Summary of Decommissioning and Contaminated Water Management

January 26, 2017

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

Main decommissioning works and steps

Fuel removal from Unit 4 SFP had been completed and preparatory works to remove fuel from Unit 1-3 SFP and fuel debris (Note 1) removal are ongoing.

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

Fuel Removal from SFP

Units 1 & 2 / Unit 3 → Rubble removal & dose reduction → 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 FY2017
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.

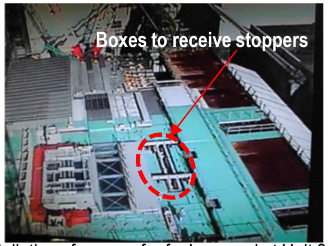
Dismantling Facilities

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 boxes to receive stoppers (January 17, 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 in 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

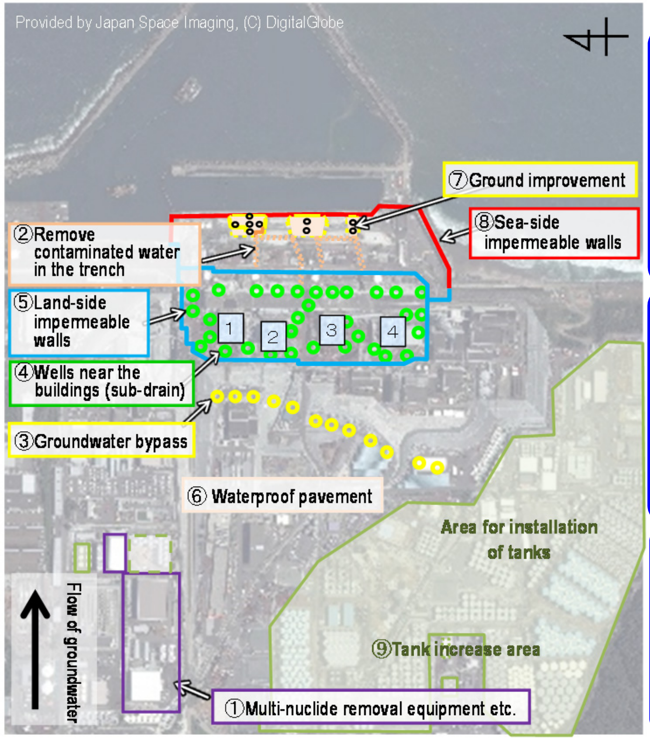
⑥ Waterproof pavement

3. Prevent leakage of contaminated water

⑦ Improve soil by 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.
- On the sea side, the underground temperature declined below 0°C 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.

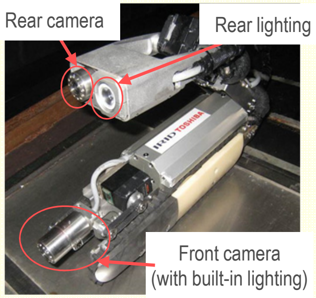
* 1 The values varied somewhat depending on the unit and location of the thermometer.
* 2 In December 2016, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.00027 mSv/year at the site boundary. The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

Efforts toward an investigation inside the Unit 2 PCV

An investigation inside the Unit 2 PCV will be conducted to identify the status of debris having fallen inside the PCV pedestal*. Prior to the investigation, a hole was made in the PCV penetration, from which a robot will be inserted, on December 23 and 24, 2016.

On January 26, a camera was inserted from the PCV penetration to check the status of the rail for CRD replacement on which the self-travelling equipment will run. Following a preliminary inspection inside the pedestal, the internal status will be investigated using the self-traveling equipment in February.

* The base supporting the RPV



<Self-traveling equipment>

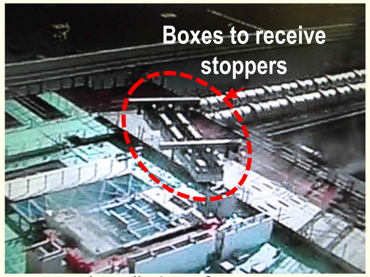
Installation start of a cover for Unit 3 fuel removal

Toward fuel removal from Unit 3, stoppers* have been installed as part of the cover for fuel removal from January 17.

To reduce exposure during the installation of a cover for fuel removal, etc., shortening human working hours and decreasing the dose are being implemented. Efforts to reduce exposure will continue.

[Shortening of human working hours]
- Prior adjustment and assembly at an external site from the power station
- Training for installation at an external site from the power station

[Dose decrease]
- Installation of temporary shields during human work



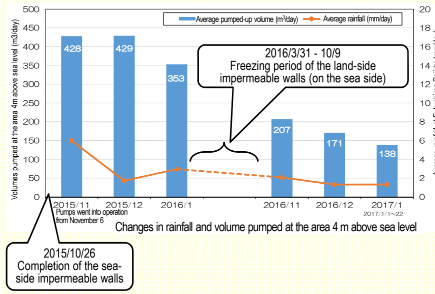
<Installation of stoppers>

* Projections to horizontally support the fuel removal cover to the reactor building

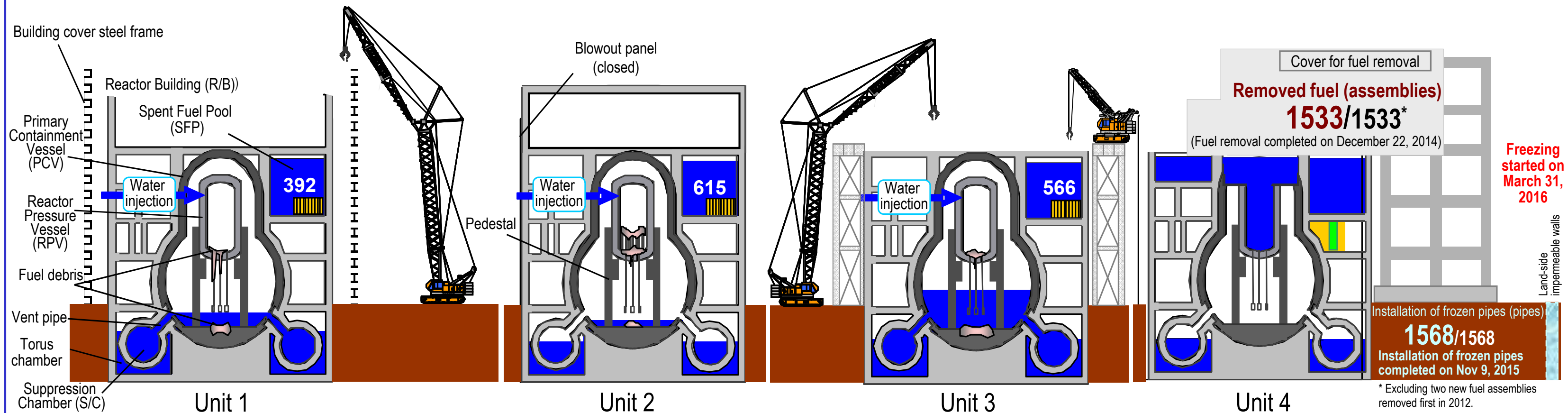
Status of the land-side impermeable walls

As for the land-side impermeable walls (on the mountain side), freezing has been advanced with a phased approach. Closure of two of seven unfrozen sections started on December 3 in addition to the ongoing supplementary method to accelerate freezing, and the area where the temperature declined below 0°C has expanded.

As for the land-side impermeable walls (on the sea side), groundwater levels and volumes pumped at the area 4 m above sea level have been monitored to evaluate the effect of the impermeable walls. The groundwater level declined further and the groundwater volume pumped at the area 4 m above sea level fell to a new low (on January 19: 107m^3/day).



Changes in rainfall and volume pumped at the area 4 m above sea level



* Excluding two new fuel assemblies removed first in 2012.

Operation start of the pretreatment equipment for groundwater drain

"Groundwater drain" is groundwater pumped up near the sea-side impermeable walls. Due to its high salinity, part of the groundwater drain was transferred to the Turbine Building and subsequently increased the amount of contaminated water.

To reduce the volume of this transfer, pretreatment (desalination) equipment is being installed.

Following preparation, the pretreatment equipment will go into operation.

Reduction of water injected volume to the reactor

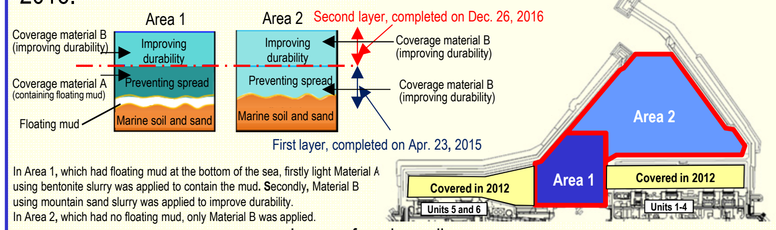
The volume of water injected into the Unit 1 reactor was reduced from 4.5 to 4.0 m^3/h from December 14, 2016; 4.0 to 3.5 m^3/h from January 5; and 3.5 to 3.0 m^3/h from January 24, 2017. In all these cases, temperatures of the RPV bottom, etc. remained within the anticipated range.

Based on these results, the optimal water injected volume, etc. will be considered. As the capacity of the water treatment equipment will be expanded by reducing the water injection volume, the equipment will be used effectively to treat contaminated water in the buildings.

From February, the water injected volume will also be reduced in Unit3 first, and then the Unit2.

