Summary of Decommissioning and Contaminated Water Management

October 27, 2016

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

Main works and steps for decommissioning

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

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: Capturing the status inside PCV/ examination of fuel debris removal method, etc. (Note 2) (Unit 1-3) → 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 road map (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 1 SFP, works to dismantle the building cover are underway.

Dismantling of the building cover and wall panels started in July 2015 and September 2016 respectively. The work is being conducted steadily, with anti-scattering measures fully implemented and the density of radioactive materials monitored.

(Dismantling of Unit 1 building cover wall panels)

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)

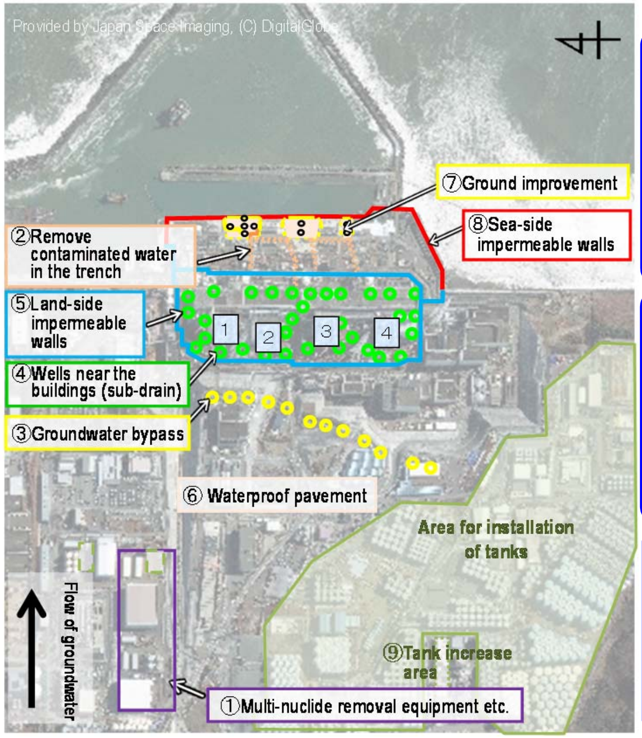
(Note 3) Underground tunnel containing pipes.

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 Soil improvement by sodium silicate
⑧ Sea-side impermeable walls
⑨ Increase tanks (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 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 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 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

◆ The temperatures of the Reactor Pressure Vessel (RPV) and the Primary Containment Vessel (PCV) of Units 1-3 have been maintained within the range of approx. 25-35°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 September 2016, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.00037 mSv/year at the site boundary. The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

Dismantling of the Unit 1 R/B cover wall panels

To help remove rubble on the Unit 1 Reactor Building (R/B) top floor, dismantling of wall panels (18 in total) started from September 13 and 13 panels had been dismantled up until October 26. The dismantling of all 18 panels will be completed by November.

No significant variation attributable to the work was identified at the dust monitors installed in the workplace and near the site boundary.

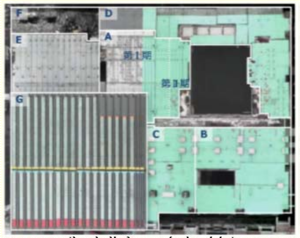
Following the dismantling of wall panels, pillars and beams of the building cover will be modified to install windbreak sheets.

Dose reduction by installing shields on the Unit 3 R/B top floor

Prior to setting up a cover for Unit 3 spent-fuel removal, shields are being installed to reduce the dose on the R/B top floor. The average dose rate on the R/B top floor was reduced by 86% as of September compared to pre-installation.

Installation of large shields will be completed in November.

Following the subsequent installation of complementary shields for the large shields, a cover for fuel removal and a fuel-handling machine will also be installed.



<Installation of shields>

Reduction of heat stroke cases

Measures to prevent heat stroke were enhanced, including: newly installing WBGT (heat index)* indicators and other instruments in places where many workers can see them; and checking health conditions using check sheets. Other frameworks promoted included: introducing dedicated breathable clothing on site and reducing the usage rate of full-face masks. Through these measures, the number of heat stroke cases due to work reduced from 12 last fiscal year to four this fiscal year.

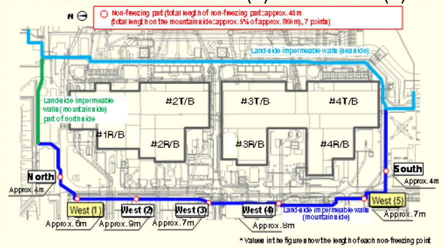
Measures to prevent heat stroke will continue to further improve the environment from the following fiscal year onward.

* WBGT (heat index): Index using three perspectives of humidity, radiation heat and temperature, which significantly impact on the heat balance of human bodies

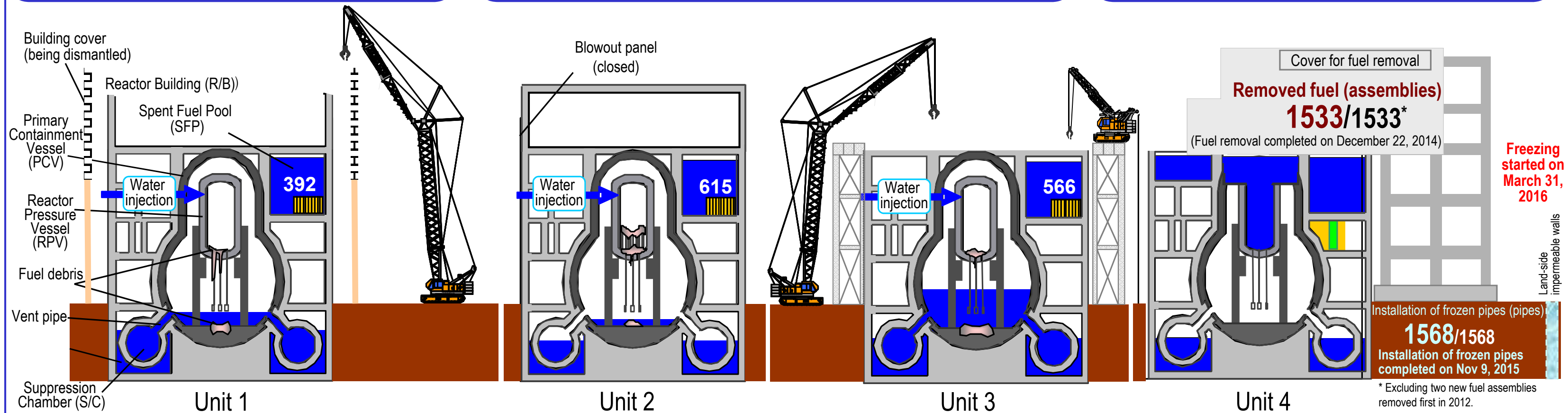
Status of the land-side impermeable walls

On the sea side of the land-side impermeable walls, the underground temperature declined below 0°C throughout the scope requiring freezing, except the unfrozen parts under the sea-water pipe trenches and the areas above the groundwater level.

On the mountain side, an application to change the implementation plan was submitted on October 17 to expand the freezing scope from 95%. The change included freezing two unfrozen sections: "West (1)" and "West (5)."



<Freezing scope of land-side impermeable walls>



Water drippage from the multi-nuclide removal equipment into the building

On October 15 and 17, water drippage from the multi-nuclide removal equipment was identified. The dripped water remained within the building and no leakage outside was identified.

Causes will be investigated and countermeasures implemented.

Dose reduction for accumulated-water treatment in the Unit 1 T/B

To prepare for accumulated-water treatment of the Unit 1 Turbine Building (T/B), work has been underway from October 5 to remove and dilute water in the Unit 1 condenser, in which high-density contaminated water accumulated immediately after the disaster and flush the high-dose pipes linking to the condenser.

After reducing the dose and removing work area obstacles, pipes and pumps will be installed to remove accumulated water on the basement floor within this fiscal year.

Status of the Radioactive Waste Incinerator

It was confirmed that the pin holes and cracks identified at the Radioactive Waste Incinerator in August were attributable to stress corrosion cracking and other corrosion due to generation of condensed corrosive water. The parts will be replaced with resistant materials, and necessary measures, such as installation of insulation materials to the similar parts, will be implemented.

Work is underway to resume operation in November.

Measures for drainage channels

Regarding the C drainage channel which drained rainwater in the tank area, appropriate measurement was unavailable due to insufficient water flow during clear weather, which meant the radiation monitor repeatedly measured the same water. The drainage destination of the power station west side area was switched to C drainage channel from October 11 to ensure sufficient drainage volume.

Besides, Work will start from November to switch the destination of A drainage channel, which drained rainwater of the multi-nuclide removal equipment.

Water drippage from a flange tank to the fence inside

On October 6, water drippage from the side flange part was identified at a flange tank. It was also confirmed that the drippage ceased by reducing the tank's water level to below the drippage location. The dripped water remained within the fences no leakage outside was identified. Similar flange parts of the leakage tank are being repaired.

The flange parts of other flange tanks will be inspected systematically.

Major initiatives – Locations on site

Provided by Japan Space Imaging, (C) DigitalGlobe

* Data of Monitoring Posts (MP1-MP8.)

Data (10-minute value) of Monitoring Posts (MPs) measuring airborne radiation rate around site boundaries show 0.581 – 2,219 μSv/h (September 28 – October 25, 2016).

We improved the measurement conditions of monitoring posts 2 to 8 for precise measurement of air dose rate. Construction works such as tree-clearing, surface soil removal and shield wall setting were implemented from February 10 to April 18, 2012.

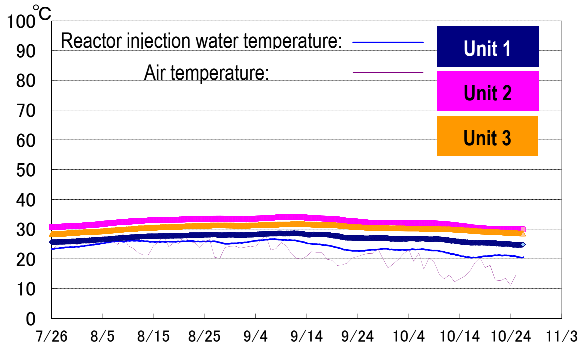
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

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 fallen down due to further cutting down of the forests, etc.

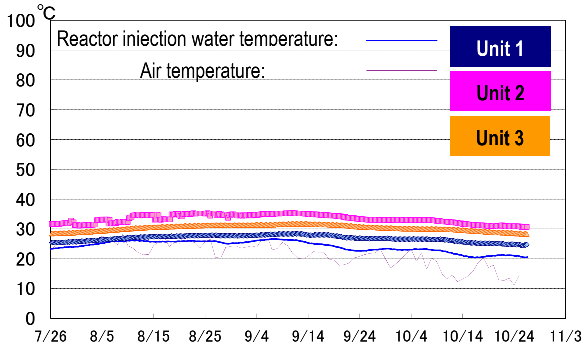
I. Confirmation of the reactor conditions

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 have been maintained within the range of approx. 25 to 35°C for the past month, though they vary depending on the unit and location of the thermometer.



