Summary of Decommissioning and Contaminated Water Management

May 26, 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

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 PCV/ examination of 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 road map (June 2015). The method for the first unit will be confirmed in the first half of FY2018.

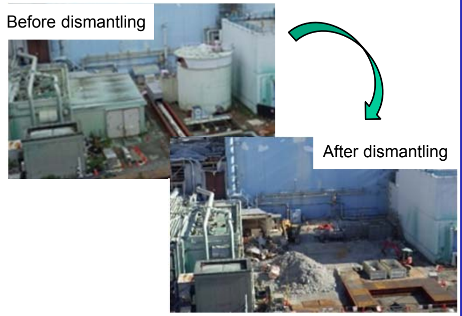
Dismantling Facilities

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

Toward fuel removal from pool

Toward fuel removal from Unit 2 SFP, preparation around the building is underway.

Dismantling of hindrance buildings around the Reactor Building has been underway since September 2015 to clear a work area within which to install large heavy-duty machines, etc.



(Preparation around the Unit 2 Reactor Building)

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

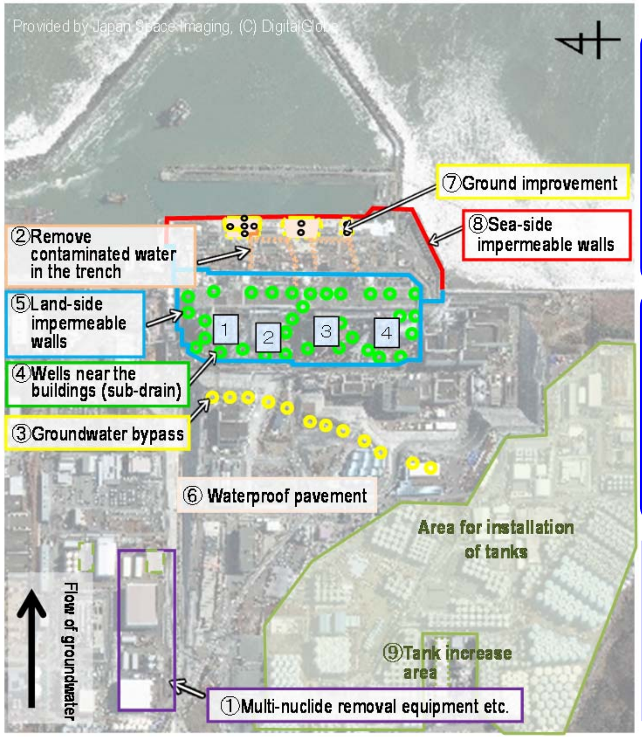
⑥ Waterproof pavement

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.
- On-site tests have been conducted since August 2013. Construction work commenced in June 2014.
- Construction on the mountain side was completed in September 2015.
- Construction on the sea side will be completed in February 2016.
- Freezing started from March 2016.

(Adherence of ice to frozen pipes)

Sea-side impermeable walls

- Impermeable walls are being installed on the sea side of Units 1-4, to prevent the flow of contaminated groundwater 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 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 have been maintained within the range of approx. 15-35°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 April 2016, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.00068 mSv/year at the site boundary.
The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

Status of dismantling of the Unit 1 Reactor Building cover

To facilitate the rubble removal on the top floor of Unit 1 Reactor Building, a pole camera was inserted from the southeast side of the building to investigate the status around the spent fuel pool (SFP).

The investigation confirmed that though the fuel-handling machine (FHM) and overhead crane on the SFP were distorted, they would not have an immediate influence on the SFP.

For future rubble removal, methods to protect the SFP will be considered.

Works to suck up small rubble on the fallen roof will start from May 30 to reduce the risk of dust dispersion.

<Investigation of rubble on the Reactor Building top floor (southeast part of FHM)>

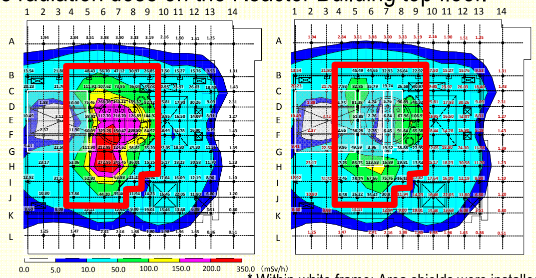
Radiation dose after installing shields on the Unit 3 R/B top floor

To facilitate the installation of a cover for spent fuel removal at Unit 3, decontamination and installation of shields are underway to reduce the radiation dose on the Reactor Building top floor.

The measurement of radiation dose after installing shields on the floor (shield plug) covering the reactor confirmed the decrease to 1/100 or lower.

The shield installation also reduced the dose above the ground within a distance of several hundred meters from Unit 3.

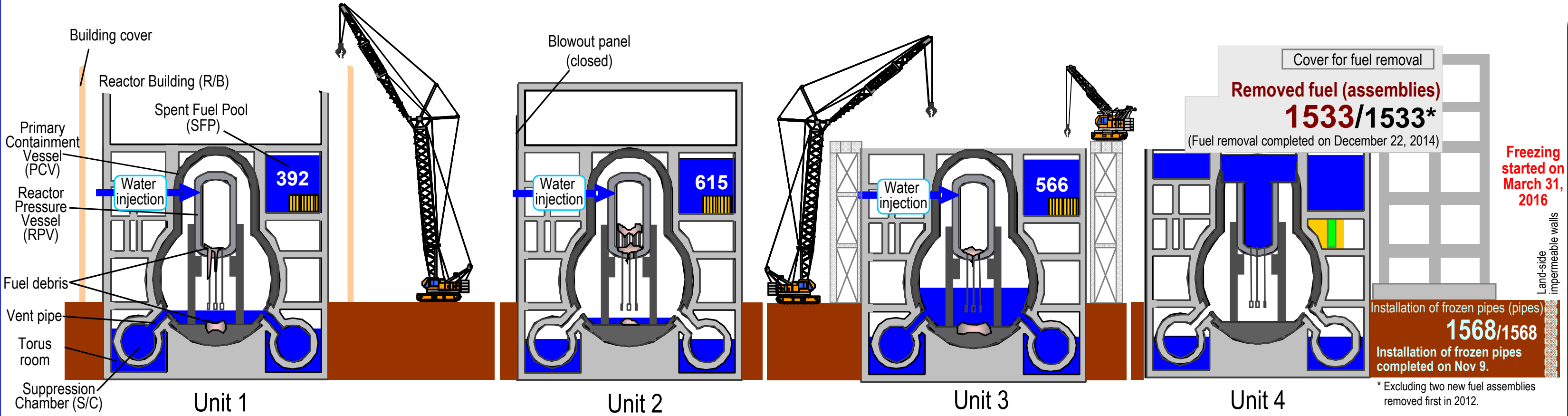
Efforts to reduce the radiation exposure dose will continue through measures such as installing shields on the Reactor Building top floor.



(Before installing shields)

* Within white frame: Area shields were installed
(After installing shields)

<Radiation dose before and after installing shields>

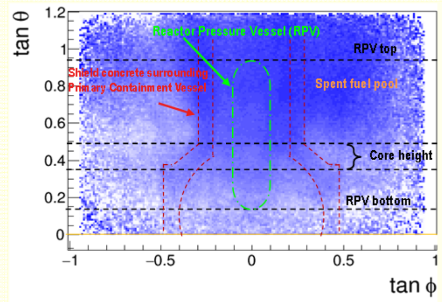


Investigation of fuel debris inside the Unit 2 reactor through measurement using muons

To capture the location of fuel debris inside the Unit 2 reactor, measurement using muons Note (a kind of elemental particle) started on March 22.

Data has been steadily collected and accumulated for about two months, from which shadows of the PCV and the SFP were identified.

Measurement will be continued to evaluate the existence of fuel debris inside the reactor.



<Measurement results of muon transmission rate (interim report)>

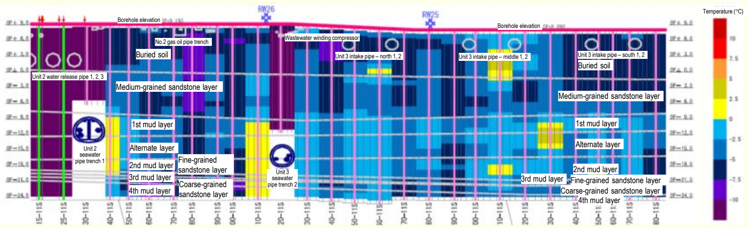
Note: The same muon transmission method as used for Unit 1

Status of the land-side impermeable walls

For the land-side impermeable walls to suppress the increase of contaminated water, freezing started from March 31 on the sea-side and part of the land-side. The underground temperature in approx. 90% of the freezing scope decreased to 0°C or lower.

Difference in underground water levels was gradually identified between inside and outside the impermeable walls.

The progress in freezing will continue to be monitored and measures implemented to the required points.

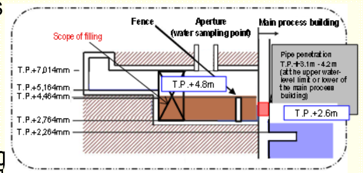


<Example of underground temperature status (Unit 3 Turbine Building east side)>

Status of measures for communication ducts with the waste treatment building

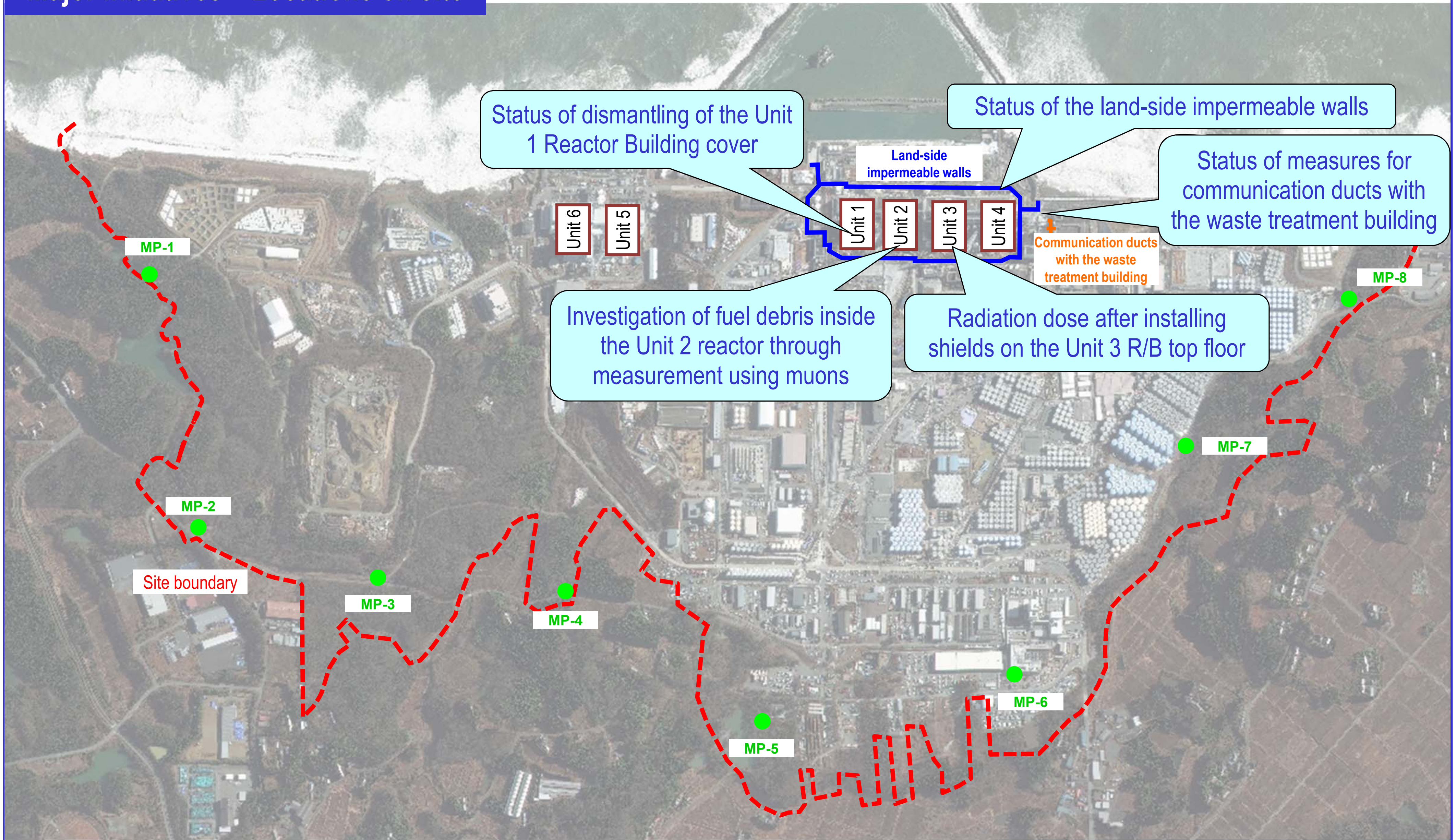
The density of radioactive materials had increased in the accumulated water in the communication ducts with the waste treatment building, located on the north side of the main process building. Filling in the ducts and transfer of accumulated water started from May 10 and will be completed within June.