Completion of marine soil coverage inside the port

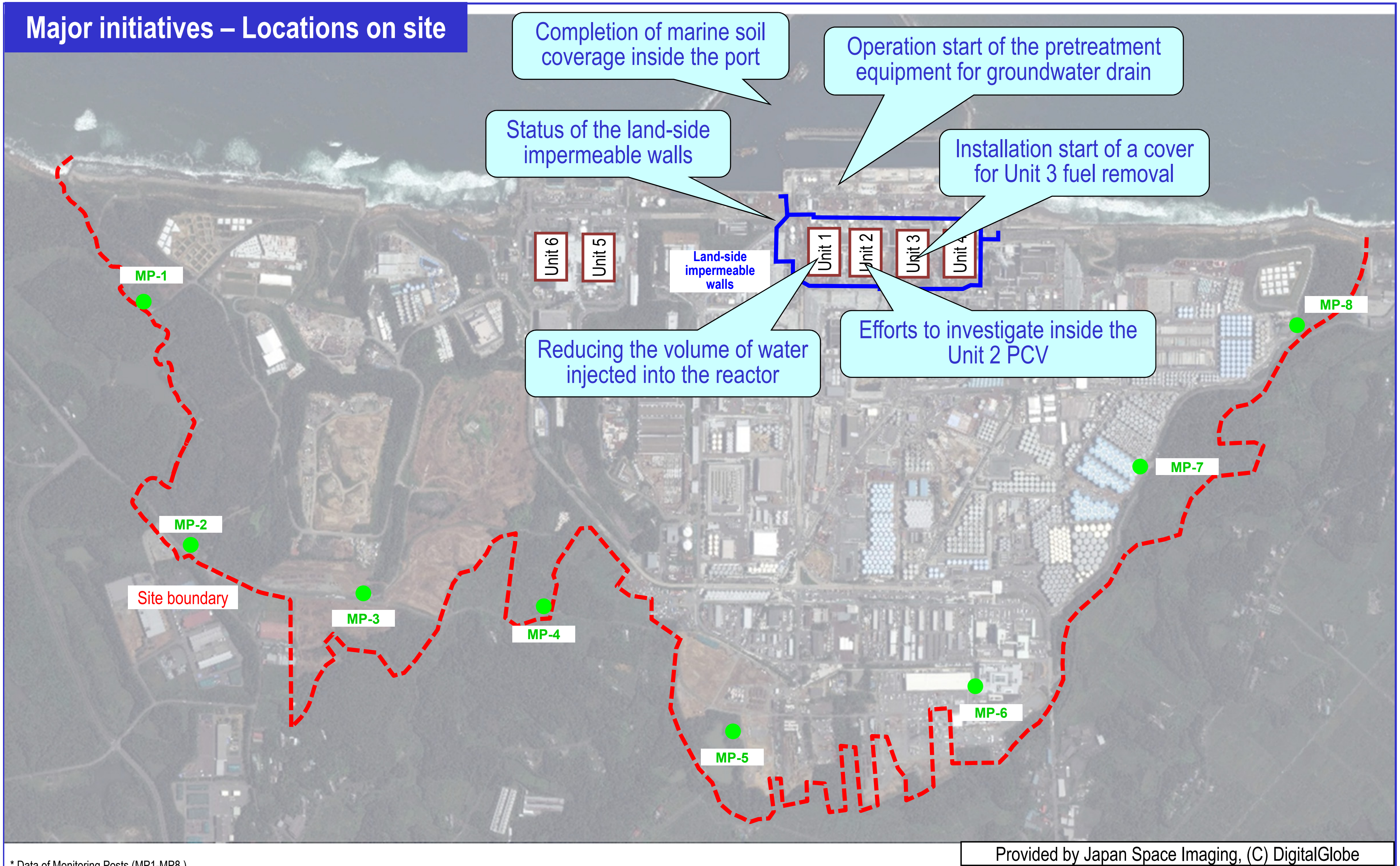
For marine soil inside the port, in addition to the first layer coverage installed to prevent the spread of radioactive materials (completed in April 2015), the second layer coverage to improve durability was completed on December 26, 2016.



In Area 1, which had floating mud at the bottom of the sea, firstly light Material A using bentonite slurry was applied to contain the mud. Secondly, Material B using mountain sand slurry was applied to improve durability.
In Area 2, which had no floating mud, only Material B was applied.

<Image of marine soil coverage>

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 0.503 – 2.114 μSv/h (December 21, 2016 – January 24, 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.

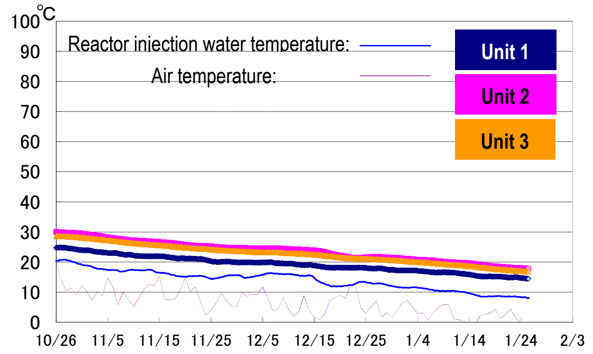
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

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.

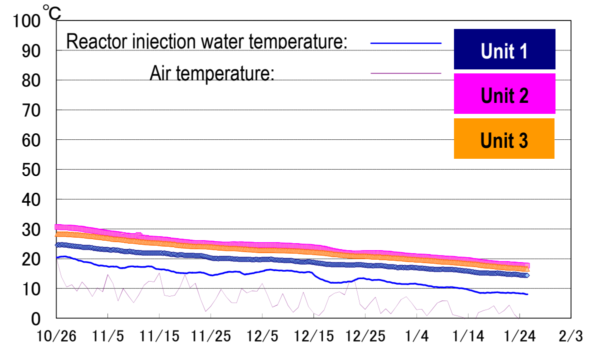
I. Confirmation of the reactor conditions

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)



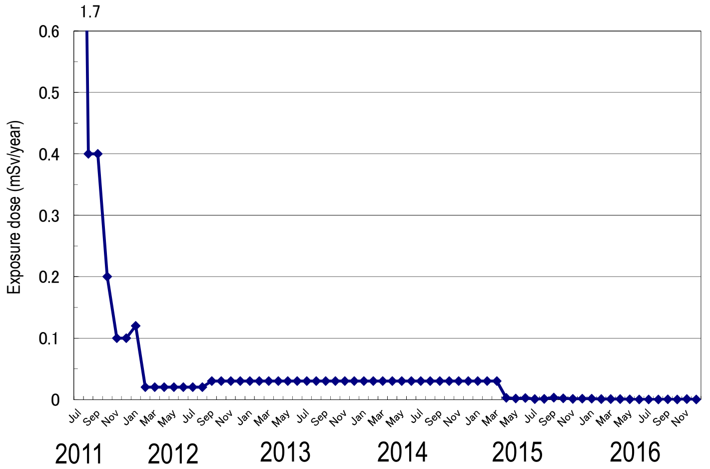
PCV gas phase temperatures (recent quarter)

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

2. Release of radioactive materials from the Reactor Buildings

As of December 2016, 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. 3.5×10^{-12} Bq/cm³ for Cs-134 and 6.8×10^{-12} Bq/cm³ for Cs-137 at the site boundary. The radiation exposure dose due to the release of radioactive materials was less than 0.00027 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 0.503 – 2.114 μSv/h (December 21, 2016 – January 24, 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

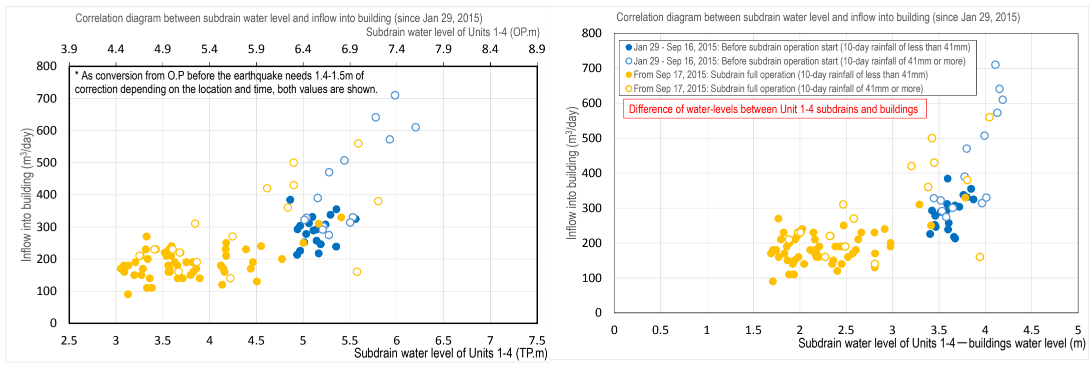
To tackle the increase in accumulated water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➢ Operation of 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 January 24, 2017, 251,909 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 January 24, 2017, a total of 265,031 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 January 24, 2017, a total of approx. 116,200 m³ had been pumped up. Approx. 30 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period December 15, 2016 – January 18, 2017).
- The effect of groundwater inflow control by subdrains is evaluated by both correlations: the “subdrain water levels”; and the “difference between water levels in subdrains and buildings”, for the time being.
- However, given insufficient data on the effect of rainfall after the subdrains went into operation, the method used to evaluate the inflow into buildings will be reviewed as necessary, based on data to be accumulated.
- Inflow into buildings tended to decline to below 200 m³/day when the subdrain water level decreased to below T.P. 3.5 m or when the difference in water levels with buildings decreased to below 2 m after the subdrains went into operation.
- As a measure to enhance subdrains and groundwater drains, shared pipes from subdrain pits to the No. 5 relay tank were divided into independent pipes for each pit and operation started (from January 20). In addition, to reduce the volume of groundwater drain transferred to the Turbine Buildings, pretreatment equipment is being installed and will go into operation when preparation is completed.



As of January 19, 2017

Figure 1: Evaluation of inflow into buildings after the subdrains went into operation

➢ Construction status of the land-side impermeable walls

- As for the land-side impermeable walls (on the mountain side), freezing has been advanced with a phased approach. Closure of two of seven unfrozen sections started on December 3, in addition to the ongoing supplementary method to accelerate freezing, and the area where temperature declined to below 0°C has expanded.
- As for the land-side impermeable walls (on the sea side), groundwater levels and groundwater volumes pumped at the area 4 m above sea level have been monitored to evaluate the effect of the impermeable walls. The groundwater level declined further and the groundwater volume pumped at the area 4 m above sea level fell to a new low (on January 19: 107 m³/day).

