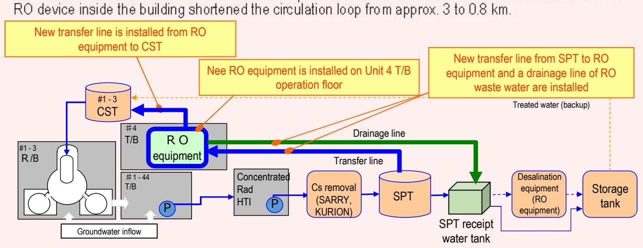
March 30, 2017
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

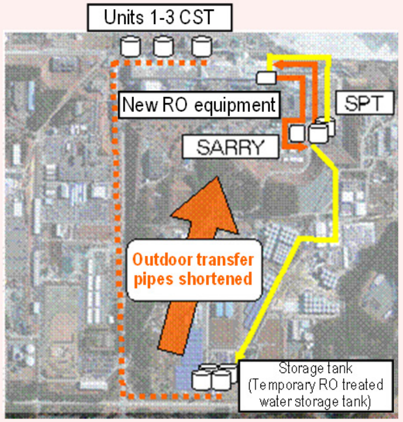
Progress toward decommissioning: Work related to circulation cooling and accumulated water treatment line

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

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





* 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 (12 tanks) in H1 east area was completed in October 2015. Dismantling of all flange tanks (28 tanks) in H2 area was completed in March 2016. Dismantling of H4 , H5 and B area flange tanks is underway.

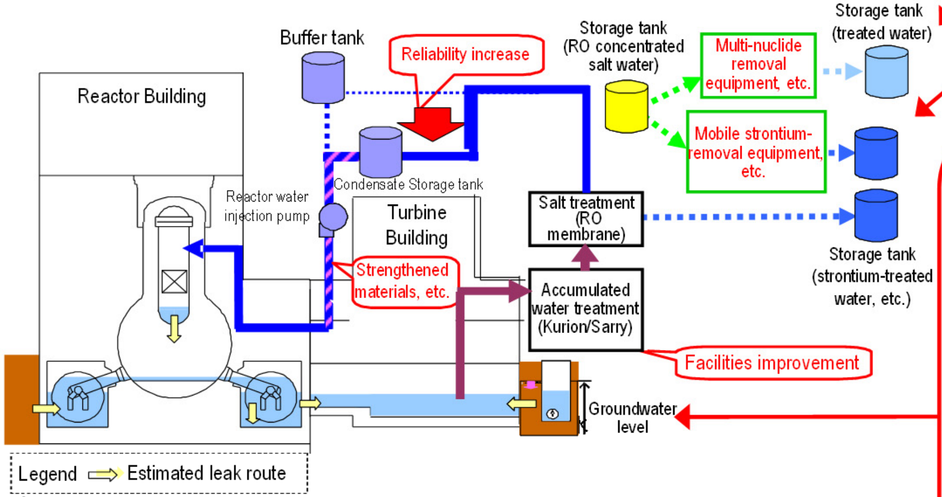

Start of dismantling in H1 east area

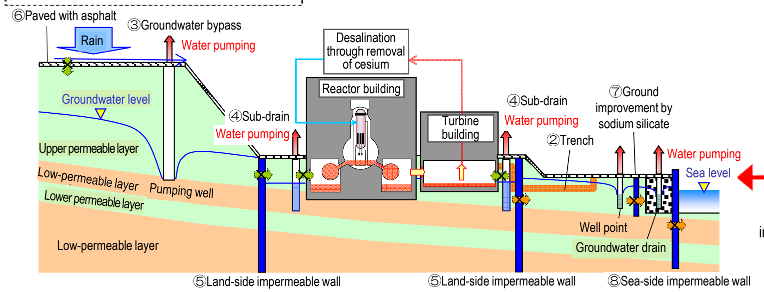

After dismantling in H1 east area

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.

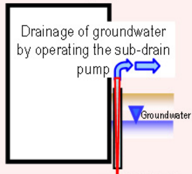
The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.





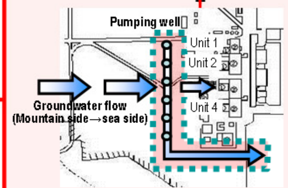
Land-side impermeable wall

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.

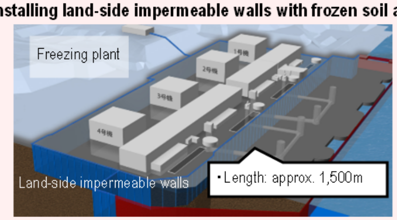
The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets.