RPV bottom temperatures (recent quarter)



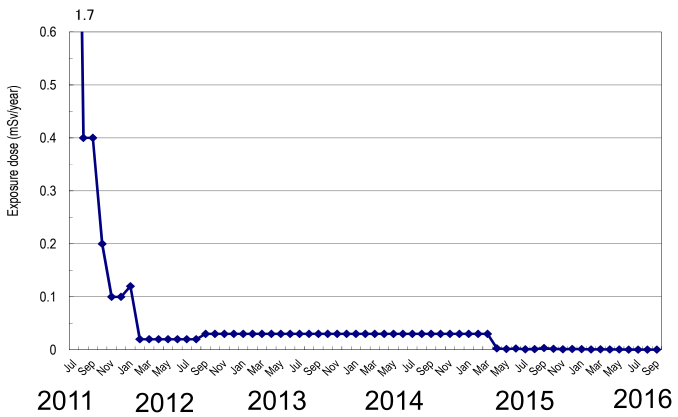
PCV gas phase temperatures (recent quarter)

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

2. Release of radioactive materials from the Reactor Buildings

As of September 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. 4.4×10^{-12} Bq/cm³ for Cs-134 and 2.0×10^{-11} Bq/cm³ for Cs-137 respectively. The radiation exposure dose due to the release of radioactive materials was less than 0.00037 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]: 2×10^{-5} Bq/cm³
  [Cs-137]: 3×10^{-5} Bq/cm³
- * Dust density around the site boundaries of Fukushima Daiichi Nuclear Power Station (actual measured values):
  [Cs-134]: ND (Detection limit: approx. 1×10^{-7} Bq/cm³)
  [Cs-137]: ND (Detection limit: approx. 2×10^{-7} Bq/cm³)
- * Data of Monitoring Posts (MP1-MP8).
  Data of Monitoring Posts (MPs) measuring the airborne radiation rate around the site boundary showed 0.581 – 2.219 μSv/h (September 28 – October 25, 2016).
  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

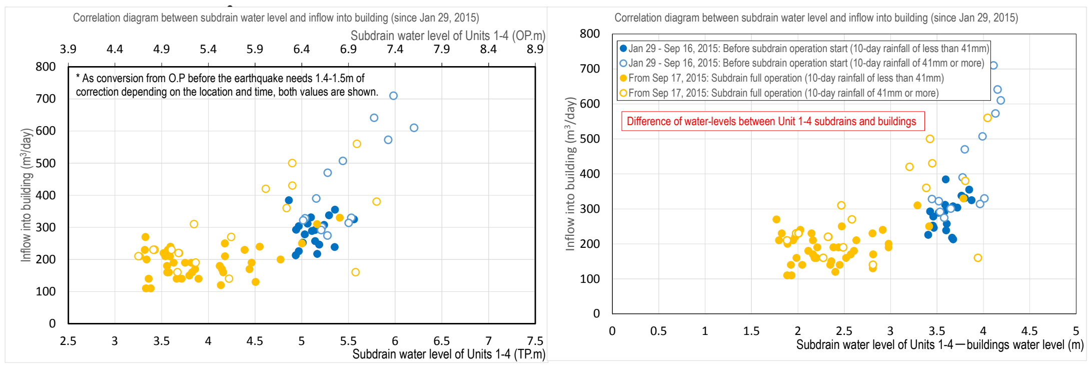
To tackle the increase in accumulated water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➢ 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 October 25, 2016, 227,156 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 October 25, 2016, a total of 211,122 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 October 25, 2016, a total of approx. 103,100 m³ had been pumped up. Approx. 250 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period September 22 – October 19, 2016).
- The effect of ground water 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 declined to approx. 150 - 200 m³/day when the subdrain water level decreased to approx. T.P. 3.5 m or when the difference in water levels with buildings decreased to approx. 2 m after the subdrains went into operation.
- Measures are planned to enhance the water treatment facility special for subdrains and groundwater drains, targeting an increased treatment capacity. As part of this enhancement, an application to change the implementation plan was submitted on October 21 regarding expansion of the purification facility to two systems.



As of October 20, 2016

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 sea side), the underground temperature declined below 0℃ throughout the scope requiring freezing except for unfrozen parts under the seawater pipe trenches and areas above groundwater level (as of the end of October). The disparity in groundwater levels between the inside and outside of the land-side impermeable walls had been expanding until early August. Since then, after the groundwater levels increased on both sides during rainfall, the disparity has been fluctuating because the subdrains going into operation only impacted on the inside groundwater level. The impermeability of the frozen walls meant no influence of the variation in groundwater levels inside the land-side impermeable walls was registered on those outside.
- As for the land-side impermeable walls (on the mountain side), a supplementary method is being implemented for portions where the temperature currently exceeds 0℃ and is expected to remain at 0℃ or more in order of priority.
- The operation of the subdrains has been reduced on the mountain side of the buildings because the volume of pumped-up water increased on the sea side of the buildings due to background water since the closure of the

land-side impermeable walls (on the sea side). Consequently, the groundwater level around the buildings, particularly on the mountain side, has remained high with significant inflow into buildings.

- In response, an application to change the implementation plan was submitted on October 17 to reduce the groundwater inflow from the mountain side into the buildings by closing some unfrozen parts (two or so sections) of the land-side impermeable walls (on the mountain side) in the scope where subdrain operation continues. The change included closing part of two sections: "West (1)" and "West (5)".

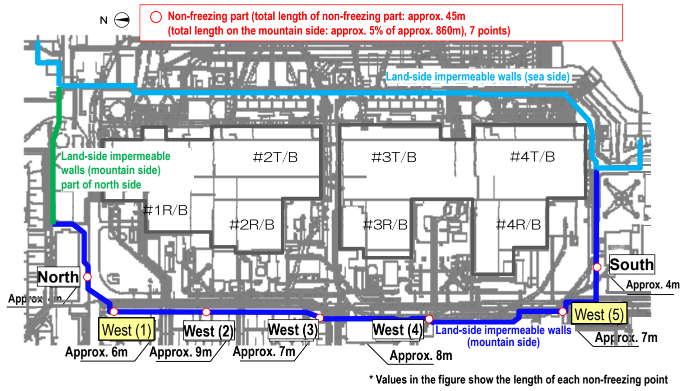
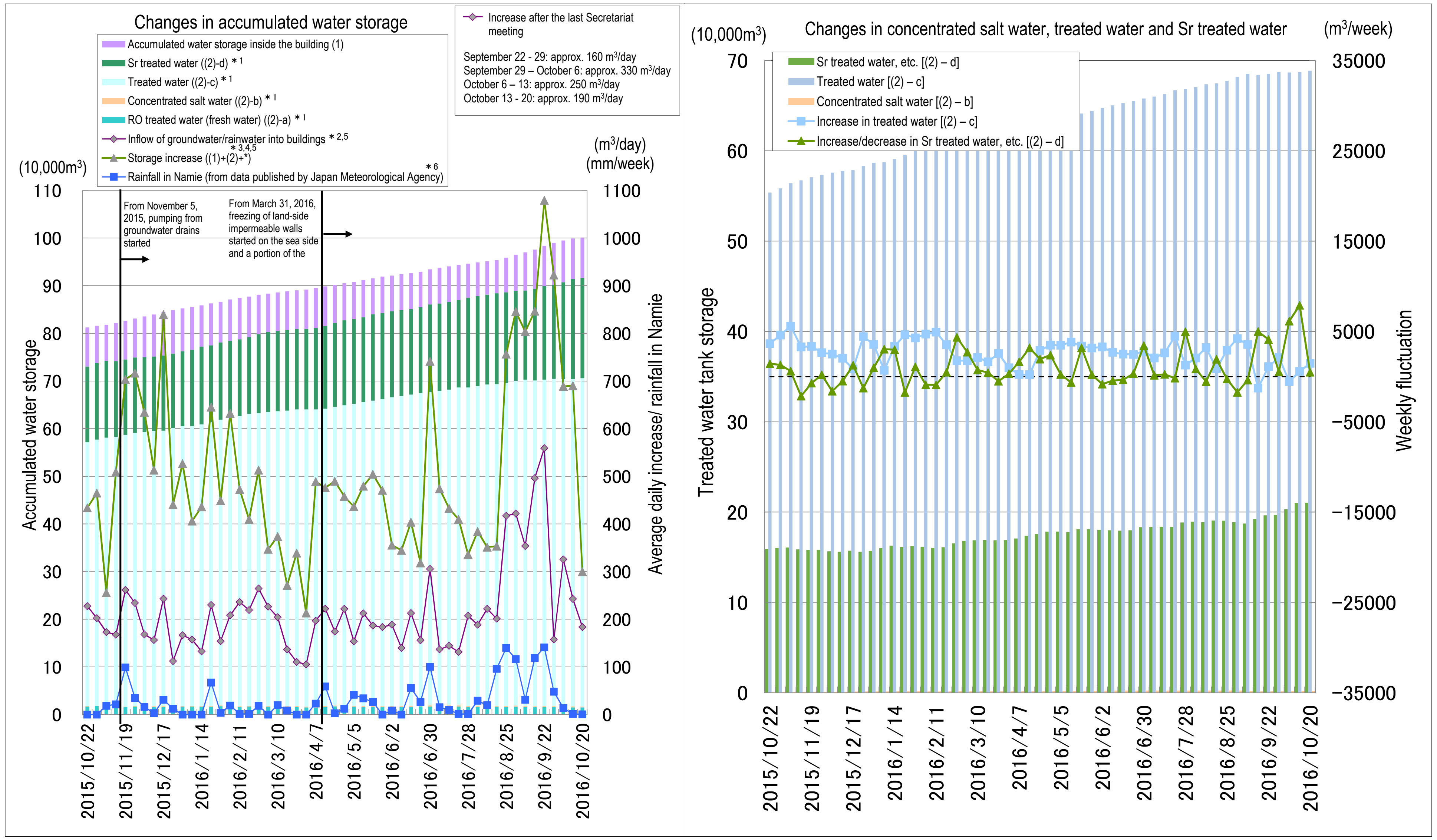


Figure 2: Closure of part of the land-side impermeable walls (on the mountain side)

➢ Operation of multi-nuclide removal equipment

- Regarding the multi-nuclide removal equipment (existing, additional and high-performance), hot tests using radioactive water have been 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 October 20, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 314,000, 303,000 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 October 20, approx. 269,000 m³ had been treated.
- On October 15 and 17, water drippage from the multi-nuclide removal equipment was identified. The dripped water remained within the building and no leakage outside was identified. The causes will be investigated and countermeasures implemented.



As of October 20, 2016

*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, 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

➢ 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. As of October 20, approx. 309,000 m³ had been treated.

➢ Measures in Tank Areas

- Rainwater, under the release standard and having accumulated inside 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 October 24, 2016, a total of 69,346 m³).

➢ Progress of accumulated water treatment in the Unit 1 T/B

- As part of efforts to reduce the risks of accumulated water in buildings leaking, accumulated water in the Unit 1 Turbine Building (T/B) will be treated to reduce the water level to the surface of the bottom floor within FY2016.
- Based on the on-site investigative results and other information, consideration has been made to date of methods to install and build the transfer equipment needed to reduce the accumulated water level to the T/B bottom floor surface. At present, work is underway to remove obstacles before installing the transfer equipment, which will start from around November 2016.
- To reduce the dose in the area where the transfer equipment will be installed, work is underway from October 5 to remove and dilute water in the Unit 1 condenser, in which high-density contaminated water immediately after the disaster has been accumulated and flush the high-dose pipes (heater drain pipes) around the installation area.