After the filling and water transfer, monitoring of groundwater inflow will be continued.



<Sectional view of communication ducts with the waste treatment building>

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 0.635 – 2.640 μSv/h (April 27 – May 24, 2016).

Monitoring posts 1 to 8 are being replaced from December 4, 2015 because they reached the time for replacement. During this work, some data may not be obtained and mobile monitoring posts or other equivalent facilities will be installed as alternatives.

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 Feb .10 to Apr. 18, 2012.

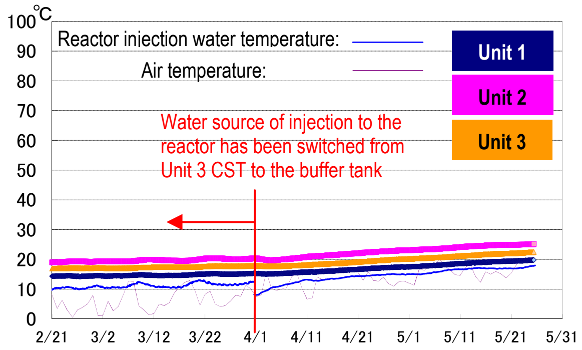
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

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.

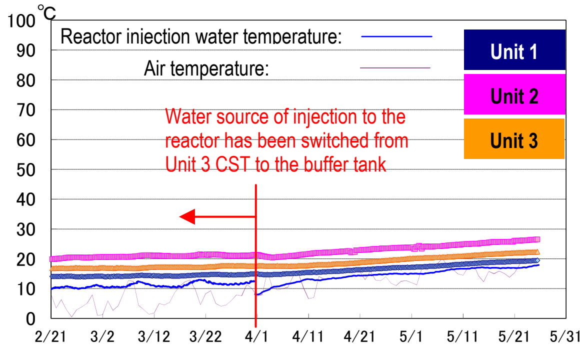
I. Confirmation of the reactor conditions

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. 15 to 35°C for the past month, though they vary depending on the unit and location of the thermometer.



RPV bottom temperatures (recent quarter)



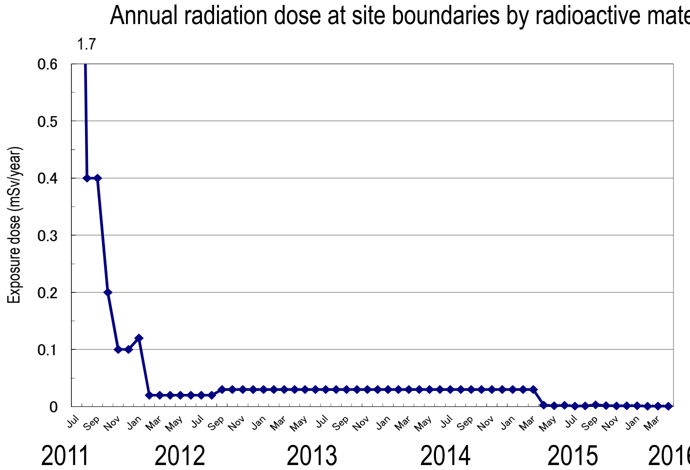
PCV gas phase temperatures (recent quarter)

* The trend graphs show part of the temperature data measured at multiple points. For air temperature, data of Namie (published by the Japan Meteorological Agency) is used. However, the data is missing from April 15 to 20.

2. Release of radioactive materials from the Reactor Buildings

As of April 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. 1.1×10^{-11} Bq/cm^3 for Cs-134 and 5.3×10^{-11} Bq/cm^3 for Cs-137 respectively. The radiation exposure dose due to the release of radioactive materials was less than 0.00068 mSv/year at the site 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 0.635 – 2.640 μSv/h (April 27 – May 24, 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

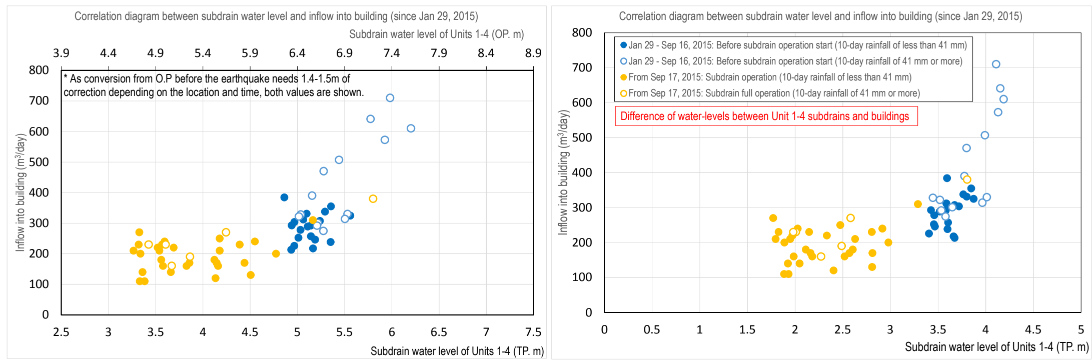
To tackle the increase in accumulated water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➢ 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. As of May 24, 2016, 189,463 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.
- For pumping well Nos. 4 and 5, pumping of groundwater was suspended for cleaning (No. 4: from May 9; No. 5: from May 19).

➢ Status of water-treatment facilities, including subdrains

- 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. As of May 24, 2016, a total of 117,163 m³ had been drained after TEPCO and a third-party organization had confirmed that the quality of this purified groundwater met operational targets.
- Due to the level of the groundwater drain pond rising since the closure of the sea-side impermeable walls, pumping started on November 5, 2015. As of May 24, 2016, a total of approx. 53,700 m³ had been pumped up. Approx. 130 m³/day is being transferred from the groundwater drain to the Turbine Buildings (average for the period April 21 – May 18, 2016).
- The effect of ground water inflow control by subdrains is evaluated by correlating both 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 effect of the inflow into buildings will be reviewed as necessary by accumulating data.
- Inflow into buildings declined to approx. 100 - 200 m³/day during times when the subdrain water level decreased to approx. T.P. 3.5 m or when the difference with the water levels in buildings decreased to approx. 2 m after the subdrains went into operation.



As of May 19, 2016

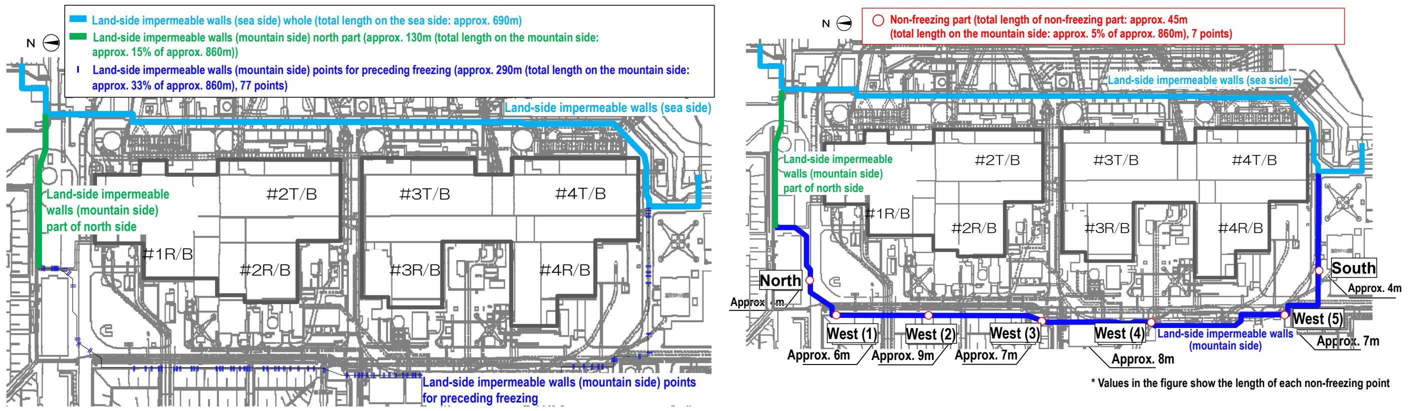
Figure 1: Evaluation of inflow into buildings after the subdrains went into operation

➢ Construction status of the land-side impermeable walls

- Regarding the installation of land-side impermeable walls surrounding Units 1-4 (a subsidy project of the Ministry of Economy, Trade and Industry), preparation for freezing was completed on February 9, 2016.
- For the scope of Stage 1: (Phase 1), freezing started from March 31.
- The underground temperature has decreased to 0°C or lower in approx. 90% of the freezing scope.
- Difference in underground water levels was identified between inside and outside of the impermeable walls except for part of the freezing scope.
- After starting the freezing operation, the water level of the Unit 1seawater pipe trench had been increased by inflow of underground water due to an unconfirmed effect, and water pumping was started from April 30.
  - ✓ Stage 1: (Phase 1) "Whole sea side," "part of the north side" and "preceding frozen parts of the mountain side (parts with difficulty in freezing due to significant intervals between frozen pipes, etc.)" will be frozen simultaneously.

(Phase 2) The remaining parts on the mountain side will be frozen except the "unfrozen parts" of Stage 1 when the effect of sea-side impermeable walls begins to emerge.

- ✓ Stage 2: The stage between Stages 1 and 3.
- ✓ Stage 3: The stage of complete closure.