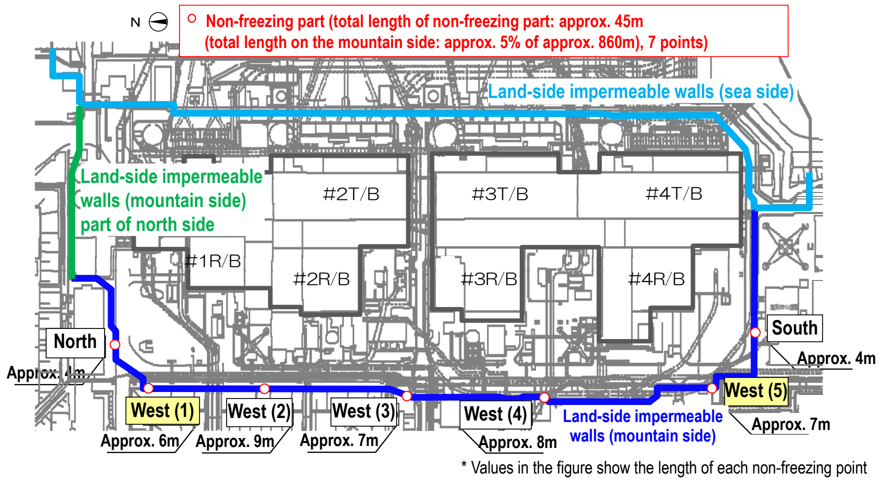


Figure 2: Closure of part of the land-side impermeable walls (on the mountain side)

➢ Operation of multi-nuclide removal equipment

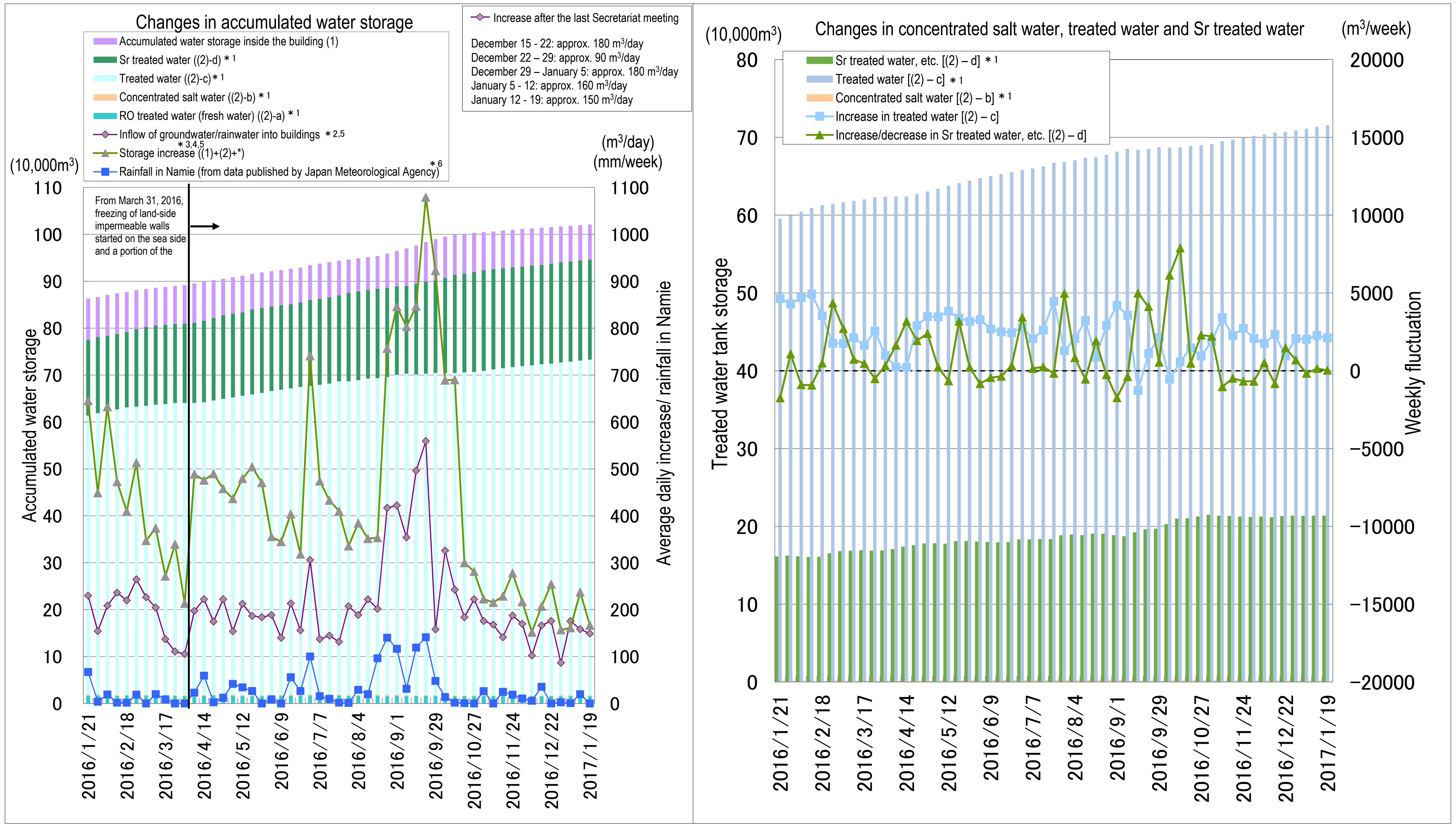
- Regarding the multi-nuclide removal equipment (existing, additional and high-performance), hot tests using radioactive water were underway (for existing equipment, System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013; for additional equipment, System A: from September 17, 2014, System B: from September 27, 2014, System C: from October 9, 2014; for high-performance equipment, from October 18, 2014).
- As of January 19, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 324,000, 321,000 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 January 19, approx. 297,000 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 January 19, approx. 340,000 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 January 23, 2017, a total of 74,198 m³).



As of January 19, 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

➢ Leakage from water treatment facilities

- On December 29, leakage was detected from a closure cap at the edge of a drain valve in the RO concentrated water transfer pump outlet pipe near the H8 tank area. Following the response comprising detachment of the closure cap from the drain valve and reattachment after rewinding the seal tape, stoppage of the leakage was confirmed.
- On December 29, a puddle was detected under pipes in the RO concentrated water transfer pump room near the H8 tank area. An inspection using operating pressure identified ooze from a valve flange of a pipe for taking out the pump outlet side pressure gauge. The flange will be repaired, including gasket replacement.
- On January 11, ooze was detected near a closure cap of a sampling valve of a rainwater desalination acceptance tank on the north side of the J1 tank east area. Following the response, comprising treatment for the seal tape and reattachment of the closure cap, stoppage of the leakage was confirmed.
- On January 11, leakage was detected from the gland of an absorption vessel outlet valve in the existing multi-nuclide removal equipment System A. The leakage stopped after retorquing the gland of the outlet valve. The valve was covered for confirmation.
- In all the above cases, leakage remained inside the fences and no external leakage was identified.

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 is being investigated (from September 13, 2016) to collect data, which will then be used when considering rubble removal methods for the Unit 1 Reactor Building operating floor. 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 is underway (from November 23).
- Pillars and beams of the building cover will be modified and windbreak sheets installed on the beams from March 2017. The pillars and beams (covered by windbreak sheets) will be restored in the 1st half of 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, construction has been underway from September 28, 2016 on the west side of the Reactor Building to install a gantry accessing the operating floor. Up until January 17, approx. 77% of the installation had been completed. (The work will be completed in late April 2017)

➢ Main work to help remove spent fuel at Unit 3

- From January 5, 2017, preparatory work started to install the cover for fuel removal.
- From January 17, installation of stoppers* started.

* Projections to horizontally support the fuel removal cover to the reactor building.

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 2 PCV

- An investigation inside the Unit 2 PCV will be conducted to identify the status of fuel debris there and structures inside the pedestal.
- On December 23 and 24, 2016, a hole was made in the PCV penetration, from which a robot will be inserted. On January 26, 2017, a preliminary investigation was conducted using a guide pipe to check for any deposits which may impact the operation of the self-traveling equipment. Following an investigation to check the damage status of the platform inside the pedestal, the status inside the pedestal will also be inspected using self-traveling equipment in February regarding fallen debris on the platform and the Control Rod Drive housing as well as structures there.

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 December 2016, the total storage volume of concrete and metal rubble was approx. 198,600 m³ (+2,700 m³ compared to at the end of November, with an area-occupation rate of 71%). The total storage volume of trimmed trees was approx. 82,900 m³ (-6,000 m³ compared to at the end of November, with an area-occupation rate of 78%). The total storage volume of used protective clothing was approx. 67,000 m³ (-2,100 m³ compared to at the end of November, with an area-occupation rate of 94%). The increase in rubble was mainly attributable to facing. The decrease in trimmed trees was mainly attributable to area arrangement associated with site preparation-related work. The decrease in used protective clothing was mainly attributable to the incineration of used clothing.

➢ Management status of secondary waste from water treatment

- As of January 19, 2017, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%) and that of concentrated waste fluid was 9,240 m³ (area-occupation rate: 86%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 3,478 (area-occupation rate: 56%).

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

➢ Reduction of water injection volume to the Unit 1-3 reactors

- The water injection volume to the Unit 1 reactor was reduced from 4.5 to 4.0 m³/h from December 14. The volume was also reduced from 4.0 to 3.5 m³/h from January 5 and 3.5 to 3.0 m³/h from January 24, 2017. No abnormality attributable to the reduction was detected in the cold shutdown condition.
- The water injection volume to Unit 2 and 3 reactors will be reduced by 0.5m³/h from 4.5 to 3.0 m³/h from March and February 2017 respectively.

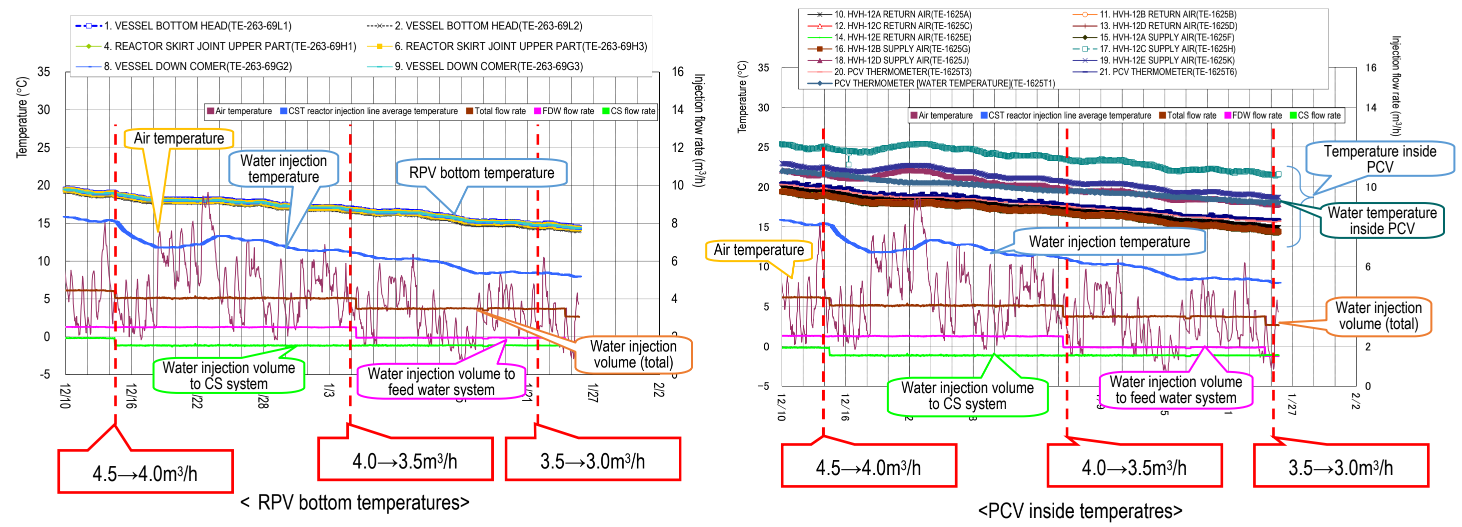


Figure 4: Change in temperatures after reducing the Unit 1 reactor water injection volume