➢ Water drippage from E area flange tank

- On October 6, drippage from a T-shaped flange connection part was identified at a flange tank in E area. The estimated leakage volume peaked at approx. 32 liters. On October 6 and 7, it was confirmed that the water level had declined below the drippage height and that the drippage had ceased. The T-shaped flange connection parts (28 points) of the tank will be repaired.

➢ Decline in G area flange tank water levels

- On October 13, it was confirmed that the water levels of flange tanks in G6 area had declined by approx. 6 cm over one month from mid-September, based on long-term trend data of those water levels. As an investigation identified a continuous increase (of approx. 5 cm) in the water levels of both tanks coupled via a connection valve, the increase was considered attributable to a seat leakage of the valve, which subsequently created an inflow of strontium-treated water from the higher water-level tank to the other lower water-level tank. An on-site inspection of the pipes linking these two tanks identified no abnormality such as leakage. In addition, a dose measurement over the side surface of these two tanks also confirmed that the dose was at a level similar to the background. Based on these results, no strontium-treated water was deemed to have leaked.

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

- On July 28, 2015, work started to dismantle the roof panels of the building cover and by October 5, 2015, all six roof panels had been dismantled. Anti-scattering agents were sprayed from the side during the period between August 4 and September 3, 2016 and the dismantling of wall panels started from September 13, 2016 (13 panels had been dismantled up until October 26). No significant variation attributable to the work was identified at the monitoring posts and dust monitors. The building cover is being dismantled, with anti-scattering measures steadily implemented and safety first.
- As well as dismantling the building cover wall panels, the status of rubble under the fallen roof is being investigated to collect data, which will then be used when considering rubble removal methods (from September 13).

➢ 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, roadbeds have been constructed on the west and south sides (excluding the transformer area) to clear a work area, within which large heavy-duty machines and other instruments will be installed. Up until October 24, 94% and 50% of construction had been completed on the west and south sides respectively. (The work will be completed in mid-December).
- Construction started from September 28 on the west side of the Reactor Building to install a gantry accessing the operating floor. Up until October 24, 9% of installation had been completed. (The work will be completed in late April 2017)
- On October 19, a hydraulic-oil leak was identified in the lower part of the operating room of a 450 t crawler crane, which was used in the west-side yard of the Unit 2 Reactor Building. The damaged hydraulic-oil hose was replaced and operation resumed on October 26.

➢ Main work to help remove spent fuel at Unit 3

- On the operating floor of the Reactor Building, the installation of shields has been underway (A zone: April 12-22, July 29 – September 7; B zone: July 13-25; C zone: July 11 – August 4; D zone: July 27 – August 11; F zone: from October 28; G zone: September 9-20; shields between the supplementary and gantry: from August 24).
- The installation of shields reduced the average dose rate on the Reactor Building operation floor by approx. 86% as of September compared to pre-installation.

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.

➢ Dose reduction on the Unit 1-3 Reactor Building 1st floors

- On the Unit 1 Reactor Building 1st floor, dose-reduction measures have been implemented. The average airborne radiation has been reduced to approx. 2 mSv/h in the northwest and west areas (approx. 50% compared to before the measures started). In the south side area, the high-dose AC pipes and DHC facilities account for the majority of the total dose. Methods are being examined to eliminate the dose source inside the AC pipes and remove residual contaminated water inside the DHC facilities.
- On the Unit 2 Reactor Building 1st floor, a high dose rate was confirmed at ducts in the middle and elevated parts. Dose-reduction measures were implemented and the average dose in the area declined to approx. 5 mSv/h.
- On the Unit 3 Reactor Building 1st floor, dose-reduction measures were implemented and the average dose declined to approx. 9 mSv/h in the northwest and west areas and approx. 7 mSv/h in the southeast area (approx. 50% reduction compared to before measures started). Though the airborne radiation in the southwest area has been reduced by approx. 40%, the average remains high at approx. 19 mSv/h. Removal of the dose source continues, such as small rubble in narrow parts on the floor.

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

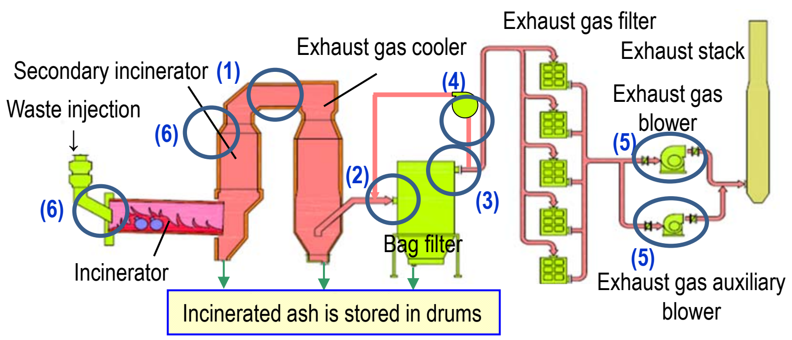
- As of the end of September 2016, the total storage volume of concrete and metal rubble was approx. 195,400 m³ (+2,600 m³ compared to at the end of August, with an area-occupation rate of 70%). The total storage volume of trimmed trees was approx. 89,800 m³ (+100 m³ compared to at the end of August, with an area-occupation rate of 84%). The total storage volume of used protective clothing was approx. 68,300 m³ (+1,200 m³ compared to at the end of August, with an area-occupation rate of 96%). The increase in rubble was mainly attributable to construction to install tanks. The increase in trimmed trees was mainly attributable to construction related to site preparation work. The increase in used protective clothing was mainly attributable to acceptance of used clothing.

➢ Management status of secondary waste from water treatment

- As of October 20, 2016, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%) and that of concentrated waste fluid was 9,267 m³ (area-occupation rate: 87%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 3,361 (area-occupation rate: 54%).

➢ Status of Radioactive Waste Incinerator

- Operation of the Radioactive Waste Incinerator was suspended because pin holes were identified at the bellows (System B) between the secondary incinerator and the exhaust gas cooler of the facility during operation on August 9 and cracks were identified at the bellows (Systems A and B) between the waste gas coolers and bag filters on August 10 (since the pressure inside the facility and its building was kept negative, no radioactive materials was deemed to have impacted the outside of the building). Following an investigation, the pin holes and cracks were considered attributable to pitting corrosion and stress corrosion cracking respectively.
- Investigation of similar parts identified stress corrosion cracking in other bellows, small-caliber pipes and equipment nozzles, as well as paint peeling and corrosion inside the flue (see Figure 4).
- As the corrosion was mainly attributable to an environment in which condensed water containing chloride ions was generated, the use of materials sensitive to stress corrosion cracking and residual stress during production, etc., countermeasures are being taken, including installing heaters and insulation materials in parts prone to condensation, changing corrosion-resistant materials and repainting the flue, to resume operation the incinerator within November.



	Section	Phenomenon
(1)	Bellows between secondary incinerator and exhaust gas cooler (B)	Pitting corrosion (SUS316L)
(2)	Bellows of bag filter inlet (A and B)	Stress corrosion cracking (SUS304)
(3)	Bellows of bag filter outlet (B)	Stress corrosion cracking (SUS304)
(4)	Bellows of bag filter outlet hot-air circulation line (A and B)	Stress corrosion cracking (SUS304)
(5)	Bellows before and after exhaust gas auxiliary blower and small-caliber pipes around the blower (A and B)	Stress corrosion cracking (SUS304)
(6)	Secondary incinerator nozzle (A and B) Inlet hood nozzle (B)	Stress corrosion cracking (SUS304)
–	Part of flue (Exhaust gas cooler – exhaust stack)	Paint peeling and corrosion (carbon steel)

Figure 4: Overview of Radioactive Waste Incinerator

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

➢ Progress of work to install the common facility for the Unit 1-3 spent fuel pool circulating cooling facility secondary system

- Regarding the Unit 1 spent fuel pool circulating cooling facility, not all air could be completely eliminated from the primary system pump bearing cooling water pipe when water was filled for the test operation of the new facility from August 23-25, 2016. As air accumulation could not be removed and passing water through the cooling water pipe could not be confirmed, work resumed to cool the spent fuel pool by the existing facility. Valves for air removal are being installed as required as well as reviewing the routing of the water-cooling pipes.
- The Unit 3 spent fuel pool circulating cooling facility secondary system was switched to a new system, which started cooling the spent fuel pool from October 25.

➢ Progress of construction to minimize the circulation loop

- A reverse osmosis (RO) device was installed in the Unit 4 Turbine Building within the circulation loop, comprising the transfer of contaminated water, water treatment and injection into the reactors and operation started from October 7. Following the operation training for approx. two weeks, normal (24-hour) operation started from October 20.
- The risk of leakage from the outdoor transfer pipe was reduced by shortening the circulation loop. The work shortened the circulation loop (outdoor transfer pipe) from approx. 3 to 0.8 km (approx. 2.1 km, including the accumulated-water transfer line).

➢ Nitrogen injection from the Unit 1 jet pump instrumentation line

- As for Unit 1, nitrogen has currently been injected from the reactor head spray line to the RPV. To enhance reliability, work is underway to install a new line for nitrogen injection through the jet pump instrumentation line.
- On May 30, the implementation plan was authorized. On completion of work to install the line in September, it underwent a pre-operation test in October, which involved injecting nitrogen from the lines additionally installed in this work through the jet pump instrumentation line to the RPV.
- Based on the pre-operation test results, a line will be selected for regular use and air blow will be verified.

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, the tritium density at groundwater Observation Hole No. 0-3-2 has been gradually increasing since January 2016 and currently stands at around 40,000 Bq/L.
- Regarding the groundwater near the bank between the Unit 1 and 2 intakes, though the tritium density at groundwater Observation Hole No. 1-9 has been increasing to approx. 800 Bq/L since December 2015, it declined and currently stands at around 200 Bq/L. Though the density of gross β radioactive materials at groundwater Observation Hole No. 1-16 had remained constant at around 90,000 Bq/L, after declining to 6,000 Bq/L, it has been increasing since August 2016 and currently stands at around 60,000 Bq/L. Though the tritium density at groundwater Observation Hole No. 1-17 had remained constant at around 50,000 Bq/L, it has been increasing and declining since March 2016 and currently stands at around 1,000 Bq/L. Though the density of gross β radioactive materials at the same groundwater Observation Hole had remained constant at around 7,000 Bq/L, it has been increasing since March 2016 and currently stands at around 200,000 Bq/L. Since August 15, 2013, pumping of groundwater continued (at the well point between the Unit 1 and 2 intakes: August 15, 2013 – October 13, 2015 and from October 24; at the repaired well: October 14 - 23, 2015).
- Regarding radioactive materials in the groundwater near the bank between the Unit 2 and 3 intakes, though the density of gross β radioactive materials at groundwater Observation Hole No. 2-5 had remained constant at around 10,000 Bq/L, it had increased to 500,000 Bq/L since November 2015 and currently stands at around 10,000 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 tritium density at groundwater Observation Hole No. 3-2 had remained constant at around 800 Bq/L, it has been increasing since September 2016 and currently stands at around 3,000 Bq/L. As for the density of gross β radioactive materials, though having remained constant at around 1,000 Bq/L, it has also been increasing since September 2016 and currently stands at around 3,000 Bq/L. At groundwater Observation Hole No. 3-3, though the tritium density had remained constant at around 800 Bq/L, it has been increasing since September 2016 and currently stands at around 1,000 Bq/L. As for the density of gross β radioactive materials, though having remained constant at around 4,000 Bq/L, it has also been increasing since September 2016 and currently stands at around 5,000 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).