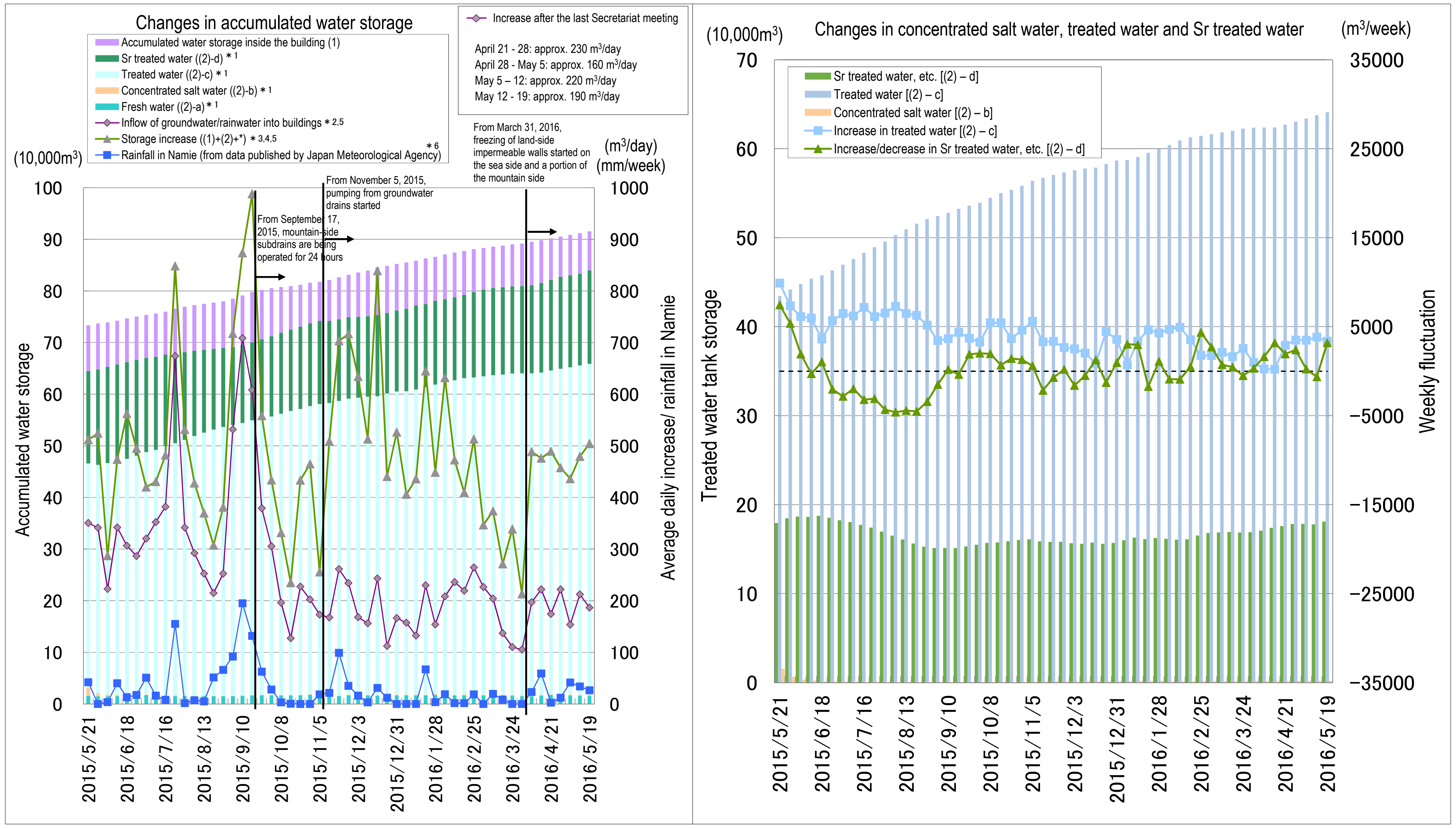


Stage 1 (Phase 1) Stage 1 (Phase 2)

Figure 2: Scope of freezing of land-side impermeable walls

➢ Operation of multi-nuclide removal equipment

- Regarding 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 May 19, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 284,000, 261,000 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).
- For the additional multi-nuclide removal equipment System A, facility inspections have been underway (System A: December 1, 2015 – May 12, 2016).
- To reduce the risks of strontium-treated water, treatment by 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). As of April 21, approx. 201,000 m³ had been treated.



As of May 19, 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: Values calculated including the calibration effect of the building water-level gauge
(March 10-17, 2016: Main Process Building, March 17-24, 2016: High-Temperature Incinerator Building (HTI))

*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 the cesium absorption apparatus (KURION) (from January 6, 2015) and the secondary cesium absorption apparatus (SARRY) (from December 26, 2014) have been underway. As of May 19, approx. 237,000 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 May 23, 2016, a total of 55,580 m³).

➢ Status of measures for communication ducts with the waste treatment building

- The density of radioactive materials has increased in the accumulated water in the communication ducts with the waste treatment building compared with FY2014. As no continuous inflow into the ducts was identified, filling in the ducts and transfer of accumulated water started from May 10 and 11 respectively to remove accumulated water (scheduled for completion in June).

➢ Treatment of accumulated water in the Unit 1 Turbine Building

- Measures, including a reduction in the amount of accumulated water in the building and the radioactive material density in the accumulated water, have been implemented; aiming to complete the treatment of accumulated water in the building by 2020.
- The Unit 1 Turbine Building was disconnected from the circulation water-injection line in March 2016. To proceed further treatment of accumulated water until it declines to the lowest floor surface of the building (completion scheduled for March 2017), installation of an additional transfer facility to reduce the water level is being considered, as well as reducing the dust-scattering risk emerging from the exposure of the building and equipment due to the decreased water level.

➢ Status of inspection of the reverse cleaning pits

- Water levels have been measured monthly for the reverse cleaning pits installed on the east side of Unit 1-4 Turbine Buildings. The measurement identified trend of decline in water levels have increased since the monthly inspection in April. The supposed cause was the increased space between the inside and outside of the pit due to unconfirmed changes in the environment around the pit. A roof was installed over the Unit 1 reverse cleaning pit, in which the cesium density is relatively higher, to suppress rainwater inflow. At present, no change has been identified in the cesium density in subdrains etc. Monitoring and investigations will be continued.

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, removal of the roof panels of the building cover started. By October 5, 2015, all six roof panels were removed. The installation of a sprinkler system has been underway (from February 4). Works to suck up small rubble will be started from June. The dismantlement of building cover is continued with steadily implementation of anti-scattering measures, on the basis of safety first.
- To facilitate the formulation of a rubble-removal plan from the Reactor Building operating floor, an investigation using actual machines was conducted to examine the applicability of the investigative equipment prepared for the investigation into the conditions of rubble under the fallen roof. (precedent investigation: March 28 - April 7). Based on the positive results of the precedent investigation, a future investigation plan into rubble under the fallen roof will be formulated, and according to the plan, investigations will continue based on the progress of removing building-cover wall panels.
- To examine how best to protect the spent fuel pool (SFP), a pole camera was inserted from the southeast side of the building to investigate the status of the overhead crane and fuel-handling machine, etc. The investigation confirmed that they would not impact on the SFP and its cooling system (investigation on the southeast part of the operating floor: April 26-27). Investigations in the southwest part of the operating floor will follow as the removal of building-cover wall panels progresses.

➢ 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, dismantling of hindrance buildings around the Reactor Building has been underway since September 7, 2015 to clear a work area within which large heavy-duty machines, etc. will be installed.

➢ Main work to help remove spent fuel at Unit 3

- From April 12 to 22, shields were installed in the shield plug (Phase I). This installation decreased the radiation dose rate from 323 mSv/h to 3 mSv/h at the breast height of the shields. The radiation dose rate on the ground around Unit 3 was also decreased by about 10%.

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 accessibility to the PCV

➢ Capturing the location of fuel debris inside the Unit 2 reactor through measurement using muons

- To capture the location of fuel debris inside the Unit 2 reactor, measurement using by the muon transmission method, the effect of which was confirmed based on measurement results of Unit 1, started on March 22 using a new small device developed by the subsidy for decommissioning and contaminated water-treatment project "Development of Technology to Detect Fuel Debris inside the Reactor."
- Data has been steadily collected and accumulated for about two months, from which shadows of the PCV and SFP were identified. The measurement will continue and the accumulated data will be verified and summarized.

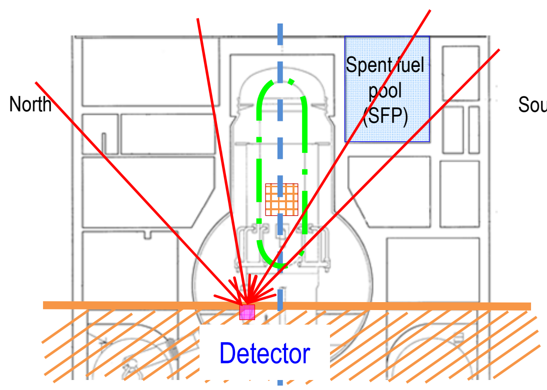


Figure 4: Image of measurement using muon

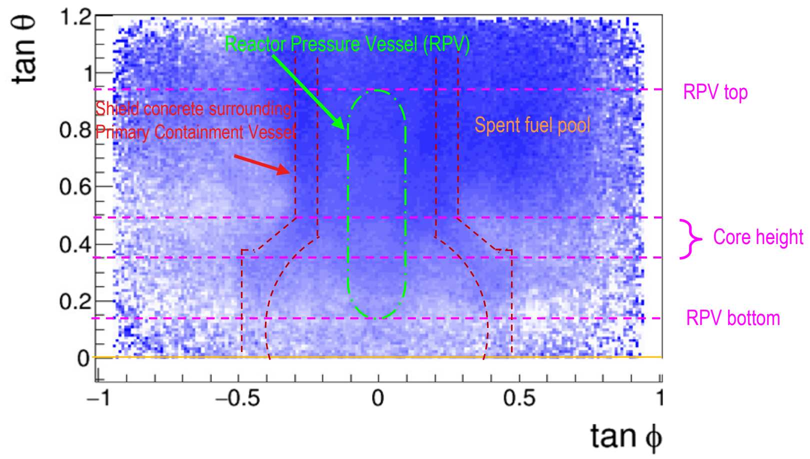
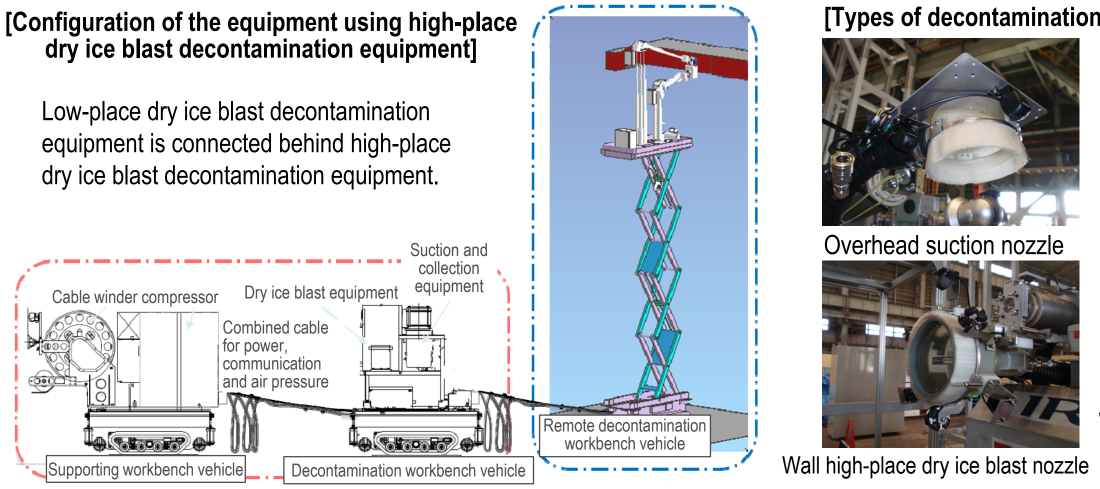


Figure 5: Measurement results of muon transmission rate (interim report)

➢ Performance verification results of high-place decontamination equipment on the Unit 3 Reactor Building 1st floor

- To formulate a decontamination plan of high places on the Unit 3 Reactor Building 1st floor, tests were conducted to verify the basic decontamination performance of high-place decontamination equipment (dry-ice blast decontamination equipment) (Decontamination period: January 15 – February 19, 2016). It was confirmed that a method to combine suction and dry-ice blast will be applied to achieve the target decontamination coefficient 5.