➢ Leakage from cooling systems

- On January 9, water leakage was detected from the gland of a filtered water acceptance tank inlet valve in the desalination equipment (inner RO equipment) (A) inside the Unit 4 Turbine Building. Though the leakage stopped after retorquing the gland, the leaking portion was covered by plastic sheets for confirmation.
- On January 12, ooze was detected at the closure cap of a drain valve in a pipe connecting the Unit 4 spent fuel pool alternative cooling system with the desalination equipment as well as a puddle under the closure cap. The cap was covered by plastic sheets

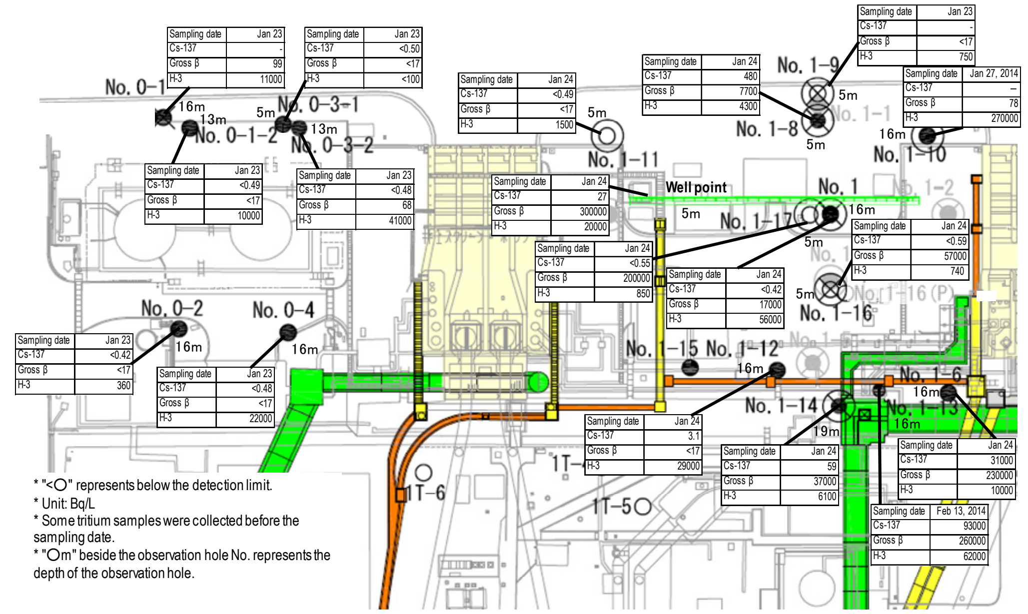
- In both the above cases, leakage remained inside the fences and no external leakage was identified.

6. Reduction in radiation dose and mitigation of contamination

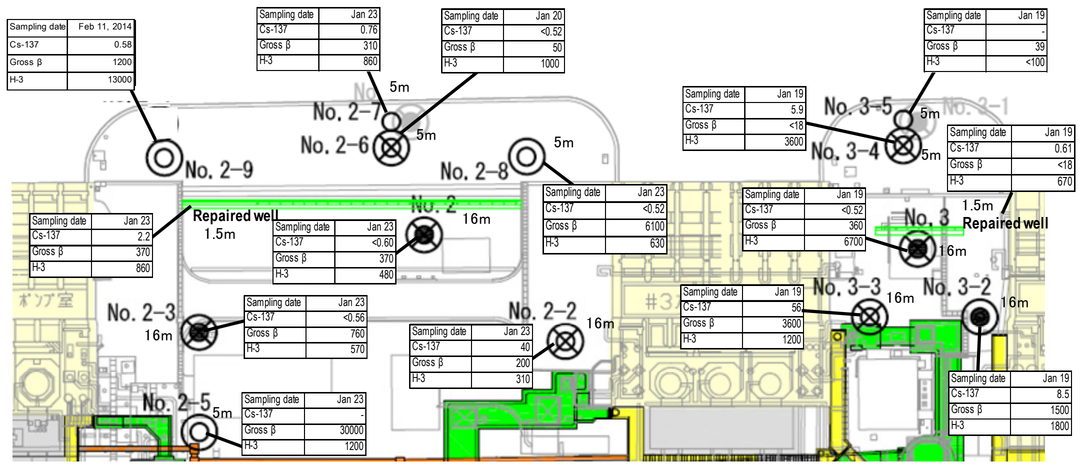
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

➢ 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, though the tritium density at groundwater Observation Hole No. 0-1 has been gradually increasing since October 2016, it currently stands at around 10,000 Bq/L. Though the tritium density at groundwater Observation Hole No. 0-3-2 had been gradually increasing since January 2016, it has remained constant since mid-October 2016 and stands at around 40,000 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 250,000 Bq/L. Though the density of gross β radioactive materials at groundwater Observation Hole No. 1-16 had been increasing 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 currently stands at around 800 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 500 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 gradually increasing since mid-October 2016 and currently stands at around 60,000 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).
- 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 3,000Bq/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, though the tritium density had been increasing 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 is currently slightly lower than the decline at around 3,500 Bq/L. Since April 1, 2015, pumping of groundwater continued (at the well point between the Unit 3 and 4 intakes: April 1 – September 16, 2015; at the repaired well: from September 17, 2015).
- Regarding the radioactive materials in seawater in the Unit 1-4 intake 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, the 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.
- For marine soil inside the port, in addition to the coverage, to prevent the spread of radioactive material (completed in April 2015), coverage to improve durability was completed on December 26, 2016.



<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

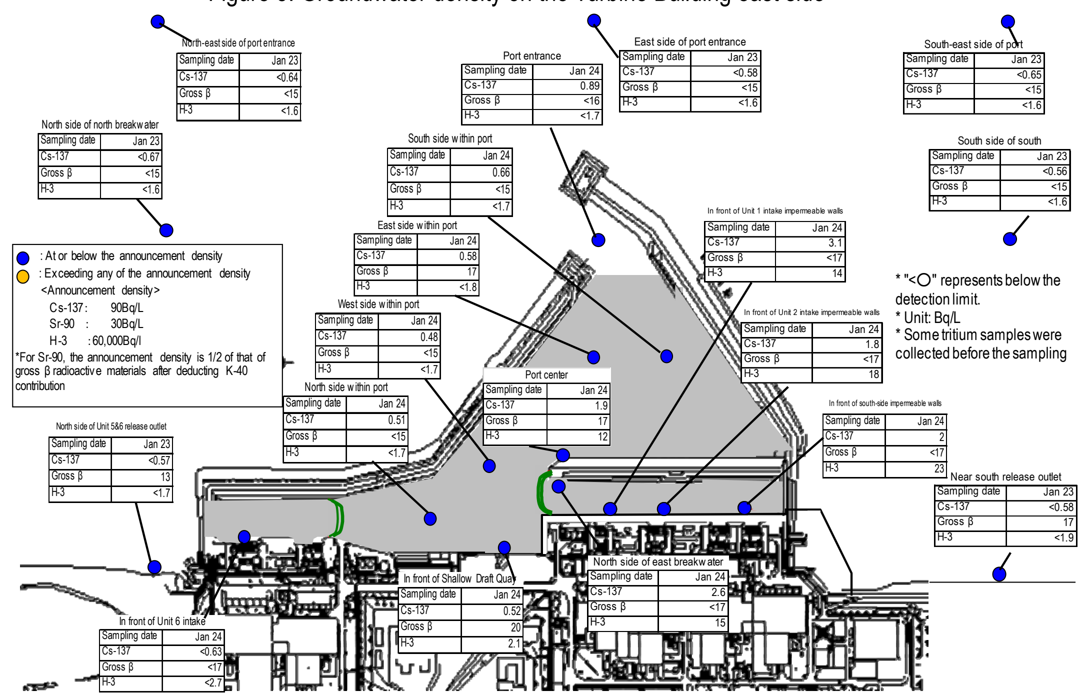


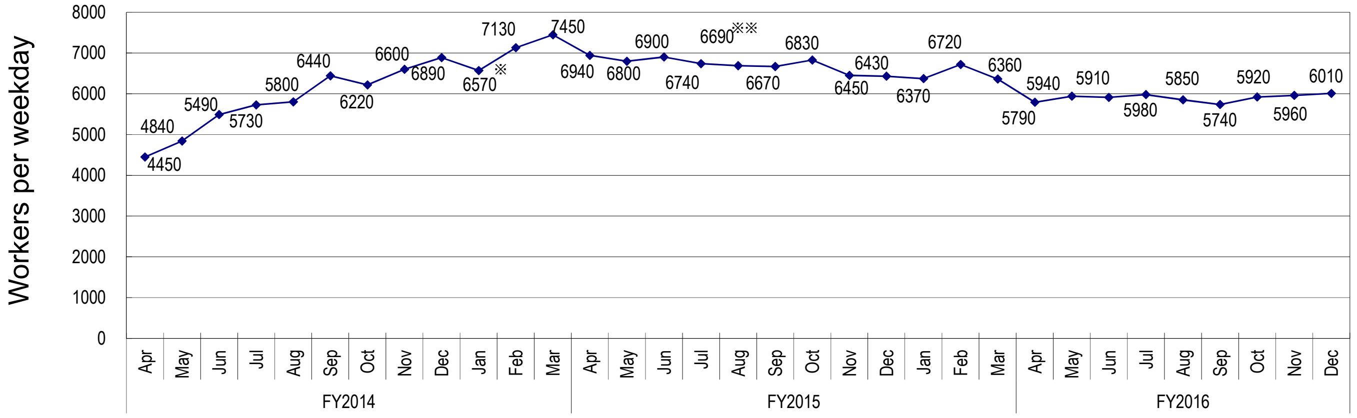
Figure 6: Seawater density around the port

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 September to November 2016 was approx. 12,500 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 9,800). 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 February 2017 (approx. 5,940 per day: TEPCO and partner company workers)* would be secured at present. The average numbers of workers per day for each 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 February 2017.
- The number of workers from outside Fukushima Prefecture has decreased. The local employment ratio (TEPCO and partner company workers) as of December 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