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. On the sea side, the underground temperature declined 0℃ or less throughout the scope requiring freezing except for the unfrozen parts under the sea-water pipe trenches and the areas above groundwater level in October 2016.

Freezing started for two of seven unfrozen sections on the mountain side from December 2016, and four of the remaining five unfrozen sections from March 2017.

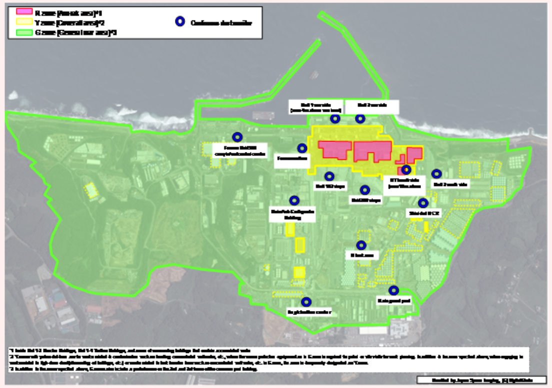
Progress toward decommissioning: Work to improve the environment within the site

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

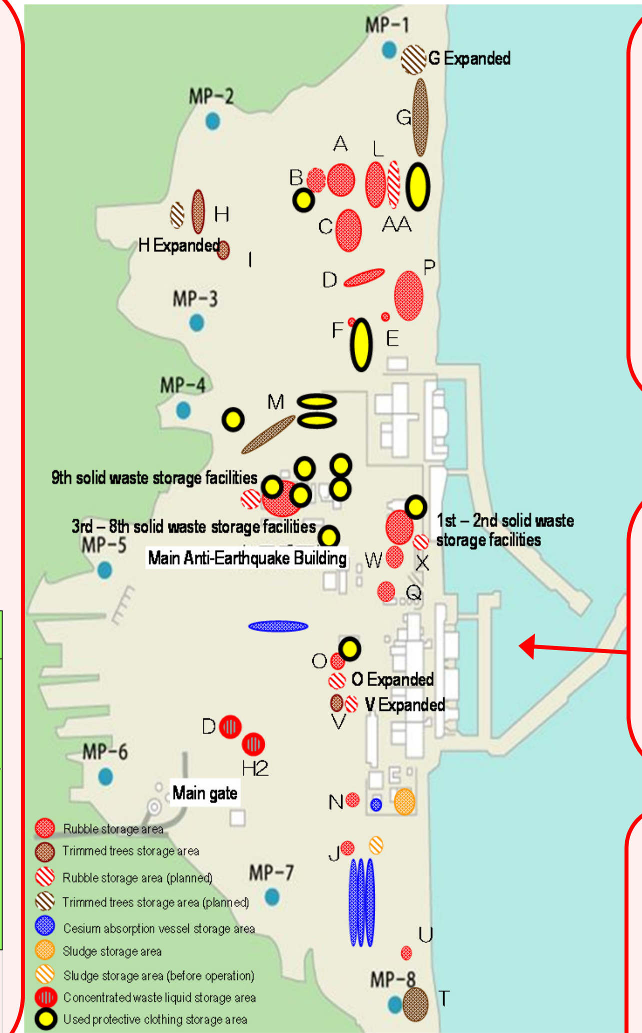
Based on the progress of measures to reduce environmental dosage on site, the site is categorized into two zones: highly contaminated area around Unit 1-4 buildings, etc. and other areas to optimize protective equipment according to each category aiming at improving safety and productivity by reducing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

From March 8, 2016, limited operation started in consideration of workers' load. From March 30, 2017 the G Zone is expanded.



R zone (Anorak area)	Y zone (Coverall area)	G zone (General wear)
Full-face mask 	Full-face or half-face masks *1 *2  	Disposable disposable mask 
Anorak on coverall Or double coveralls 	Coverall 	General*3  Dedicated on-site wear 

*1 For works in buildings including water-treatment facilities [multi-nuclide removal equipment, etc.] (excluding site visits), wear a full-face mask.
*2 For works in tank areas containing concentrated salt water or Sr-treated water (excluding works not handling concentrated salt water, etc., patrol, on-site investigation for work planning, and site visits) and works related to tank transfer lines, wear a full-face mask.
*3 Specified light works (patrol, monitoring, delivery of goods brought from outside, etc.)



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 Dose-rate monitor

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.

Installation of steel pipe sheet piles for sea-side impermeable wall

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.