[Equipment specifications]
Dimensions: 2069mm (total length)
930mm (total width)
1961mm (total height)
Weight: approx. 1700 kg
Highest reach: approx. 8000 mm

Figure 6: Overview of high-place dry ice blast decontamination equipment

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 April, 2016, the total storage volume of concrete and metal rubble was approx. 185,200 m³ (+3,000 m³ compared to at the end of March, with an area-occupation rate of 67%). The total storage volume of trimmed trees was approx. 84,200 m³ (+1,400 m³ compared to at the end of March, with an area-occupation rate of 79%). The total storage volume of used protective clothing was approx. 69,000 m³ (-1,300 m³ compared to at the end of March, with an area-occupation rate of 93%). The increase in rubble was mainly attributable to construction related to facing and the installation of tanks. The increase in trimmed trees was mainly attributable to the acceptance of branches and leaves processed into tips. The decrease in used protective clothing was mainly attributable to incineration of the clothing.

➢ Management status of secondary waste from water treatment

- As of May 19, 2016, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%) and that of concentrated waste fluid was 9,269 m³ (area-occupation rate: 84%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 3,165 (area-occupation rate: 51%).

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 construction to minimize the circulation loop

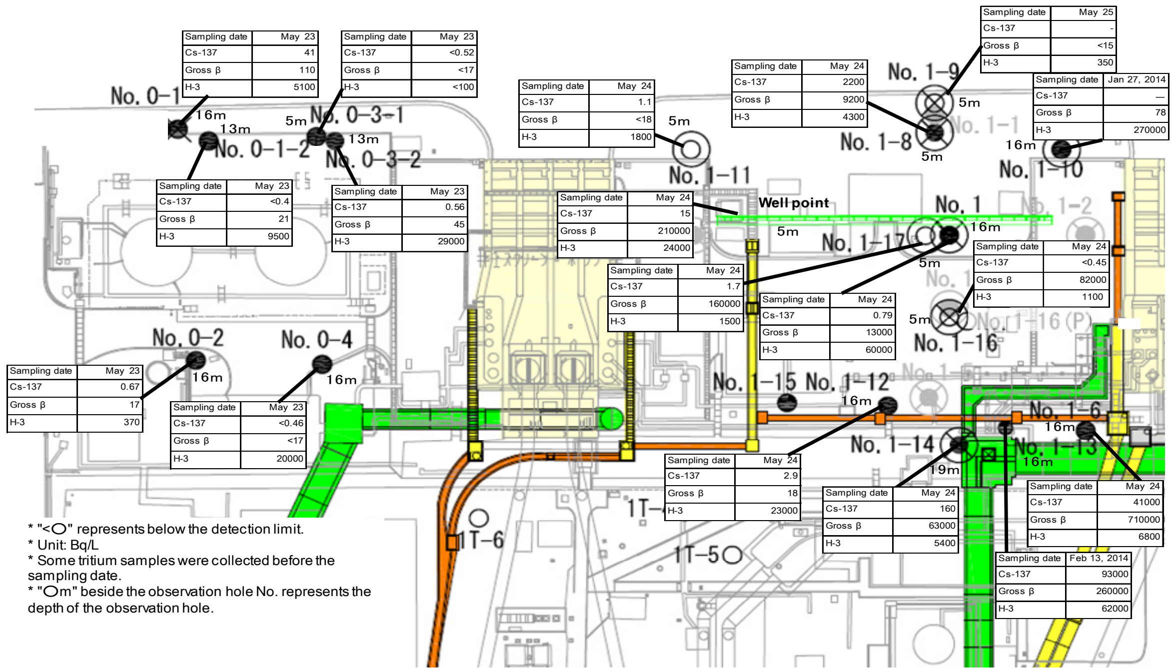
- With the aim of reducing the risk of leakage from the outdoor transfer pipe by shortening the loop, a reverse osmosis (RO) device will be installed in the Unit 4 Turbine Building within the circulation loop, comprising the transfer of contaminated water, water treatment and injection into Reactor Buildings, which will shorten the circulation loop (outdoor transfer pipe) from approx. 3 to 0.8 km (approx. 2.1 km including the accumulated-water transfer line).
- A function verification test identified a foreign substance (washer) mixed in a pump. A cause investigation confirmed a lack of consideration for foreign substances mixed during the on-site installation in an area around which rubble and unnecessary articles were not cleaned sufficiently. Measures will be implemented based on these results.
- During the function verification test, a pump was suspended due to low pressure at the pump inlet before reaching the rated flow rate. The supposed cause was the difference in shape between PE and steel pipes (smaller joint of fusion parts and inner diameter of elbow parts manufactured in the factory) and insufficient consideration of pressure damage to the pipe. Measures, including expansion of the pipe diameter, will be considered and implemented.

6. Reduction in radiation dose and mitigation of contamination

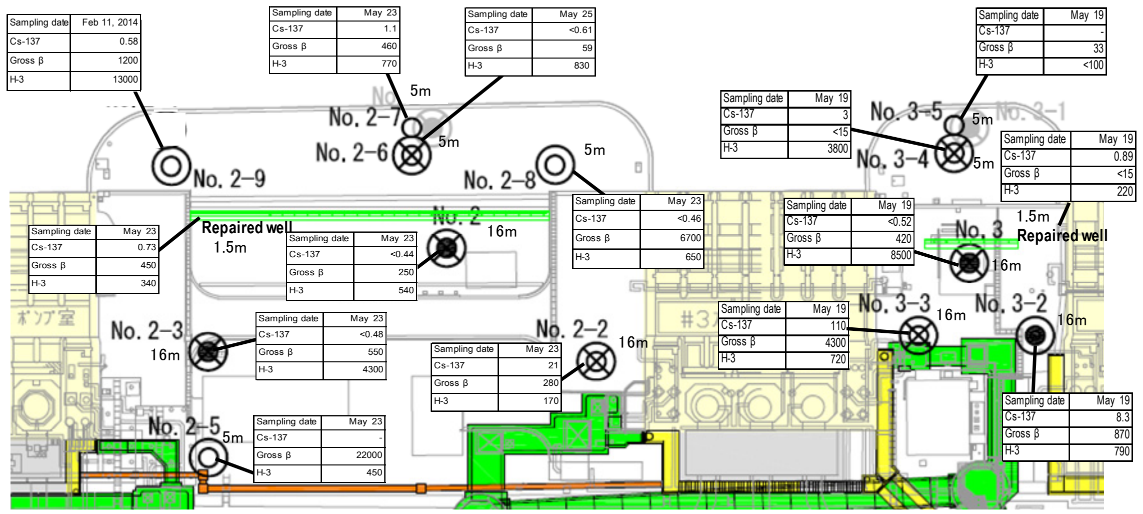
Reduction of effective dose at site boundaries and purification of seawater in the port to mitigate the impact of radiation on the external environment

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

- Regarding the 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. 0-1 has been increasing since December 2015 and currently stands at around 5,000 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 currently stands at around 300 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 fluctuated after having declined to 2,000 Bq/L since March 2016 and currently stands at around 2,000 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 150,000 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 20,000 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 density of gross β radioactive materials at groundwater Observation Hole No. 3-2 had been increasing to around 1,200 Bq/L since December 2015, it currently stands at around 900 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 have remained within the same range previously recorded.