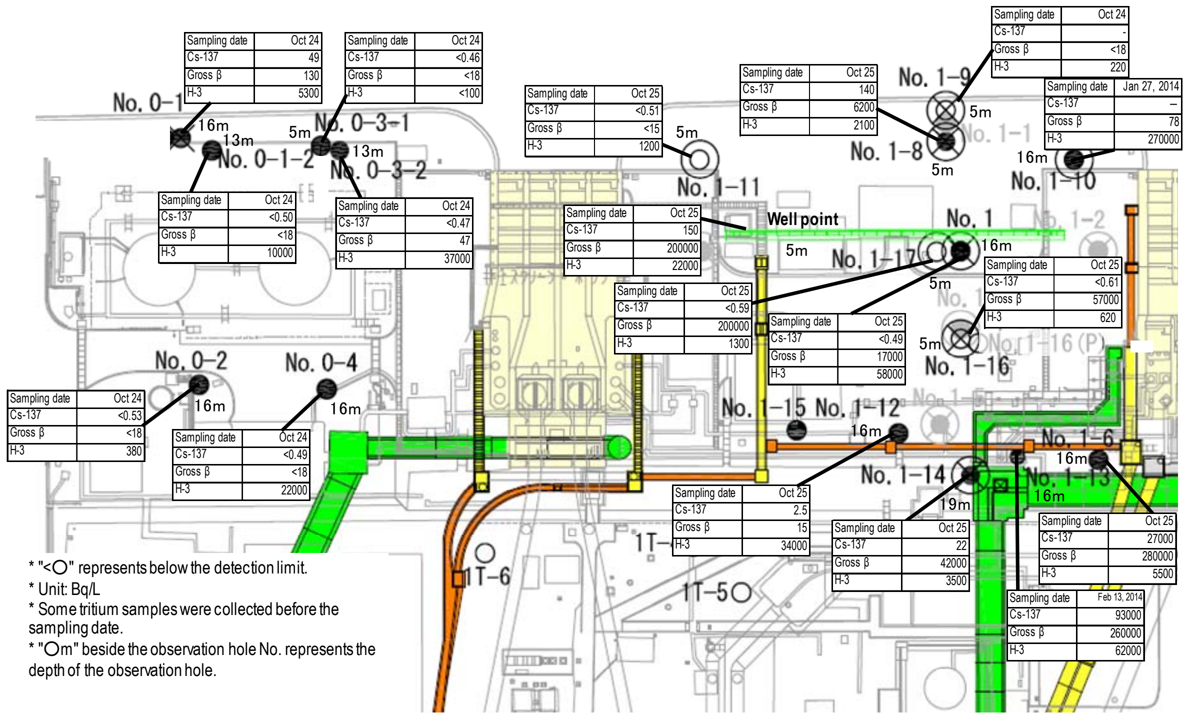
- Regarding the radioactive materials in seawater outside the sea-side impermeable walls and within the open channels of Units 1 - 4, as well as those inside the port, the density was declining due to the effect of the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls.
- Regarding the radioactive materials in seawater outside the port, the densities of radioactive materials remained within the same range previously recorded. The location of the sampling point “Near south release outlet” shifted from a point “approx. 1.3 km away” to another point “approx. 330 m away” from the Unit 1-4 south release outlet, because of the difficulty in gaining access due to the breakdown of the bank.

➢ Response to the Unit 1 and 2 exhaust stack drain sump pit

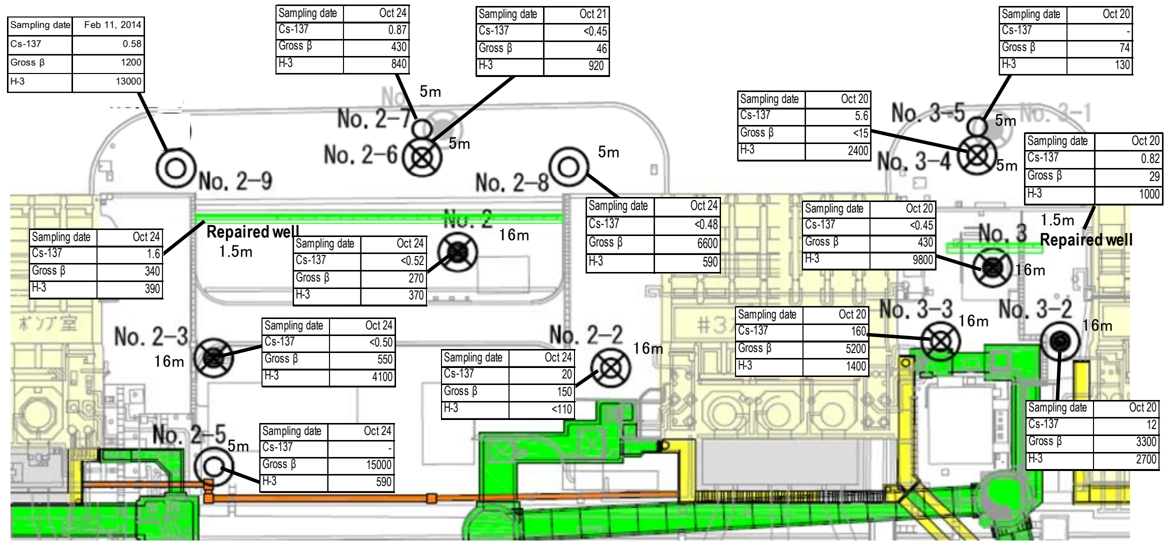
- For the exhaust stack drain sump pit, which was evaluated as “requiring investigation” in the comprehensive risk review, the water level and quality were investigated and countermeasures will be taken using a remote-controlled robot and other equipment given the high dose around the pit.
- On-site preparation has been conducted since July 25 and work to open a portion of the pit cover started from August 26. A portion of the inspection aperture inside the pit was also opened and the inspection on September 9 identified the internal water level at approx. 60 cm. On September 12, accumulated water was sampled for analysis. (Gross β: approx. 6.0 × 10^7 Bq/L; Cs134: approx. 8.3 ×10^6 Bq/L; Cs137: approx. 5.2 × 10^7 Bq/L)
- Accumulated water inside the pit, which could contaminate surrounding facilities and other buildings, has been transferred to an underground area of the Unit 2 waste treatment building since September 14.
- On October 3, the installation of a water-level gauge and a temporary drain facility was completed. At present, the water level is being monitored and water is being transferred as necessary.

➢ Measures for drainage channels

- Regarding C drainage channel, which drained rainwater in the tank area, appropriate measurement by the radiation monitor was unavailable due to insufficient water flow of the channel. The drainage destination of the power station west-side area was switched to C drainage channel from October 11 to ensure sufficient drainage volume.
- Work to switch the destination of A drainage channel, which drains rainwater of the multi-nuclide removal equipment, to inside the port, will start from November.