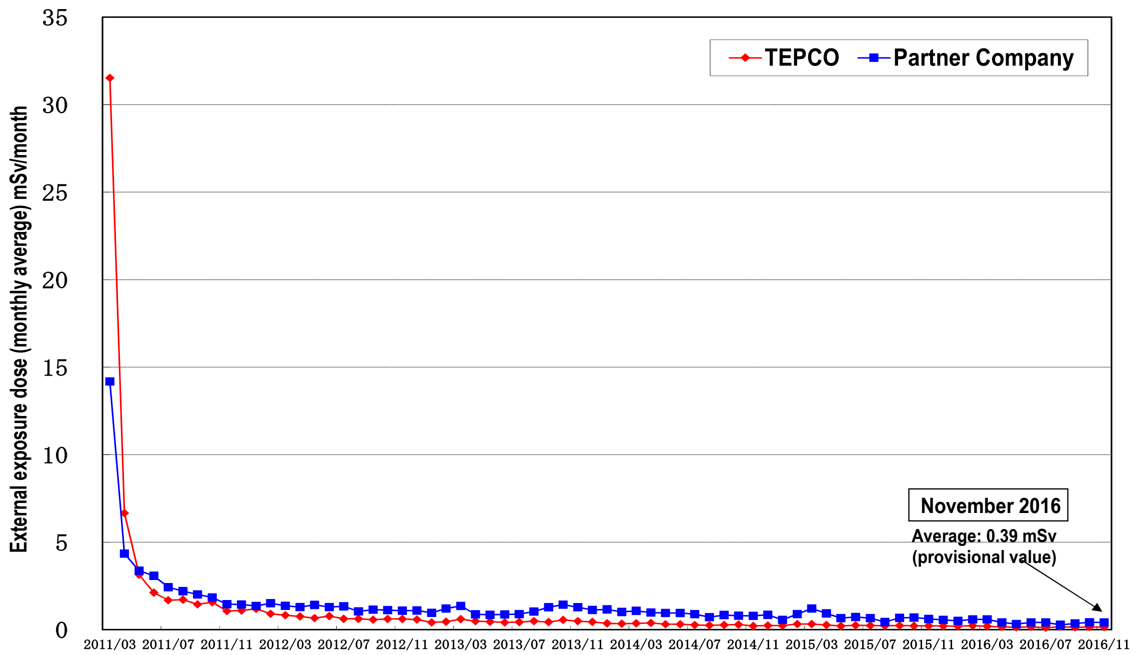


Figure 8: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

➢ 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 24, a total of 8,161 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 third week of 2017 (January 16-22, 2017), there were 194 influenza infections and 14 norovirus infections. The totals for the same period for the previous season showed 14 cases of influenza and seven norovirus infections.

➢ Health management of workers at the Fukushima Daiichi Nuclear Power Station

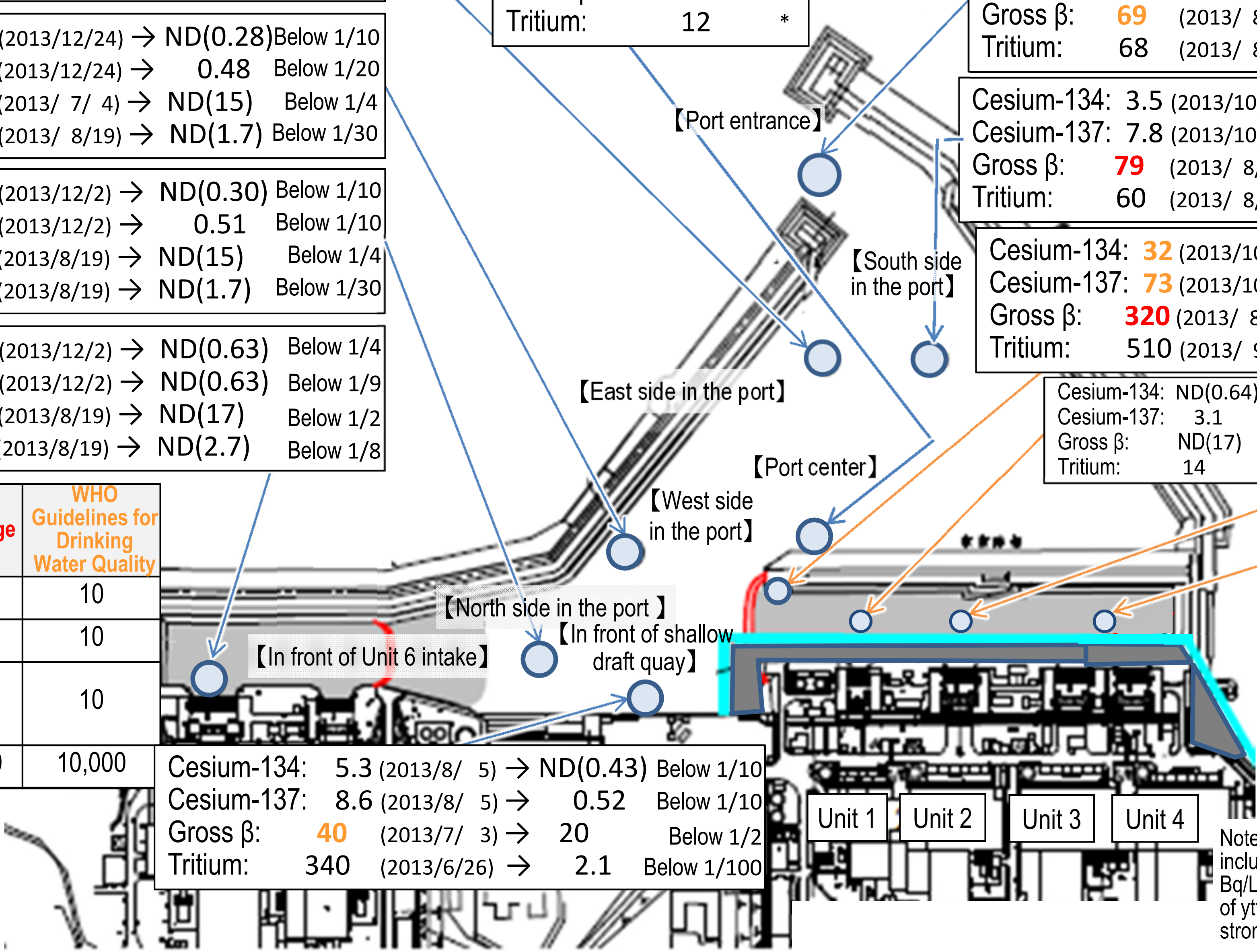
- As health management measures in line with the guidelines of the Ministry of Health, Labour and Welfare (issued in August 2015), a scheme was established and went into operation from July 2016, where primary contractors confirmed reexamination at medial institutions and the subsequent status of workers who are diagnosed as "detailed examination and treatment required" in the health checkup and TEPCO confirmed the operation status by the primary contractors. The recent report on the management status of health checkup during the second quarter (July – September) confirmed that the primary contractors had provided appropriate guidance and properly managed the operation under the new scheme. The operation will continue to be checked.

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

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

Sea side impermeable wall
Silt fence



Cesium-134:	3.3 (2013/10/17)	→ ND(0.34)	Below 1/9
Cesium-137:	9.0 (2013/10/17)	→ 0.58	Below 1/10
Gross β:	74 (2013/ 8/19)	→ 17	Below 1/4
Tritium:	67 (2013/ 8/19)	→ ND(1.8)	Below 1/30

Cesium-134:	4.4 (2013/12/24)	→ ND(0.28)	Below 1/10
Cesium-137:	10 (2013/12/24)	→ 0.48	Below 1/20
Gross β:	60 (2013/ 7/ 4)	→ ND(15)	Below 1/4
Tritium:	59 (2013/ 8/19)	→ ND(1.7)	Below 1/30

Cesium-134:	5.0 (2013/12/2)	→ ND(0.30)	Below 1/10
Cesium-137:	8.4 (2013/12/2)	→ 0.51	Below 1/10
Gross β:	69 (2013/8/19)	→ ND(15)	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(0.63)	Below 1/9
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(0.46)
Cesium-137:	1.9
Gross β:	17
Tritium:	12 *

Cesium-134:	3.3 (2013/12/24)	→ ND(0.42)	Below 1/7
Cesium-137:	7.3 (2013/10/11)	→ 0.89	Below 1/8
Gross β:	69 (2013/ 8/19)	→ ND(16)	Below 1/4
Tritium:	68 (2013/ 8/19)	→ ND(1.7)	Below 1/40

Cesium-134:	3.5 (2013/10/17)	→ ND(0.30)	Below 1/10
Cesium-137:	7.8 (2013/10/17)	→ 0.66	Below 1/10
Gross β:	79 (2013/ 8/19)	→ ND(15)	Below 1/5
Tritium:	60 (2013/ 8/19)	→ ND(1.7)	Below 1/30

Cesium-134:	32 (2013/10/11)	→ ND(0.54)	Below 1/50
Cesium-137:	73 (2013/10/11)	→ 2.6	Below 1/20
Gross β:	320 (2013/ 8/12)	→ ND(17)	Below 1/10
Tritium:	510 (2013/ 9/ 2)	→ 15	Below 1/30

Cesium-134:	ND(0.64)
Cesium-137:	3.1
Gross β:	ND(17)
Tritium:	14 *

Cesium-134:	ND(0.57)
Cesium-137:	1.8
Gross β:	ND(17)
Tritium:	18 *

Cesium-134:	ND(0.48)
Cesium-137:	2.0
Gross β:	ND(17)
Tritium:	23 *

Cesium-134:	5.3 (2013/8/ 5)	→ ND(0.43)	Below 1/10
Cesium-137:	8.6 (2013/8/ 5)	→ 0.52	Below 1/10
Gross β:	40 (2013/7/ 3)	→ 20	Below 1/2
Tritium:	340 (2013/6/26)	→ 2.1	Below 1/100

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

* 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 January 25

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 January 16-24)

	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 (0.52)
Cesium-137: ND (2013) → ND (0.64)
Gross β: ND (2013) → ND (15)
Tritium: ND (2013) → ND (1.6)

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

Cesium-134: ND (2013) → ND (0.68)
Cesium-137: 1.6 (2013/10/18) → ND (0.58) Below 1/2
Gross β: ND (2013) → ND (15)
Tritium: 6.4 (2013/10/18) → ND (1.6) Below 1/4

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

Cesium-134: ND (2013) → ND (0.74)
Cesium-137: ND (2013) → ND (0.65)
Gross β: ND (2013) → ND (15)
Tritium: ND (2013) → ND (1.6)

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

Cesium-134: ND (2013) → ND (0.63)
Cesium-137: ND (2013) → ND (0.67)
Gross β: ND (2013) → ND (15)
Tritium: 4.7 (2013/ 8/18) → ND (1.6) Below 1/2