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



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

Figure 7: Groundwater density on the Turbine Building east side

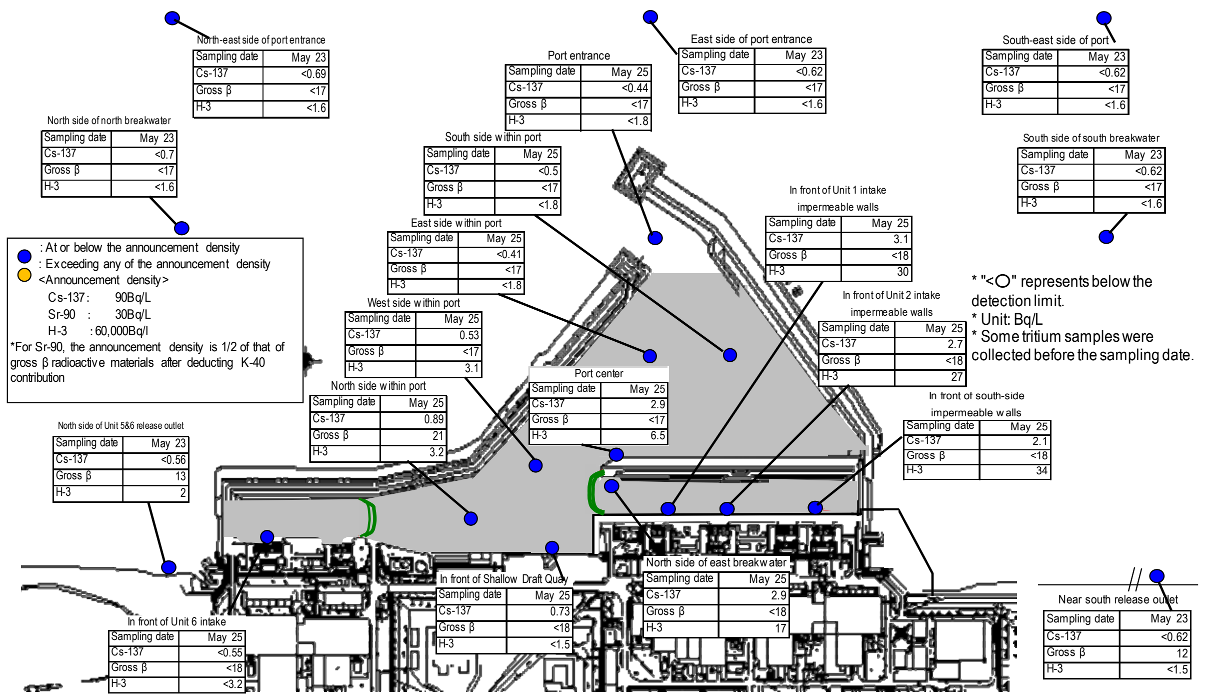


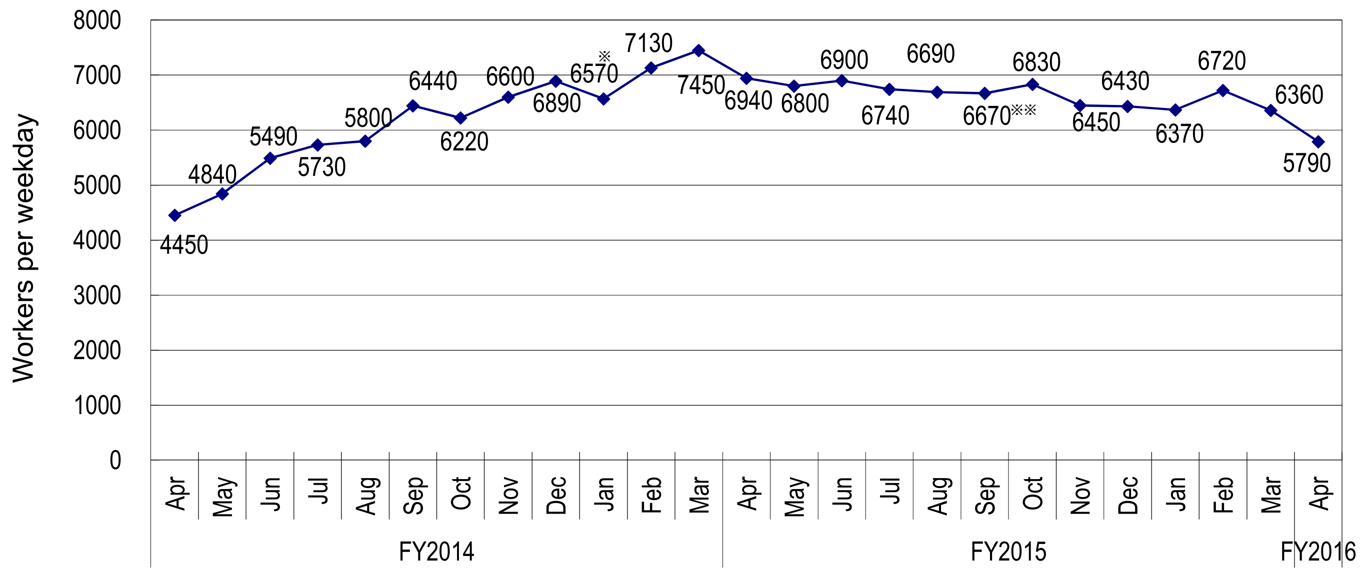
Figure 8: Seawater density around the port

7. Review 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 January to March 2016 was approx. 13,500 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 10,500). 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 June 2016 (approx. 6,130 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 9). Some works for which contractual procedures have yet to be completed were excluded from the estimate for June 2016.
- The total number of workers from Fukushima Prefecture has decreased. The local employment ratio (TEPCO and partner company workers) as of April 2016 remained at around 50%.
- 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 9: Changes in the average number of workers per weekday for each month since FY2013

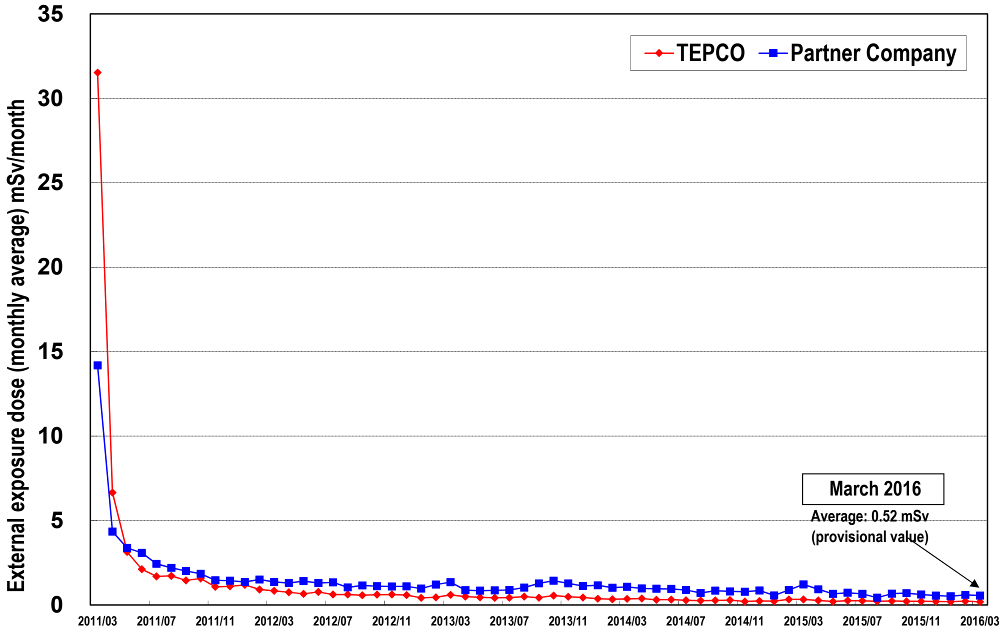


Figure 10: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

- Outbreak of influenza and norovirus infections (end of preventive measures against infection and expansion)
  - In response to the decline in influenza cases, measures to prevent infection and expansion were concluded at the end of April 2016. During this season (2015-2016), there were 372 cases of influenza infections and 15 cases of norovirus infections in total. The totals for the entire previous season (2014-2015) showed 353 cases of influenza infections and 10 cases of norovirus infections.

    Note: The above data is based on reports from TEPCO and partner companies, which include diagnoses at medical clinics outside the site. The subjects of this report were workers of partner companies and TEPCO in Fukushima Daiichi and Daini Nuclear Power Stations.
  - Compared to the previous season, the number of influenza cases increased by 19 and norovirus infections increased by 5.
  - One of the possible factors for the increased influenza cases includes the extension of measurement and reporting period by one month due to the delayed pandemic in this season.
  - Regarding norovirus, though infections occurred sporadically, the number of cases remained at a low level and no outbreak was confirmed. There was also no food poisoning. These results demonstrate the effective measures to prevent expansion.
  - Though station-wide measures were concluded, measures to prevent infection and expansion will be taken when infection cases are identified in the workplaces.

- Measures to prevent heat stroke
  - Continued from last fiscal year, measures to prevent heat stroke commenced from May to cope with the hottest season.
  - The measures are implemented with focus on the following items:

    [Enhancing heat acclimatization]
    - ○ When starting work, setting an acclimatization period for about seven days will be required to get acclimatized to the heat. The period usually begins with a shorter work time, and gradually extending it.

    [Checking the previous history of heat stroke and present health conditions]
    - ○ Worker's regular medical-checkup results will be confirmed before starting work to assign each worker to an appropriate job in consideration of the worker's previous diseases.
    - ○ Health conditions will be confirmed using a check sheet before starting and during work to make necessary changes to the work.

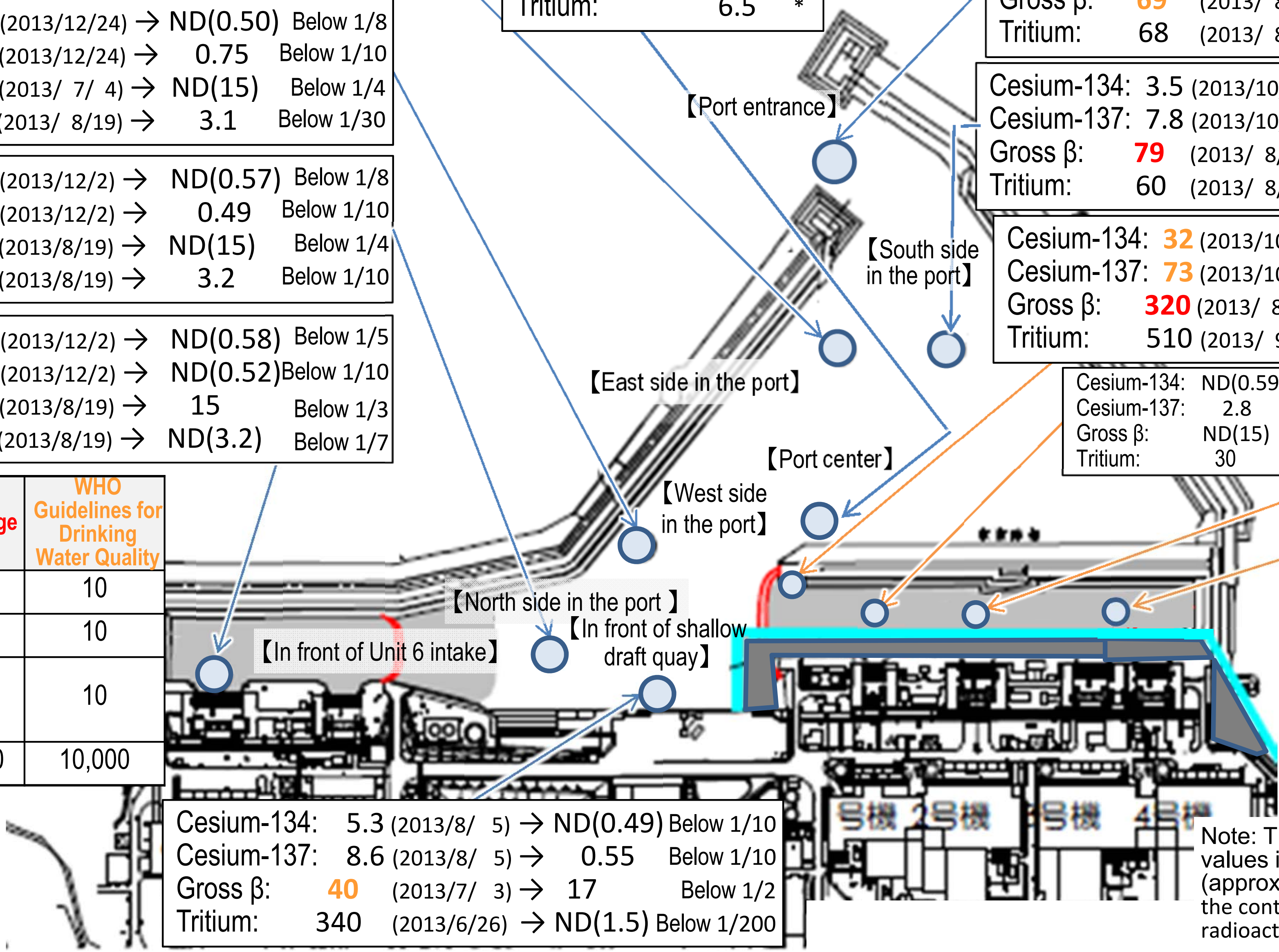
    [Early detection of workers with medical problems]
    - ○ Heat stroke managers will check the following physical conditions as symptoms of heat stroke according to the work status:
      - ✓ Sweating status (heavy sweating, etc.)
      - ✓ Feeling of exhaustion, vertigo, consciousness loss, etc. in addition to heart rate and body temperature
    - ○ Early diagnosis at the emergency room (ER) will be promoted.