<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

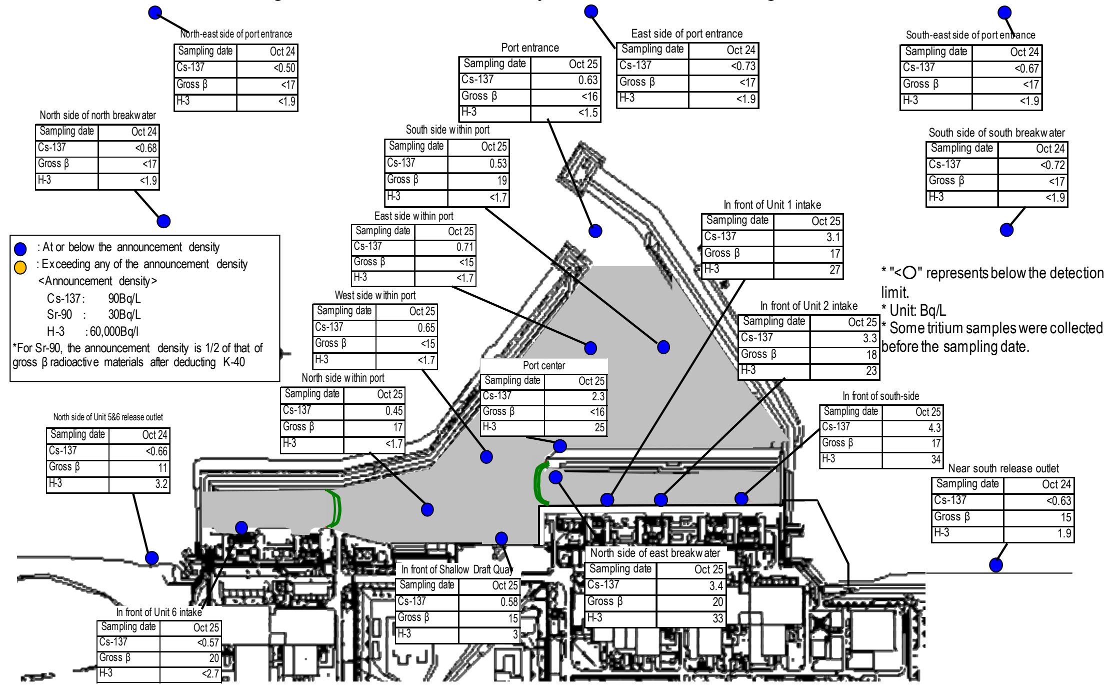


Figure 6: Seawater density around the port

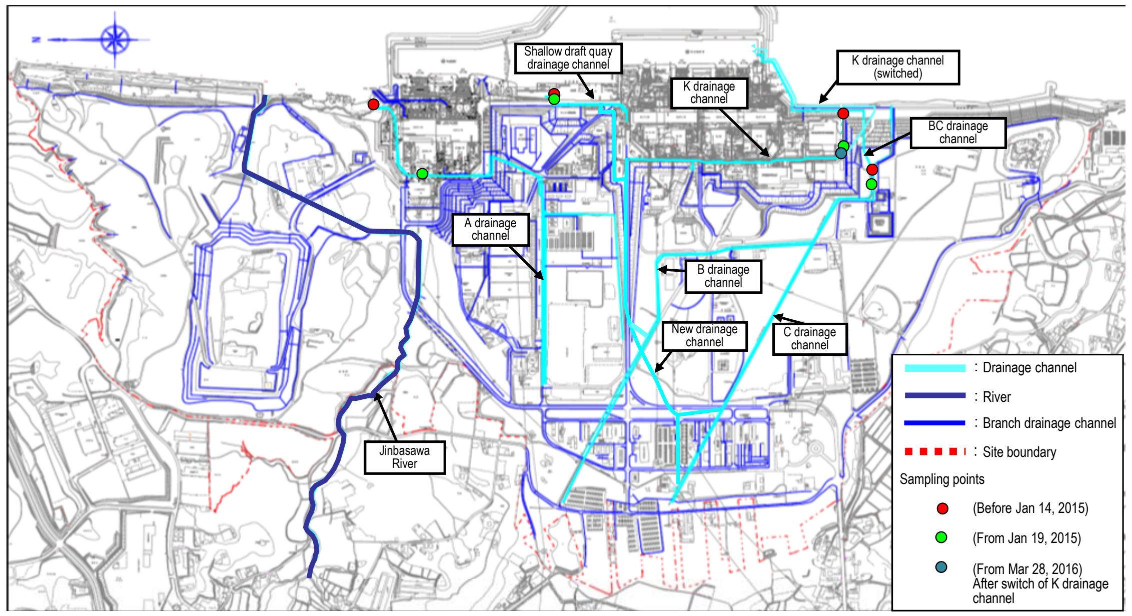


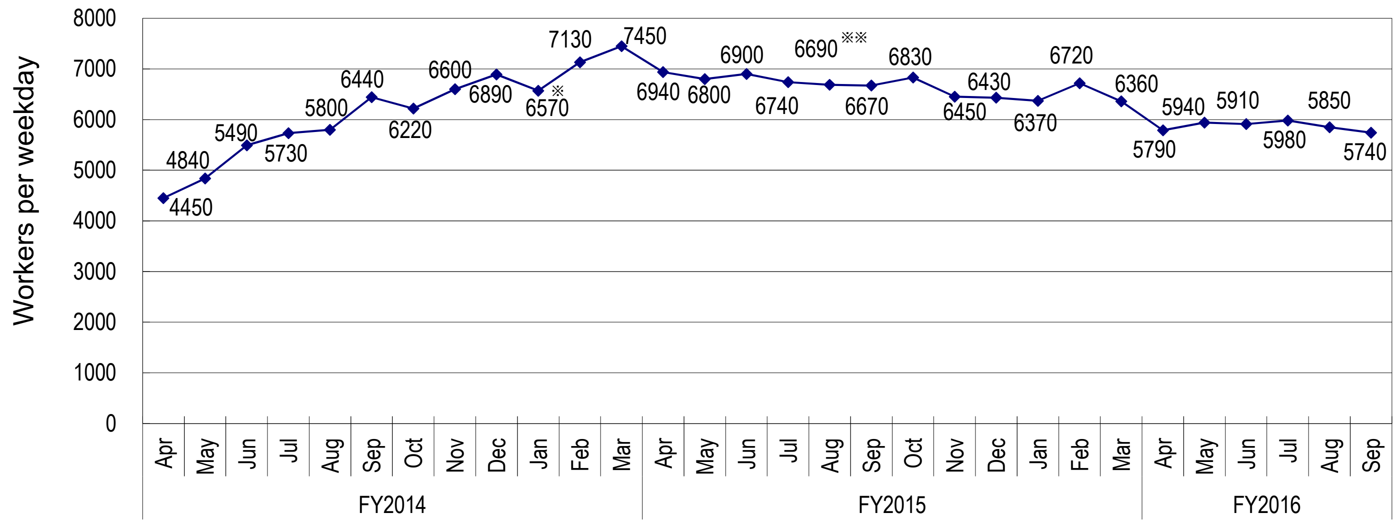
Figure 7: Layout of drainage channels

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 June to August 2016 was approx. 12,700 (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 November 2016 (approx. 5,730 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 8). Some works for which contractual procedures have yet to be completed were excluded from the estimate for November 2016.
- The total number of workers has increased, from both within and outside Fukushima Prefecture. The local employment ratio (TEPCO and partner company workers) as of September 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 8: Changes in the average number of workers per weekday for each month since FY2014

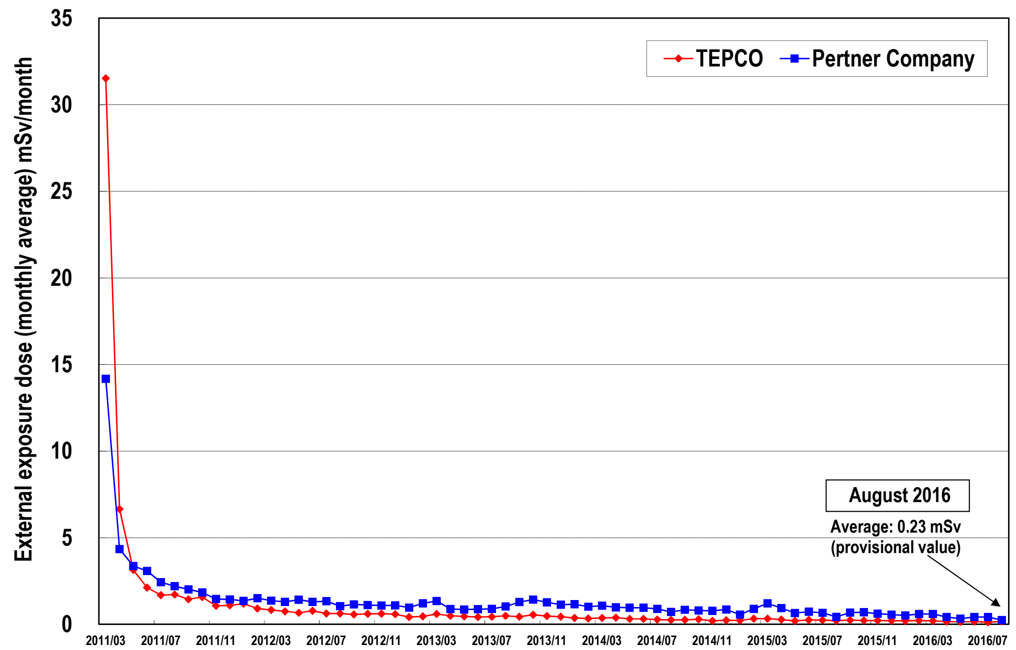


Figure 9: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

➢ Status of heat stroke cases

- In FY2016, four workers had suffered heat stroke due to work and three workers had suffered light heat stroke (with no medical treatment required) up until October 26. Continued measures will be taken to prevent heat stroke. (In FY2015, 12 workers had heat stroke due to work and three workers had light heat stroke up until the end of October.)
- Compared to the previous fiscal year, the number of heat stroke cases significantly decreased (from 12 to 4) and there were no heat stroke cases necessitating an absence from work. These results were deemed attributable to measures including: the continuous implementation of unified rules and other frameworks to prevent heat stroke; the introduction of dedicated breathable clothing on site and the reduced usage rate of full-face masks by reviewing on-site controlled areas.
- This fiscal year, ongoing measures (unified rules to prevent heat stroke) continued to be implemented, including: the use of WBGT*; prohibiting outdoor work from 14:00 to 17:00; wearing cool vests; and prohibiting work at WBGT 30°C or higher in principle. In addition, new measures were also introduced and promoted, including: newly installing WBGT measuring instruments, indicators and clocks on site; particularly enhancing heat acclimatization measures; checking health conditions using check sheets; and strengthening the framework to detect workers in poor physical condition at an early stage.
- The following fiscal year, the unified rules will continue to be implemented and thoroughly enforced while implementing measures to further improve the environment, etc. to prevent heat stroke.

* WBGT (heat index): Index using three perspectives of humidity, radiation heat and temperature, which significantly impact on the heat balance of human bodies

8. Other

➢ Dose investigation of the Unit 1 and 2 exhaust stacks

- Dose rates were investigated at the exhaust stacks to pinpoint the conditions that will be used to estimate the required manpower, evaluate the exposure dose and assess the feasibility of construction, while considering methods to dismantle the exhaust stacks. The investigation into the exterior of the exhaust stacks was completed on October 7. An investigation performed using a camera from the upper part of the exhaust stacks following an incident where a dosimeter fell inside the shaft detected an obstacle inside the same. Henceforth, no dose investigation will be conducted inside the shaft. Instead, methods to dismantle the exhaust stacks will be considered, based on the dose investigative results obtained to date.

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 October 17-25)"; unit (Bq/L); ND represents a value below the detection limit

Source: TEPCO website Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station http://www.tepco.co.jp/nu/fukushima-np/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) → 0.71 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(0.28) Below 1/10
Cesium-137: **10** (2013/12/24) → 0.65 Below 1/10
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(0.25) Below 1/20
Cesium-137: 8.4 (2013/12/2) → 0.45 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(0.67) Below 1/4
Cesium-137: 5.8 (2013/12/2) → ND(0.57) Below 1/10
Gross β: **46** (2013/8/19) → 20 Below 1/2
Tritium: 24 (2013/8/19) → ND(2.7) Below 1/8

	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: ND(0.59)
Cesium-137: 2.3
Gross β: ND(16)
Tritium: 25 *

Cesium-134: 3.3 (2013/12/24) → ND(0.51) Below 1/6
Cesium-137: 7.3 (2013/10/11) → 0.63 Below 1/10
Gross β: **69** (2013/ 8/19) → ND(16) Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.5) Below 1/40

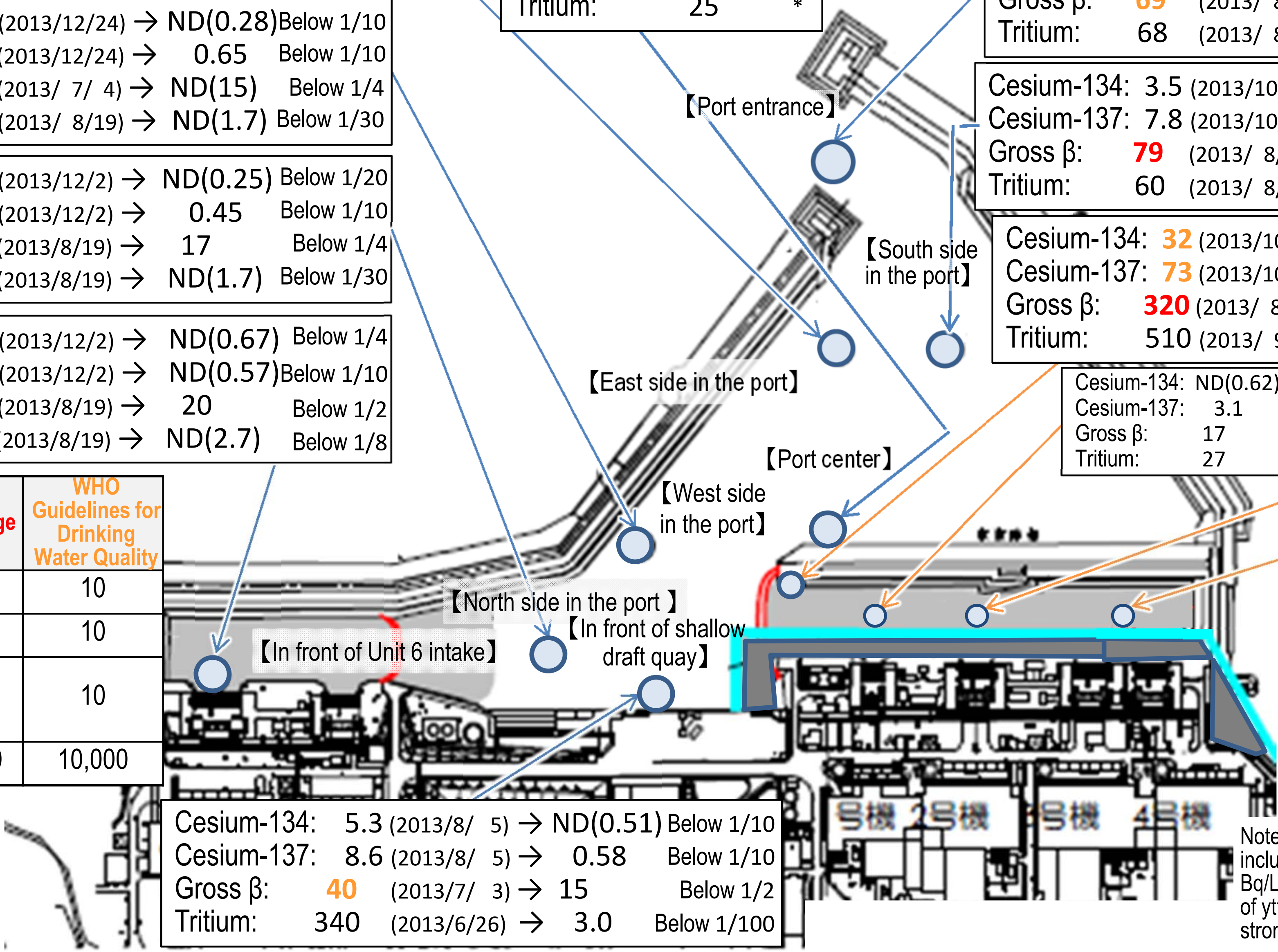
Cesium-134: 3.5 (2013/10/17) → ND(0.42) Below 1/8
Cesium-137: 7.8 (2013/10/17) → 0.53 Below 1/10
Gross β: **79** (2013/ 8/19) → 19 Below 1/4
Tritium: 60 (2013/ 8/19) → ND(1.7) Below 1/30