【Port entrance】

Cesium-134: 3.3 (2013/12/24) → ND (0.42) Below 1/7
Cesium-137: 7.3 (2013/10/11) → 0.89 Below 1/8
Gross β: 69 (2013/ 8/19) → ND (16) Below 1/4
Tritium: 68 (2013/ 8/19) → ND (1.7) Below 1/40

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

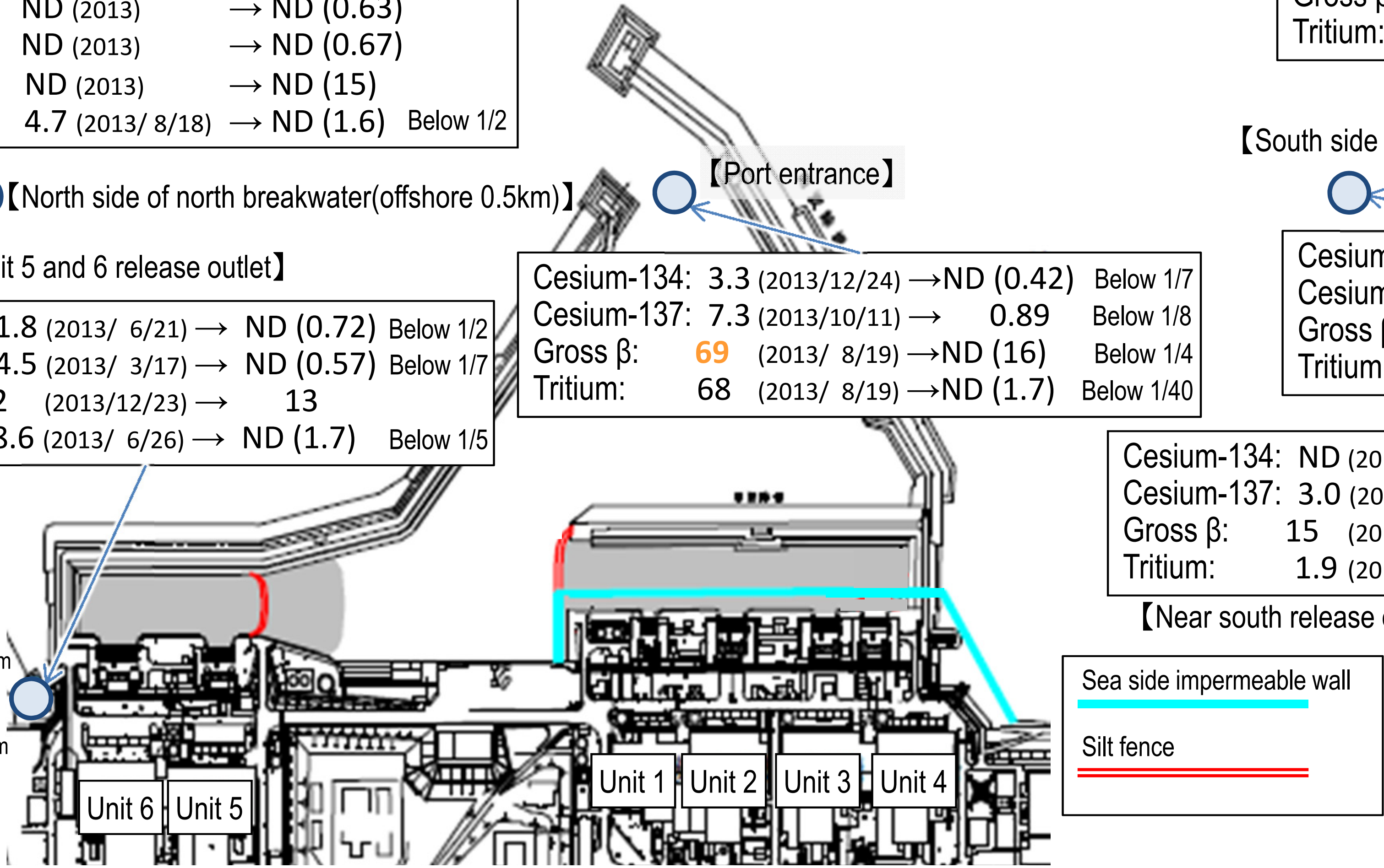
Cesium-134: ND (2013) → ND (0.84)
Cesium-137: ND (2013) → ND (0.56)
Gross β: ND (2013) → ND (15)
Tritium: ND (2013) → ND (1.6)

【North side of Unit 5 and 6 release outlet】

Cesium-134: 1.8 (2013/ 6/21) → ND (0.72) Below 1/2
Cesium-137: 4.5 (2013/ 3/17) → ND (0.57) Below 1/7
Gross β: 12 (2013/12/23) → 13
Tritium: 8.6 (2013/ 6/26) → ND (1.7) Below 1/5

【Near south release outlet】

Cesium-134: ND (2013) → ND (0.68)
Cesium-137: 3.0 (2013/ 7/15) → ND (0.58) Below 1/5
Gross β: 15 (2013/12/23) → 17
Tritium: 1.9 (2013/11/25) → ND (1.9)



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.

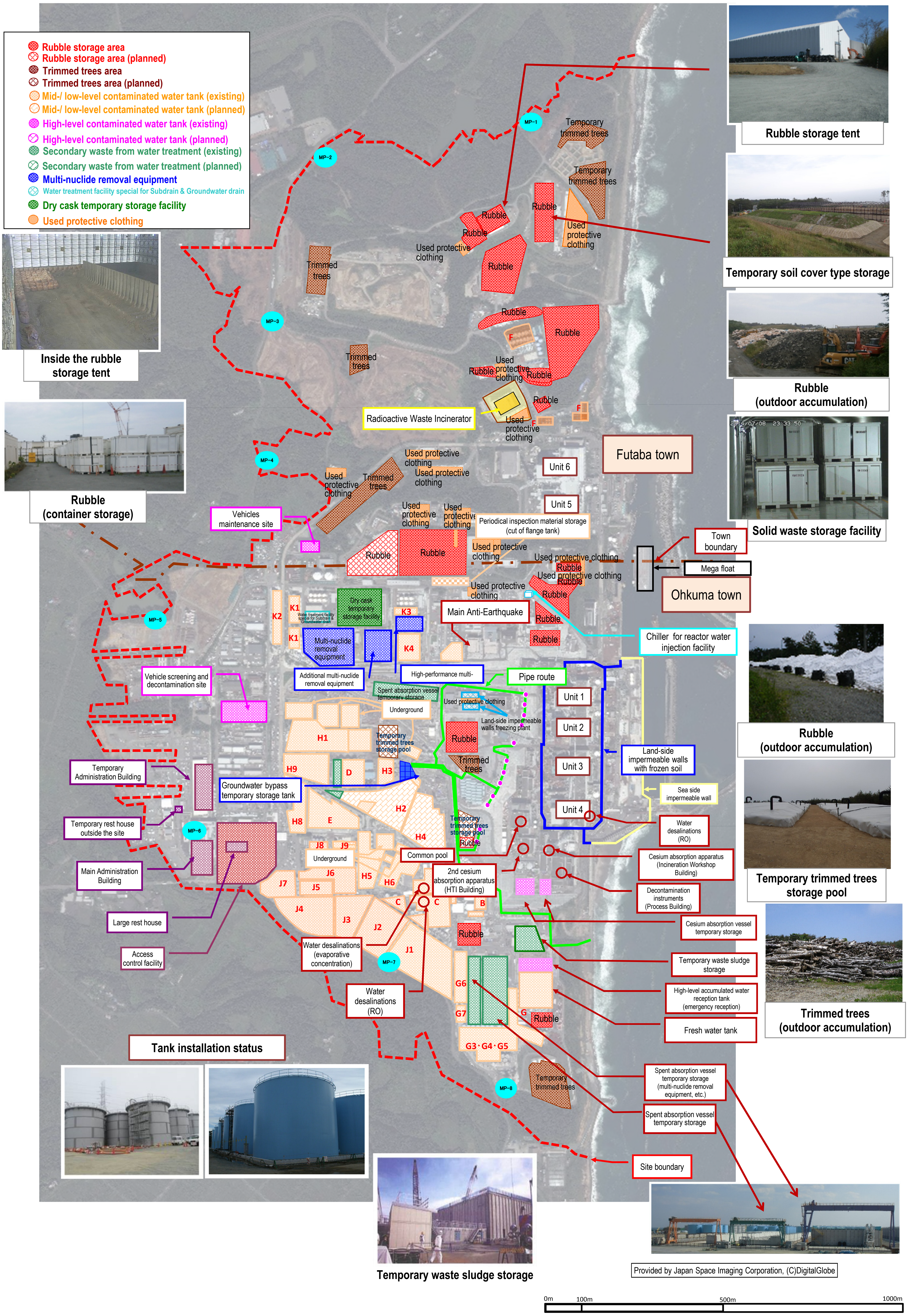
Note: Because safety of the sampling points was unassured due to the influence of Typhoon No. 10 in 2016, samples were taken from approx. 330 m south of the Unit 1-4 release outlet.

Summary of TEPCO data as of January 25

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
January 26, 2017

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site



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 operating floor[*1].

Before starting this plan, the building cover was dismantled to remove rubble from the top of the operating floor, with anti-scattering measures steadily implemented.

All roof panels and wall panels of the building cover were dismantled by November 10, 2016. Following the investigation into the status of rubble on the operating floor, pillars and beams of the building cover will be modified and windbreak sheets installed. 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.

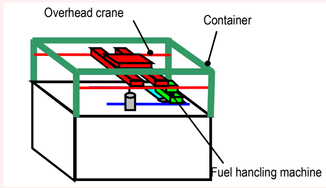


Image of Plan 1

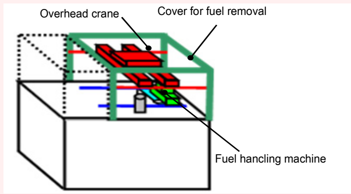


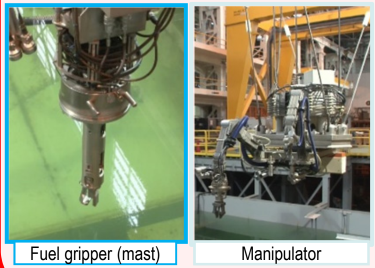
Image of Plan 2

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-handling facility (in the factory)

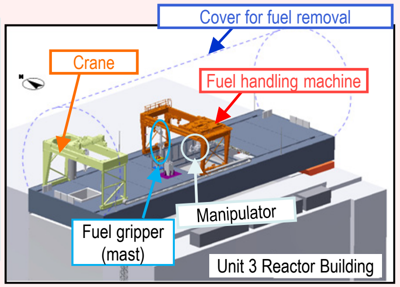


Image of entire fuel handling facility inside the cover

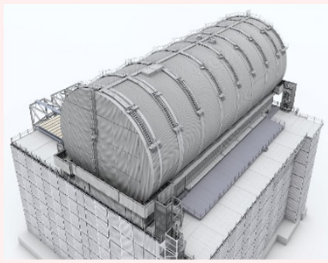


Image of the cover for fuel removal

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)

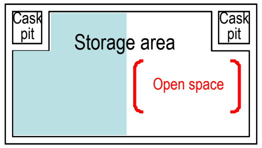
This marks the completion of fuel removal from the Unit 4 Reactor Building.