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 May 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(0.51) Below 1/6
Cesium-137: 9.0 (2013/10/17) → ND(0.49) Below 1/10
Gross β: 74 (2013/ 8/19) → ND(15) Below 1/4
Tritium: 67 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.50) Below 1/8
Cesium-137: 10 (2013/12/24) → 0.75 Below 1/10
Gross β: 60 (2013/ 7/ 4) → ND(15) Below 1/4
Tritium: 59 (2013/ 8/19) → 3.1 Below 1/30

Cesium-134: 5.0 (2013/12/2) → ND(0.57) Below 1/8
Cesium-137: 8.4 (2013/12/2) → 0.49 Below 1/10
Gross β: 69 (2013/8/19) → ND(15) Below 1/4
Tritium: 52 (2013/8/19) → 3.2 Below 1/10

Cesium-134: 2.8 (2013/12/2) → ND(0.58) Below 1/5
Cesium-137: 5.8 (2013/12/2) → ND(0.52) Below 1/10
Gross β: 46 (2013/8/19) → 15 Below 1/3
Tritium: 24 (2013/8/19) → ND(3.2) Below 1/7

Cesium-134: ND(0.56)
Cesium-137: 3.4
Gross β: ND(15)
Tritium: 6.5 *

Cesium-134: 3.3 (2013/12/24) → ND(0.47) Below 1/7
Cesium-137: 7.3 (2013/10/11) → ND(0.54) Below 1/10
Gross β: 69 (2013/ 8/19) → 17 Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 3.5 (2013/10/17) → ND(0.56) Below 1/6
Cesium-137: 7.8 (2013/10/17) → 0.59 Below 1/10
Gross β: 79 (2013/ 8/19) → 15 Below 1/5
Tritium: 60 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 32 (2013/10/11) → 0.51 Below 1/60
Cesium-137: 73 (2013/10/11) → 2.7 Below 1/20
Gross β: 320 (2013/ 8/12) → ND(15) Below 1/20
Tritium: 510 (2013/ 9/ 2) → 34 Below 1/10

Cesium-134: ND(0.59)
Cesium-137: 2.8
Gross β: ND(15)
Tritium: 30 *

Cesium-134: ND(0.54)
Cesium-137: 2.8
Gross β: 17
Tritium: 27 *

Cesium-134: ND(0.61)
Cesium-137: 3.0
Gross β: ND(15)
Tritium: 17 *

Cesium-134: 5.3 (2013/8/ 5) → ND(0.49) Below 1/10
Cesium-137: 8.6 (2013/8/ 5) → 0.55 Below 1/10
Gross β: 40 (2013/7/ 3) → 17 Below 1/2
Tritium: 340 (2013/6/26) → ND(1.5) Below 1/200

	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 May 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 May 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 (0.71)	
Cesium-137:	ND (2013)	→ ND (0.69)	
Gross β:	ND (2013)	→ ND (17)	
Tritium:	ND (2013)	→ ND (1.6)	

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

Cesium-134:	ND (2013)	→ ND (0.72)	
Cesium-137:	1.6 (2013/10/18)	→ ND (0.62)	Below 1/2
Gross β:	ND (2013)	→ ND (17)	
Tritium:	6.4 (2013/10/18)	→ ND (1.6)	Below 1/4

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

Cesium-134:	ND (2013)	→ ND (0.77)	
Cesium-137:	ND (2013)	→ ND (0.62)	
Gross β:	ND (2013)	→ ND (17)	
Tritium:	ND (2013)	→ ND (1.6)	

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

Cesium-134:	ND (2013)	→ ND (0.66)	
Cesium-137:	ND (2013)	→ ND (0.70)	
Gross β:	ND (2013)	→ ND (17)	
Tritium:	4.7 (2013/ 8/18)	→ ND (1.6)	Below 1/2

【Port entrance】

Cesium-134:	3.3 (2013/12/24)	→ ND (0.47)	Below 1/7
Cesium-137:	7.3 (2013/10/11)	→ ND (0.54)	Below 1/10
Gross β:	69 (2013/ 8/19)	→ 17	Below 1/4
Tritium:	68 (2013/ 8/19)	→ ND (1.8)	Below 1/30

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

Cesium-134:	ND (2013)	→ ND (0.69)	
Cesium-137:	ND (2013)	→ ND (0.62)	
Gross β:	ND (2013)	→ ND (17)	
Tritium:	ND (2013)	→ ND (1.6)	

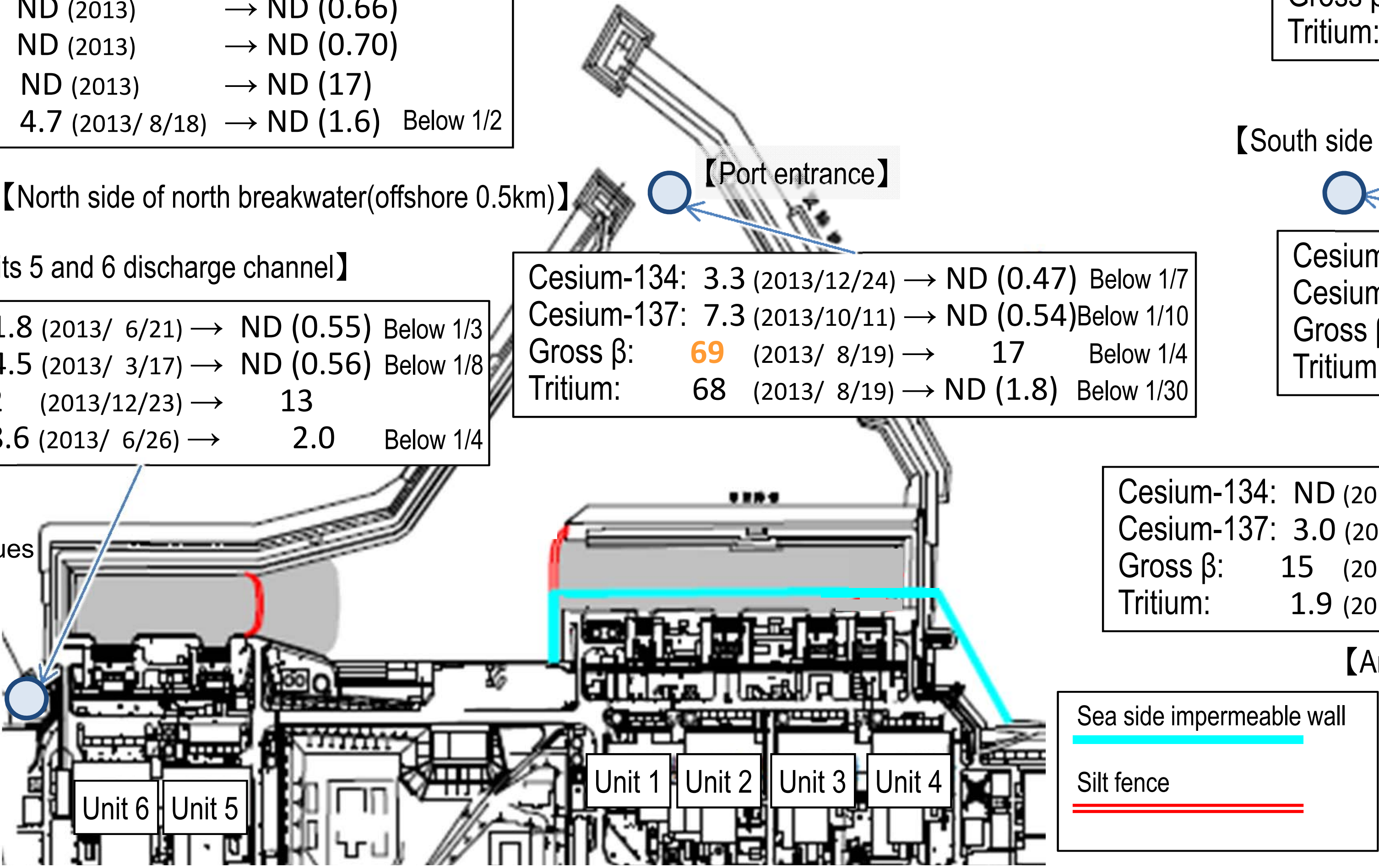
【North side of Units 5 and 6 discharge channel】

Cesium-134:	1.8 (2013/ 6/21)	→ ND (0.55)	Below 1/3
Cesium-137:	4.5 (2013/ 3/17)	→ ND (0.56)	Below 1/8
Gross β:	12 (2013/12/23)	→ 13	
Tritium:	8.6 (2013/ 6/26)	→ 2.0	Below 1/4

【Around south discharge channel】

Cesium-134:	ND (2013)	→ ND (0.57)	
Cesium-137:	3.0 (2013/ 7/15)	→ ND (0.62)	Below 1/4
Gross β:	15 (2013/12/23)	→ 12	
Tritium:	1.9 (2013/11/25)	→ ND (1.5)	

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

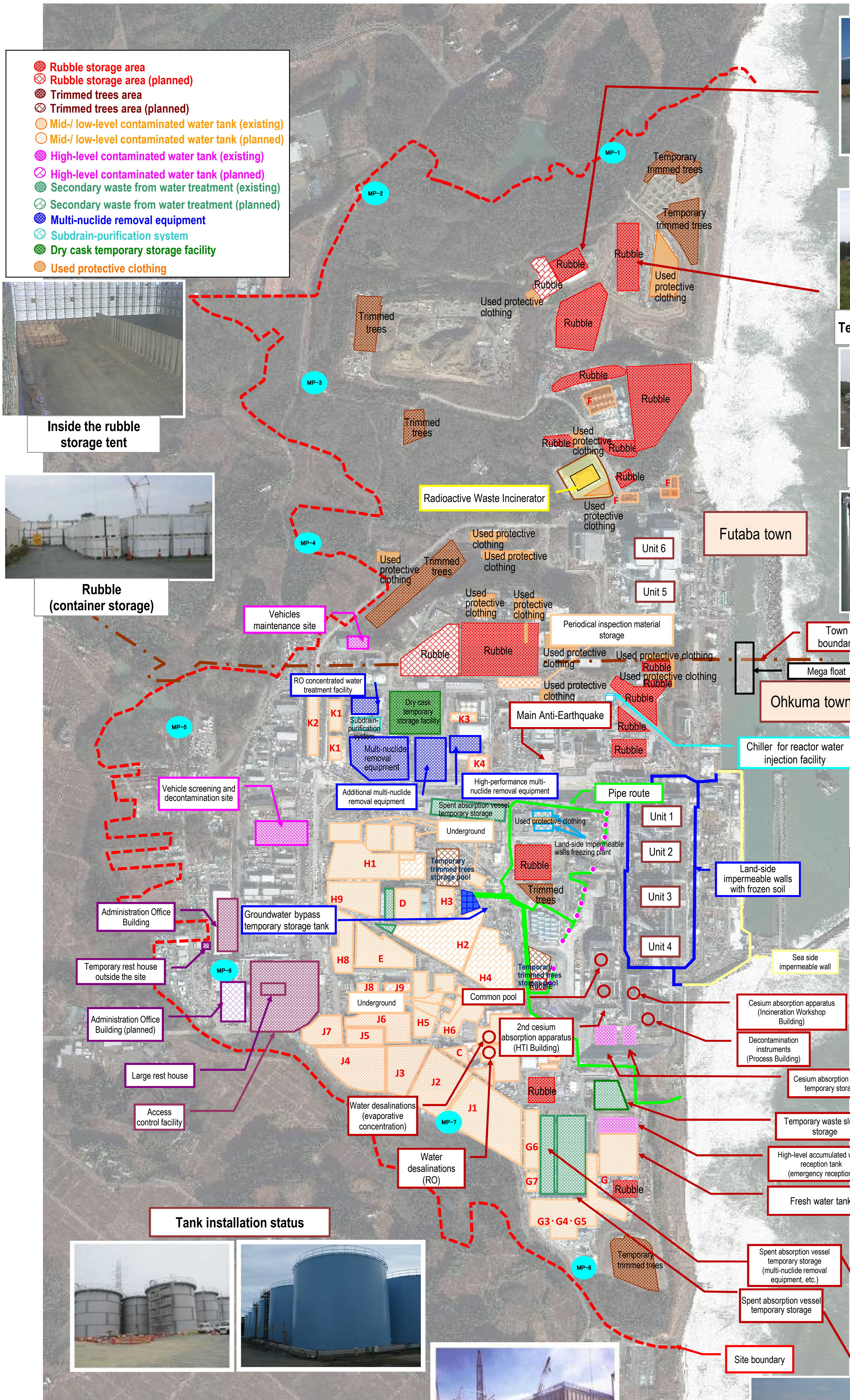


Summary of TEPCO data as of May 25

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
May 26, 2016

TEPCO Holdings Fukushima Daiichi Nuclear Power Station Site




Rubble storage tent


Temporary soil cover type storage


Rubble (outdoor accumulation)