Cesium-134: **32** (2013/10/11) → 0.82 Below 1/30
Cesium-137: **73** (2013/10/11) → 3.4 Below 1/20
Gross β: **320** (2013/ 8/12) → 20 Below 1/10
Tritium: 510 (2013/ 9/ 2) → 33 Below 1/10

Cesium-134: ND(0.62)
Cesium-137: 3.1
Gross β: 17
Tritium: 27 *

Cesium-134: 0.69
Cesium-137: 3.3
Gross β: 18
Tritium: 23 *

Cesium-134: ND(0.53)
Cesium-137: 4.3
Gross β: 17
Tritium: 34 *



Cesium-134: 5.3 (2013/8/ 5) → ND(0.51) Below 1/10
Cesium-137: 8.6 (2013/8/ 5) → 0.58 Below 1/10
Gross β: **40** (2013/7/ 3) → 15 Below 1/2
Tritium: 340 (2013/6/26) → 3.0 Below 1/100

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

Summary of TEPCO data as of October 26

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

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

(The latest values sampled during October 17-25)

	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 (0.51)
Cesium-137: ND (2013) → ND (0.50)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.9)

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

Cesium-134: ND (2013) → ND (0.70)
Cesium-137: 1.6 (2013/10/18) → ND (0.73) Below 1/2
Gross β: ND (2013) → ND (17)
Tritium: 6.4 (2013/10/18) → ND (1.9) Below 1/3

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

Cesium-134: ND (2013) → ND (0.55)
Cesium-137: ND (2013) → ND (0.67)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.9)

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

Cesium-134: ND (2013) → ND (0.66)
Cesium-137: ND (2013) → ND (0.68)
Gross β: ND (2013) → ND (17)
Tritium: 4.7 (2013/ 8/18) → ND (1.9) Below 1/2

【Port entrance】

Cesium-134: 3.3 (2013/12/24) → ND (0.51) Below 1/6
Cesium-137: 7.3 (2013/10/11) → 0.63 Below 1/10
Gross β: 69 (2013/ 8/19) → ND (16) Below 1/4
Tritium: 68 (2013/ 8/19) → ND (1.5) Below 1/40

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

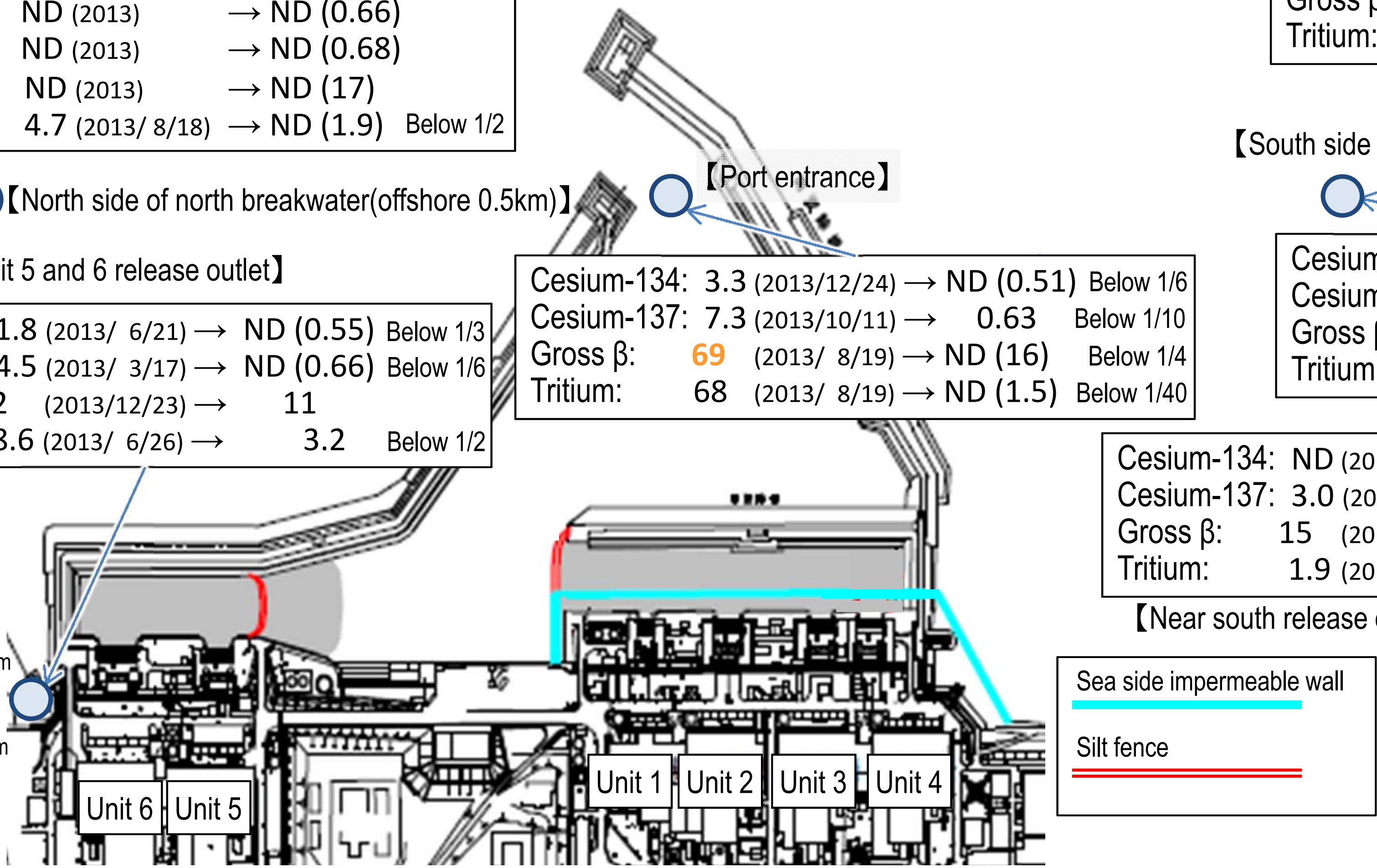
Cesium-134: ND (2013) → ND (0.78)
Cesium-137: ND (2013) → ND (0.72)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.9)

【North side of Unit 5 and 6 release outlet】

Cesium-134: 1.8 (2013/ 6/21) → ND (0.55) Below 1/3
Cesium-137: 4.5 (2013/ 3/17) → ND (0.66) Below 1/6
Gross β: 12 (2013/12/23) → 11
Tritium: 8.6 (2013/ 6/26) → 3.2 Below 1/2

【Near south release outlet】

Cesium-134: ND (2013) → ND (0.76)
Cesium-137: 3.0 (2013/ 7/15) → ND (0.63) Below 1/4
Gross β: 15 (2013/12/23) → 15
Tritium: 1.9 (2013/11/25) → 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.

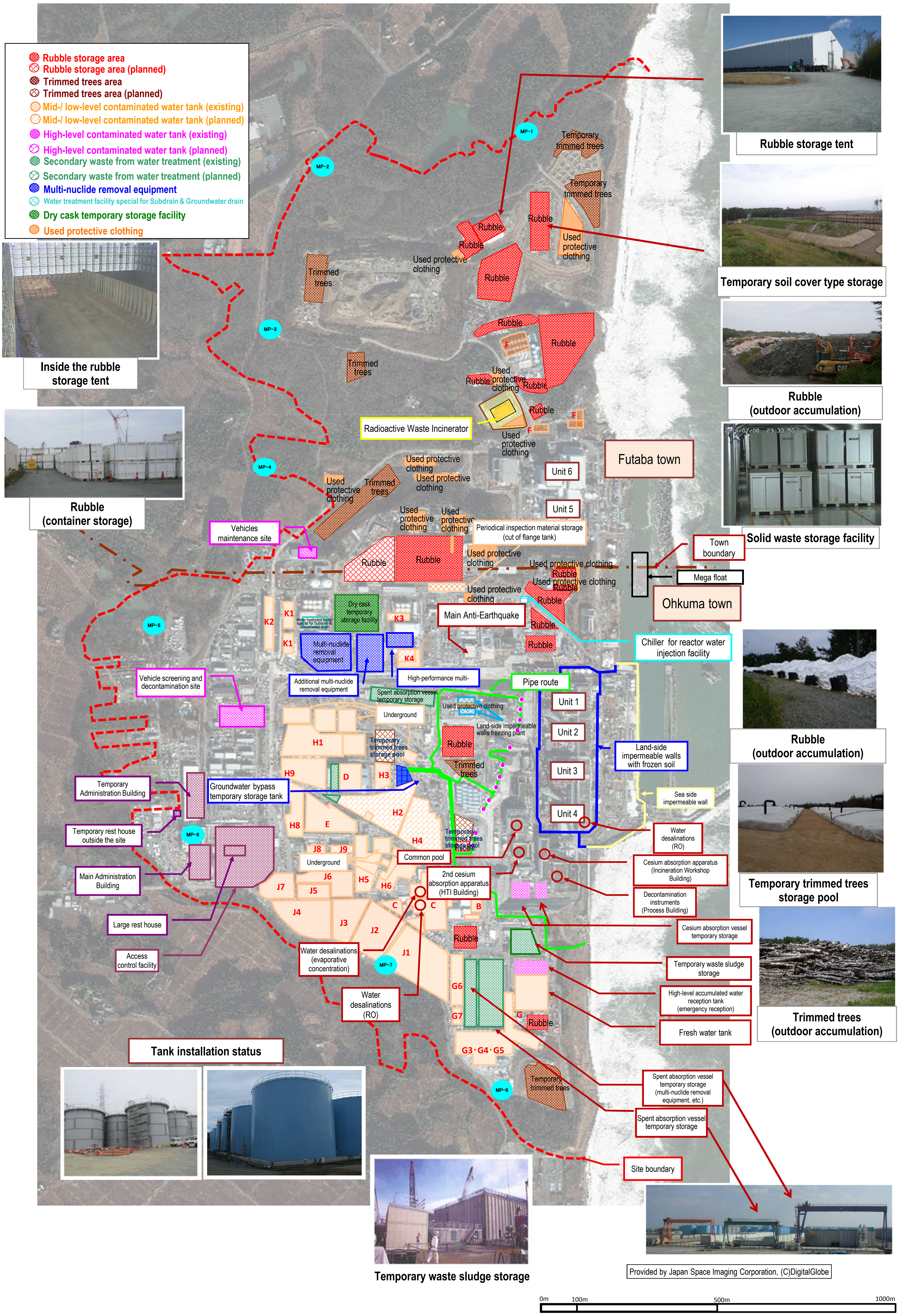
Note: Because safety of the sampling points was unassured due to the influence of Typhoon No. 10, samples were taken from approx. 330 m south of the Unit 1-4 release outlet.