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

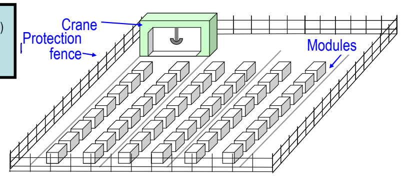


An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

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 (*3) 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>

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

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

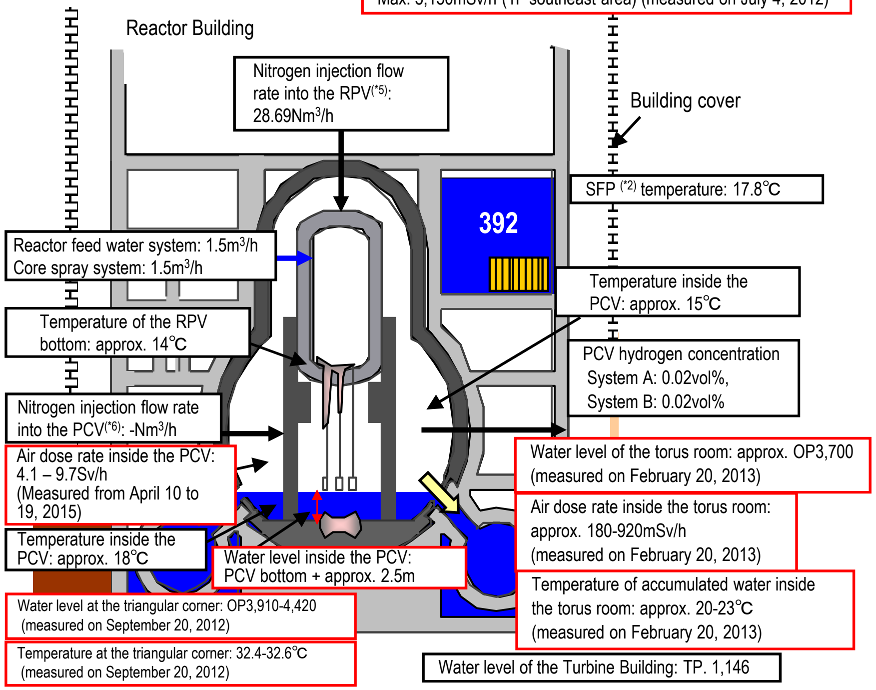
Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

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, January 25, 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
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

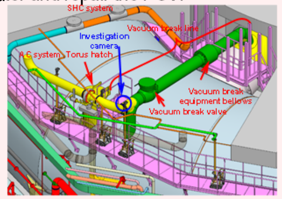


Image of the S/C upper part investigation

Status of equipment development toward investigating inside the PCV

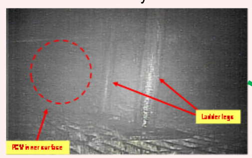
Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigation inside the PCV is scheduled.

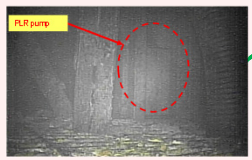
[Investigative outline]

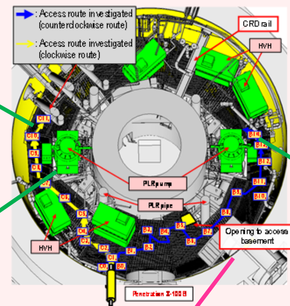
- Inserting equipment from Unit 1 X-100B penetration(*5) to investigate in clockwise and counter-clockwise directions.

[Status of investigation equipment development]

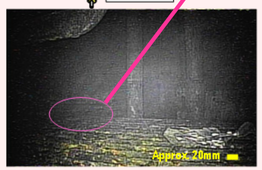
- Using the crawler-type equipment with a shape-changing structure which allows it to enter the PCV from the narrow access entrance (bore: ϕ 100mm) and stably move on the grating, a field demonstration was implemented from April 10 to 20, 2015. Through this investigation, information including images and airborne radiation inside the PCV 1st floor was obtained.
- Based on the investigative results in April 2015 and additional information obtained later, an investigation on the PCV basement floor will be conducted in a method of traveling on the 1st floor grating and dropping cameras, dosimeters, etc. from above the investigative target to increase feasibility.







Investigative equipment



Investigation inside PCV

<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)

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.

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

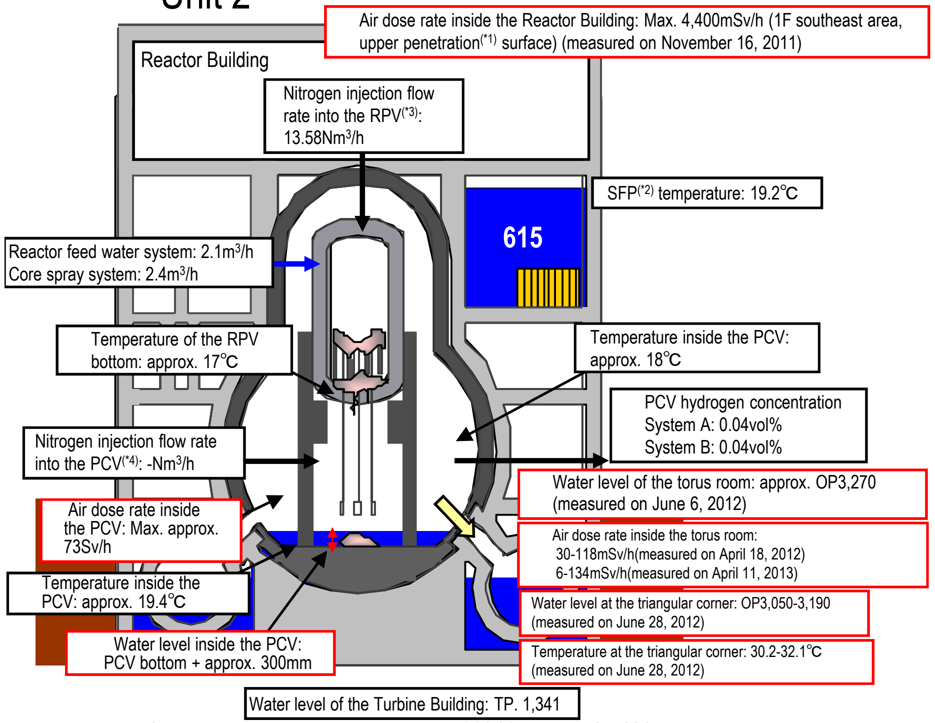
(1) Replacement of the RPV thermometer

- 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

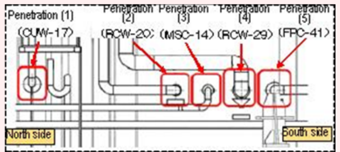


* Indices related to plant are values as of 11:00, January 25, 2017

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
Leakage points from PC	- No leakage from torus room rooftop - No leakage from all inside/outside surfaces of S/C	

Investigative results on torus room walls

- The torus room 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

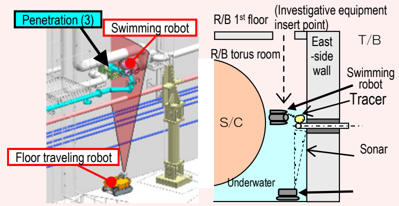


Image of the torus room east-side cross-sectional investigation

Status of equipment development toward investigating inside the PCV

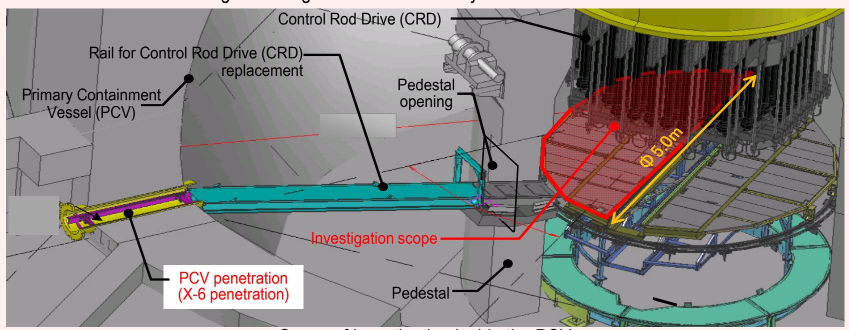
Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigations inside the PCV are scheduled.

[Investigative outline]

- Inserting the equipment from Unit 2 X-6 penetration(*1) and accessing inside the pedestal using the CRD rail to conduct investigation.

[Progress status]

- Based on issues confirmed by the CRD rail status investigation conducted in August 2013, the investigation method and equipment design were examined.
- As manufacturing of shields needed for dose reduction around X-6 penetration was completed, a hole was made at the PCV penetration from which a robot will be inserted in December 2016.
- On January 26, a camera was inserted from the PCV penetration to check the status of the rail for CRD replacement on which the robot will travel. Following a preliminary inspection inside the pedestal, the status inside the PCV will be investigated using the robot in February.