Solid waste storage facility

Inside the rubble storage tent

Rubble (container storage)


Rubble (outdoor accumulation)


Temporary trimmed trees storage pool


Trimmed trees (outdoor accumulation)

Tank installation status


Temporary waste sludge storage

Provided by Japan Space Imaging Corporation, (C)DigitalGlobe

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

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

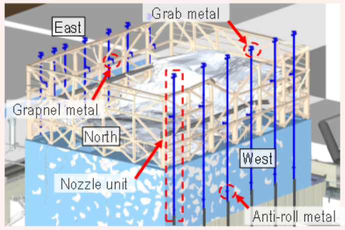
Unit 1

Regarding fuel removal from Unit 1 spent fuel pool, there is a plan to install a dedicated cover for fuel removal over the 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. Installation of sprinklers as measures to prevent dust scattering has been underway since February 4, 2016.

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



<Image of sprinkler system>

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.

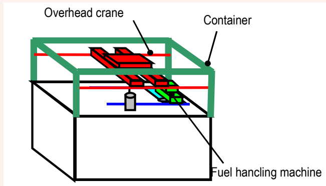


Image of Plan 1

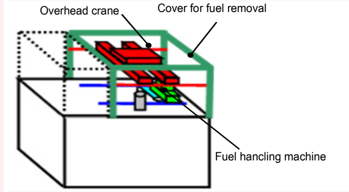


Image of Plan 2

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)

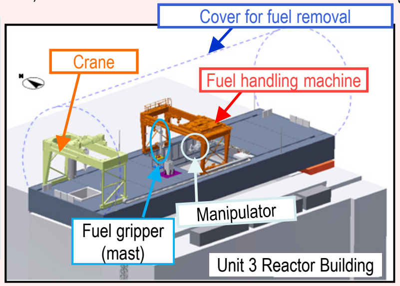


Image of entire fuel handling facility inside the cover

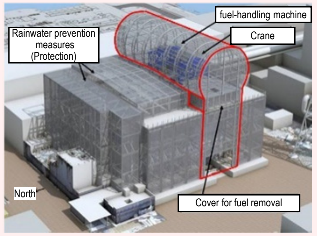


Image of the cover for fuel removal

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)

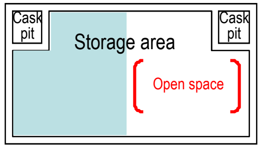
This marks the completion of fuel removal from the Unit 4 Reactor Building.

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

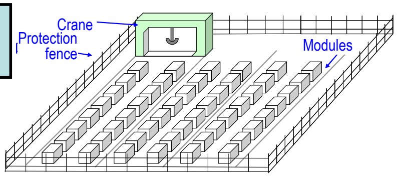


An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

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.

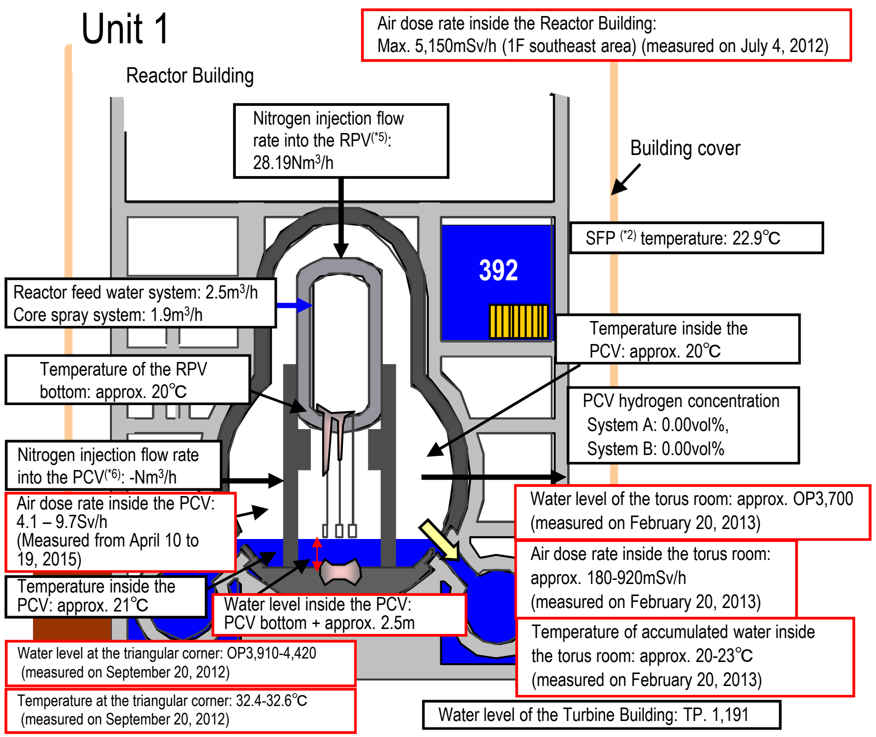
Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

May 26, 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

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.



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

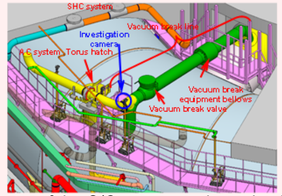


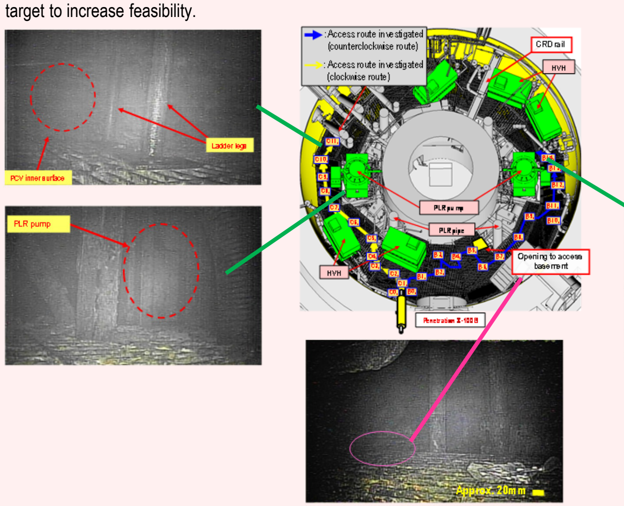
Image of the S/C upper part investigation

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)

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

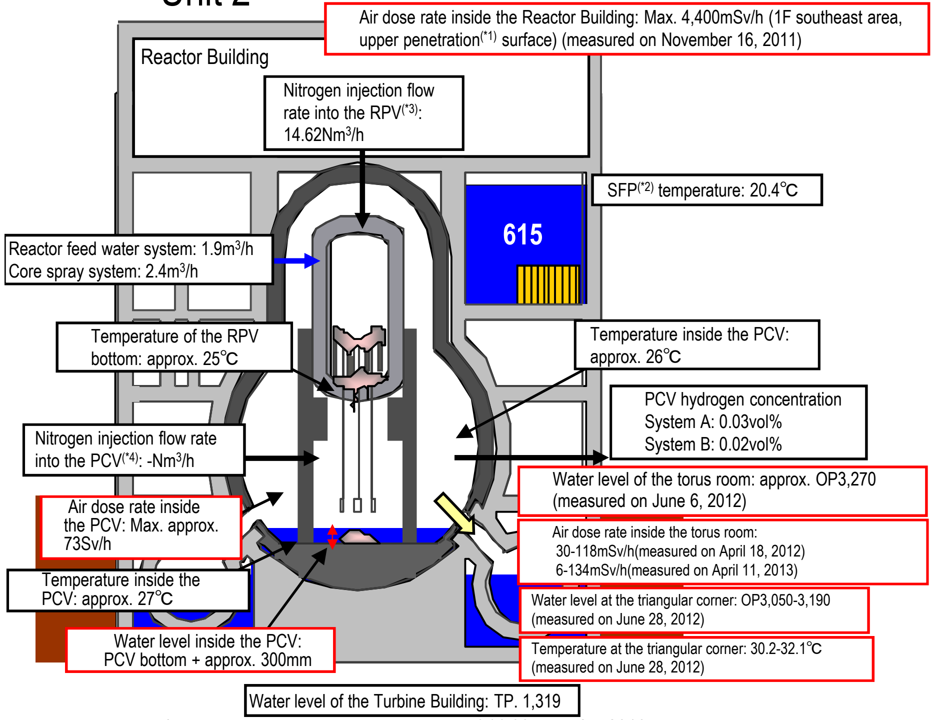
Immediate target	Identify the plant status and commence R&D and decontamination toward fuel debris removal

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

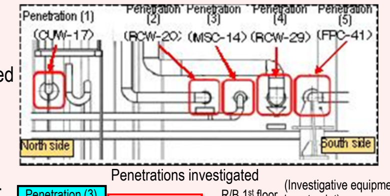


* Indices related to plant are values as of 11:00, May 25, 2016

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

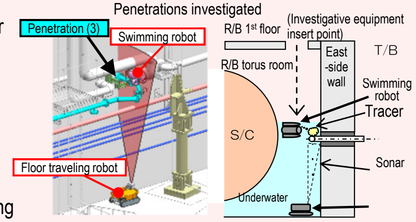


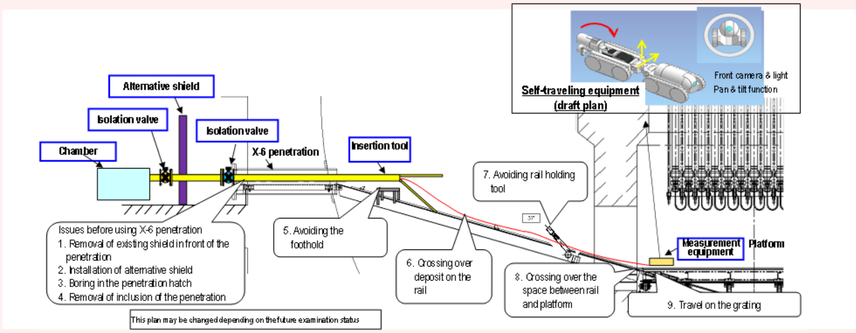
Image of the torus room east-side cross-sectional investigation

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. As the dose was not decreased to the target level through decontamination (removal of eluted materials, decontamination by steam, chemical decontamination, surface grind), dose reduction methods including anti-dust scattering measures will be re-examined. Investigations inside the PCV will be conducted according to the decontamination status.