Summary of TEPCO data as of October 26

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
October 27, 2016

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 will be dismantled to remove rubble from the top of the operating floor, with anti-scattering measures steadily implemented.

All panels were removed by October 5, 2015. Operation of sprinklers started on June 30, 2016 as a measure to prevent dust scattering. Suction of rubble was completed on August 2, 2016. Dismantling of wall panels started on September 13, 2016.

Dismantling of the building cover will proceed with radioactive materials thoroughly monitored.

<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.

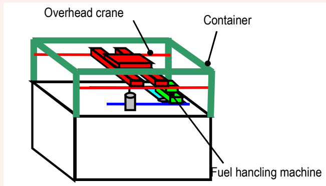


Image of Plan 1

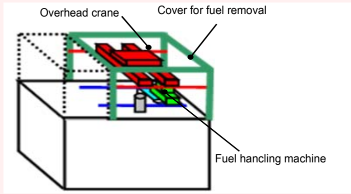


Image of Plan 2

Unit 3

To facilitate the installation of a cover for fuel removal, removal of large rubble from the spent fuel pool was completed in November 2015. Measures to reduce dose (decontamination and shielding) are underway. (from October 15, 2013)

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).

After implementing the dose-reduction measures, the cover for fuel removal and the fuel-handling machine will be installed.

Fuel gripper (mast)

Manipulator

Fuel-handling facility (in the factory)

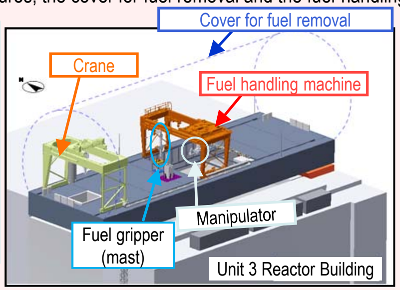


Image of entire fuel handling facility inside the cover

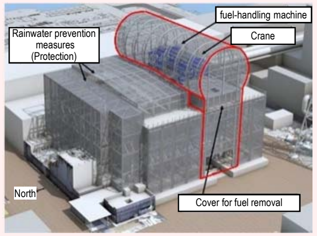


Image of the cover for fuel removal

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)

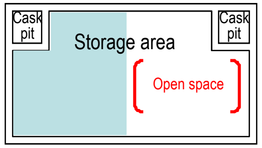
This marks the completion of fuel removal from the Unit 4 Reactor Building.

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

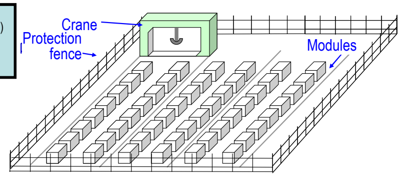


An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

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 (*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.

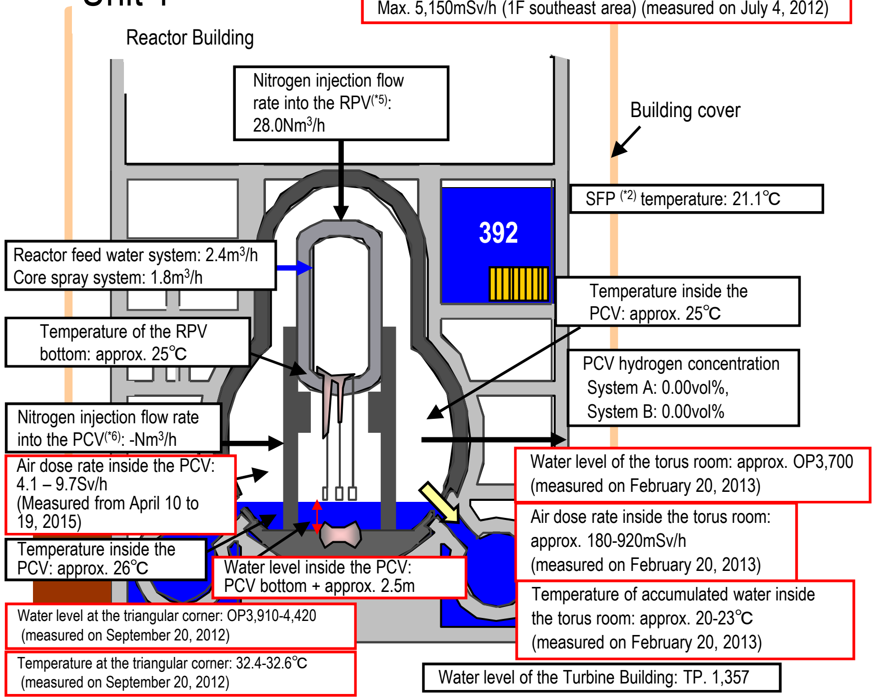
Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

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, October 26, 2016

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

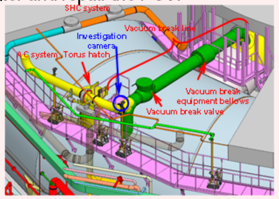


Image of the S/C upper part investigation

Status of equipment development toward investigating inside the PCV

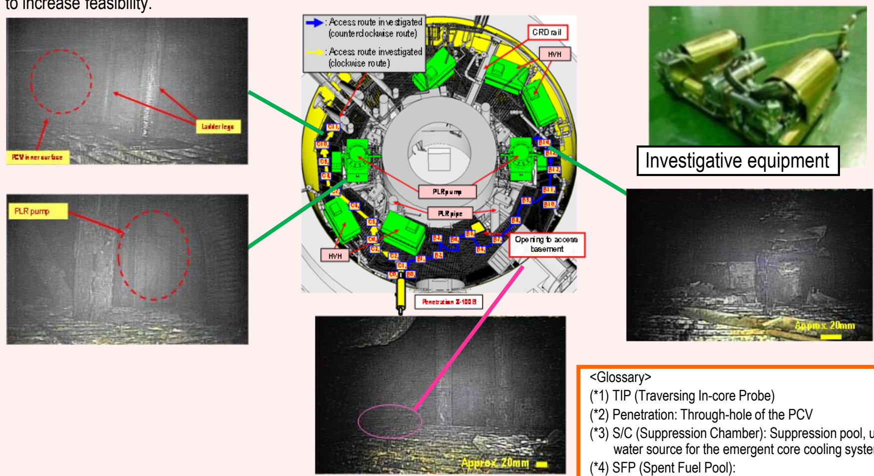
Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigation inside the PCV is scheduled.

[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.



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

October 27, 2016
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

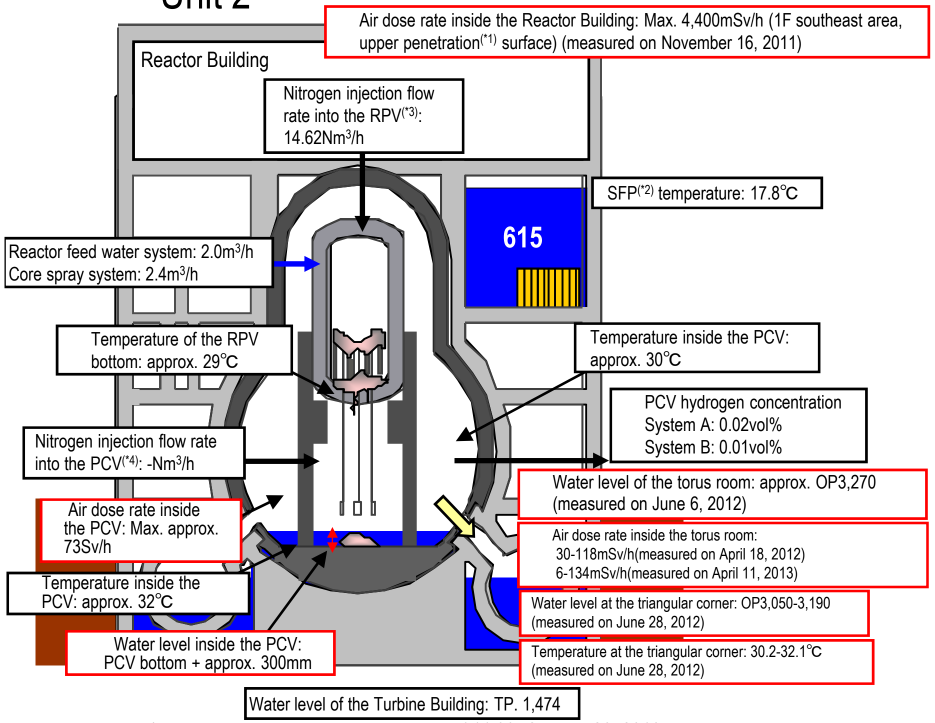
Immediate target	Identify the plant status and commence R&D and decontamination toward fuel debris removal

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

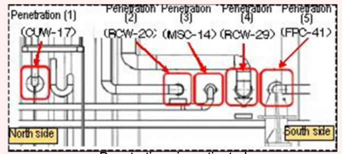


* Indices related to plant are values as of 11:00, October 26, 2016

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

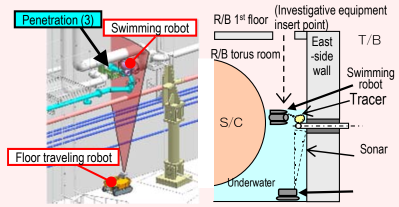


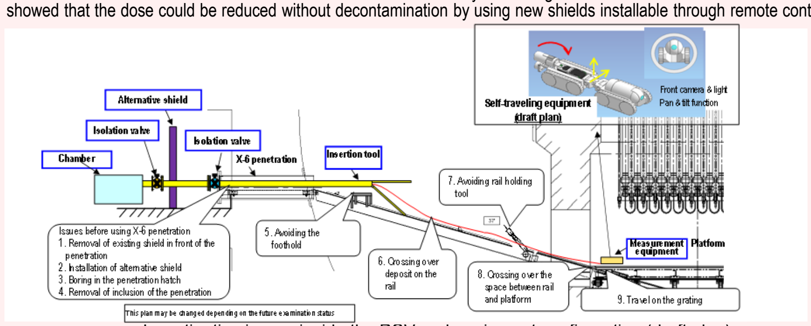
Image of the torus room east-side cross-sectional investigation

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.

[Status of investigative equipment development]
- Based on issues confirmed by the CRD rail status investigation conducted in August 2013, the investigation method and equipment design are currently being examined.
- As a portion of shielding blocks installed in front of X-6 penetration could not be moved, a removal method using small heavy machines was planned. The work for removing these blocks resumed on September 28, 2015 and removal of interfering blocks for future investigations was also completed on October 1, 2015.
- To start the investigation into the inside of PCV, dose on the floor surface in front of X-6 penetration needs to be reduced to approx. 100 mSv/h. However, the dose was not decreased to the target level through decontamination (removal of eluted materials, decontamination by steam, chemical decontamination, and surface grind).
- An examination on the extent to which the dose could be reduced by combining additional decontamination and shielding showed that the dose could be reduced without decontamination by using new shields installable through remote control.