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

January 26, 2017
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

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

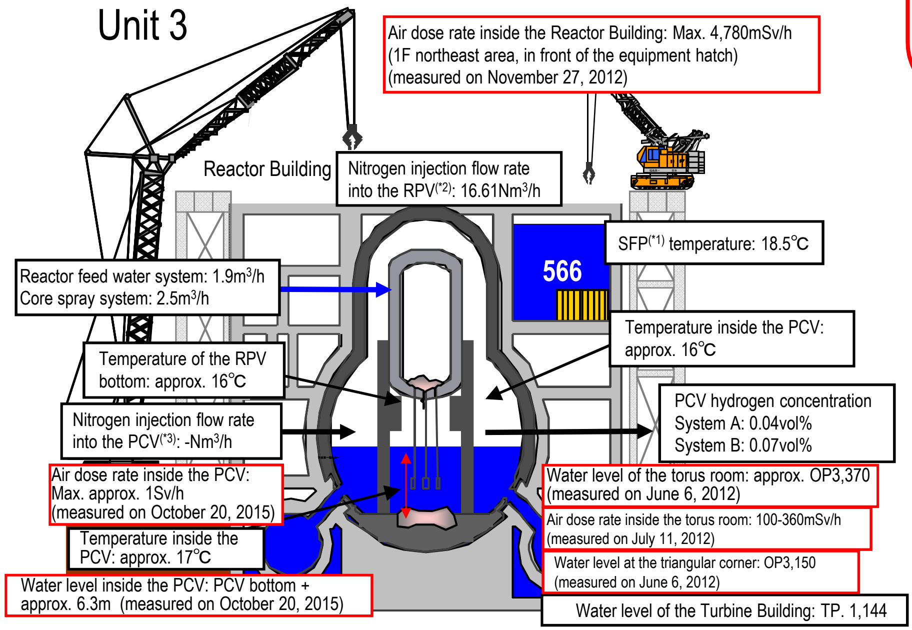
On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no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

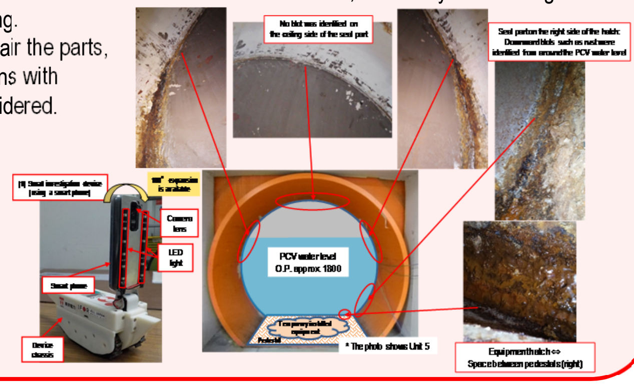


* Indices related to plant are values as of 11:00, January 25, 2017

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.

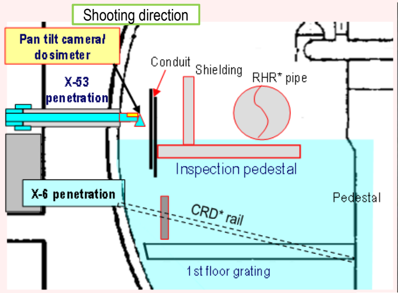


Investigation inside the PCV

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

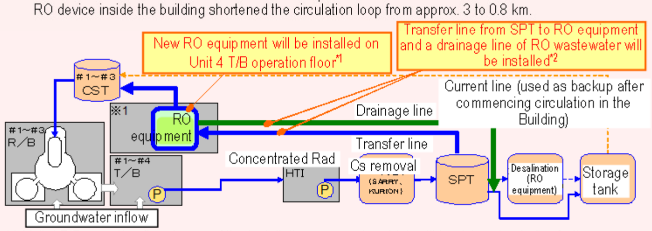
<Glossary>
(*1) SFP (Spent Fuel Pool)
(*2) RPV (Reactor Pressure Vessel)
(*3) PCV (Primary Containment Vessel)
(*4) Penetration: Through-hole of the PCV

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

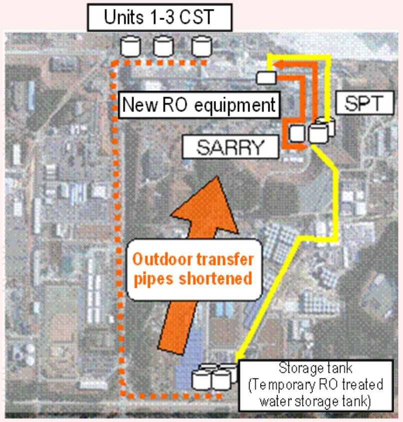
Immediate target	Stably continue reactor cooling and accumulated water treatment, and improve reliability

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 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.



*1 Unit 4 T/B operation floor is one of the installation proposals, which will be determined after further examination based on the work environment
*2 A detailed line configuration will be determined after further examination



* 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 flange tanks is underway.

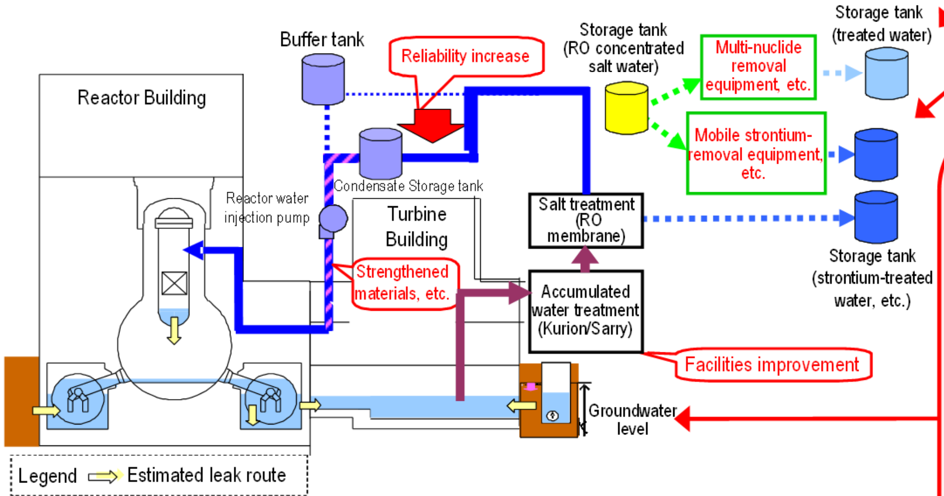

Start of dismantling in H1 east area

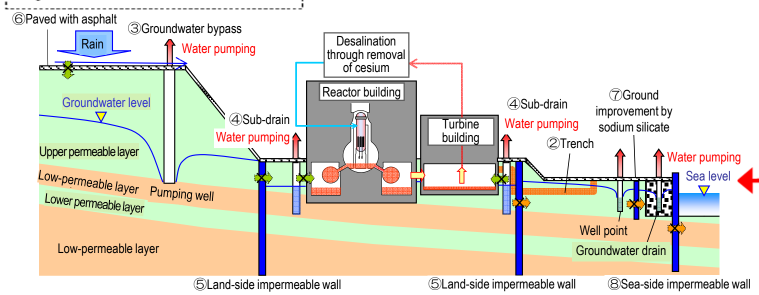

After dismantling in H1 east area

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.

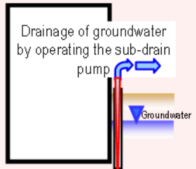
The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.





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

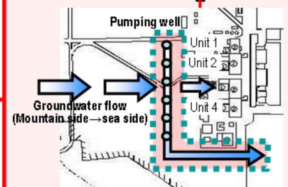
Measures to pump up groundwater flowing from the mountain side upstream of the Building to reduce the groundwater inflow (groundwater bypass) have been implemented.

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.

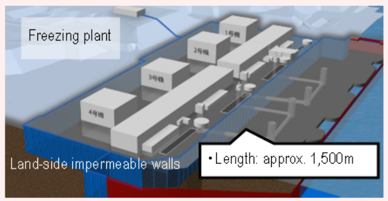
Through periodical monitoring, pumping of wells and tanks is operated appropriately.

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 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.

Installation of frozen pipes commenced on June 2, 2014. Construction for freezing facilities was completed in February 2016.

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 below 0°C throughout the scope requiring freezing except for the unfrozen parts under the sea-water pipe trenches and the areas In October 2016.

<Glossary>
(*1) CST (Condensate Storage Tank)
Tank for temporarily storing water used in the plant.

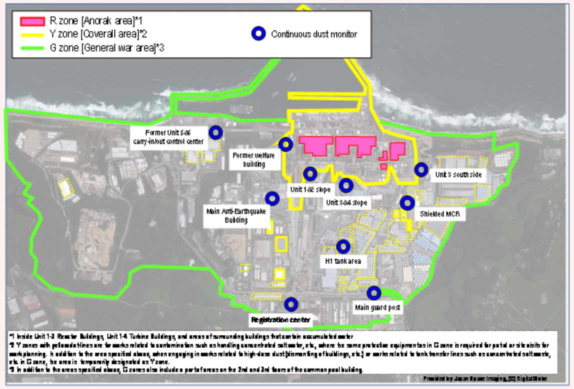
Progress toward decommissioning: Work to improve the environment within the site

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

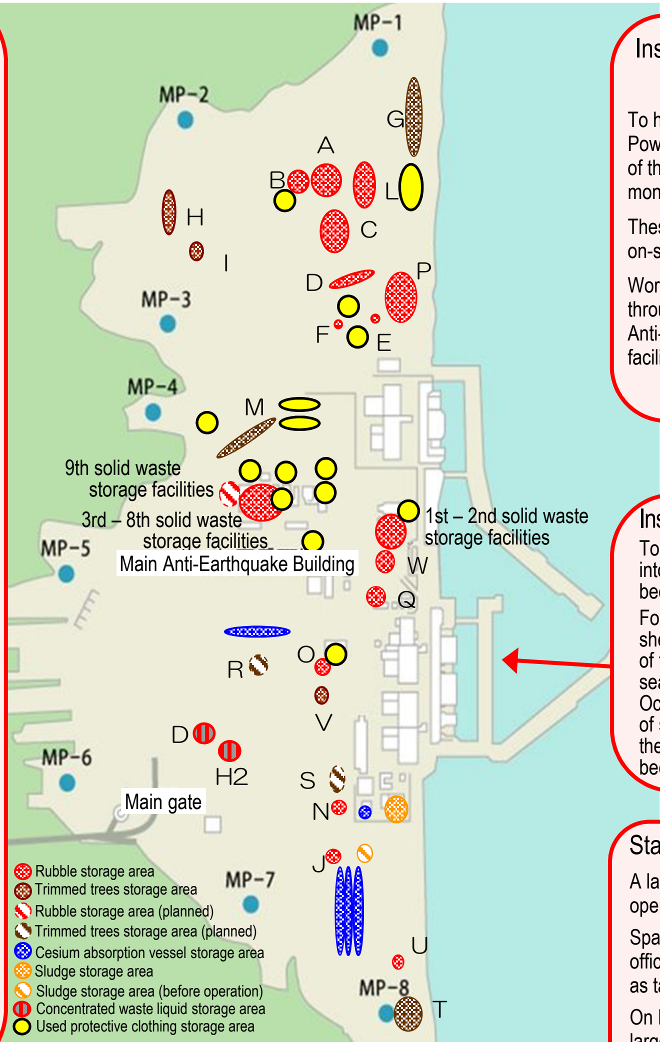
Based on the progress of measures to reduce environmental dosage on site, the site is categorized into two zones: highly contaminated area around Unit 1-4 buildings, etc. and other areas to optimize protective equipment according to each category aiming at improving safety and productivity by reducing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

From March 8, 2016, limited operation started in consideration of workers' load.



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.