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

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

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

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

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

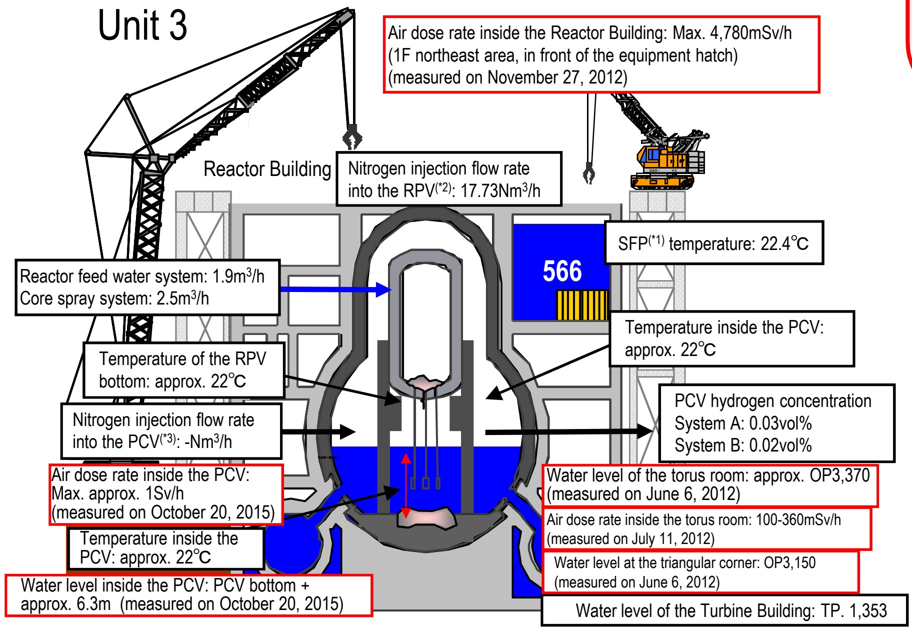
On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no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

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

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

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

Unit 3

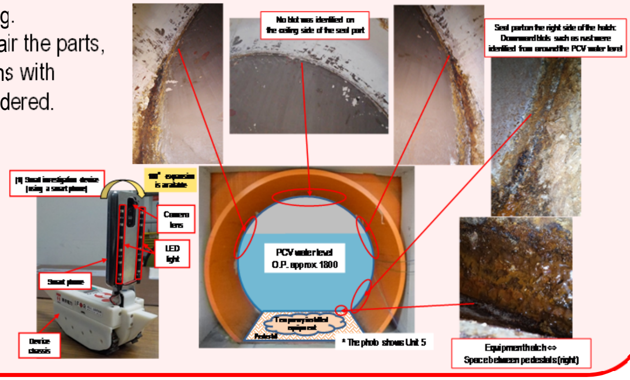


* Indices related to plant are values as of 11:00, May 25, 2016

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.



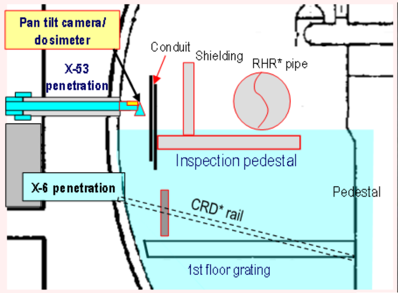
Investigation inside the PCV

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

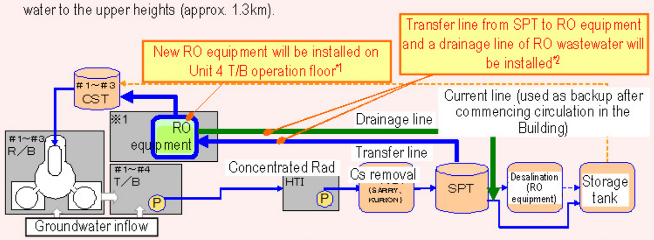
Progress toward decommissioning: Work related to circulation cooling and accumulated water treatment line

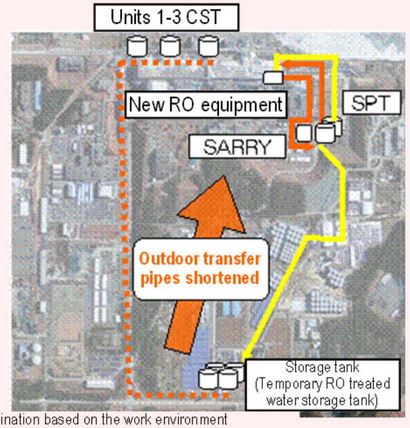
Immediate target	Stably continue reactor cooling and accumulated water treatment, and improve reliability

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, in addition to the shortened outdoor line, the reliability of the reactor water injection system was enhanced, e.g. by increasing the amount of water-source storage and enhancing durability.
- By newly installing RO equipment inside the Reactor Building, the reactor water injection loop (circulation loop) will be shortened from approx. 3km to approx. 0.8km*.

* 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).





*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

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.

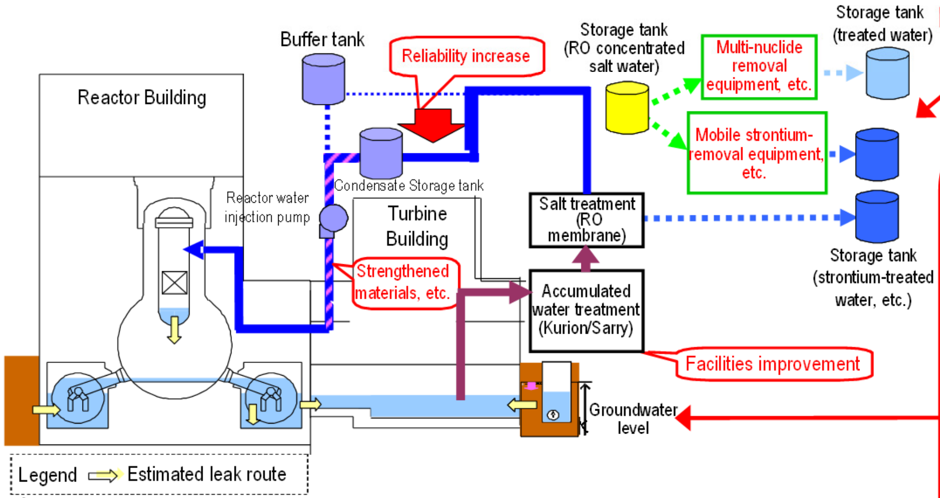

Start of dismantling in H1 east area

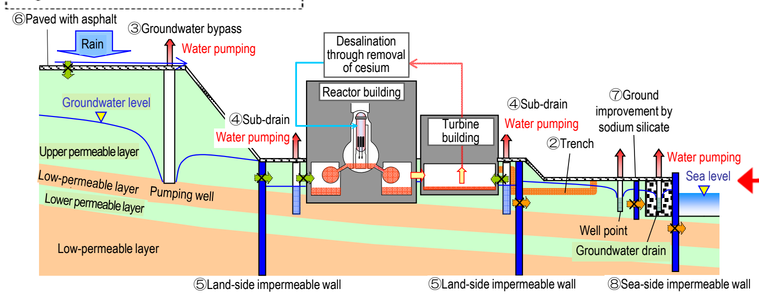

After dismantling in H1 east area

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.

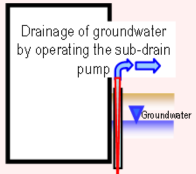
The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.

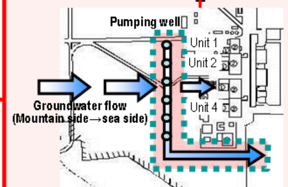




Land-side impermeable wall

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.

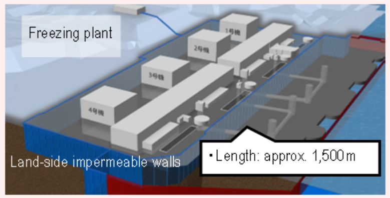
The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets.

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 in March 2016.

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

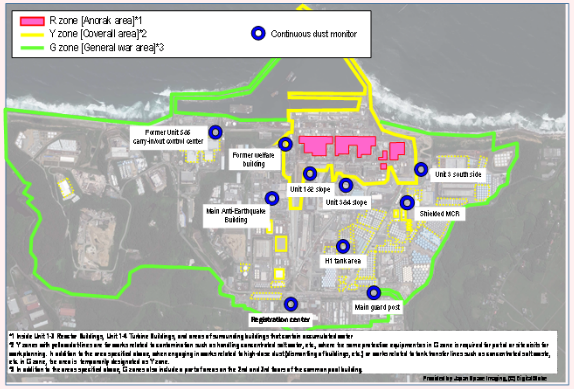
Progress toward decommissioning: Work to improve the environment within the site

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

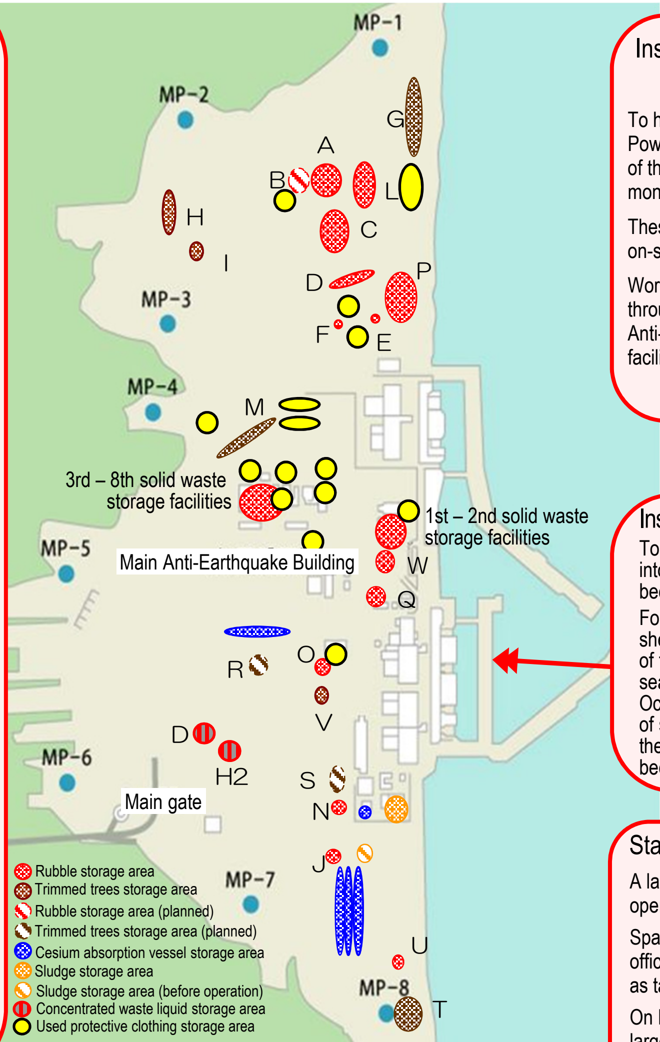
Based on the progress of measures to reduce environmental dosage on site, the site is categorized into two zones: highly contaminated area around Unit 1-4 buildings, etc. and other areas to optimize protective equipment according to each category aiming at improving safety and productivity by reducing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