Investigative issues inside the PCV and equipment configuration (draft plan)

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

October 27, 2016
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

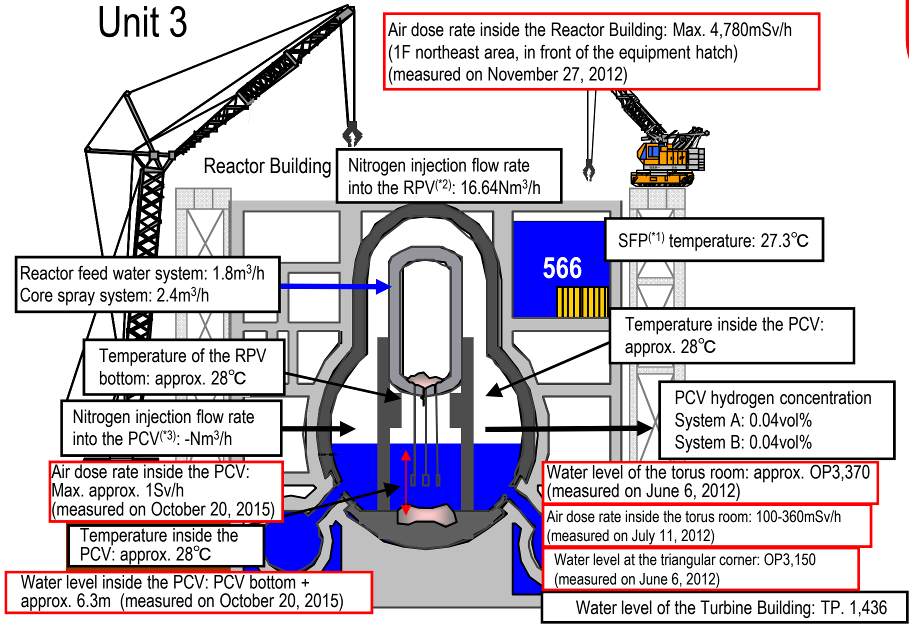
On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no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

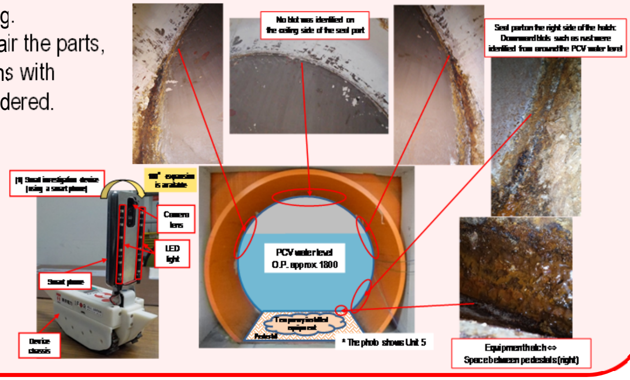


* Indices related to plant are values as of 11:00, October 26, 2016

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.

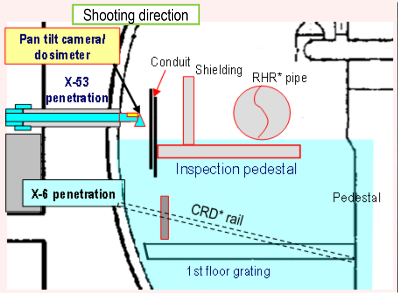


Investigation inside the PCV

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

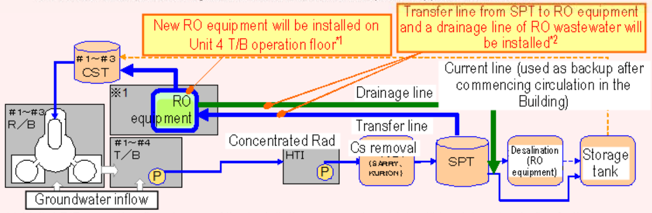
<Glossary>
(*1) SFP (Spent Fuel Pool)
(*2) RPV (Reactor Pressure Vessel)
(*3) PCV (Primary Containment Vessel)
(*4) Penetration: Through-hole of the PCV

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

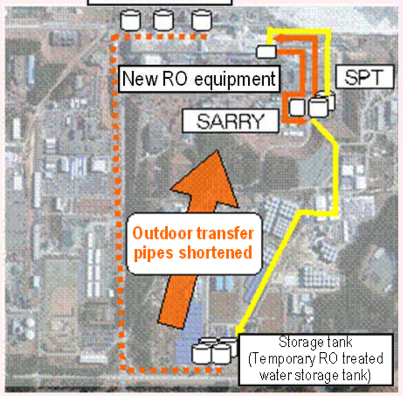
Immediate target	Stably continue reactor cooling and accumulated water treatment, and improve reliability

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.

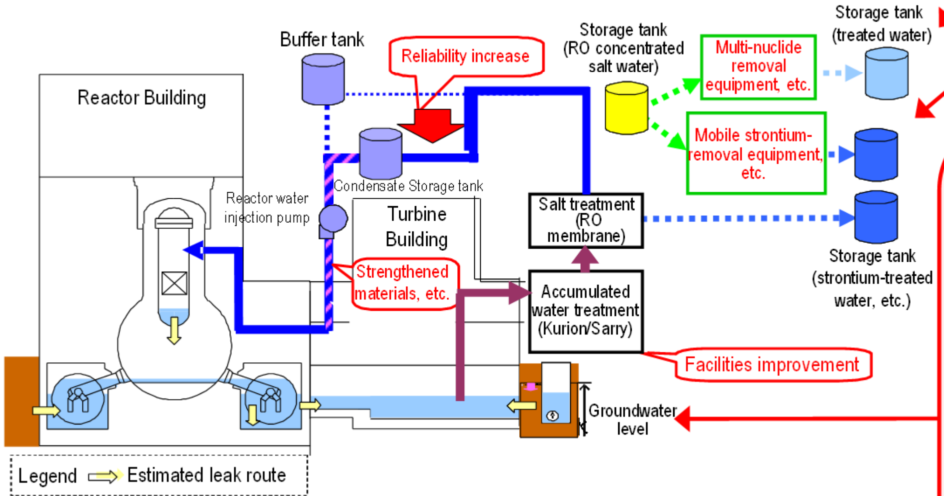
Start of dismantling in H1 east area

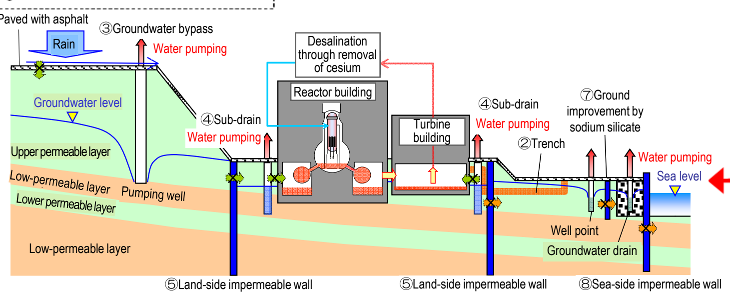
After dismantling in H1 east area

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.

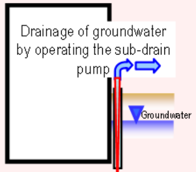
The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.





Land-side impermeable wall

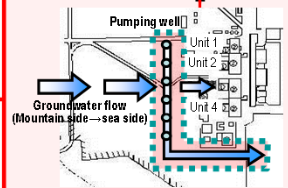
Preventing groundwater from flowing into the Reactor Buildings



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.

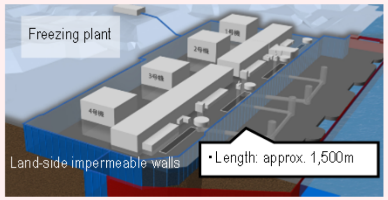
The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets.

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 R/B



To prevent the inflow of groundwater into the Reactor 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.

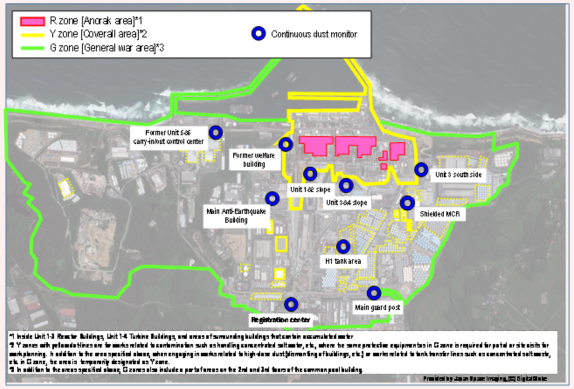
Progress toward decommissioning: Work to improve the environment within the site

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

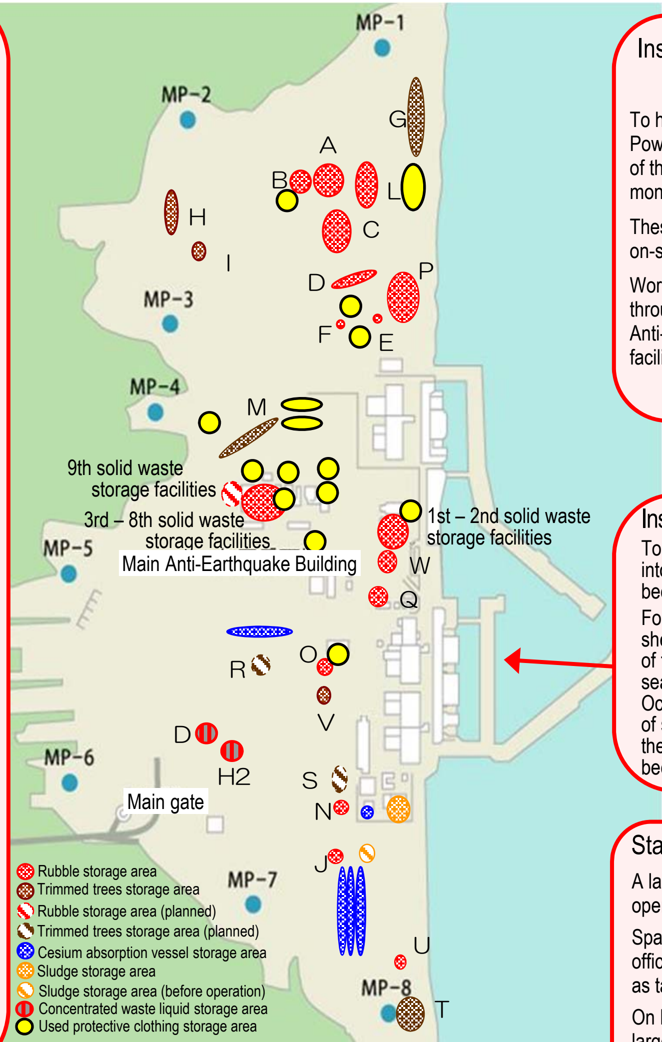
Based on the progress of measures to reduce environmental dosage on site, the site is categorized into two zones: highly contaminated area around Unit 1-4 buildings, etc. and other areas to optimize protective equipment according to each category aiming at improving safety and productivity by reducing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